JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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V.1

RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Arizona - Colorado - New Mexico - Utah - Wyoming

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NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

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SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

WATER RESOURCES
CENTER ARCHIVES

MAR 1966

UNIVERSITY OF CALIFORNIA
BERKELEY

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Commission

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UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME I

Record of Preliminary Governors' Meeting, and
for Commission Meetings No. 1-5, inclusive

FOREWORD

The Upper Colorado River Basin Compact Commission authorized this three volume compilation of its official Record of Proceedings. There is attached the certificate of the Chairman and Secretary of the Commission that the record is complete and correct.

The Upper Colorado River Basin Compact Commission was composed of commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and one commissioner appointed by the President of the United States to represent the Federal Government. After a preliminary meeting of the Governors of the States, the Commission commenced its negotiations at Salt Lake City, Utah, on July 31, 1946. As a result of its deliberations, the Compact, known as the Upper Colorado River Basin Compact, was signed at the Palace of Governors, Santa Fe, New Mexico, on October 11, 1948. Subsequently the Compact was ratified by the respective legislatures of the signatory States. The consent of the Congress of the United States, required by Article I, Section 10 of the Federal Constitution, was granted by Public Law 37, 81st Congress, First Session (63 Stat. 31), which was approved by the President of the United States on April 6, 1949. The Compact became effective and binding on the signatory States upon the latter date.

The Compact Commission did not adjourn sine die until August 5, 1949. It maintained its organization until that time to further the ratification of the Compact by the States and the approval of the Compact by the Congress and to perform certain other related duties and functions.

All of the States which negotiated and ratified the Upper Colorado River Basin Compact are signatories to the Colorado River Compact which was signed at Santa Fe, New Mexico, on November 24, 1922, and subsequently ratified by the seven States of the Colorado River Basin (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming). The Congress of the United States gave its consent to the original Compact by the Boulder Canyon Project Act (45 Stat. 1057) in 1928. The provisions of the 1948 Upper Colorado River Basin Compact are subject to the provisions of the 1922 Compact.

The Colorado River Compact of 1922 did not apportion Colorado River water, or its use, among the signatory States. Instead, it divided the beneficial consumptive use of Colorado River water between the Upper and Lower Basins. The division point between the two basins was fixed as Lee Ferry, Arizona, which is located a short distance south of the Arizona-Utah boundary line. The Compact placed an obligation on the Upper Division States (Colorado, New Mexico, Utah, and Wyoming) to deliver specified quantities of water at Lee Ferry for the use of the Lower Basin. Provision was made for the satisfaction of any subsequently created treaty obligations to Mexico. The use of surplus water, over and above that apportioned to the two basins, was reserved for future apportionment.

The Upper Colorado River Basin Compact apportioned among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming the beneficial consumptive use of the water apportioned to the Upper Basin by Article III (a) of the 1922 Compact (7,500,000 acre-feet annually). Provision was made as to the responsibility of the States of Colorado, New Mexico, Utah, and Wyoming in regard to their joint obligation to deliver water at Lee Ferry for use in the Lower Basin.

The 1948 Compact created an administrative agency known as the "Upper Colorado River Commission." This body, in addition to administering the Compact, is charged with the duty of expediting the development of the Upper Colorado River Basin. It is composed of five commissioners, one representing the United States of America, and one representing each of the States of Colorado, New Mexico, Utah, and Wyoming. Arizona is not represented on the Commission because of its relatively small area in the Upper Colorado River Basin. The Federal representative is chairman of the Commission. As an official body, it occupies the unique position of being able to expedite Upper Colorado River Basin development, to aid in shaping such development, and to integrate Federal and State activities and interests.

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Harry W. Bashore, for the United States of America, Chairman
Charles A. Carson, for Arizona
Clifford H. Stone, for Colorado
Fred E. Wilson, for New Mexico (1)
Edward H. Watson, for Utah (2)
L. C. Bishop, for Wyoming
Grover A. Giles, Secretary

(1) Replaced Thomas M. McClure who died during the time the compact was under negotiation.

(2) Was replaced by Harold A. Linke after the compact was signed but before the Commission adjourned sine die.

ENGINEERING ADVISORY COMMITTEE

J. R. Riter, for the United States of America, Chairman
H. P. Dugan, for the United States of America
R. Gail Baker, for Arizona
R. I. Meeker, for Arizona
Royce J. Tipton, for Colorado
R. M. Gildersleeve, for Colorado
Frank C. Merriell, for Colorado
John H. Bliss, for New Mexico
John R. Erickson, for New Mexico
C. O. Roskelley, for Utah
R. D. Goodrich, for Wyoming
H. T. Person, for Wyoming

Charles L. Patterson for Colorado, F. W. Cottrell for Utah and C. S. Jarvis for Utah served as members of the Committee during the early months of the negotiations.

LEGAL COMMITTEE

Charles A. Carson, for Arizona, Chairman
Jean S. Breitenstein, for Colorado
Fred E. Wilson, for New Mexico
W. J. Wehrli, for Wyoming
J. A. Howell, for Utah
J. G. Will, for the United States of America

EXPLANATORY NOTE

This compilation of the Record of the proceedings of the Upper Colorado River Basin Compact Commission is contained in three volumes, as follows:

Volume 1 - Containing the Record of the preliminary Governors' Meeting, and the Record of Meetings Nos. 1 to 5, inclusive, of the Commission.

Volume 2 - Containing the Record of Meetings Nos. 6 to 11, inclusive, of the Commission.

Volume 3 - Containing the Final Report of the Engineering Advisory Committee, and the Inflow-Outflow Manual.

These various meetings, in Volumes Nos. 1 and 2, are separated by blue insert-sheets, to indicate the division between meetings.

A Subject Index for meetings of the Commission appears at the beginning of Volumes Nos. 1 and 2. (See explanation for use, which prefaces the Subject Index). A separate Index for the Engineering Advisory Committee Report appears in Volume No. 3, as a part of that Report.

There appears in this compilation, at the beginning of each separate meeting of the Commission, a chronological Table of Contents, covering developments in each such meeting.

There were 11 official meetings of the Upper Colorado River Basin Compact Commission before it adjourned sine die at Salt Lake City, Utah, on August 5, 1949.

The schedule of all meetings pertaining to the Compact was as follows:

	GOVERNORS' MEETING		
Preliminary	Cheyenne, Wyoming	July 22, 1946	Volume 1
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Meeting No. 2	Santa Fe, New Mexico	Sept. 17-18, 1946	Volume 1
Meeting No. 3	Public Hearings	Oct. 28-30-31 and Nov. 2, 1946	Volume 1
Meeting No. 4	Cheyenne, Wyoming	Sept. 8, 1947	Volume 1
Meeting No. 5	Denver, Colorado	Dec. 1-2-3-4, 1947	Volume 1
Meeting No. 6	Denver, Colorado	Feb. 17-18-19-20-21, 1948	Volume 2
Meeting No. 7	Vernal, Utah	July 7-21, 1948	Volume 2
Meeting No. 8	Santa Fe, New Mexico	Oct. 4-11, 1948	Volume 2
	POST-COMPACT MEETINGS		
Meeting No. 9	Denver, Colorado	Dec. 29-30, 1948	Volume 2
Meeting No. 10	Salt Lake City, Utah	Feb. 17-18, 1949	Volume 2
Meeting No. 11	Salt Lake City, Utah	August 5, 1949	Volume 2

C E R T I F I C A T E

Harry W. Bashore, Chairman, and Grover A. Giles, Secretary, of the Upper Colorado River Basin Compact Commission, do hereby certify that the record and proceedings of such Commission, from the 31st day of July, 1946 to the 5th day of August 1949, when the Commission adjourned sine die, contained in the three volume compilation to which this certificate is attached, are a complete and correct reproduction of such record and proceedings, including the Final Report of the Engineering Advisory Committee and the "Inflow-Outflow Manual" approved and adopted by the Commission.

Harry W. Bashore
Chairman

Grover A. Giles
Secretary

SUBJECT INDEX

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* * * * This Subject Index is prepared according to a code number system in this manner: 1:5:21; 2:6:34-40; 2:7:141-142. Interpreted, this code means: Volume 1, Meeting 5, Page 21; Volume 2, Meeting 6, Pages 34 to 40; and Volume 2, Meeting 7, Pages 141 and 142.

In brief, the code is:

First figure	=	Volume Number
Second figure	=	Meeting Number
Other figures in series	=	Page Numbers

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RG 0037

STATE ENGINEER

UPPER COLORADO RIVER COMMISSION

Hearings
Compacts
Litigation
Green River
Adjudication
Media Presentations
Hoover Dam Flood Control

D5
1720

BOX 11

UPPER COLORADO RIVER COMMISSION
Upper Colorado River Compact
1930, 1944-49, 1956

(2nd)

PRELIMINARY SUGGESTION

FOR AN

UPPER COLORADO RIVER COMPACT

- - - -

Embodying Feature

of

Unrestricted development without interstate priorities or adverse servitudes, permitted by topography and natural controlling conditions.

November, 1929.

UPPER COLORADO RIVER COMPACT

(Preliminary Draft)

The State of Colorado, New Mexico, Utah and Wyoming, desiring to remove all causes of present and future controversy between said States and between citizens of one against citizens of other or others with respect to the waters of the Upper Colorado River and being moved by considerations of interstate comity, have resolved to conclude a compact with respect to such waters and, by their respective Governors, have named as their Commissioners:

Delph E. Carpenter, for the State of Colorado;

Francis C. Wilson, for the State of New Mexico;

William R. Wallace,
W. W. Ray, and
W. D. Beers,) for the State of Utah; and

John A. Whiting, for the State of Wyoming;

who, after negotiations participated in by _____ _____, appointed by the President as the representative of the United States of America, have agreed upon the following Articles:

ARTICLE I.

The purposes of this compact are to provide for the equitable division and apportionment of the beneficial uses of the waters of the Upper Colorado River among the approving States; to provide for contribution of waters by the signatory States under Article III of the Colorado River Compact; to provide for the construction and operation of works in two or more approving States; to provide for division of benefits and revenues from and for taxation of such works; and for other purposes.

ARTICLE II.

As used in this compact:

The States of Arizona, Colorado, New Mexico, Utah and Wyoming are designated as "Arizona", "Colorado", "New Mexico", "Utah", and "Wyoming", respectively.

The term "Upper Colorado River" means all that part of the Colorado River and its tributaries, above Lee Ferry.

The term "Lee Ferry" means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

The term "Waters of the Upper Colorado River" means those waters originating and/or flowing within the drainage basin of the Upper Colorado River.

The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah and Wyoming within and from

which waters naturally drain into the Colorado River above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which now are or hereafter may be beneficially served by waters diverted from the Upper Colorado River.

The term "Colorado River Compact" means that compact signed at Santa Fe, New Mexico, November 24, 1922, by Commissioners for the States of Arizona, California, Colorado, New Mexico, Nevada, Utah and Wyoming, and by a representative of the United States, and approved by the Congress of the United States, December 21, 1928.

The term "interested States" when used with reference to any project, means the approving States in which the project is located and/or waters are used thereby.

The term "project" means an entire enterprise including each and all of its component units or parts, and including all storage basins, reservoirs, dams, canals, conduits, power plants (exclusive of transmission lines), works, appliances, structures and properties constructed, owned or used thereon or therewith.

The term "power project" means any project used principally for generating or creating power.

The term "irrigation project" means any project used principally for irrigation of lands and/or other agricultural purposes.

The term "domestic projects" means any project used prin-

cipally for supplying water for domestic purposes.

The term "power" as applied to the use of water, means all use of water for the generation of energy.

The term "divert" means to effect a diversion.

The term "point of diversion" means the place at which water is diverted from a tributary or from the main channel of the Upper Colorado River.

The term "storage" of water means impounding thereof in reservoirs for future use or release.

The term "reservoir" means a natural or artificial basin used for impounding, storage, control or regulation of the flow of water and includes all dams, works and other appliances used in connection therewith and all lands within the storage basin or appurtenant thereto.

The term "above" when used with reference to diversion, storage or use of water, means all points of greater elevation from which waters of the stream and its tributaries naturally flow to the point or place under consideration.

The term "tributary" means any watercourse ultimately draining into the Upper Colorado River.

The term "signatory States" means States signing this compact, by their Commissioners.

The term "approving States" means the signatory States and the State of Arizona, at its election.

ARTICLE III.

The provisions hereof respecting each approving State shall include and bind its citizens and corporations and all others engaged or interested in the diversion and/or use of the waters of the Upper Colorado River in that State.

ARTICLE IV.

Subject to the provisions of this compact, each approving State may beneficially use the waters of the Upper Colorado River within its territory without regard to uses in other approving States, and such beneficial uses shall not vest, give rise to or be asserted as the bases of prior, preferred or superior rights or claims of right to the use of the waters of the Upper Colorado River as against any other approving State and/or users of water therein nor interfere with the free and uninterrupted uses of waters thereby, and shall not be asserted as the bases of claims of servitudes upon the territory or the waters of any other approving State.

ARTICLE V.

(a) Irrigation and domestic projects may be constructed and/or diversions of water may be made thereby in an upper State for the benefit of lower State of States and/or users of water therein, subject to this Article unless otherwise provided by compact or agreement between the interested States.

(b) Consent of the upper State shall be obtained previous to initiation or vesting of any rights or claims or to construction and/or operation of works, occupation of lands or use of water.

(c) Only such waters as otherwise naturally would flow unused from the upper State into the lower State after all present and future uses in the upper State, may be so stored or diverted.

(d) Diversion, carriage, storage and/or uses of water by any such project shall not vest or become or be asserted as the bases of prior, preferred and/or superior appropriations, rights, interests or titles of, in or to uses of waters of the Upper Colorado River, or interfere with uses of such waters, within or above or as against the State in which such diversion, carriage and/or storage of water is made and shall not vest, give rise to or be asserted as the basis of any servitude upon such waters.

ARTICLE VI.

(a) Power projects may occupy territory and use waters of the Upper Colorado River within two or more States, subject to this Article unless otherwise provided by compact or agreement between the interested States.

(b) Consent of each interested State shall be obtained

previous to the initiation or vesting of any rights or to the construction and/or operation of works, the occupation of lands or uses of water.

(c) The project (exclusive of transmission lines) shall be considered and appraised as a single unit for purposes of taxation, for collection and distribution of incomes, tolls and/or revenues other than those derived by taxation, for allocation of power and distribution of benefits derived from its operation, for control and regulation of diversion, storage and/or the release of waters and for other purposes.

(d) Unless otherwise provided by this Article, each interested State shall participate equally with the other interested States in all matters concerning the project.

(Alternative provision)

(d) Unless otherwise provided by this Article, each interested State shall participate in all matters concerning such project proportionately as the fall of the river utilized by the project within that State bears to the total fall of the river utilized by the entire project.

(e) Diversion, carriage, storage and/or use of water by the project shall not vest or become or be asserted as the basis of any prior, preferred and/or superior appropriation, right, interest or title of, in or to the use of waters of the Upper Colorado River as against any State including the uppermost State in which such project is located, or as against users of water

above said project and such project shall not store water at any time when the same is needed for domestic and agricultural purposes.

(f) Diversion, storage, release and uses of water by the project shall be regulated and controlled by the interested State in which the principal control works are located.

(g) Each interested State shall have a preferred right to purchase and/or to control the purchase and distribution of its share (to be ascertained by section (d) of this article) of the power generated at said project in amounts of 5,000 horsepower or more upon one year's notice to those in control of the project and at prices no greater than at such times paid by the most favored purchaser of power from the project, subject to readjustment every ten years thereafter.

(h) The valuation of the project for purposes of taxation where the project is subject to taxation by the interested States, shall be determined annually by representatives of the interested States, each representative to be designated according to the laws of his State. If the valuation shall have been determined by the Interstate Commerce Commission or some other duly authorized agency of the United States, such valuation may be accepted by the interested States. The representatives of the interested States before September first of each year, shall certify to the proper taxing officials of their respective States,

the valuation of the whole project and the undivided part of such total valuation available to each interested State for taxation in like manner as other similar property is taxed in that State. The undivided part of such total valuation available to each interested State for taxation, shall be determined by the provisions of Section (d) of this Article and shall be certified and assessed and collection of taxes enforced against such property as "an undivided _____(fraction)_____ interest in _____(name)_____ project". In event of failure of such representatives to certify such valuation and the apportionment thereof, before said date, the valuation and apportionment certified for the preceding year shall be taken as correct for that year. If no valuation or certification is made for two successive years, the taxing authorities of each of the interested States may fix the valuation of the taxable interest of such State in such project until a valuation has been certified.

(i) All tolls, incomes and/or revenues derived from any such project, other than those derived by taxation, and payable to the interested States, shall be divided among and distributed to such States pursuant to the provisions of Section (d) of this Article.

ARTICLE VII.

(a) Subject to the provisions of Articles V and VI, the

approving States severally grant the right to construct and operate, within their respective territories, the projects in said Articles authorized, and to the exercise of eminent domain within each State, for the acquisition of rights of way and other property necessary or convenient for the construction and/or operation of such projects.

(b) The provisions of Articles V and VI are and shall be construed as conditions and limitations upon and running with all concessions and grants therein made or authorized and with all rights to the use of water by the projects therein authorized.

ARTICLE VIII.

(a) Storage and/or use of waters of the Upper Colorado River for power purposes shall be subservient to the use and consumption of such waters for agricultural and domestic purposes and shall not interfere with or prevent use or diminish the supply necessary for such dominant purposes.

(b) If and when it may be necessary for the signatory States to deliver water at Lee Ferry pursuant to Article III of the Colorado River Compact, power projects shall release water from storage in quantities equivalent to all losses of water at such projects and, if such waters are insufficient to supply the amounts required for delivery at Lee Ferry, each signatory State

shall deliver that portion of the deficiency which the aggregate acreage irrigated in that State within the Upper Basin bears to the total acreage irrigated within said Upper Basin. Determination of acreage each year shall be by the then last federal census. No approving State shall store or withhold water passing through its territory from another State for contribution to any such delivery.

ARTICLE IX.

Should any claim or controversy arise between any two or more of the approving States; (a) with respect to the waters of the Upper Colorado River not covered by the terms of this compact; (b) over the meaning or performance of any of the terms of this compact; (c) as to the allocation of burdens incident to the performance of any article of this or other compacts or the delivery of waters thereunder; (d) as to the construction or operation of works within the basin of the Upper Colorado River, to be situated in two or more States or to be constructed in one State for the benefit of another State, where consent to construction of such works under this compact is refused by the State in which construction is proposed; or (e) where consent of the upper State is refused for the diversion of water in one State for the benefit of another State; the Governors of the States effected, upon the request of one of them, shall forthwith appoint commissioners with power to consider and adjust such

claim or controversy, subject to ratification by the legislatures of the states so effected.

Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or by legislation of the interested states.

ARTICLE X.

Unless and until otherwise provided by compact, the chief official of each approving State charged with the administration of water rights, ex officio, shall act as a member of a permanent commission to administer this compact.

ARTICLE XI.

Whenever any official of either State is designated herein to perform any duty under this compact, such designation shall be interpreted to include the state official or officials upon whom the duties now performed by such official hereafter may devolve, and it shall be the duty of such officials to administer this compact without the necessity of enactment of special statutes for such purposes.

ARTICLE XII.

Uses and distribution of waters of La Plata River, as between Colorado and New Mexico, shall be governed by the La Plata

River Compact concluded at Santa Fe, New Mexico, November 27, 1922, and/or by any other compact respecting said waters hereafter concluded by said States.

ARTICLE XIII

Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian Tribes.

ARTICLE XIV.

The physical and other conditions peculiar to the Upper Colorado River and to the territory drained and served thereby constitute the basis for this compact and none of the approving States hereby concedes the establishment of any general principle or precedent with respect to other interstate streams.

ARTICLE XV.

This compact is subject, supplemental and subsidiary to the Colorado River Compact as between the signatory States. PROVIDED, HOWEVER, That if Arizona hereafter elects, by act of its legislature, to accept and approve the provisions of this compact, the same shall not be subject and subsidiary to said Colorado River Compact with respect to Arizona unless and until so provided by act of the Legislature of that State.

ARTICLE XVI.

This compact shall become operative when approved by the Legislature of each of the signatory States and by the Congress of the United States. The State of Arizona may accept the provisions of and approve this compact by Act of the Legislature. Notice of approval by the Legislature shall be given by the Governor of each State to the Governors of the other States and to the President of the United States of America, and the President is requested to give notice to the Governors of the approving States of the approval by the Congress of the United States.

IN WITNESS WHEREOF, The Commissioners have signed this compact in a single original, which shall be deposited in the archives of the Department of State of the United States of America and of which a duly certified copy shall be forwarded to the Governor of each of the signatory States.

Done at the City of _____, _____, this _____ day of _____, A. D., One Thousand Nine Hundred and Twenty-nine.

APPROVED:

RG 0037

STATE ENGINEER

UPPER COLORADO RIVER COMMISSION

Hearings
Compacts
Litigation
Green River
Adjudication
Media Presentations
Hoover Dam Flood Control

D5
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BOX 11

UPPER COLORADO RIVER COMMISSION
Upper Colorado River Compact
1930, 1944-49, 1956

(C-4th)

PRELIMINARY SUGGESTION

FOR AN

UPPER COLORADO RIVER COMPACT

* * * *

Embodying feature

of

Unrestricted development without interstate priorities or adverse servitudes. Permitted by topography and natural controlling conditions.

September 15, 1930.

55 2 25

(C-4th)
(9-15-30)

UPPER COLORADO RIVER COMPACT

(Preliminary Draft)

The States of Colorado, New Mexico, Utah and Wyoming, desiring to remove all causes of present and future controversy between them and between citizens of one and citizens of another or others with respect to beneficial uses of the waters of the Upper Colorado River and being moved by considerations of interstate comity, have resolved to conclude a compact with respect to such waters and, by their respective Governors, have named as their Commissioners:

Delph E. Carpenter, for the State of Colorado;

Francis C. Wilson, for the State of New Mexico;

William R. Wallace,)
W. W. Ray, and) for the State of Utah; and
W. D. Beers,)

John A. Whiting, for the State of Wyoming;

who after negotiations participated in by William J. Donovan, appointed by the President as the representative of the United States of America, have agreed upon the following Articles:

ARTICLE I.

The purposes of this compact are to provide for the equitable division and apportionment of the beneficial uses of the waters of the Upper Colorado River among the approving States; to provide for contribution of waters by the signatory States under Article III of the Colorado River Compact or otherwise necessary; to provide for construction and operation of works in two or more approving States; to provide for division of benefits and revenues from and for taxation of such works; and for other purposes.

ARTICLE II.

As used in this compact:

The States of Arizona, Colorado, New Mexico, Utah and Wyoming are designated as "Arizona", "Colorado", "New Mexico", "Utah", and "Wyoming", respectively.

The term "Upper Colorado River" means all that part of the Colorado River and its tributaries, above Lee Ferry.

The term "Lee Ferry" means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

The term "Waters of the Upper Colorado River" means those waters originating and/or flowing within or from the drainage basin of the Upper Colorado River.

The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which now are or hereafter may be beneficially served by waters diverted from the Upper Colorado River.

The term "Colorado River Compact" means that compact signed at Santa Fe, New Mexico, November 24, 1922, by Commissioners for the States of Arizona, California, Colorado, New Mexico, Nevada, Utah and Wyoming, and by a representative of the United States, and approved by the Congress of the United States, December 21, 1928.

The term "interested States" when used with reference to any project, means the approving States in which the project is located and/or waters are used thereby.

The term "project" means an entire enterprise including each and all of its component units or parts, and includes all lands, rights of way, storage basins, reservoirs, dams, canals, conduits, power plants (exclusive of transmission lines), works, appliances, structures and properties constructed, owned or used thereon, therewith or appurtenant thereto.

The term "power project" means any project used principally for generating or creating power.

The term "irrigation project" means any project used principally for irrigation of lands and/or other agricultural purposes.

The term "domestic project" means any project used principally for supplying water for domestic purposes.

The term "domestic" refers to uses of water as defined in Article II, Par. (h) of the Colorado River Compact.

The term "power" as applied to the use of water, means all use of water for the generation of energy.

The term "divert" means to affect a diversion.

The term "point of diversion" means the place at which water is diverted from a tributary or from the main channel of the Upper Colorado River.

The term "storage" of water means impounding thereof in reservoirs for future use or release.

The term "reservoir" means a natural or artificial basin used for impounding, storage, control or regulation of the flow of water and includes all dams, works and other appliances used in connection therewith and all lands within the storage basin or appurtenant thereto.

The term "above" when used with reference to diversion, storage or use of water, means all points of greater elevation from which waters of the stream and its tributaries naturally flow to the point or place under consideration.

The term "tributary" means any watercourse or source of

water supply ultimately draining into the Upper Colorado River.

The term "signatory States" means the States of Colorado, New Mexico, Utah and Wyoming.

The term "approving States" means the signatory States and the State of Arizona, at its election.

ARTICLE III.

The provisions hereof respecting each approving State shall include and bind its citizens, corporations and all others engaged or interested in the diversion and/or use of waters of the Upper Colorado River in that State.

ARTICLE IV.

Subject to the provisions of this compact, each approving State may beneficially use the waters of the Upper Colorado River within its territory without regard to uses in other approving States, and such beneficial uses shall not vest, give rise to or be asserted as the bases of prior, preferred or superior rights or claims of right to the use of the waters of the Upper Colorado River as against any other approving State, and/or users of water therein, nor interfere with the free and uninterrupted uses of waters thereby, and shall not be asserted as the bases of claims of servitude upon the territory or the waters of any other approving State.

ARTICLE V.

(a) Irrigation and/or domestic projects may be constructed and diversions or storage of water may be made thereby in an upper State for the benefit of a lower State or States and/or users of water therein, subject to this Article unless otherwise provided by compact or agreement between the interested States.

(b) Consent of the upper State shall be obtained previous to initiation or vesting of any rights or claims or to construction and/or operation of works, occupation of lands or uses of water.

(c) Diversions and/or storage of water by the project shall be limited exclusively to waters not needed by or within the upper State for present and/or future uses and which otherwise would flow unused from the upper State into the lower State or States.

(d) Diversion, carriage, storage and/or uses of water by any such project shall not vest or become or be asserted as the bases of prior, preferred and/or superior appropriations, rights, interests or titles of, in or to uses of waters of the Upper Colorado River, or interfere with uses of such waters, within or above or as against the upper State and shall not vest, give rise to or be asserted as the bases of claims of servitude upon the waters or territory of such upper State.

ARTICLE VI.

(a) Power projects may occupy territory and use waters of the Upper Colorado River within two or more States, subject to this Article unless otherwise provided by compact or agreement between the interested States.

(b) Consent of each interested State shall be obtained previous to initiation or vesting of any rights or to construction and/or operation of works, occupation of lands or uses of water.

(c) The project (exclusive of transmission lines) shall be considered and appraised as a single unit for purposes of taxation; for collection and distribution of incomes, tolls and/or revenues other than those derived by taxation; for allocation of power and distribution of benefits derived from its operation; for control and regulation of diversion, storage and/or release of waters; and for other purposes.

(d) Unless otherwise provided by this Article, each interested State shall participate equally with the other interested States in all matters concerning the project.

(Alternative provision)

(d) Unless otherwise provided by this Article, each interested State shall participate in all matters concerning such project proportionately as the fall of the river utilized by the project within that State bears to the total fall of the river utilized by the entire project.

(e) Diversion, storage, release and/or uses of water by the project (1) shall be regulated and controlled by the interested State in which the principal control works are located and (2) shall not vest or become or be asserted as the basis of any prior, preferred and/or superior appropriation, right, interest or title of, in or to the use of waters of the upper Colorado River as against any approving State other than the State in which the principal control works are located, or as against users of water above said project. Such project shall not store water at any time when the same is needed for domestic and/or agricultural purposes.

(f) Each interested State shall have a preferred right to purchase and/or to control the purchase and distribution of its share (to be ascertained by paragraph (d) of this Article) of the power generated at said project in amounts of 5,000 horsepower or more upon one year's notice to those in control of the project and at prices no greater than at such times paid by the most favored purchaser of power from the project, subject to readjustment every ten years thereafter.

(g) The valuation of the project for purposes of taxation, where the project is subject to taxation by the interested States, shall be determined annually by representatives of the interested States, each representative to be

designated according to the laws of his State. Such representatives shall determine the valuation of the whole project and of the undivided part (according to paragraph (d) of this Article) of such total valuation available to each interested State for taxation as other similar property is taxed in that State, and, before September first of each year, shall certify to the proper taxing officials of the interested States the valuation of such project and the undivided part thereof which may be taxed by each interested State. The undivided part of the total valuation of the project available to each State for taxation shall be certified and assessed and collection of taxes enforced against such property as "an undivided _____(fraction)_____ interest in _____(name)_____ project". In event of failure of such representatives to certify such valuation and the apportionment thereof, before said date, the valuation and apportionment certified for the preceding year shall be taken as correct for the current year. If no valuation or certification is made for two successive years, the taxing authorities of each of the interested States may fix the valuation of the taxable interest of such State in such project until a valuation has been certified.

(h) All tolls, incomes and/or revenues derived from any such project, other than those derived by taxation, and

payable to the interested States, shall be divided among and districuted to such States pursuant to the provisions of paragraph (d) of this Article.

(i) Rates and charges for electrical current and other benefits to be derived from the project, shall be uniform to all consumers receiving the same class of service and shall be fixed and determined by the commission authorized by Article X of this compact.

ARTICLE VII

(a) Subject to the provisions of this compact, the approving States severally grant the right to construct and operate, within their respective territories, the projects authorized by Articles V and VI and to the exercise of eminent domain for the acquisition of rights of way and other property necessary or convenient for the construction and/or operation of such projects; and the provisions of this compact are and shall be construed as conditions and limitations upon and running with all concessions and grants herein made or authorized and with all rights to the use of water by said projects.

ARTICLE VIII

(a) Storage and/or use of waters of the Upper Colorado River for power purposes shall be subservient to the use and consumption of such waters for agricultural and domestic purposes and shall not interfere with or prevent use or

diminish the supply necessary for such dominant purposes.

(b) If and when it may be necessary for the signatory or the approving States to deliver water at Lee Ferry pursuant to Article III of the Colorado River Compact or otherwise, power projects shall release water from storage in quantities equivalent (1) to all losses of water at such projects and (2) equivalent to the extent of interference by such projects with necessary deliveries of water at Lee Ferry for agricultural, domestic and other required purposes. If such waters are insufficient to supply the amounts required for delivery at Lee Ferry, each signatory State shall deliver that portion of the deficiency which the aggregate acreage irrigated (including irrigated lands of Indian Tribes) in that State within the Upper Basin bears to the total acreage irrigated within said Upper Basin with waters of the Upper Colorado River. The acreage irrigated shall be determined and release and deliveries of water shall be enforced by the Upper Colorado River Commission. Acreage irrigated may be computed upon the basis of the federal census as regards lands irrigated within the drainage basin of the Upper Colorado River, and upon the basis of two-thirds the total average annual diversions as regards waters carried from said drainage basin for agricultural purposes. No approving State shall store or withhold water passing through its territory from another State for contribution to any such delivery.

ARTICLE IX.

Should any claim or controversy arise between any two or more of the approving States: (a) with respect to the waters of the Upper Colorado River not covered by the terms of this compact; (b) over the meaning or performance of any of the terms of this compact; (c) as to the allocation of burdens incident to the performance of any article of this or other compacts or the delivery of waters thereunder; (d) as to the construction or operation of works within the basin of the Upper Colorado River, to be situated in two or more States or to be constructed in one State for the benefit of another State, where consent to construction of such works under this compact is refused by the State in which construction is proposed; or (e) where consent of the upper State is refused for the diversion of water in that State for the benefit of a lower State; the Governors of the States affected, upon the request of one of them, shall forthwith appoint commissioners with power to consider and adjust such claim or controversy, subject to ratification by the Legislatures of the States so affected.

Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or by legislation of the interested States.

ARTICLE X.

Unless and until otherwise provided by compact, the chief official of each approving State charged with the

administration of water rights, ex officio, shall act as a member of a permanent commission to administer this compact. Such Commission shall be known as the Upper Colorado River Commission and shall have authority to make, amend, promulgate and enforce such consistant rules, regulations and orders necessary or essential for enforcement of the provisions of this compact.

ARTICLE XI.

Whenever any official of either State is designated herein to perform any duty under this compact, such designation shall be interpreted to include the state official or officials upon whom the duties now performed by such official hereafter may devolve, and it shall be the duty of such officials to administer this compact without the necessity of enactment of special statutes for such purposes.

ARTICLE XII.

(a) Uses and distribution of waters of La Plata River, as between Colorado and New Mexico, shall be governed by the La Plata River Compact concluded at Santa Fe, New Mexico, November 27, 1922, and/or by any other compact respecting said waters hereafter concluded by said States.

(b) Uses and distribution of waters of the Little Snake River in the vicinity of the boundary common to Colorado and Wyoming, as between those States, shall be governed by a separate compact between those States.

ARTICLE XIII.

Nothing in this compact shall be construed as effecting the obligations of the United States of America to Indian Tribes.

ARTICLE XIV.

The physical and other conditions peculiar to the Upper Colorado River and to the territory drained and served thereby constitute the basis for this compact and none of the approving States hereby concedes the establishment of any general principle or precedent with respect to other interstate streams.

ARTICLE XV.

This compact is subject, supplemental and subsidiary to the Colorado River Compact with respect to the signatory States, but not with respect to Arizona unless and until that State shall have so provided by act of the Legislature or shall have approved the Colorado River Compact.

ARTICLE XVI.

Arizona, at any time hereafter, may accept, approve and become a party to this compact by Act of the Legislature.

ARTICLE XVII.

This compact shall become operative when approved by the Legislature of each of the signatory States and by the Congress of the United States. Notice of approval by the Legislature shall be given by the Governor of each State to

the Governors of the other States and to the President of the United States of America, and the President is requested to give notice to the Governors of the approving States of the approval by the Congress of the United States.

IN WITNESS WHEREOF, The Commissioners have signed this compact in a single original, which shall be deposited in the archives of the Department of State of the United States of America and of which a duly certified copy shall be forwarded to the Governor of each of the signatory States.

Done at the City of _____, _____, this _____ day of _____, A.D., One Thousand Nine Hundred and Thirty.

APPROVED:

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	**D, E**	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

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UPPER COLORADO RIVER COMMISSION

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BOX 11

UPPER COLORADO RIVER COMMISSION
Upper Colorado River Compact
1930, 1944-49, 1956

(C-4th)
(9-15-30)

R E M A R K S

In Re

PRELIMINARY DRAFT

Of

UPPER COLORADO RIVER COMPACT

- - - -

Studies of the water supply of the Upper Colorado River, in its relations to geography, topography, state lines, location of present and potential opportunities for uses, location of reservoir sites and other features, reveal: (1) that nature has fixed natural berriers which now and forever will limit and localize diversions and uses of water; (2) that the sources of water supply are generally distributed over the drainage basin; (3) that intrabasinal mountain ranges localize opportunities for uses of water; (4) that state lines generally conform with natural distribution of sources of water supplies; (5) that potentialities upon most of the principal streams do not equal the water supplies available in each instance leaving surpluses to flow to States below and ultimately to Lee Ferry; (6) that most of the waters of the States of origin enter canyons before leaving the parent State; (7) that thereafter such waters remain in the canyons unavailable for agricultural or domestic uses to points below Lee Ferry; and

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that unlimited development within the headwater States will not unreasonably interfere with lower States and will facilitate development by reason of equalization of stream flows.

Power development will involve structures situated in two or more States, thereby complicating problems of administration, taxation, sale and distribution of power, with conflicting resultant claims to uses of water. One power development generally aids rather than interferes with another. Each upper reservoir relieves equalization and storage burdens of lower projects.

These and other controlling or influencing factors induced the preparation of the accompanying suggestions for a draft of an Upper Colorado River Compact. The plan is simple and, in the main, is selfexecuting. Other plans, such as those predicated upon acreages, water supply, etc., involve constant and unnecessary administration, tend to frequent rivalries and disputes and are largely artificial.

The principal burdens, present and future, are set forth in Article III of the Colorado River Compact. Beyond supplying those burdens, the Upper River will care for itself. There never will be opportunities such as possessed by California, for a State to carry away from the stream to a foreign drainage the greater part of the water supply of the river. Nature has so placed its mountains and canyons that man must forever conform to natural conditions in making uses of the waters.

Arizona is an Upper Basin State. While furnishing but a trivial part of the water supply above Lee Ferry, the great canyon from the Utah line to Lee Ferry, with its power and water storage potentialities, is in Arizona. Arizona has not approved the Colorado River Compact and probably will prefer to take no action which might embarrass or complicate future action by the State. In order to meet this situation, provision has been made for Arizona's approval of the Upper Colorado River Compact, either with or without approval of the Colorado River Compact.

SUGGESTED COMPACT

We briefly point out the features of the suggested draft of compact, in the order of provisions:

Article I. Purposes.

Article II. Definitions. Attention is directed to definitions of "signatory States" and "approving States".

Article III. Provisions bind citizens.

Article IV. Is the heart of the compact. It provides for general freedom for development within each State without interstate priorities and adverse servitudes.

Article V. Interstate canals. Provides for construction and operation of canals diverting water within an upper State for use upon lands in a lower State, without creating adverse priorities or servitudes. It requires

previous consent of the upper State, which may be granted by special statutes, general laws, executive orders or otherwise.

Article VI. Interstate power projects. Provides for operation, valuation, taxation, apportionment of power, revenues and benefits, control of water by the State where principal power plant is located and for uses of water without creation of adverse claims or servitudes upon territory above the project.

Article VII. (a) Grants by States to neighboring States to construct interstate projects authorized by Articles V and VI, with exercise of eminent domain etc. (b) Makes provision of said Articles, conditions and limitations running with the grants made by Article VII.

Article VIII. (a) Embodies substantially provisions of paragraph (b) of Article IV of the Colorado River Compact. (b) Provides for delivery of water at Lee Ferry, by the signatory or approving States in compliance with Article III of the Colorado River Compact or otherwise and provides for distribution of the burden first upon storage and consumption of water in violation of paragraph (a) and next upon the signatory States proportionably to the acreage irrigated in each from the Upper Colorado River. Colorado, New Mexico, Utah and Wyoming constitute the States of the Upper Division, while the States of the Upper Basin comprise those States together with the State or Arizona. In the present draft, the

former group are termed the "signatory States" and the latter group are termed the "approving States". The distinction is followed throughout the draft.

Article IX. Provides for adjustment of interstate controversies by compacts, leaving the door open to interstate suits if thought advisable. It follows the form approved in the Colorado River Compact.

Article X. Provides for administration, to the limited degree required by the compact, which is largely self-executing.

Article XI. Provides for official succession.

Article XII. Recognizes La Plata River Compact and provides for the Little Snake Compact.

Article XIII. Exempts Indian interests in the same language used in the Colorado River Compact.

ARTICLE XIV. Limits the plan followed to the conditions covered by the compact.

Article XV. Makes the compact supplemental and subsidiary to the Colorado River Compact as regards the signatory States but not as regards Arizona, unless that State shall so elect. Here, again, the distinction between States of the "Upper Division" and States of the "Upper Basin" made by the Colorado River Compact opens the way to approval and acceptance of this compact by Arizona without recognition

or approval of the Colorado River Compact by that State. Arizona's approval of this compact will settle Upper Basin conditions without embarrassment to Arizona. If Arizona fails to approve this compact, the same will still be effective between the four upper States.

Article XVI. Provides for approval by Arizona.

Article XVII. Provides for legislative and congressional approval.

COLORADO RIVER COMPACT

It is proposed to equitably apportion the waters of the Upper Basin of the Colorado River System among the interested States.

The Colorado River Compact is the law of the Colorado River System as regards the United States and as regards six States: California, Colorado, Nevada, New Mexico, Utah and Wyoming. Its provisions are a first consideration.

Article VI authorizes the proposed Upper Basin Compact.

Article II defines the parties to any Upper Colorado River Compact. It provides:

"(f) The term 'Upper Basin' means those parts of the States of Arizona, Colorado, New Mexico, Utah and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System above Lee Ferry." (II-f).

The "States of the Upper Basin" are Arizona, Colorado, New Mexico, Utah and Wyoming.

"(c) The term 'States of the Upper Division' means the States of Colorado, New Mexico, Utah and Wyoming." (II-c)

It is important to bear in mind that Arizona is a State of the Upper Basin although not a State of the Upper Division. All that part of her territory above Lee Ferry is in the Upper Basin. While the States of the "Upper Division" are obligated to supply one half of any deficiency in the Mexican burden (if any), it is the States of the "Upper Basin" which are obligated to make delivery at Lee Ferry. The apportionment made by Article III, paragraph (a), is to the "Upper Basin", while paragraph (e), relating to power uses, applies to divisions and not to basins.

Waters To Be Divided

Article III of the compact provides:

"(a) There is hereby apportioned from the Colorado River System in perpetuity to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist." (III-a).

"(b) In addition to the apportionment in paragraph (a), the Lower Basin is hereby given the right to increase its beneficial consumptive use of such waters by one million acre-feet per annum." (III-b)

The above apportionment is from the entire water supply of the Colorado River System including all Arizona tributaries.

"(c) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River System, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then the burden of such deficiency shall be equally borne by the Upper Basin and the Lower Basin, and whenever necessary the States of the Upper Division shall deliver at the Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d)". (III-c).

The international burden (if any) falls upon the entire Colorado River System and equally upon the two "Divisions".

"(d) The States of the Upper Basin will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reconed in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact." (III-d).

This paragraph has no reference to the specific allocations in paragraph (a). The fact that the average annual delivery will be 7,500,000 acre-feet has no reference

to the allocation of 7,500,000 acre-feet to each "Basin". This paragraph provides no allocation. It is solely a guaranty of amount of the minimum flow from one Basin to the other Basin and includes waters to supply part of the international burden (if any), unallocated surplus waters in which both Basins have an undetermined interest, and all other waters properly to flow into the Lower Basin. Its provisions are subject to paragraph (c) which follows.

"(c) The States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural uses." (III-c).

This paragraph limits the burden of interdivisional delivery to that necessary for domestic and agricultural purposes. It modifies the provisions of paragraph (d) and, in effect, provides that the States of the Upper Division shall not be obligated to deliver 75,000,000 acre-feet in ten year periods, unless all of such waters may reasonably be applied to domestic and agricultural uses. Its provisions do not prevent power uses in the Upper Division unless such uses will interfere with domestic and agricultural uses in the Lower Division. A contrary construction would defeat the provisions of Article IV, paragraph (b) authorizing use for power.

"(f) Further equitable apportionment of the beneficial uses of the waters of the Colorado River System unapportioned by paragraphs (a), (b) and (c) may be made in the manner provided in paragraph (g) at any time after October first, 1963, if and when either Basin shall have reached its total beneficial consumptive use as set out in paragraphs (a) and (b)." (III-f)

All the Colorado River States have a recognized interest in any unallocated surplus waters of the entire Colorado River System. This paragraph preserves such waters for future allocation and the last paragraph, (g) of the Article provides the procedure for such further apportionment.

The States of the "Upper Division" all have ratified the compact and are bound by its provisions. Any compact among them must be subject to the Colorado River Compact. They may treat with respect to the "exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum"; also respecting other waters, subject to the restrictions of the compact.

Article IV controls uses of water for navigation and power:

By paragraph (a) the United States relinquishes any preferred right to control the waters for navigation and makes such use subservient to the uses of such waters for domestic, agricultural and power purposes.

Paragraph (b) provides:

"(b) Subject to the provisions of this compact, water of the Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes." (IV-b).

Power uses must not interfere with delivery of water to the Lower Basin for agricultural and domestic purposes as required by Article III, paragraphs (d) and (e). Power uses must be the first to suffer in supplying any deficiency under paragraph (a).

Paragraph (c) limits the operation of the compact to interstate relations, leaving to each State the regulation of its internal affairs.

Article V creates the nucleus of an administrative commission. Any Upper Basin board for administration of a local compact should conform to this Article.

Article VIII makes burden of satisfying demands of present perfected rights fall upon the allocation to each Basin.

S U M M A R Y

Arizona is a State of the "Upper Basin" but not a State of the "Upper Division". She contributes but a small

part of the waters naturally passing Lee Ferry. Probably the Paria is the main contribution. Throughout its course in Arizona, the Colorado River flows in a deep canon and Arizona's use is limited to power. Waters delivered by the States of the Upper Division at the Arizona-Utah boundary, by force of gravity, inevitably will flow to Lee Ferry except as dissipated by evaporation in Glenn Canon or some similar reservoir.

Under these conditions, Arizona is a necessary party to a complete division of the waters of the Upper Basin but not an indespensible party, especially if a compact is concluded upon a basis of unlimited development within each State without interstate priorities.

The Colorado River Compact fixes the following status:

Navigation is made subservient to all other uses of water and may be disregarded.

Power is made subservient to domestic and agricultural uses. Wherever power interferes, it must give way and in cases of shortage, it must be the first to suffer. We are spared the task of covering this field as it is already settled.

The compact makes no preference between domestic and agricultural uses, although common practice gives domestic needs preference. Such is the law with most of the arid States.

If and when it may be necessary for the Upper States

to deliver water at Lee Ferry to supply any deficiency under paragraphs (d) and (e) of Article III of the Colorado River Compact, waters shall be obtained from the following sources:

(1) Power projects shall discontinue all losses and shall release water from storage in quantities equivalent to all losses of water at such projects and equivalent to storage of water occasioned by power uses which has interferred with or diminished the supply agreed to be delivered at Lee Ferry.

(2) If the waters delivered are insufficient to fulfill the compact provisions, the shortage must be supplied by the States by reducing diversions and uses of water for agricultural purposes. We are not concerned with the plan adopted by each State to accomplish this end. Our concern is limited to the contribution by the States. It would seem equitable for each State to contribute proportionately with the benefits enjoyed through use of water.

It is hardly to be conceived that it ever will be necessary to disturb domestic uses.

R E M A R K S

In Re

PRELIMINARY SUGGESTED DRAFT

Of

UPPER COLORADO RIVER COMPACT

- - - -

Studies of the water supply of the Upper Colorado River, in its relations to geography, topography, state lines, location of present and potential opportunities for uses, location of reservoir sites and other features, reveal (1) that nature has fixed natural carriers which now and forever will limit and localize diversions and uses of water; (2) that the sources of water supply are generally distributed over the drainage basin; (3) that intrabasinal mountain ranges localize opportunities for uses of water; (4) that state lines generally conform with natural distribution of sources of water supplies; (5) that potentialities upon most of the principal streams do not equal the water supplies available in each instance leaving surpluses to flow to States below and ultimately to Lee Ferry; (6) that most of the waters of the States of origin enter canyons before leaving the parent State; (7) and that unlimited development within the headwater states will not unreasonably interfere with lower States and will facilitate development by reason of equalization of stream flows.

Power development will involve structures situated in two or more States, thereby complicating problems of administration,

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taxation, sale and distribution of power, with conflicting resultant claims to uses of water. One power development generally aids rather than interferes with another. Each upper reservoir relieves equalization and storage burdens of lower projects.

These and other controlling or influencing factors induced the preparation of the accompanying suggestions for a draft of an Upper Colorado River Compact. The plan is simple and, in the main, is selfexecuting. Other plans, such as those predicated upon acreages, water supply, etc., involve constant and unnecessary administration, tend to frequent rivalries and disputes and are largely artificial.

The principal burdens, present and future, are set forth in Article III of the Colorado River Compact. Beyond supplying those burdens, the Upper River will care for itself. There never will be opportunities such as possessed by California, for a State to carry away from the stream to a foreign drainage the greater part of the water supply of the river. Nature has so placed its mountains and canyons that man must forever conform to natural conditions in making uses of the waters.

Arizona is an Upper Basin State. While furnishing but a trivial part of the water supply above Lee Ferry, the great canyon from the Utah line to Lee Ferry, with its power and water storage potentialities, is in Arizona. Arizona has not approved the Colorado River Compact and probably will prefer to take no

action which might embarrass or complicate future action by the State. In order to meet this situation, provision has been made for Arizona's approval of the Upper Colorado River Compact, either with or without approval of the Colorado River Compact.

SUGGESTED COMPACT

We briefly point out the features of the suggested draft of compact, in the order of provisions:

Article I. Purposes.

Article II. Definitions. Attention is directed to definitions of "signatory States" and "approving States".

Article III. Provisions bind citizens.

Article IV. Is the heart of the compact. It provides for general freedom for development without interstate priorities and adverse servitudes.

Article V. Interstate canals. Provides for construction and operation of canals diverting water within an upper State for use upon lands in a lower State, without creating adverse priorities or servitudes. It requires previous consent of the upper States, which may be granted by special statutes, general laws, executive orders or otherwise.

Article VI. Interstate power projects. Provides for operation, valuation, taxation, apportionment of power, revenues and benefits, control of water by the State where principal power

plant is located and for uses of water without creation of adverse claims or servitudes upon territory above the project.

Article VII. (a) Grants by States to neighboring States to construct interstate projects authorized by Articles V and VI, with exercise of eminent domain etc. (b) Makes provision of said Articles, conditions and limitations running with the grants made by Article VII.

Article VIII. (a) Embodies substantially provisions of paragraph (b) of Article IV of the Colorado River Compact. (b). Provides for delivery of water at Lee Ferry, by the signatory States in compliance with Article III of the Colorado River Compact and provides for distribution of the burden first upon storage and consumption of water in violation of paragraph (a) and next upon the signatory States proportionably to the acreage irrigated in each from the Upper Colorado River. The Colorado River Compact provides that the "States of the Upper Division" shall make contribution at Lee Ferry, as distinguished from the States of the "Upper Basin". Colorado, New Mexico, Utah and Wyoming constitute the States of the Upper Division while the States of the Upper Basin comprise those States together with the State of Arizona. In the present draft, the former group are termed the "signatory States" and the latter group are termed the "approving States". The distinction is followed throughout the compact, particularly in Article VII.

Article IX. Provides for adjustment of interstate controversies by compacts, leaving the door open to interstate suits

if thought advisable. It follows the form approved in the Colorado River Compact.

Article X. Provides for administration, to the limited degree required by the compact, which is largely self-executing.

Article XI. Provides for official succession.

Article XII. Recognizes La Plata River Compact.

Article XIII. Exempts Indian interests in the same language used in the Colorado River Compact.

Article XIV. Limits the plan followed to the conditions covered by the compact.

Article XV. Makes the compact supplemental and subsidiary to the Colorado River Compact as regards the signatory States but not as regards Arizona, unless that State shall so elect. Here again, the distinction between States of the "Upper Division" and States of the "Upper Basin" made by the Colorado River Compact opens the way to approval and acceptance of this compact by Arizona without recognition or approval of the Colorado River Compact by that State. Arizona's approval of this compact will settle Upper Basin conditions without embarrassment to Arizona. If Arizona fails to approve this compact, the same will still be effective between the four upper States.

Article XVI. Provides for legislative and congressional approval with optional approval by Arizona.

RG 59 General Records of the
Department of State

CENTRAL DECIMAL FILE
1930-1939

From: 711.1216M/686

To: 711.1216M/870

Box 3970

3970

Moore

DEPARTMENT OF STATE

DIVISION OF MEXICAN AFFAIRS

DEPARTMENT OF STATE
RECEIVED
JUL 28 1934
DIVISION OF
COMMUNICATIONS AND RECORDS

July 12.

A-W

Mr. Welles:

This may interest you in connection with the conversation you had yesterday with Mr. Lawson.

E.R.

ASSISTANT SECRETARY OF STATE
JUL 12 1934
MR. WELLES

Mr. Reed -

The attached paper comes from Mr. Savings who, as an attorney, is committed with the All American Canal project - Although it seems you have received a copy, I am sending this copy for your file.

Rhalter Moore

July 12/34

DIVISION OF MEXICAN AFFAIRS,
JUL 12 1934
Department of State.

711.1216M

FILED
JUL 28 1934

For ast. Sec of State Judge Moore
Left by Phil D. Swing

Resolutions Adopted at a Conference of Representatives of the States of Colorado, New Mexico, Utah and Wyoming, and the Bureau of Reclamation, called by the Secretary of the Interior, at Denver, Colorado, on June 29 and 30, 1934.

Mexican Treaty on Colorado River

WHEREAS:-

The conditions affecting the Colorado River Basin are those:

See pp 2 3 4

1st. It covers an area of 242,000 square miles - 240,000 square miles within the United States.

2nd. It appears that irrigable lands of high fertility within its borders and similar lands that can be irrigated through trans-mountain diversion, the requirements of which may exceed the water supply even after the water supply has been completely conserved.

3rd. The climatic conditions throughout its entire area are almost ideal for human health and well being.

4th. Mineral resources are of almost unbelievable value. Coal fields and phosphate beds within its borders are enormous. Oil shales and oil sands contain hydro-carbons sufficient in quantity to provide a sure source of gasoline with which to supply the needs of the United States based upon present consumption, for a period of at least one hundred years.

5th. From Wyoming to the Gulf of California there is a drop in elevation of about 7000 feet, making possible the development of millions of electric horsepower.

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JUL 28 1934

6th. Because of these facts the Congress of the United States enacted Section 15 of the Boulder Canyon Project Act, which reads:

> "Section 15. The Secretary of the Interior is authorized and directed to make investigation and public reports on the feasibility of projects for irrigation, generation of electric power, and other purposes in the States of Arizona, Nevada, Colorado, New Mexico, Utah, and Wyoming for the purpose of making such information available to said states and to the Congress, and of formulating a comprehensive scheme of control and improvement and utilization of the water of the Colorado River and its tributaries. The sum of $250,000.00 is hereby authorized to be appropriated from said Colorado River Dam fund, created by Section 2 of this Act, for such purposes."

7th. It is self evident that such "comprehensive scheme" can be based only upon full knowledge concerning the following items:

Land values
Water measurements and supply
Topography
Mineral values
Hydro-electric power
Soil erosion
Forests, shrubs and grasses.

8th. The dam now under construction will be completed about June, 1935, and thereafter the river flow below the dam will be equalized, thus making it physically possible for the Republic of Mexico to put to beneficial use these waters which will have been conserved entirely at the expense of the United States, and which therefore belong to the United States.

Thus will not be true during the 3 years or more that the reservoir is filling

9th. In order to provide the necessary data upon which to base the "comprehensive scheme" called for in the Boulder Canyon Act for the "improvement and utilization of the waters of the Colorado River

and its tributaries" it is the opinion of the representatives of the states here assembled that the sum of one million dollars should be provided with which to secure all available data within the shortest possible time. It will readily be agreed that the sum ($250,000.00) heretofore provided, with which to make the suggested "comprehensive plan" is entirely inadequate when it is recognized that the area involved is six times as large as the area of the Tennessee Valley; that its agricultural development will eventually equal that of the famed Valley of the Nile; and that its mineral resources have a potential value possibly exceeding that of its agricultural resources.

Now therefore, it is here declared to be the opinion of the representatives of the States of Colorado, New Mexico, Utah and Wyoming, here assembled, that the Governors of the respective states should respectfully set forth the facts herein stated to the Honorable Harold L. Ickes, Federal Public Works Administrator, and ask that the sum of one million dollars be made immediately available with which to complete the plan for the "comprehensive development of the lands and waters of the Colorado River Basin;" and provide the necessary basic facts upon which the states may base a fair division of the Colorado River waters among themselves.

We recognize the propriety of the making by the United States of a treaty with our neighbor, the Republic of Mexico, whereby upon grounds of comity rather than of law, the United States may

allot to that Republic a portion of the waters of the Colorado River system; provided that due compensation be allowed for the impairment of any vested rights in the United States. In view, however, of the fact that the mileage of that Republic upon the river system is less than 200 miles, as against the many thousands of miles of the seven Colorado River States upon the system, and of the fact that over ninety-nine per cent of the waters of the system are contributed by the Colorado River States alone and of the further fact that the total production of the water of the river system is only approximately twenty-one million acre feet per annum on the average, we believe that an allotment of 750,000 acre feet per annum, as approved by the American Section of the International Water Commission, to that country would be a fair proportion. We are opposed to any greater allocation.

It is further respectfully suggested, in order to expedite the work, that all fact finding agencies of the United States cooperate therein.

We find from the presentation of Dr. Mead and Engineer Preston that the Bureau of Reclamation has completed a substantial part of its land classification and the water needs and possibilities of the Colorado River Basin under the Boulder Canyon Project Act and that the completion of the work is indispensable to the development of the Basin and to the full negotiation of an Interstate Compact among the four upper states supplemental to the general Colorado River Compact.

It is our further view that the Government in completing this work should make a survey of identical basic standards in each of the states; and that it should include ultra-basin uses of water as well as intra-basin uses.

We express our appreciation of the cooperation of the Secretary of the Interior and of the Commissioner of Reclamation, at whose instance this Interstate Conference is held.

Since the State of Arizona assumes none of the burdens of the Colorado River Compact and the Boulder Canyon Project Act, not having ratified said Compact, but is attempting to secure the benefits of waters impounded or actually made available by the Compact and by the provisions of the Boulder Canyon Project Act, we earnestly urge that Arizona has no right to any waters from the project until she ratifies the Compact and that the other Colorado River States are entitled to be heard as to the terms of any contracts, proposed over the protest of any of said states, which may be subject to negotiation between the United States and Arizona, in order to make sure that its provisions shall be in harmony with the division of water made by the Colorado River Compact and by the Boulder Canyon Project Act. We insist said states have the right to be heard on any proposed contract of the character mentioned.

We favor the negotiation of an Interstate Compact among the four upper states of the Colorado River Basin at the earliest possible date. In the meantime it is our belief that each state should go ahead with its development without objection by other states, as contemplated by the Colorado River Compact, unless the development, in addition to

already existing water uses, would, in the opinion of such other states or any of them, be considered as approaching too nearly the equitable share of water that under compact might eventually be apportioned to such state out of the waters involved.

The representatives of the States of Colorado, New Mexico, Utah and Wyoming, assembled in Denver, Colorado, on the 30th day of June, 1934, desire to pay a tribute of respect and affection to the Honorable Delph E. Carpenter, of Greeley, confined to his home by long illness, the citizen and official of the upper States who first conceived the idea of attempting to apply the general principle of interstate compacting to the solution of the interstate controversy over the waters of the Colorado River, and we send him our greetings and our appreciation of his great service to the States of the Colorado River Basin and to the United States.

A copy of these resolutions is being sent to the Secretary of State, the Secretary of the Interior, the Commissioner of the Bureau of Reclamation, the Governor and proper interstate stream officials of each of the Colorado River States, the senators and representatives thereof, the Honorable Delph E. Carpenter, and the press.

Colorado:
(Signed) M. C. Hinderlider
" Paul P. Prosser
" Edward T. Taylor
" Fred Cummings
" L. Ward Bannister
" Ralph L. Carr
" Henry T. Lab, Jr.
" Henry C. Vidal
" Thomas J. Warren
" R. J. Wright
" G. F. Snyder
" Moses E. Smith
" Frank M. Bancroft
" George J. Bailey
" Frank Delaney
" D. W. Aupperle
" [illegible]

Utah:
(Signed) Wm. R. Wallace
" T. H. Humpherys

New Mexico:
(Signed) E. K. Neumann
" Thomas M. McClure

Wyoming:
(Signed) Edwin W. Burritt
" James B. True
" Nels Jorgenson

Docket No.

List No.

Mixed Claims Commission

UNITED STATES AND GERMANY

UNITED STATES AGENCY
1511 K STREET
WASHINGTON

(D a t e)

There are returned herewith by registered mail documents or other exhibits which were transmitted to this Agency in connection with evidence filed in your claim.

The Agency is returning these exhibits, your case having been disposed of and there being no further need for them in the records of the Commission.

Very truly yours,

For the American Agent, Robert W. Bonynge:

Attorney.

Enclosures:

Form No. 6.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
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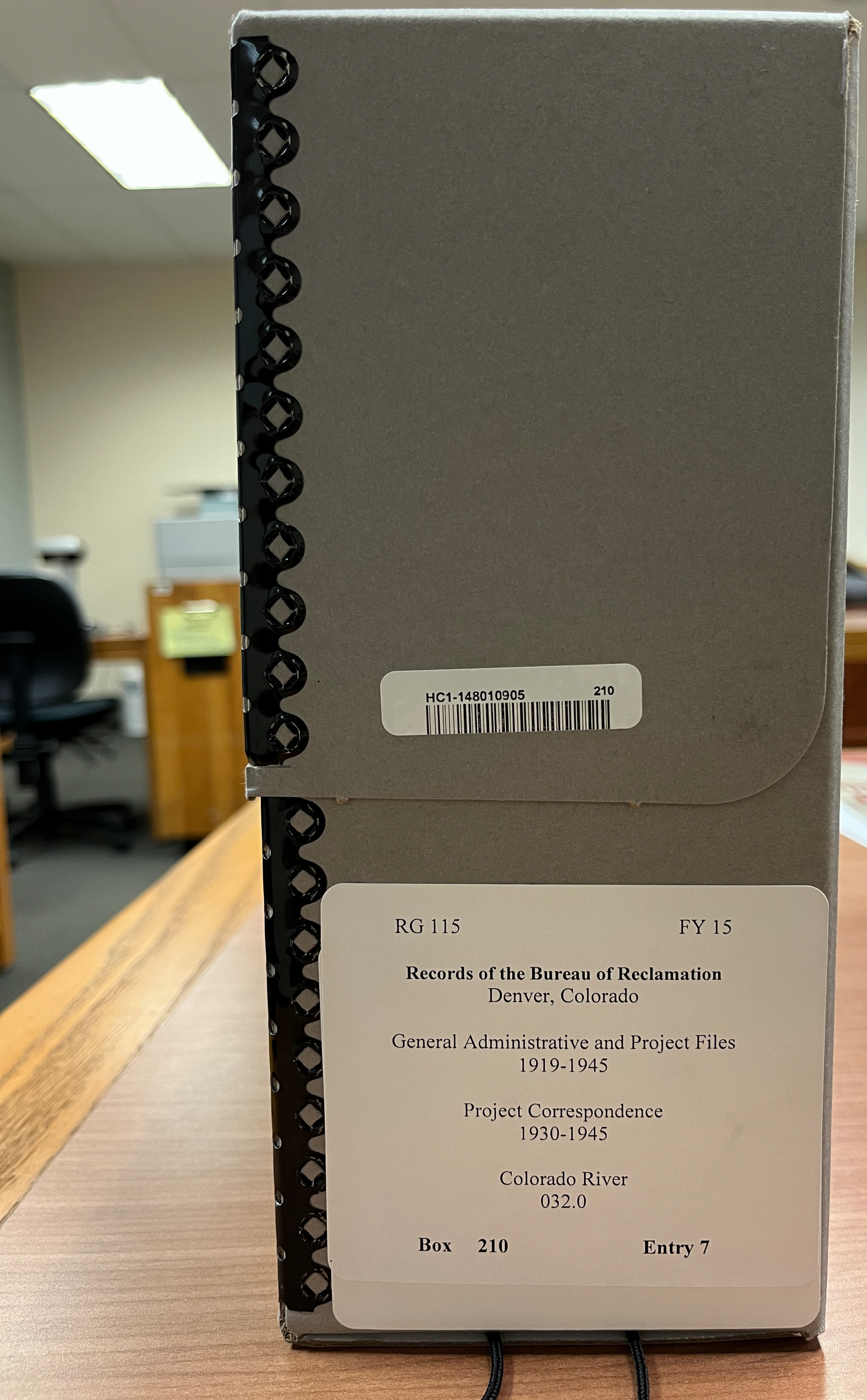
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI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RG 115
FY 15
Records of the Bureau of Reclamation
Denver, Colorado
General Administrative and Project Files
1919-1945
Project Correspondence
1930-1945
Colorado River
032.0
Box 210
Entry 7

052.- COLORADO RIVER SETTLEMENT OF WATER RIGHTS. COLORADO RIVER COMPACT. UPPER BASIN ALLOCATION. 1938 THRU NOV. 1938. 3 of 3

052.- COLORADO RIVER SETTLEMENT OF WATER RIGHTS COLORADO RIVER COMPACT. UPPER BASIN ALLOCATION. 0

1938 THRU Nov. 1938

INDEXED IN GENERAL INDEX & IN THE COLORADO RIVER INDEX AS FOLLOWS:

COLORADO RIVER COMPACT-UPPER BASIN ALLOC.
COLORADO RIVER-SETTLEMENT OF WATER RIGHTS-UPPER BASIN (4 STATES)
FOUR STATE AGREEMENT FOR ALLOC. OF COLO. RIVER UPPER BASIN WATER RIGHTS.
UPPER COLORADO RIVER BASIN-SETTLEMENT OF WATER RIGHTS.

MONTROSE (COLO) DAILY PRESS
JUL - 2 1934

032. COLO. RIVER COMPACT
UPPER BASIN ALLOCATION
COLORADO RIVER

MEETING 4 UPPER BASIN STATES IS HARMONIOUS ONE

DENVER, July 2.—With a commendable display of harmony, officials of the four states in the upper basin of the Colorado river got together on a definite, concentrated move which they hope will solve a problem that has vexed the states for nearly 30 years.

That problem is allocation of the waters of the Colorado on a basis that will be satisfactory to each of the states involved, Colorado, Wyoming, New Mexico and Utah.

They did not decide how the 7,500,000 acre feet of the stream alloted to the four states under the six-state compact should be divided among the four.

But they did take what they declared were the most important steps in that direction. These steps, they said, are the provisions of a lengthy resolution finally adopted by the conference, and a copy handed to Dr. Elwood Mead, director of the federal reclamation service, who attended the conference.

The major points of the resolution:

1. Urges Secretary of Interior Ickes to appropriate an additional $1,000,000 to supplement an original grant of $250,000 to finance a searching survey of the Colorado basin's potentialties.

2. Favors "the negotiations of an interstate compact among the four upper states of the Colorado river basin at the earliest possible date."

3. Urges that Arizona "has no right to any waters" from the Boulder dam project until she ratifies the compact already signed by the six other states in the upper and lower basins.

4. Points out that when construction of the Boulder dam is finished in 1935, "the river flow below the dam will be equalized, thus making it physically possible for the republic of Mexico to put to beneficial use these waters which will have been conserved entirely at the expense of the United States and which therefore belong to the United States."

5. Expresses the opinion that an allotment of 750,000 acre feet to the stream flow to Mexico, as approved by the American section of the international water commission, "would be a fair proportion."

6. Declares that the Colorado basin contains "irrigable lands of high fertility," mineral resources "of almost unbelievable value," including coal fields, phosphate beds and oil shales and sands to assure a source of gasoline for at least 100 years, and potentialities for development of millions of electric horsepower.

Congressman Edward T. Taylor, who presided, suggested the two men and E. K. Neumann, New Mexico attorney general, who had some suggestions to offer, collaborate on a single resolution which was adopted at the afternoon session.

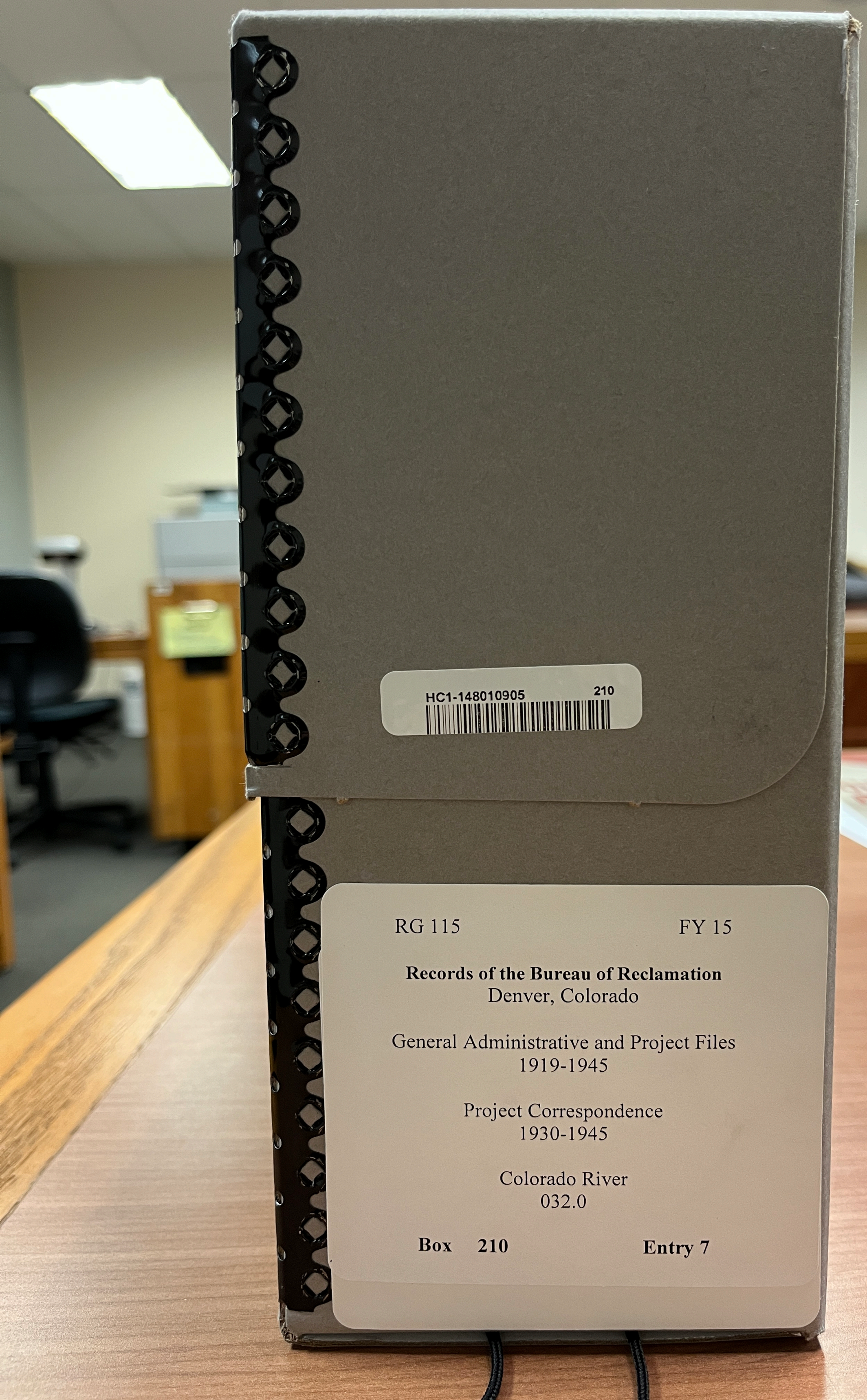
The resolution pictured the basin as having the promise of an agricultural development to "eventually equal that of the famed valley of the Nile."

Dr. Mead praised the delegates' action as representing a union of the four states for the betterment of all and a massed front on a "sound water development policy."

The final resolution was a combination of earlier resolutions submitted by William R. Wallace, Utah water commissioner, and L. Ward Bannister Denver attorney and member of the Colorado contingent.

Altho in agreement on some points, the original resolutions contrasted keenly on others and led to lively discussion and occasional heated exchanges between Bannister and the white-haired-white goateed Utah commissioner.

The conference adjourned until an indefinite date to await action of the federal government in regard to its suggestions.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032. COLO. RIVER COMPACT
UPPER BASIN ALLOCATION
COLORADO RIVER

MONTROSE (COLO) DAILY PRESS
JUL - 3 1934

STATES OF UPPER BASIN OFFER PLAN

DENVER, July 3.—With considerable display of harmony officials of the four states in the upper basin of the Colorado river got together on a definite concentrated move which they hope will solve a problem that has vexed the states for nearly 30 years.

The problem is allocation of the waters of the Colorado on a basis that will be satisfactory to each of the states involved, Colorado, Wyoming, New Mexico and Utah.

They did not decide how the 7,500,000 acre-feet of the stream allotted to the four states under the six-state compact should be divided among the four.

But they did take what they declared were the most important steps in that direction. These steps, they said, are the provisions of a lengthy resolution finally adopted by the conference and a copy handed to Dr. Elwood Mead, director of the federal reclamation service who attended the conference.

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JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
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Colorado Water Conservation Board

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THE UPPER COLORADO RIVER BASIN COMPACT

By Jean S. Breitenstein
Attorney for Colorado Water Conservation Board

On April 6 of this year President Truman signed the act of Congress consenting to the Upper Colorado River Basin Compact between the States of Arizona, Colorado, New Mexico, Utah, and Wyoming. This act made effective an agreement which is one of the most outstanding recent examples of interstate cooperation - a cooperation which many decried as an utter impossibility.

It has been said that the Colorado River is the Nile of the Southwest and the State of Colorado is its Soudan. In no area of the United States is water such a critical factor. The very life of great cities, the support of agriculture, the maintenance of industry, and the generation of hydroelectric energy all depend upon the beneficial utilization of the flows of this most erratic stream. Competition between the States of the basin for the right to use Colorado River water has been a most understandable result. This competition has long existed. It first came to national attention over thirty years ago when disasterous floods in the Imperial Valley of California and the need of the Los Angeles vicinity for additional hydroelectric power, stimulated

an insistent demand for the construction by the federal government of a huge dam on the Lower Colorado to control floods and generate power. Efforts to obtain Congressional authorization of such a project resulted in a sharp and bitter controversy between the lowlands and the uplands of the basin.

In the affected States the riparian doctrine of water law does not apply. Instead the appropriation doctrine - first in time, first in right - is the prevailing law. In the proposal to construct a multipurpose dam on the Lower Colorado, the Upper Basin States saw an effort by the Lower Basin to obtain appropriative rights which would forever encumber, if not prevent, development along the upper reaches. The unified opposition of the upper States prevented favorable action by Congress. A stalemate was in prospect until the concept of a solution by means of an interstate compact was first suggested by Delph Carpenter of Colorado.

Pursuant to the necessary statutory authorizations a compact commission was set up in 1922. It was composed of representatives of the basin States, Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming together with the Hon. Herbert Hoover, then Secretary of Commerce, as the representative of the United States. The Commission, after prolonged discussions, determined that the available factual

data was insufficient to permit a definitive apportionment of water among the respective states. Instead a unique device was adopted. The stream was divided into two basins. The area naturally tributary above Lee Ferry, Arizona, was to constitute the Upper Basin and that naturally tributary below that point was the Lower Basin. Beneficial consumptive use of water was divided between the two basins upon the basis of 8,500,00 acre-feet annually to the Lower Basin and 7,500,000 acre-feet annually to the Upper Basin. Surplus water over and above the quantity so divided and the quantity necessary to supply any recognized right of Mexico was to be divided in 1963 or later, if and when either Basin had put to use its allotted share. The four Upper Division States, Colorado, New Mexico, Utah, and Wyoming, were obligated to deliver at Lee Ferry in each ten year period 75,000,000 acre-feet plus one-half of any amount required to satisfy the Mexican right, if the surplus was insufficient for such purpose. No apportionment was made to any individual State.

This 1922 compact was promptly ratified by all affected States except Arizona. In 1928 Congress passed the Boulder Canyon Project Act which made the compact effective upon six state approval plus the agreement by California to limit its uses to defined quantities. Upon

such ratification, the construction of Hoover Dam and the All-American Canal was authorized. All States but Arizona agreed and California passed the necessary statute. On June 25, 1929, President Hoover proclaimed the Compact effective.

One of the features of the Boulder Canyon Project Adjustment Act, passed in 1940 to permit revision of the rates chargeable for power produced at Hoover Dam, was the creation of a fund to be expended by the Bureau of Reclamation in the investigation of and report on a comprehensive plan for the development of both the Upper and Lower Basins. Such work proceeded slowly. From 1922 to the present but one major project, the Colorado-Big Thompson, has been authorized for federal construction in the Upper Basin. In 1946 the Bureau released its report "The Colorado River" which inventoried potential projects to utilize Colorado River water. Most significantly the report stated without qualification that the available water supply was insufficient to permit the construction of all projects inventoried. Such finding resulted in the issuance of directives by the Commissioner of Reclamation, the Secretary of the Interior, and the Director of the Bureau of the Budget that no new major projects dependent upon the Colorado River would be

approved for federal construction until the basin States had made an apportionment of water among themselves. Thus, the States were placed under the impelling necessity of dividing the share allotted to each basin by the 1922 compact among the States lying within the respective basins.

Representatives of the five Upper Basin States met in Cheyenne, Wyoming, in July, 1946, to formulate plans for the negotiation of an Upper Basin Compact. The necessary commissioners were duly appointed. Former Commissioner of Reclamation Harry W. Bashore was designated as the representative of the United States. Formal meetings began shortly thereafter. It was apparent from the outset that additional information as to water production, existing uses, and development potentialities had to be secured. Accordingly the Compact Commission set up an engineering advisory committee charged with the duty of supplying such information. For nearly two years the technical experts making up such committee labored with the assigned task. During that period the Commission, rather than sitting back and waiting for the engineers to report, was busy with what may be called political and legal problems. Field meetings were held in the various states, both to get the views of the local water users and also to acquaint them with the work of the Commission. The support thus engendered on the local level was of primary

value when the Compact was later submitted to the legislatures of the various States.

In July, 1948, the Commission held a three week session in Vernal, Utah, at which a tentative compact draft was hammered out. This was a major accomplishment. The available water supply was admittedly insufficient to satisfy the demands against it. Colorado, which produces more than 70% of the Lee Ferry flow, emphasized its contributions to the stream. New Mexico's Indian problem required serious consideration. The needs of the Bonneville Basin in Utah had to be satisfied as best they could. Wyoming demanded water for both agricultural and industrial development in the Green River drainage. These conflicts presented obstacles which at times seemed unsurmountable. Patience, perseverance, and above all a sincere desire to cooperate prevailed to bring about agreement on the division of the water. Technical engineering and legal complications then provoked much argument. The existence of important interstate tributary streams compelled the incorporation of provisions defining the rights of the states affected. Finally a draft of compact was made which the Commissioners tentatively accepted. The Vernal meeting adjourned with the understanding that the representatives of each State would submit the draft to their constituents for comments and suggestions. Thus,

an opportunity was afforded for the expression of local opinion prior to the preparation and execution of the final compact.

Meeting at Santa Fe, New Mexico, in October, 1948, the Commissioners reviewed the Vernal draft in the light of the critical comments which had been received. The basic apportionment remained unchanged but numerous alterations and modifications had to be made in technical details. In the historic Palace of the Governors at Santa Fe, the Commissioners, on October 11, 1948, signed the Compact which represented not the views of one state or one individual but the fairest and best possible composite view of all concerned.

The satisfactory quality of the result is best shown by the legislative history of the Compact. In all signatory States legislatures met in the winter of 1949. In the first three months of the year, the legislature of each of the five States ratified the Compact and the Congress of the United States gave the constitutionally required consent with a total of only two votes being cast in opposition. In four of the States and in the Congress the approving action was unanimous. This is most impressive evidence of the wisdom and ability of the Commissioners and their Chairman, the federal representative.

The Compact is intended to determine for all time the rights of the affected States to the use of the waters of the Colorado River apportioned to the Upper Basin by the 1922 Compact. Of primary interest is the allocation made to each State. The Commissioners recognized that while the 1922 Compact by its paragraph III (a) apportions to the Upper Basin the beneficial consumptive use of 7,500,000 acre-feet annually, such use is subject to the availibility of water. The States of the Upper Division, that is, Colorado, New Mexico, Utah, and Wyoming, are required by the 1922 Compact to maintain certain flows at Lee Ferry. The water available for use is that remaining after the Lee Ferry delivery requirements are satisfied. In view of the uncertainty as to the total amount of water which might be available for use the Commission determined that so far as the States of the Upper Division are concerned the apportionment must be in terms of percentages of the total amount of water apportioned to, and available for use in, the Upper Basin. Accordingly, an apportionment was made on the following basis: Arizona, which is not a State of the Upper Division, was granted the right to use a maximum of 50,000 acre-feet annually. The use of water apportioned to, and available for use in, the Upper Basin and remaining after the deduction of the use by Arizona of not to exceed 50,000 acre-feet annually, was apportioned as follows:

To Colorado 51.75%;

To New Mexico 11.25%;

To Utah 23%;

To Wyoming 14%.

The Compact does not apportion any water which under the terms of the 1922 Compact falls within the category of surplus. It is specifically provided that the apportionment made by the Compact shall not be taken as any basis for the allocation of benefits arising from the generation of power.

The apportionment of beneficial consumptive use of water is incomplete and unsatisfactory unless some yardstick is recognized by which such beneficial consumptive use may be measured. A serious defect in the 1922 Compact, and one which has given rise to serious dispute, is the failure of the compact to furnish the necessary yardstick. Two theories have been advanced as to the measurement of use, viz, (1) diversions less returns, and (2) stream depletions. Under the first, all headgate diversions are measured and totaled and from such sum return flows are subtracted. Such method is suitable in situations where there are a few large diversions in a stream section where returns can be calculated with reasonable certainty. It is utterly unworkable in the Upper Basin where there are literally thousands of diversions many of which are on tributaries and of very small quantities.

To require the installation of automatic measuring devices on each headgate and then to compute the return flows by some obscure and as yet untried method is to be utterly unrealistic and impractical. If the Upper Basin Compact had set up any such machinery for measurement, it most surely would have failed of ratification.

Recognizing the practical difficulties but at the same time determined to provide some method of measurement, the Commissioners adopted the second theory and agreed that consumptive use should be measured "by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry." The "inflow-outflow" method is an engineering procedure whereby the quantity of water occurring in the Upper Basin is measured by a series of index rim stations. The outflow is determined by the flow at Lee Ferry. The amount of consumptive use is represented by the change in the relationship between the index stations from that existing under virgin conditions and that existing at any particular time after the stream has been depleted by man's activities. "Man-made depletions" means the reduction in river flow caused by the activities of man. "Virgin flow", sometimes called "reconstructed flow", means the quantity of water flowing in the river before any of it is put to use by man's activities. The actual determination of consumptive

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use is made a responsibility of the administrative agency created by the Compact. Recognizing that in the future some other method of measurement might become necessary or desirable, the Compact grants to the agency the right by unanimous action to adopt a different method of measurement.

Another defect of the 1922 Compact was the failure to provide for the charging of reservoir losses. Storage is essential to equate the flows of the stream. Reservoir losses, especially from evaporation, are substantial. Probably no technical problem gave the Commissioners as much trouble as did that of determining an equitable procedure for charging such losses. A formula was finally devised and incorporated in the Compact. Essentially it provides for a distribution of such charges in a manner proportionate to the use of water made in each state during the year when the losses occur.

The Upper Basin Compact specifically recognizes the paramountcy of the 1922 Compact and contains many provisions designed to assure compliance. The most important of these requires the curtailment of use in the States of the Upper Division so as to prevent a depletion of the flow to an extent which would violate the 1933 Compact. A definite formula is provided for making the necessary determinations. Authority to decide the extent of curtailment, both as to quantity and

and time, is vested in the administrative agency.

Another brain teaser for the Commission was the complication arising from the fact that in order to utilize fully the waters of the Upper Basin it will be necessary to have facilities in one State to divert, store, convey, and regulate water for use both in aother State and in satisfying the Lee Ferry delivery obligations. Lawyers will appreciate the difficulties attendant upon the attempt by one State to exercise the power of eminent domain in another State. To overcome this obstacle a procedure was devised under which the State in which the facility is to be located will, upon the request of another State, acquire the necessary land and right of way by either purchase or condemnation. As a condition precedent to the use of such facilities, it is provided that, except in the case of the United States, those for whose benefit the facilities are constructed must pay to the State in which the facilities are located, in lieu of taxes lost, a sum equivalent to the average amount of taxes levied and assessed against the land and improvements thereon during the ten years preceding the acquisition of the land for the benefit of the other State.

In order to assure Congressional consent to the Compact it was imperative to recognize specifically the rights of the United States. It is stated that nothing

in the Compact affects the obligations of the United States to Indian tribes or under the Treaty with the United Mexican States. Likewise, the Compact does not distrub the rights or powers of the United States in the waters of the Upper Colorado River System or its capacity to acquire rights in and to the use of such waters. The Compact expressly provides that it does not subject any property of the United States to taxation or to any payments whatsoever in reimbursement for loss of taxes. Property of the United States is not subjected to the laws of any State "to an extent other than the extent to which such laws would apply without regard to this Compact."

The Commission realized that a multitude of problems, which can neither be foreseen nor solved at this time, may arise in connection with the use of Upper Basin water. A desirable feature of any compact is flexibility. These factors influenced the creation of an interstate administrative agency to be known as the "Upper Colorado River Commission." Arizona, because of its slight interest in the Upper Basin was not given a place on such agency. The other four States each have a Commissioner appointed in accordance with their respective laws. The President of the United States is requested to designate a Commissioner for the United States who shall be the presiding officer and shall have the same

powers and rights as the Commissioner of any Sate. A quorum consists of any four members. Expenses of the Commissi on, except the salaries and expenses of each Commissi oner and the expenses paid by the United States, are borne by the four Upper Division States according to the percentage of consumptive use apportioned to each. The Commission is required to appoint a Secretary who shall not be a member of the Commission or an employee of any signatory State or of the United States. Engineering, legal, clerical or other personnel may be employed without regard to the civil service laws of any State. The Commission is given numerous specific powers. Among the more important are the following: To adopt rules and regulations, to establish gaging stations, to forecast water run-off, to report on water supplies and uses, to make findings on matters covered by the Compact, to acquire and hold personal and real property, and to make annual reports. All of these powers must be exercised in a manner consistent with the Compact. Concurrence of four members of the Commission is necessary on any matter except where the Compact requires unanimous action. Findings of fact made by the Commission, while not conclusive in any court, constitute prima facie evidence of the facts found.

The Upper Colorado River Commission is unique in that no similar interstate administrative agency has ever

been created by a Compact apportioning the water of a western interstate stream. The nearest parallel is the Rio Grande Commission created by the Compact made by Colorado, New Mexico, and Texas to govern the use of the waters of the Rio Grande, but that Commission has little power except fact finding. While the Upper Basin States retain their own local administrative control over the water apportioned to them, the Commission which they have created can, if it acts with force and imagination, become a most vital factor in the development of the inter-mountain region. It constitutes a facility for bringing the States closer together so that, with an understanding of mutual problems, they can cooperate for the good of all. There should result a balanced program to supply the water needs of municipalities, agriculture, and industry. Through unified action will come the development of natural resources.

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Upper Colorado River Commission

STEELINE FOLDER

(Tabs with Concealed Steel Reinforcement)

U. S. Patent No. 179848

Reorder SC-118

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

The Colorado River

"A NATURAL MENACE BECOMES A NATIONAL RESOURCE"

Interim Report on the Status of the Investigations Authorized To Be Made by the Boulder Canyon Project Act and the Boulder Canyon Project Adjustment Act

UNITED STATES DEPARTMENT OF THE INTERIOR

J. A. Krug, Secretary

BUREAU OF RECLAMATION

Michael W. Straus, Commissioner

JULY 1947

HOUSE DOCUMENT 419 — 80TH CONGRESS, 1ST SESSION

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"A NATURAL MENACE BECOMES A NATIONAL RESOURCE"

A Comprehensive Report on the Development of the Water Resources of the Colorado River Basin for Irrigation, Power Production, and Other Beneficial Uses in Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming

By THE UNITED STATES DEPARTMENT OF THE INTERIOR

J. A. Krug, Secretary

SPONSORED BY AND PREPARED UNDER THE GENERAL SUPERVISION OF THE BUREAU OF RECLAMATION

Michael W. Straus, Commissioner

E. A. Moritz, Director, Region 3; E. O. Larson, Director, Region 4

MARCH 1946

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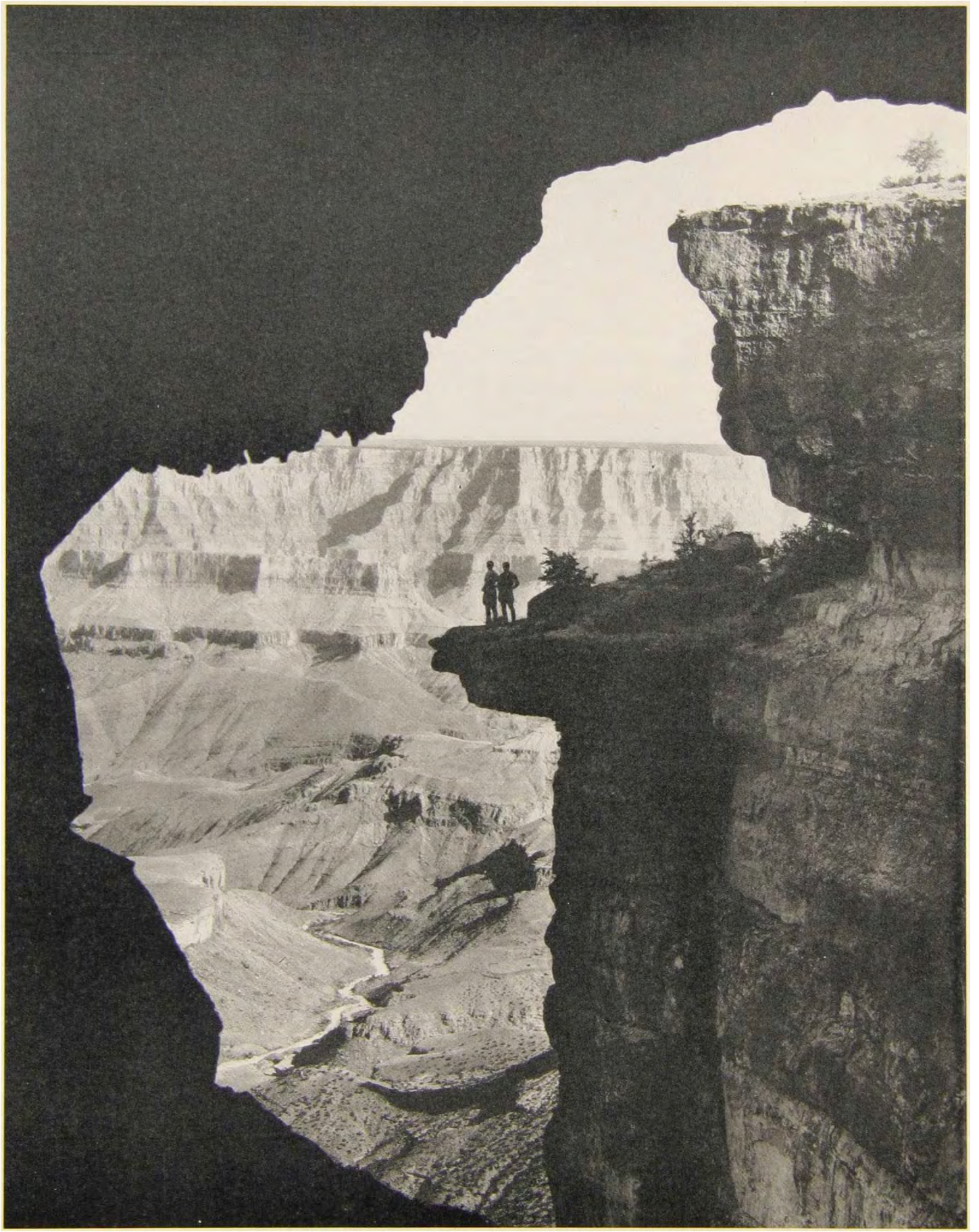
Proposed Report of the Secretary of the Interior

"[*This*] *report includes a description of the basin's resources, its needs and problems, and its present and potential development. . . .*

"*Upon clearance with the affected States and with the Secretary of War, copies of the report, together with comments, if any, of the affected States, and of the Secretary of War, will be submitted for your* [*the Secretary of the Interior's*] *transmittal to the President and, subsequently, to the Congress.*"



GRAND CANYON IN ARIZONA—*Carved by the Colorado River*

Proposed Report of the Secretary of the Interior

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WASHINGTON 25, D. C.

The SECRETARY OF THE INTERIOR.

JUNE 6, 1946.

SIR: I submit herewith a report dated March 22, 1946, on the Colorado River, which is a comprehensive report on the development of the water resources of the Colorado River Basin for irrigation, power production, flood and silt control, and other beneficial uses in the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

The report includes a description of the basin's resources, its needs and problems, and its present and potential development. Projects for future development of the water resources within the natural drainage basin are listed and their over-all results and benefits summarized. Projects for the exportation of water from the Colorado River Basin to adjacent basins are also discussed.

There is not enough water available in the Colorado River system for full expansion of existing and authorized projects and for development of all potential projects outlined in the report, including those possibilities for exporting water to adjacent watersheds. The formulation of an ultimate plan of river development, therefore, will require selection from among the possibilities for expanding existing or authorized projects as well as from among the potential new projects. Before such a selection for ultimate development can be made it will be necessary that, within the limits of the general allocation of water between upper basin and lower basin States set out in the Colorado River Compact, the Colorado River Basin States agree on suballocations of water to the individual States.

I concur generally in the recommendations of the regional directors as summarized in paragraph 70, page 22, of their report.[1] I hope that the Colorado River Basin States will recommend for construction, as the next stage of development, projects for which the stream flow depletions will assuredly fall within the ultimate allocation of Colorado River water which may be made to the individual States. I hope that the States of the Colorado River Basin will agree on suballocations of water within the limits of general allocations made by the Colorado River Compact. In addition, I suggest that arrangements be made for Federal participation in any conferences among States relating to suballocations of water. This will be important to insure that the Federal interest in over-all development is served fully.

The 134 potential projects or units of projects as described in the report are in addition to the existing and presently authorized projects or extensions of projects. Their estimated current construction costs are as follows:

[1] These recommendations appear on page 21, Regional Directors' Report, this volume.

Potential projects in the Colorado River Basin

Project and unit	Location of project	Source of water supply	Purpose to be served[1]	Estimated current construction costs
Upper basin				
Sublette	Wyoming	Green River	I, F, P	$58, 400, 000
West Side	do	do	I, F	
Daniel	do	do	I, F	
Elkhorn	do	do	I, P, F	
Paradise	do	New Fork River	I	
Eden	do	Big Sandy Creek	I	
Lower Big Sandy	do	do	I	
LaBarge	do	LaBarge Creek	I, F	
Fontenelle	do	Fontenelle Creek	I, F	
Seedskadee	do	Green River	I	
Opal	do	Hams Fork	I, F	5, 760, 000
Lyman	do	Blacks Fork, Smiths Fork	I, F	6, 928, 000
Henrys Fork	Wyoming, Utah	Henrys Fork	I, F	2, 352, 000
Flaming Gorge	do	Green River	P, F, H, S	16, 000, 000
Red Canyon	Utah	do	P, F	6, 560, 000
Little Snake River	Wyoming, Colorado	Little Snake River tributaries	I, P, F	34, 400, 000

See footnotes at end of table.

Potential projects in the Colorado River Basin—Continued

Project and unit	Location of project	Source of water supply	Purpose to be served [1]	Estimated current construction costs
Upper basin—Continued				
Upper Yampa	Colorado	Yampa River	I, F	$3, 680, 000
Wessels	do	do	I, F	1, 760, 000
Mount Harris	do	Tributaries of Yampa River	I, F	5, 280, 000
Great Northern	do	Elkhead Creek and Elk River	I, F	4, 320, 000
Yellow Jacket	do	White River and Milk Creek	I, F	7, 520, 000
Deadman Bench	Colorado, Utah	Yampa River	I, P, F, H, S	38, 080, 000
Maybell	Colorado	do	I	1, 120, 000
Cross Mountain	do	do	P	8, 000, 000
Lily Park	do	do	P, F	3, 040, 000
Josephine Basin	do	White River	I	480, 000
Piceance	do	Piceance Creek	I, F	1, 280, 000
Moon Lake extension	Utah	Duchesne River and tributaries	I, F	12, 640, 000
Fruitland	do	Red Creek	I, F	640, 000
Castle Peak	do	Duchesne River	I, F	8, 480, 000
Mosby	do	Deep Creek, Whiterocks River	I, F	1, 760, 000
Vernal	do	Ashley Creek	I, F	2, 400, 000
Jensen	do	Brush Creek	I, F	480, 000
Minnie Maud	do	Minnie Maud Creek	I, F	160, 000
Green River Pumping	do	Green River	I	640, 000
Echo Park	Colorado	do	P, F, H, S	68, 800, 000
Split Mountain	Utah	do	P, F, H, S	36, 800, 000
Emery County	do	Cottonwood Creek	I, F	4, 000, 000
Buckhorn	do	Huntington Creek	I, F	1, 920, 000
Gunnison Valley	do	Green River	I	1, 760, 000
Desolation Canyon	do	do	P, F, H	33, 600, 000
Rattlesnake Power	do	do	P, F, H	36, 800, 000
Troublesome	Colorado	Troublesome Creek	I, F	3, 536, 000
Muddy Creek	do	Muddy Creek	I, F	800, 000
Gore Canyon	do	Colorado River	P	6, 080, 000
Fourmile	do	Fourmile Creek	I, F	960, 000
Cattle Creek	do	Cattle Creek	I, F	688, 000
Capitol Creek	do	Snowmass Creek	I	208, 000
Woody Creek	do	Roaring Fork	I	272, 000
Silt	do	Rifle Creek	I, F	2, 112, 000
West Divide	do	Middle Willow Creek	I, F	2, 080, 000
Hunter Mesa	do	Buzzard Creek	I, F	2, 400, 000
Roan Creek	do	Carr Creek	I, F	976, 000
Collbran	do	Plateau Creek	I, F, M	3, 104, 000
Grand Valley Extension	do	Colorado River	I	664, 000
Cisco-Thompson	Colorado, Utah	Colorado River [2]	P, I, F, H, S	54, 784, 000
Tomichi Creek	Colorado	Tomichi Creek	I, F	2, 976, 000
Cochetopa Creek	do	Cochetopa Creek	I, F	1, 840, 000
Ohio Creek	do	Anthracite and Castle Creeks	I, F	1, 728, 000
Lake Fork	do	Lake Fork	P, F	2, 080, 000
Sapinero	do	Gunnison River	P, F	12, 480, 000
Fruitland Mesa	do	Curecante and Sapinero Creeks	I, F	5, 600, 000
Smith Fork	do	Smith Fork	I, F	3, 520, 000
Paonia	do	East Muddy Creek and North Fork	I, F	2, 240, 000
Minnesota	do	Minnesota Creek	I, F	1, 312, 000
Leroux Creek	do	Leroux Creek	I, F	4, 480, 000
Grand Mesa	do	Currant, Surface, and Tongue Creeks.	I, F	3, 072, 000
Ouray	do	Uncompahgre River	P, I, F	6, 560, 000
Redlands	do	Gunnison River	I, F	587, 000
Saucer Valley	do	Disappointment Creek	I, F	1, 504, 000
Nucla	do	Horsefly and Cottonwood Creeks	I, F	2, 400, 000
San Miguel	do	Anderson, Naturita and Dry Creeks, and San Miguel River.	I, F	10, 544, 000
West Paradox	do	West Paradox, Deep, and Geyser Creeks.	I, F	1, 024, 000
Dewey	Utah	Colorado River	P, F, H, S	60, 800, 000
Moab	do	do	P, F, H, S	15, 840, 000
Pack Creek	do	Mill Creek	I, F	1, 240, 000
Hatch Creek	do	Hatch Creek	I, F	640, 000
Dulce-Chama-Navajo	Colorado	Navajo River	I, F	2, 603, 200
South San Juan	New Mexico	San Juan River	I, F	56, 000, 000
Carracas	Colorado	do	I	57, 600
O'Neal Park	do	Piedra River	I	1, 408, 000
Hammond	New Mexico	San Juan River	I	1, 160, 000
Shiprock	do	San Juan River	I, F	33, 825, 600
Emerald Lake	Colorado	Pine River	P, F	9, 920, 000
Pine River Extension	Colorado, New Mexico	do	I	2, 936, 000
Florida	Colorado	Florida River	I, F	3, 664, 000
Animas-LaPlata	Colorado, New Mexico	Animas and LaPlata Rivers	I, P, F, S	101, 654, 400
McElmo	Colorado	McElmo Creek	I, F	624, 000

See footnotes at end of table.

Potential projects in the Colorado River Basin—Continued

Project and unit	Location of project	Source of water supply	Purpose to be served [1]	Estimated current construction costs
Upper basin—Continued				
Montezuma Valley Extension	Colorado	Dolores River	I, F	$2,080,000
Dolores	Colorado, Utah	do	I, F, S	19,520,000
Blanding	Utah	Recapture Creek	I, F	907,200
Navajo Indian Project	Colorado	San Juan River	I, F, S	4,656,000
Bluff	Utah	do	P, F	30,400,000
Goosenecks	do	do	P, S, F, H	8,320,000
Slick Horn Canyon	do	do	P, S, F, H	10,080,000
Great Bend	do	do	P, S, F, H	16,000,000
Fremont	do	Fremont River	I, F	1,280,000
Torrey	do	do	I, F	320,000
Escalante	do	Escalante River	I, F	1,440,000
Dark Canyon	do	Colorado River	P, F, S, H	168,000,000
Glen Canyon	Arizona	do	P, F, S, H	102,400,000
Transmission Grid				255,000,000
Subtotal, Upper Basin				1,471,227,200
Lower basin				
Snowflake	do	Showlow and Silver Creeks	I, F, S	4,160,000
Black Creek	do	Black Creek	I, F, S	2,880,000
Holbrook	do	Little Colorado River	I, F, S, C	2,080,000
Winslow	do	Clear and Chevelon Creeks	I, F, S	30,400,000
Kanab Creek	do	Kanab Creek	I	320,000
Hurricane	Utah, Arizona	Virgin River	I, P, S, F	14,720,000
Santa Clara	Utah	Santa Clara River	I, F, S	2,720,000
Panaca Valley	Nevada	Meadow Valley Wash	I, F	2,080,000
Moapa Valley	do	Muddy River	I, F, S	1,120,000
Moapa Valley Pumping	do	Lake Mead	I	4,480,000
Marble Canyon-Kanab Creek	Arizona	Colorado River	P, F, S, H	611,200,000
Coconino	do	Little Colorado River	F, S, H	6,400,000
Bridge Canyon	do	Colorado	P, I, F, S, H	234,400,000
Virgin Bay Pumping	Nevada	Lake Mead	I	2,080,000
Las Vegas Pumping	do	do	I, M	13,440,000
Davis Reservoir Pumping	do	Davis Reservoir	I	800,000
Big Bend Pumping	do	Colorado River	I	1,120,000
Fort Mojave	do	do	I	1,280,000
Mojave Valley	Arizona	do	I	3,040,000
Alamo	do	Bill Williams River	F, P, H	5,120,000
Palo Verde Mesa	California	Colorado River	I	4,960,000
Wellton-Mohawk	Arizona	do	I	16,960,000
Sentinel	do	Gila River	F, H	24,000,000
River rectification and control	California, Arizona	Colorado River	F	8,000,000
Central Arizona	Arizona	do	I, F, P, M, U	692,480,000
Salt River				
Paradise Valley				
San Carlos				
Charleston				
Safford Valley				
San Francisco				
Duncan-Virden Valley				
New Mexico				
Chino Valley	do	Granite and Willow Creek	I	240,000
Hassayampa	do	Hassayampa River	I, F	10,640,000
Transmission Grid				288,150,000
Subtotal, Lower Basin				1,989,270,000
Total, Colorado River Basin				3,460,497,200

[1] Symbols used: I = irrigation, F = flood control, P = power, H = hold-over storage for river regulation, S = silt retention, M = municipal, U = underground water recharge, C = channel improvement. In addition many potential reservoirs would have value for recreation and fish and wildlife conservation.
[2] Half the water required for this project would be diverted from the Gunnison River by exchange.

Estimates of the annual benefits from construction of the above potential projects have been made for illustrative purposes to show the probable economic justification of the ultimate comprehensive development. On the basis of average annual benefits and annual costs based on current prices the ratio of benefits to costs is approximately 1.00 to 1.00, which is a conservative estimate.

There are, in addition to the projects listed in the foregoing table, six existing Indian projects which now have an irrigated area of 2,470 acres. It is planned to enlarge these projects (Fort Mojave, Havasupai, Hualapai, Hopi, Moapa, and Uncompahgre) by an additional irrigable area of 30,200 acres which, when completed, could cause an estimated depletion of 73,000 acre-feet annually.

Sufficient data concerning these projects were not available to warrant their inclusion in the table, but their depletions, which represent less than one-half of one percent of the total depletions, should be considered in any allocation of water.

The Geological Survey has broad programs of geologic investigations and topographic mapping in the basin similar to those outlined to obtain basic hydrological facts which will contribute importantly to sound economic development. These surveys and investigations should be prosecuted actively so that data secured will be representative and adequate for the needs of planning and development.

The report is submitted to you pursuant to section 9 of the Reclamation Project Act of 1939 (53 Stat. 1187) and pursuant to section 15 of the Boulder Canyon Project Act (45 Stat. 1057). Upon clearance with the affected States and with the Secretary of War, copies of the report, together with comments, if any, of the affected States, and of the Secretary of War, will be submitted for your transmittal to the President and, subsequently, to the Congress.

I recommend that you adopt this report as your proposed report and that you authorize me, in your behalf, to transmit copies of this letter and of the attached proposed report to the affected States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and to the Secretary of War in accordance with the requirements of section 1 of the act of December 22, 1944 (58 Stat. 887).

Respectfully,

WILLIAM E. WARNE,
Acting Commissioner.

Approved: June 7, 1946.

OSCAR L. CHAPMAN,
Acting Secretary of the Interior.

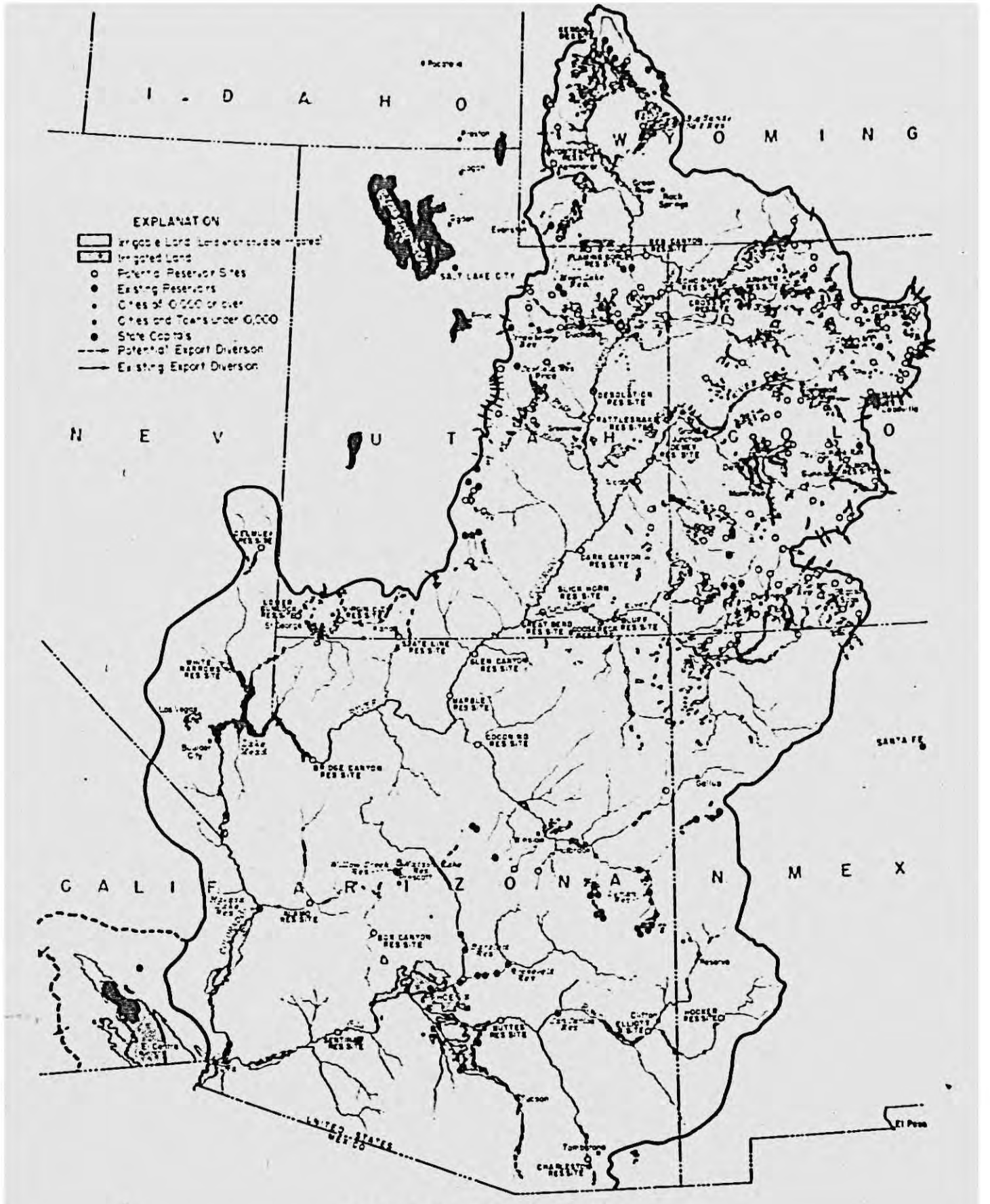
Regional Directors' Report

"There is not enough water available in the Colorado River system for full expansion of existing and authorized projects and for all the potential projects outlined in the report . . . [*Therefore . . . it is recommended*]

. . . "That the States of the Colorado River Basin, acting separately or jointly, recommend for construction, as the next stage of development, a group of projects, the stream flow depletions of which will assuredly fall within ultimate allocations of Colorado River water which may be made to the individual States.

. . . "That the States of the Colorado River Basin determine their respective rights to deplete the flow of the Colorado River consistent with the Colorado River Compact . . . .

"In the Colorado River Basin arable land without water is worth $1 to $5 an acre. Improved and irrigated it would be worth $75 to $300 an acre. The reclaiming of 1,500,000 acres would probably add more than one-quarter billion dollars to taxable values and supplemental water for 1,100,000 acres would further expand the tax base from 50 to 100 million dollars."



COLORADO RIVER BASIN

Regional Directors' Report

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MARCH 22, 1946.

From: Regional Director, Region III, Boulder City, Nevada.
Regional Director, Region IV, Salt Lake City, Utah.

To: The Commissioner, Bureau of Reclamation.

Subject: A comprehensive report on the development of the water resources of the Colorado River Basin in Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

1. This letter is a report in brief form on the development of the water resources of the Colorado River Basin, which lies within the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The substantiating material on which the report is based has been prepared as a presentation of the Department of the Interior, sponsored and coordinated by the Bureau of Reclamation. That material is attached.

Scope and Purpose

2. In order to show how the people in the basin and in the Nation can best be benefited by further development of the water resources of the basin, the report includes a description of the basin's resources, its needs and problems, and its present and potential development. Some 134 projects or units of projects are listed as possibilities for future development of the water resources within the natural drainage basin of the Colorado River. Estimates of costs, benefits, possible reimbursability and depletory effect on stream flow of these developments are presented. The report also discusses present and potential projects for the export of water from the Colorado River Basin to adjacent basins, but no estimates of construction costs, benefits, or reimbursability are presented. Because of the limited water supply all of the potential projects cannot be constructed and all of the existing and authorized projects expanded to the possible extent of their ultimate potentialities. The potential within-basin projects as a group are an index of the over-all results and benefits to be expected from the development of all the water resources of the basin. This report, with its substantiating material, provides a basin-wide perspective for planning development on a sound basis. It is intended to serve as a medium through which the Congress may be apprised of the potentialities for the development of the basin's water resources and as a guide in the selection of projects that ultimately will comprise the comprehensive plan for the utilization of the waters of the Colorado River system for irrigation, electrical power, and other purposes.

Authority for the Report

3. This report is authorized to be made by virtue of the Reclamation Act of June 17, 1902 (32 Stat. 388) and acts amendatory thereof or supplementary thereto, particularly the Boulder Canyon Project Act (45 Stat. 1057) and the Boulder Canyon Project Adjustment Act (54 Stat. 774).

Cooperation and Acknowledgments

4. The preparation of the report has been a joint effort of numerous Federal, State, and local governmental agencies, all looking toward the formulation of a comprehensive plan of ultimate development of the basin's water resources. The Geological Survey, National Park Service, Fish and Wildlife Service, Grazing Service, Bureau of Mines, Office of Indian Affairs, General Land Office, and Bureau of Reclamation, all within the Department of the Interior; the Federal Power Commission; and the Forest Service of the Department of Agriculture have prepared reports which are appended hereto as substantiating material. The experience and data files of the Corps of Engineers, War Department, and of the Soil Conserva-

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tion Service and Bureau of Plant Industry, Department of Agriculture, have been drawn on heavily through consultation with their personnel and free use of their publications.

5. The States of the basin have contributed materially to the report, formally through the Committees of Fourteen and Sixteen, which reviewed critically and constructively the initial draft of the substantiating material upon which this report is based, and less formally, but most usefully, through free access to their data and ready consultative services of their engineering and administrative personnel. The helpful services of many local governmental and private agencies, too numerous to be listed here, are gratefully acknowledged.

Description of Area

6. The Colorado River rises in the Rocky Mountains of Colorado and Wyoming, flows southwest about 1,400 miles and enters the Gulf of California. It drains an area of 242,000 square miles in this country—one-twelfth of the area of continental United States. The Salton Sea Basin in southeastern California, which includes the Coachella and Imperial Valleys, is discussed in this report because of its intimate relationship to the Colorado River.

7. In its course from the high peaks of the Rocky Mountains, the Colorado River traverses the mountain valleys of Colorado and Wyoming; flows through spectacular canyons, of which the Grand Canyon of the Colorado is the outstanding example, in southeastern Utah and northern Arizona; and finally, below Lake Mead, it courses through broad, alluvial valleys interspersed with mountain chains.

8. Climatologically, the basin has the extremes of year-round snow cover and heavy precipitation on the high peaks of the Rockies and truly desert conditions, in which precipitation is a rarity, in the Yuma area. Temperatures range from the temperate, affording only a 90-day growing season in the high mountain meadows of Colorado and Wyoming, to the semitropical with year-round cropping in the Yuma-Phoenix area. Developments by man within the basin are likewise startling in contrast, ranging from none in the remote plateaus of southeastern Utah and northern Arizona, inaccessible by highway or railroad and seen only by an occasional sheepherder, to the intensely developed suburban and agricultural areas surrounding Phoenix and Yuma and within the Imperial Valley.

9. The basin is important in the Nation's economy. Agricultural products include cattle and sheep from the vast range areas and the irrigated hay meadows of Wyoming, Colorado, New Mexico, Utah, and Arizona; temperate-climate fruits from Colorado; and citrus fruits, winter vegetables, livestock, and hay from the Phoenix-Yuma and Imperial Valley areas. There are now under irrigation 2,260,000 acres in the Colorado River watershed and an additional 416,000 acres are irrigated with Colorado River water in the Salton Sea Basin of southern California. In addition to the water used for this irrigation, 184,000 acre-feet annually are being exported to other adjacent stream basins in Colorado and Utah to supply requirements for irrigation, power, and domestic and municipal purposes, and 63,000 acre-feet were exported in 1945 to serve the Metropolitan Water District of Southern California.

10. Enormous beds of bituminous and subbituminous coal within the basin in eastern Utah, southern Wyoming, and western Colorado are estimated to contain nearly one-fourth of all the coal reserves in the United States. Mines in these areas now supply most of the coal requirements in the Rocky Mountain and Pacific Coast areas, including transcontinental railroads and the Utah and California steel industries. Vast deposits of oil shale and bituminous sandstone are undeveloped but, with coal, are becoming increasingly important as petroleum reserves approach exhaustion. Natural gas from basin fields in Wyoming, Colorado, and New Mexico supplies local needs and is piped to industrial areas outside the basin. Mines in Utah and Colorado are the leading domestic source of vanadium, uranium, radium, and molybdenum. Since 1910, Arizona has consistently led all States in copper production through mines and ore reduction mills within the basin. Gold and silver and several other metals, largely byproducts of copper mining, are mined in important quantities. Great beds of thinly-covered phosphate rock centering around the corner common to Utah, Wyoming, and Colorado provide a basis for a potential fertilizer industry.

11. Present development of hydroelectric power also presents a contrast as between areas in the basin. In the upper basin, that is, the basin above Lee Ferry, Arizona, only about 60,000 kilowatts of hydroelectric power have been developed. In the lower basin, on the other hand, the Boulder and Parker Dam power plants, those on the Salt River near Phoenix, and other lesser hydroelectric developments have an aggregate installed capacity of 1,258,000 kilowatts—roughly 50 percent of the dependable capacity available to the southern California-Arizona area. In 1945 Boulder and Parker Dam power plants alone produced 6.1 billion kilowatt-hours—about 60 percent of the energy consumed in that area. Further installation of 580,000 kilowatts of hydroelectric power is authorized or definitely planned.

12. The basin is important to the Nation from a recreational standpoint. Rocky Mountain, Mesa Verde, Bryce Canyon, Zion, and Grand Canyon National Parks, many National monuments, and the Boulder Dam National Recreational area lie wholly or partly within the

basin. These areas formally withdrawn for recreational purposes, together with the mountain streams and their unmatched trout fishing, the big game hunting, the Indian reservations, and the painted deserts of northern Arizona make the basin a National playground.

13. The construction of Boulder Dam by the Bureau of Reclamation was a great step in the control and development of the Colorado River. It has changed the character of a 565-mile section of the river from Grand Canyon to the Gulf of California. The dam controls destructive floods that formerly harassed farms and communities far downstream, and releases a controlled stream as needed for power development and municipal purposes and to irrigate lands in the lower Colorado River, Imperial, and Coachella Valleys. As a result of construction of Boulder Dam the domestic water supply of 14 cities 250 miles west of the Colorado River in the vicinity of Los Angeles is being augmented through the Colorado River Aqueduct of the Metropolitan Water District of Southern California. A new recreational area that attracts more than half a million people a year has been created by the dam and Lake Mead in an area formerly forbidding and unvisited. The lake is stocked with fish and has become one of the important features in the migration flyways for wild waterfowl. Power from Boulder Dam has made possible the vast industrial expansion of the Pacific Southwest, including the great shipyards, aircraft factories, and light metal refineries that helped so much to shorten the war.

Problems of the Basin

14. Substantial as is the contribution of the basin to the National economy, a much greater contribution can be made when its existing problems are eliminated and its potentialities developed. The basin's 900,000 people are less than one percent of the Nation's total but they occupy eight percent of the country's land area. Paradoxically, however, population pressure in parts of the basin forces young people to migrate elsewhere for opportunities. In this arid and semiarid area optimum use of the vast land resources is dependent on water being available for irrigation. Crop production without irrigation is possible in only a few areas and is of negligible importance. A stabilized and increased irrigation supply would permit a shift to more intensive types of farming in some sections thus providing agricultural opportunities for more people. The practical limit of water resources development by private enterprise has been reached. Development of the vast mineral resources is awaiting the low-cost power that can be generated at multipurpose dams which will serve also for irrigation and flood and silt control. The recreational resources—no inconsiderable asset—will be further realized as the basin's other resources and attendant community improvements are developed.

15. More specifically, inability to produce sufficient hay to winter-feed livestock has prevented optimum use of the fine range land of Wyoming, Colorado, and northern Utah; and lack of winter feed in southern Utah, New Mexico, and Arizona has forced use of the range the greater part of the year, possible because of the milder climate, and vast areas have been overgrazed with attendant erosion and destruction of national import.

16. Intensive irrigation farming is carried out in various parts of the upper basin, notably in the Grand Valley area in Colorado and the Uinta Basin in Utah. Several Federal Reclamation projects provide a fairly adequate irrigation supply in some areas but construction of additional projects is needed to supplement irrigation supplies for inadequately irrigated lands, permit more lands to be irrigated, and provide for substantial improvement in domestic water facilities.

17. Examples of lack of developed land and water resources to sustain existing communities are found in the Virgin River and Little Colorado River Basins. In the Virgin River Basin, somewhat isolated commercially and dependent almost exclusively upon an agricultural economy, the average area per irrigated farm is about 30 acres. To supplement his income the farmer has been forced to overstock the range, with the result that it has become denuded. Economic distress in the midst of undeveloped land and water resources prevails. The same conditions hold in the Little Colorado River Basin.

18. Population pressure, with its attendant demand for farm homes, has resulted in an overdevelopment of the water resources of the Phoenix area. Irrigators first relied on surface waters of the Gila and Salt Rivers, but expansion of irrigated areas led next to pumping of ground waters for purposes of drainage, and finally to overdraft of the ground water supply for irrigation. Ground water levels are being continually lowered, and pumping lifts already have become so great that substantial acreages in this very rich valley have been abandoned. Ultimate abandonment of as much as 200,000 acres is indicated unless a new supply of irrigation water is brought into the area.

19. Only by substantial drafts on Lake Mead storage has the southern California-southern Arizona power market area been able to meet its electric energy requirements during the war years immediately past. Normal load growth will require that this area, its oil and natural gas fuel supplies being seriously depleted, look to further hydroelectric power development on the lower Colorado River. Likewise expanding power loads in Utah, Colorado, and Wyoming focus attention on hydroelectric power possibilities in the upper basin. War emergency construction with the installation of 100,000 kilowatts of steam generating capacity in the Salt Lake City area

was necessary despite the importation to that area of a substantial amount of energy from Idaho and Montana.

20. The Colorado River carries a tremendous volume of silt, depositing annually approximately 137,000 acre-feet into Lake Mead. The silt discharge of the river does not portend immediate serious effect on the useful life of Lake Mead, a tremendous reservoir, but the service of this reservoir would be prolonged with upstream silt control. The small potential reservoirs at Bridge Canyon and Marble Canyon immediately upstream from Lake Mead would retain most of the silt now carried into Lake Mead but would soon be filled. Dams on heavy silt-carrying tributaries above these sites for the control of floods and silt, aided by proper watershed management, would do much to prevent impairment of the value of these main-stream reservoirs for river regulation and power development.

21. The Colorado River has always been an unstable stream through the alluvial plains and its delta area below the site of Boulder Dam. Recent rising of the river bed from silt deposition in the Needles-Topock area has required continuous raising of levees to prevent destructive flooding. In building its delta, the river has placed itself on a ridge, building it ever higher and continually threatening to break through protective works. In 1905 the river broke through and flooded the Imperial Valley, vastly enlarging the Salton Sea, and substantially damaging irrigation works, agricultural lands and improvements, and the roadbed of the Southern Pacific Railroad Co. before it was turned back into its channel in 1907. With desiltation of the river at Lake Mead, the channel downstream is undergoing a change in adjusting to the new regime. For the first 88 miles below Lake Mead the channel has been progressively lowered with most of the material being deposited in the 32-mile stretch next downstream. Control of the river channel below Boulder Dam is an important and difficult problem which will require attention for many years.

22. Although Boulder Dam provides full flood control of the Colorado River at Black Canyon, the area below is still subject to floods of lesser degree originating in the watershed areas of the Colorado, Gila, and Bill Williams Rivers below Boulder Dam. Above the dam there are no flood-control structures of significance to the river system as a whole. Local damage occurs frequently along tributary streams. For hundreds of miles above Boulder Dam the river and the lower stretches of its tributaries are confined in deep and barren canyons where floods can do no damage, but it is from these regions that most of the silt is carried into the river.

23. Flows of most tributary streams from which irrigation diversions are made recede in late summer to such an extent that crops suffer seriously from lack of water. Numerous reservoirs are needed to store flood flows for release as required for irrigation. The construction of Boulder Dam temporarily has solved the water-supply problem for main-stem diversion in the lower basin, but as expanding uses in all parts of the basin deplete available supplies, additional main-stream storage reservoirs will be necessary for the holding of water from wet to dry years and to permit it to be metered out to the manifold interests having rights in the stream. Dams built primarily for river regulation could serve also for power production, flood control, silt retention, fish and wildlife propagation, recreation, and other purposes.

24. The treaty between the United States and Mexico, which became effective on November 8, 1945, requires construction of Davis Dam (already authorized) by the United States within 5 years of that date, and necessitates certain facilities and arrangements for delivery of water to Mexico.

25. Numerous small projects now divert water from the Upper Colorado River Basin and convey it by tunnels or transmountain canals to adjoining watersheds for irrigation, domestic use, and power production. About 184,000 acre-feet are now being exported each year. The Colorado-Big Thompson project in Colorado and the Duchesne Tunnel of the Provo River project in Utah, both under construction by the Bureau of Reclamation, together with possible expansion under existing projects will provide for the exportation of an additional 474,000 acre-feet from the upper basin. There is a growing demand for more water from the Colorado River from water users in the adjacent North Platte, South Platte, Arkansas, Rio Grande, and Bonneville Basins. An ultimate diversion of 3,380,000 acre-feet annually from the upper basin is physically possible apparently at reasonable cost but the exportation of this amount would substantially limit potential within-basin uses.

26. The All-American Canal and the Colorado River Aqueduct are now exporting about 2,500,000 acre-feet of water from the Lower Colorado River for use in California. Potential expansion of these diversions to 5,300,000 acre-feet is possible but would likewise conflict with potential uses within the basin.

27. These major problems and others of smaller degree but nonetheless important to the economy of the basin and the Nation have prompted the preparation of this report.

Water Supply

28. In its virgin condition, before diversions were made by man, the Colorado River is estimated to have carried an average of 17,720,000 acre-feet of water annually across the International Boundary into Mexico. The annual flow varied from about 5,000,000 acre-feet to 25,000,000 acre-feet. Under the Mexican Treaty it is estimated that Mexico will receive 1,500,000 acre-feet

annually, leaving for consumption in the United States an average of 16,220,000 acre-feet plus such water as was consumed under virgin conditions by natural losses, preventable in part with full basin development.

29. Present water uses in the United States are estimated to deplete the virgin water supply at the boundary by about 7,120,000 acre-feet annually, leaving an average of about 9,100,000 acre-feet to meet expanding uses under existing or authorized projects and to supply new demands for potential projects within the Colorado River Basin States.

Division of Water

30. The Colorado River Compact, signed at Santa Fe, N. Mex., November 24, 1922, and made effective by subsequent ratification by the seven basin States, and by enactment of the Boulder Canyon Project Act (45 Stat. 1057), apportions the waters of the Colorado River system between the upper basin and the lower basin and provides that the States of the upper division (Colorado, New Mexico, Utah, and Wyoming) will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years. The compact also provides for a division of surplus waters after October 1, 1963. There is no final agreement among the States of the Colorado River Basin as to the amount of Colorado River water to be allocated to individual States nor have all of the States made final allocations of water among projects within their boundaries. There is not complete agreement among the States regarding the interpretation of the compact and its associated documents (the Boulder Canyon Project Act, the California Self-Limitation Act, and the several contracts between the Secretary of the Interior and individual States or agencies within the States for the delivery of water from Lake Mead). This report makes no attempt to interpret the Colorado River Compact or any other acts or contracts relating to the allocation of Colorado River water among the States and among projects within the States.

Future Development of Water Resources

31. Ultimate development of the water resources of the Colorado River will involve the investigation and construction of such projects as will fully utilize for irrigation, power production, flood control, and other beneficial purposes all the water in the Colorado River system available to the United States. Looking toward the formulation of a plan for comprehensive development, this report presents for consideration 134 potential projects or units of projects, mostly multiple purpose, for use of water within the natural drainage basin of the Colorado River. Potential projects for the export of water from the Colorado River Basin to adjacent basins are also discussed. The inventory of potential projects in this report and substantiating material is intended to be of use in the selection of projects which will comprise ultimately the final comprehensive plan. It is not intended that the listing of projects in this report will preclude the consideration of others that additional investigations may show to be desirable. In the formulation of the ultimate plan, however, consideration must also be given the possibilities for expanding projects now existing or authorized. Because of the limited water supply, it is not possible for all the potential projects to be constructed and for all the existing or authorized projects to be expanded to the possible extent of their ultimate potentialities. Each development can deplete the stream flow only insofar as permitted by the Colorado River Compact and other legal limitations. The formulation of an ultimate plan of river development, therefore, will require selection from among the possibilities for expanding existing or authorized projects as well as from among the potential new projects. Before such a selection of projects can be made it will be necessary that the seven Colorado River Basin States agree upon their respective rights to deplete the water supply of the Colorado River or that the courts apportion available water among them. Each State also will need to select from the potential projects within its boundaries those it desires to have constructed to consume its allocation of water. The many decisions and selections to be made require a vast background of factual information. To assist the States in the selection of projects the several agencies which have prepared this report stand ready to make available their consultative services and all information presently at hand. A great amount of engineering and economic investigational work has been required to assemble and evaluate the information from which has been prepared this inventory of potential projects. Detailed information is available for a substantial number of potential developments and only data of a reconnaissance nature for others, but from all the information available it should be possible, prior to a final settlement of water rights, to select a group of projects which are urgently needed, or which will be key units of the comprehensive plan for construction as the next stage of the development.

32. Although there would be enough water in the river system to serve all of the 134 within-basin projects or units of projects if no further exportation of water is made, it may be found more economical and the States may elect to forego construction of some irrigation projects within the natural drainage basin in order to make water available for exportation to adjacent watersheds within the basin States. When final allocations of water are made, moreover, some States may be unable to use their full amount unless part is exported. Power projects

do not consume water except by evaporation from power reservoirs, but most of these reservoirs serve multiple purposes and are required for full river regulation and control.

33. If all the 134 within-basin potential projects or units of projects were constructed, they would deplete the flow of the Colorado River by more than 6,000,000 acre-feet annually. New possibilities exist for the exportation of an additional 3,000,000 acre-feet annually to areas outside the natural drainage basin but within the boundaries of the Colorado River Basin States, as permitted by the Colorado River Compact. If all existing or authorized projects were constructed to the possible extent of their ultimate potentialities, they would increase present depletion by approximately 4,000,000 acre-feet. With present uses depleting the stream by about 7,000,000 acre-feet, the total depletions would aggregate more than 20,000,000 acre-feet, or about 25 percent more than the estimated amount of water available. Predominant among existing or authorized projects which could be further developed are those in the lower basin made possible by the construction of Boulder Dam. Possible future development of these enterprises would increase present river depletions by about 3,600,000 acre-feet annually, of which 2,800,000 acre-feet would be used in California outside the natural drainage basin of the Colorado River and the remainder would be consumed in Arizona or California or lost by reservoir evaporation. In the upper basin completion of existing or authorized transmountain diversion projects would further deplete the river by 474,000 acre-feet annually and expansion of within-basin projects would cause a depletion of 82,000 acre-feet.

34. The depletory effect on stream flow of all within-basin and export diversion projects, including existing or authorized projects and potential projects, is shown in table 1. The depletion shown under existing or authorized projects include present depletions resulting from projects in operation and possible depletions which would result from the extension of existing projects or the construction of authorized projects. Depletions are shown for the 134 potential within-basin projects and for the new export diversion possibilities.

TABLE I.—*Present and potential stream depletions in the Colorado River Basin*

Basin and State	Estimated average annual depletion (acre-feet) [1]			
	Existing or authorized projects		Potential projects	Total ultimate depletion
	Present depletion	Possible increase		
Upper Basin				
Arizona	10,200		39,000	49,200
Colorado	1,231,300	507,000	2,522,000	4,260,300
New Mexico	68,400		450,000	518,400
Utah	515,900	32,000	1,462,700	2,010,600
Wyoming	374,000	17,000	576,000	967,000
Main stem reservoir losses			831,000	831,000
Pasture irrigation	[2]	[2]	500,000	500,000
Subtotal	2,199,800	556,000	6,380,700	9,136,500
Lower Basin				
Arizona	1,407,200	571,000	2,015,400	3,993,600
California	2,680,000	2,946,000	176,000	5,802,000
Nevada	43,800		213,000	256,800
New Mexico	29,000		8,000	37,000
Utah	45,000		56,300	101,300
Main stem reservoir losses	713,000	66,000	91,000	870,000
Subtotal	4,918,000	3,583,000	2,559,700	11,060,700
Total	7,117,800	4,139,000	8,940,400	20,197,200

Average flow available for depletion in the United States, 16,230,000 acre-feet.

[1] Includes both uses within the natural basin and export diversions to adjacent watersheds.
[2] Included in depletions shown by States.

Potential Projects

35. The 134 projects or units of projects included in the inventory of potential projects for development of the water resources of the Colorado River Basin are all located within the natural drainage basin of the Colorado River, 100 in the upper basin and 34 in the lower basin. (See par. 41, table II.) These within-basin potential projects considered as a group indicate in general the ultimate potentialities of future development. For that reason these projects are summarized in the following paragraphs. If similar basin reports for adjoining basins or individual project reports indicate the need and desirability for exporting water from the natural drainage basin for

use within the Colorado Basin States, as permitted by the Colorado River Compact, this would result in a corresponding reduction of within-basin uses. New possibilities for exportation of water to adjoining watersheds, such as the Blue River-South Platte and Gunnison-Arkansas projects in Colorado and the Central Utah project in Utah, are mentioned in the substantiating material but are not tabulated and summarized in the inventory of potential projects presented in this report.

36. If all of these 134 projects or units of projects should be constructed they would benefit 2,656,230 acres of land, 1,734,980 acres in the upper basin and 921,250 acres in the lower basin. Of this total 1,533,960 acres would be new land brought into cultivation, 1,230,810 acres in the upper basin and 303,150 acres in the lower basin, and 1,122,270 acres of inadequately irrigated land would be furnished a supplemental supply, 504,170 acres in the upper basin and 618,100 acres in the lower basin. (See par. 41, table III.) In addition to these lands vast areas of natural pasture lands in the upper basin would produce more abundantly under irrigation. These pasture lands, located mostly on gentle mountain slopes, have not been surveyed and consequently specific projects have not been planned to bring water to them, but in summarizing potentialities for new developments an ultimate river depletion of 500,000 acre-feet annually has been allowed for pasture irrigation.

37. These potential projects include 38 hydroelectric power plants with a total installed capacity of more than 3,500,000 kilowatts. (See par. 41, table IV.) Twenty-nine of the plants would be in the upper basin, mostly on tributary streams. The combined installed capacities of the upper basin plants would total 1,713,000 kilowatts and the annual energy output 9.2 billion kilowatt-hours. This is more than the anticipated requirement for power in the upper basin and would leave some for transmission to adjacent areas. The 9 new plants outlined for the lower basin would have installed capacities totaling 1,945,400 kilowatts and would produce 10.2 billion kilowatt-hours of additional energy a year. This would satisfy all expected demands in the lower basin and the adjacent West coast power market area until 1960, at which time additional power developments would be required to meet growing demands. The potential power output in both the upper and lower basins could be maintained substantially even with full development of the river system for irrigation and other purposes.

38. Potential power and irrigation reservoirs would make a substantial contribution to flood control in the basin, but the extent of that contribution cannot, of course, be determined until the projects to be constructed have been selected. Some of these reservoirs would permit use of a greater part of Lake Mead's capacity for irrigation storage and power production.

39. Reservoirs provided for irrigation, power production, or flood control would have incidental value for fishing, boating, and other recreational purposes. Reservoirs could be operated to maintain or improve the fishing in mountain streams. Specific projects are described which would furnish municipal supplies to Tucson, Ariz., and the Grand Valley area in Colorado. Future water requirements for growing municipalities and industries could be provided as needs arise. Many of the reservoirs would have storage capacity for retention of silt and mitigate that menace for a great many years to come.

40. Construction of all these potential projects for use of water in the natural drainage basin, including transmission grids, is estimated to cost $2,185,442,000 with expenditures divided $930,142,000 in the upper basin and $1,255,300,000 in the lower basin. These preliminary estimates are based on costs as of January 1940.

41. These 134 potential projects or units of projects, together with their locations, sources of water supply, purposes to be served, and estimated construction costs are listed in table II. Potential irrigation and power developments that would result from the construction of these projects are summarized in tables III and IV, respectively.

TABLE II.—*Potential projects in the Colorado River Basin*

Project and unit	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [1]
Upper basin				
Sublette	Wyoming	Green River	I, F, P	$36, 500, 000
West Side	do	do	I, F	
Daniel	do	do	I, F	
Elkhorn	do	do	I, F, P	
Paradise	do	New Fork River	I	
Eden	do	Big Sandy Creek	I	
Lower Big Sandy	do	do	I	
LaBarge	do	LaBarge Creek	I, F	
Fontenelle	do	Fontenelle Creek	I, F	
Seedskadee	do	Green River	I	
Opal	do	Hams Fork	I, F	3, 600, 000
Lyman	do	Blacks Fork, Smiths Fork	I, F	4, 330, 000
Henrys Fork	Wyoming, Utah	Henrys Fork	I, F	1, 470, 000
Flaming Gorge	do	Green River	P, F, H, S	10, 900, 000

See footnotes at end of table.

TABLE II.—*Potential projects in the Colorado River Basin*—Continued

Project and unit	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [1]
Upper basin—Continued				
Red Canyon	Utah	Green River	P, F	$4, 100, 000
Little Snake River	Wyoming, Colorado	Little Snake River tributaries	I, P, F	21, 500, 000
Upper Yampa	Colorado	Yampa River	I, F	2, 300, 000
Wessels	do	do	I, F	1, 100, 000
Mount Harris	do	Tributaries of Yampa River	I, F	3, 300, 000
Great Northern	do	Elkhead Creek and Elk River	I, F	2, 700, 000
Yellow Jacket	do	White River and Milk Creek	I, F	4, 709, 000
Deadman Bench	Colorado, Utah	Yampa River	I, P, F, H, S	23, 800, 000
Maybell	Colorado	do	I	700, 000
Cross Mountain	do	do	P	5, 000, 000
Lily Park	do	do	P, F	1, 900, 000
Josephine Basin	do	do	I	300, 000
Piceance	do	Piceance Creek	I, F	800, 000
Moon Lake Extension	Utah	Duchesne River and tributary	I, F	7, 900, 000
Fruitland	do	Red Creek	I, F	400, 000
Castle Peak	do	Duchesne River	I, F	5, 300, 000
Mosby	do	Deep Creek, Whiterocks River	I, F	1, 100, 000
Vernal	do	Ashley Creek	I, F	1, 500, 000
Jensen	do	Brush Creek	I, F	300, 000
Minnie Maud	do	Minnie Maud Creek	I, F	100, 000
Green River Pumping	do	Green River	I	400, 000
Echo Park	Colorado	do	P, F, H, S	43, 000, 000
Split Mountain	Utah	do	P, F, H, S	23, 000, 000
Emery County	do	Cottonwood Creek	I, F	2, 500, 000
Buckhorn	do	Huntington Creek	I, F	1, 200, 000
Gunnison Valley	do	Green River	I	1, 100, 000
Desolation Canyon	do	do	P, F, H	21, 000, 000
Rattlesnake Power	do	do	P, F, H	23, 000, 000
Troublesome	Colorado	Troublesome Creek	I, F	2, 210, 000
Muddy Creek	do	Muddy Creek	I, F	500, 000
Gore Canyon	do	Colorado River	P	3, 800, 000
Fourmile	do	Fourmile Creek	I, F	600, 000
Cattle Creek	do	Cattle Creek	I, F	430, 000
Capitol Creek	do	Snowmass Creek	I	130, 000
Woody Creek	do	Roaring Fork	I	170, 000
Silt	do	Rifle Creek	I, F	1, 320, 000
West Divide	do	Middle Willow Creek	I, F	1, 300, 000
Hunter Mesa	do	Buzzard Creek	I, F	1, 500, 000
Roan Creek	do	Carr Creek	I, F	610, 000
Collbran	do	Plateau Creek	I, F, M	1, 940, 000
Grand Valley Extension	do	Colorado River	I	415, 000
Cisco-Thompson	Colorado, Utah	do [2]	P, I, F, H, S	34, 240, 000
Tomichi Creek	Colorado	Tomichi Creek	I, F	1, 860, 000
Cochetopa Creek	do	Cochetopa Creek	I, F	1, 150, 000
Ohlo Creek	do	Anthracite and Castle Creeks	I, F	1, 080, 000
Lake Fork	do	Lake Fork	P, F	1, 300, 000
Sapinero	do	Gunnison River	P, F	7, 800, 000
Fruitland Mesa	do	Curecante and Sapinero Creeks	I, F	3, 500, 000
Smith Fork	do	Smith Fork	I, F	2, 200, 000
Paonia	do	East Muddy Creek and North Fork	I, F	1, 400, 000
Minnesota	do	Minnesota Creek	I, F	820, 000
Leroux Creek	do	Leroux Creek	I, F	2, 800, 000
Grand Mesa	do	Currant, Surface, and Tongue Creeks	I, F	1, 920, 000
Ouray	do	Uncompahgre River	P, I, F	4, 100, 000
Redlands	do	Gunnison River	I, F	367, 000
Saucer Valley	do	Disappointment Creek	I, F	940, 000
Nucla	do	Horsefly and Cottonwood Creeks	I, F	1, 500, 000
San Miguel	do	Anderson, Naturita, Dry Creeks, and San Miguel River.	I, F	6, 590, 000
West Paradox	do	West Paradox, Deep, and Geyser Creeks.	I, F	640, 000
Dewey	Utah	Colorado River	P, F, H, S	38, 000, 000
Moab	do	do	P, F, H, S	9, 900, 000
Pack Creek	do	Mill Creek	I, F	775, 000
Hatch Creek	do	Hatch Creek	I, F	400, 000
Dulce-Chama-Navajo	Colorado	Navajo River	I, F	1, 627, 000
South San Juan	New Mexico	San Juan River	I, F	35, 000, 000
Carracas	Colorado	do	I	36, 000
O'Neal Park	do	Piedra River	I	880, 000
Hammond	New Mexico	San Juan River	I	725, 000
Shiprock	do	do	I, F	21, 141, 000
Emerald Lake	Colorado	Pine River	P, F	6, 200, 000
Pine River Extension	Colorado, New Mexico	do	I	1, 835, 000
Florida	Colorado	Florida River	I, F	2, 290, 000

See footnotes at end of table

TABLE II.—*Potential projects in the Colorado River Basin*—Continued

Project and unit	Location of project	Source of water supply	Purpose to be served	Estimated construction cost [1]
Upper basin—Continued				
Animas-La Plata	Colorado, New Mexico	Animas and La Plata Rivers	I, P, F, S	$63, 534, 000
McElmo	Colorado	McElmo Creek	I, F	390, 000
Montezuma Valley Extension	do	Dolores River	I, F	1, 300, 000
Dolores	Colorado, Utah	do	I, F, S	12, 200, 000
Blanding	Utah	Recapture Creek	I, F	567, 000
Navajo Indian Project	Colorado	San Juan River	I, F, S	2, 910, 000
Bluff	Utah	do	P, F	19, 000, 000
Gooseneeks	do	do	P, S, F, H	5, 200, 000
Slick Horn Canyon	do	do	P, S, F, H	6, 300, 000
Great Bend	do	do	P, S, F, H	10, 000, 000
Fremont	do	Fremont River	I, F	800, 000
Torrey	do	do	I, F	200, 000
Escalante	do	Escalante River	I, F	900, 000
Dark Canyon	do	Colorado River	P, F, S, H	105, 000, 000
Glen Canyon	Arizona	do	P, F, S, H	64, 000, 000
Transmission Grid				170, 000, 000
Subtotal, upper basin				930, 142, 000
Lower basin				
Snowflake	Arizona	Showlow and Silver Creeks	I, F, S	$2, 600, 000
Black Creek	do	Black Creek	I, F, S	1, 800, 000
Holbrook	do	Little Colorado River	I, F, S, C	1, 300, 000
Winslow	do	Clear and Chevelon Creeks	I, F, S	19, 000, 000
Kanab Creek	do	Kanab Creek	I	200, 000
Hurricane	Utah, Arizona	Virgin River	I, P, S, F	9, 200, 000
Santa Clara	Utah	Santa Clara River	I, F, S	1, 700, 000
Panaca Valley	Nevada	Meadow Valley Wash	I, F	1, 300, 000
Moapa Valley	do	Muddy River	I, F, S	700, 000
Moapa Valley Pumping	do	Lake Mead	I	2, 800, 000
Marble Canyon-Kanab Creek	Arizona	Colorado River	P, F, S, H	382, 000, 000
Coconino	do	Little Colorado River	F, S, H	4, 000, 000
Bridge Canyon	do	Colorado	P, I, F, S, H	146, 500, 000
Virgin Bay Pumping	Nevada	Lake Mead	I	1, 300, 000
Las Vegas Pumping	do	do	I, M	8, 400, 000
Davis Reservoir Pumping	do	Davis Reservoir	I	500, 000
Big Bend Pumping	do	Colorado River	I	700, 000
Fort Mojave	do	do	I	800, 000
Mojave Valley	Arizona	do	I	1, 900, 000
Alamo	do	Bill Williams River	F, P, H	3, 200, 000
Palo Verde Mesa	California	Colorado River	I	3, 100, 000
Wellton-Mohawk	Arizona	do	I	10, 600, 000
Sentinel	do	Gila River	F, H	15, 000, 000
River rectification and control	California-Arizona	Colorado River	F	5, 000, 000
Central Arizona:	Arizona	do	I, F, P, M, U	132, 800, 000
Salt River.				
Paradise Valley.				
San Carlos.				
Charleston.				
Safford Valley.				
San Francisco.				
Duncan-Virden Valley.				
New Mexico.				
Chino Valley	do	Granite and Willow Creeks	I	150, 000
Hassayampa	do	Hassayampa River	I, F	6, 650, 000
Transmission Grid				192, 100, 000
Subtotal, lower basin				1, 255, 300, 000
Total, Colorado River Basin				2, 185, 442, 000

[1] Symbols used: I=irrigation; F=flood control; P=power; H=hold-over storage for river regulation; S=silt retention; M=municipal; U=underground water recharge; C=channel improvement. In addition many potential reservoirs would have value for recreation and fish and wildlife conservation.

[2] Preliminary estimates based on construction costs Jan. 1, 1940.

[3] Half the water required for this project would be diverted from the Gunnison River by exchange.

TABLE III.—*Potential irrigation development in the Colorado River Basin*

Basin and State	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total
Upper basin			
Arizona	18, 680	6, 000	24, 680
Colorado	444, 060	226, 550	670, 610
New Mexico	224, 960	15, 100	240, 060
Utah	251, 780	161, 160	412, 940
Wyoming	291, 330	95, 360	386, 690
Subtotal, upper basin	1, 230, 810	504, 170	1, 734, 980
Lower basin			
Arizona	229, 050	594, 600	823, 650
California	16, 000	0	16, 000
Nevada	13, 100	4, 500	17, 600
New Mexico	2, 000	10, 800	12, 800
Utah	13, 000	8, 200	21, 200
Subtotal, lower basin	303, 150	618, 100	921, 250
Total, Colorado River Basin	1, 533, 960	1, 122, 270	2, 656, 230

TABLE IV.—*Potential power development in the Colorado River Basin*

Basin and State	Power plant installed capacity (kilowatts)	Annual Firm generation (kilowatt-hours)
Upper basin		
Arizona	100, 000	2, 188, 000, 000
Colorado	325, 500	1, 661, 000, 000
New Mexico		
Utah	986, 000	5, 383, 000, 000
Wyoming	1, 500	9, 000, 000
Subtotal, upper basin	1, 713, 000	9, 241, 000, 000
Lower basin		
Arizona	1, 937, 800	10, 182, 000, 000
California		
Nevada		
New Mexico	3, 000	8, 000, 000
Utah	4, 600	15, 000, 000
Subtotal, lower basin	1, 945, 400	10, 205, 000, 000
Total, Colorado River Basin	3, 658, 400	19, 446, 000, 000

[1] Net firm generation, exclusive of replacement power.

Summary of Annual Benefits and Costs of Potential Projects

42. A definite analysis of basin-wide development of water resources cannot be presented until a final selection of projects has been made. The following estimates and approximations are based on development of all potential within-basin projects summarized in the report. This analysis is presented to indicate the economic feasibility of a comprehensive plan for ultimate development of the water resources of the basin. All projects are considered integral units of a basin plan and as such their economic feasibility is comprehended by the finding of feasibility for the over-all basin plan. To accommodate ultimate development to the available water supply, those projects which further investigations show to be the less desirable will be eliminated from the ultimate plan. If some States elect to use part of the water to which they are entitled in out-basin or export diversion projects, a corresponding elimination of within-basin projects will be necessary. The ultimate effect of this selective process undoubtedly will be an even more favorable showing of economic justification for the over-all basin development.

43. It is expected that an allocation of costs as provided in section 9 of the Reclamation Project Act of 1939, and acts amendatory thereof or supplementary thereto, would result in an equitable and appropriate distribution of allocable costs among the purposes to be served.

44. Estimates of benefits from irrigation, power production, municipal water supplies, and flood control are summarized in the following table. The increase in gross crop income is taken as the measure of the benefits from irrigation. For the purpose of illustration, power benefits are determined as the gross income from the sale of electric energy at an assumed rate of four mills a kilowatt-hour, delivered at load centers. Returns from the sale of water for municipal purposes are not subject to a precise analysis but a gross annual return of $500,000 is assumed as a measure of the municipal benefits. Flood control benefits resulting from the construction of numerous dams and other structures are measured by the decrease in average annual flood damages along the Colorado River and its tributaries. These benefits indicate that a basin-wide plan for full development of the water resources could return to the Nation $1.30 for each dollar required to construct, maintain and operate the projects.

Annual benefits	
Irrigation benefits	$65, 000, 000
Power benefits	72, 000, 000
Flood control benefits	1, 000, 000
Municipal benefits	500, 000
Total measurable annual benefits	138, 500, 000
Annual costs	
Operation and maintenance	23, 000, 000
Amortization of construction cost ($2,185,442,000) in 50 years at 3 percent	85, 000, 000
Total annual costs	108, 000, 000
Ratio of benefits to costs	
Ratio of annual benefits to annual costs	1.3:1

Extended Benefits to the West and to the Nation

45. The beneficial effect of complete control and utilization of waters of the Colorado River would be far-

reaching. Some benefits are tangible and are subject to measurement in monetary terms with a considerable degree of accuracy while others are less tangible and are not subject to accurate measurement. For example, a stable agriculture and abundant low-cost power together provide a sound basis for industrial and commercial expansion and thus are important to the region and the Nation but are not readily susceptible of dollar evaluation. Still other values would grow from better control of silt in the stream channels, from improved conditions for fish and wildlife, and from the enhancement of recreational facilities. A few of these less tangible benefits to the West and to the Nation are cited in the following paragraphs.

46. In the Colorado River Basin arable land without water is worth $1 to $5 an acre. Improved and irrigated it would be worth $75 to $300 an acre. The reclaiming of 1,500,000 acres would probably add more than one-quarter billion dollars to taxable values and supplemental water for 1,100,000 acres would further expand the tax base from 50 to 100 million dollars. This would provide increased return to State and local taxing institutions thus permitting improvements in the various services necessary to the welfare of the people. Increased earnings would also reflect favorably on income-tax receipts.

47. An increase in gross crop income estimated at $65,000,000 a year at prewar prices would in substantial measure represent feed for livestock. Conversion of these crops to beef, mutton, hides, wool, poultry, and dairy products would result in a much higher gross farm income. The increased revenue to the farmers would be spent in part for domestic and professional services, for common and skilled labor, for transportation and utilities, and for processing and packing. The thousands of farm families and an appreciably greater number who will provide services for the people will have increased purchasing power for services and commodities provided from nearly all parts of the Nation.

48. The availability of an abundance of low-cost electric power would stimulate industry in the entire power market area and, like expanded irrigation, would result in the creation of new taxable values, new opportunities, and increased purchasing and consuming power. Electricity could partially replace the West's diminishing oil reserves as a source of fuel and energy in homes, factories, and railroads. It would stimulate further the extraction and processing of the Colorado River Basin's vast mineral resources including metals, fertilizers, and the coal and shale which in the not-far-distant future may replace petroleum as the Nation's major source of oil and gasoline.

49. Increased production of food and fiber on basin farms would help to meet the increased demands of a growing Nation. The livestock and livestock products, citrus and other fruits, vegetables, seeds, sorghums and other agricultural produce from Colorado River Basin farms as a rule are not produced in this country in sufficient quantities to satisfy domestic needs. Foods produced in the basin are predominantly of a variety needed to improve the national diet and assure good health. The crops are supplemental to, rather than competitive with, crops produced on agricultural lands of other sections of the country. Full development of the water resources of the Colorado River will actually increase the demand for the products of farms in the great midwestern and southern farm belts.

50. Reservoirs will add scenic beauty and have recreational value. They will become the habitat of fish and wildlife. By affording control of stream flows they can be operated to improve fishing in the Colorado River and its numerous tributaries. Improved roads constructed to remote reservoirs, power plants, or tunnel portals will make accessible great scenic wonders, fishing spots, and hunting areas not now reached by modern travel.

51. Construction of the many projects would provide widespread employment. Less than half of the amount spent for labor would go to workers at project sites and the remainder to workers at producing centers, principally east of the irrigation States. As the projects are placed in operation many thousands of people will find employment opportunities in agriculture, industry, and the numerous associated and dependent enterprises that will be expanded or created as a result of these developments.

52. The Nation will more nearly approach economic self-sufficiency in the production of food and in the mining and processing of minerals. Vast facilities for increasing the national strength with food, power, industry, and mineral development, constructed in times when labor and materials are abundant, will stand ready to produce with a minimum expenditure of effort in time of war.

Reimbursement and Flood Control Allocation

53. The total estimated construction cost of all the potential within-basin projects outlined in this report is $2,185,442,000, based on January 1940 prices. Cost allocations to some benefits of a public character cannot appropriately be considered repayable by the water users under reclamation laws. Of the total cost, it is estimated that an allocation of $25,000,000 may reasonably be made to flood control. It is further estimated that gross revenues collectible from irrigators, power users, and municipalities will amount to $57,500,000 annually in excess of costs for operation and maintenance. The latter sum could be applied toward repayment of those reimbursable costs resulting from the allocations made to the various benefits.

Construction Program

54. There is need for proceeding at an early date with the construction of certain of the potential projects. In areas such as would be served by the Animas-LaPlata, Hurricane, and Snowflake projects, existing distress resulting from the lack of opportunities in irrigated agriculture should be relieved as promptly as practicable. The power markets of southern California and southern Arizona will shortly require the construction of a major hydroelectric development on the lower river; similarly, the load growth in Utah and western Colorado will require construction of power developments in the upper basin. An existing economy in the Salt and Gila River Valleys in central Arizona is threatened with serious losses through overdraft of its water supply from underground sources. Key developments necessary in many instances before lesser developments can proceed, should be constructed at an early date in order that those dependent projects may follow in logical order and basin-wide development be undertaken in stages.

55. To activate a construction program, it is suggested that the affected States decide from among the known potentialities which projects they desire to have the Bureau of Reclamation consider for construction and that such projects as are selected for construction comprise the next stage of development. The economic feasibility of the group of projects included in this next stage of development would be comprehended in the finding of feasibility for the over-all ultimate development of the basin. The group of projects should include those for which there is an immediate need and for which adequate water rights consistent with the Colorado River Compact and its associated and dependent documents are assured. As has been stated, the agencies which have prepared this report stand ready with their consultative services to assist the States in this selective process. When the next stage of development has been decided upon, it may be presented to the Congress as a program for authorization of construction.

Related Investigations

56. Various Federal agencies having an interest in development of resources in the basin have collaborated in the preparation of this report. These agencies have cooperated to the extent of funds and personnel available, and their specific comments are found in chapter VIII of the substantiating material attached,

57. The Geological Survey has furnished basic data on stream flow, ground-water supplies, quality of water, water utilization, minerals, and mapping. In order to obtain additional basic facts related to both surface water and ground water of the Colorado River Basin, the Geological Survey has outlined a 3-year investigational program estimated to cost about $650,000 a year. The basic water facts obtained by the Geological Survey are needed for use not only in the design, construction, and operation of potential projects but also in the planning, construction, operation, and administration of other structures, present and future, involving the use of water in the basin. Surveys and investigations should be prosecuted actively so that data secured will be continuous and representative.

58. The National Park Service has surveyed the recreational possibilities of the potential projects and has made a number of specific recommendations which will enhance their recreational value. The Bureau of Reclamation concurs in the objectives of these proposals. The National Park Service, however, questions the advisability of the Moab power project on the ground that it "would inundate the lower slopes and bottom of an unusually scenic canyon and eliminate the existing road which runs through the canyon between Moab and Dewey, Utah." A road could be constructed along the edge of the reservoir, and in all probability this would add to the scenic attractions of the canyon. Such differences do not represent conflicts between the purposes of these agencies both of which desire to secure maximum over-all benefits for the people of the basin.

59. The Fish and Wildlife Service has made preliminary studies of the potential projects reported herein and has made a number of specific recommendations which will assure the restoration and conservation of fish and wildlife resources. The Bureau of Reclamation concurs in principle with these recommendations. Owing to very limited stream flows which prevail during dry years, however, it would be impracticable to maintain the minimum releases of water which are desired. As detailed project plans are prepared, the interest of the Fish and Wildlife Service can be correlated into a unified program. In order to provide the increased fish stocking required for the new reservoirs the Fish and Wildlife Service should develop and expand its present facilities at Springville, Utah, construct a new combination trout-bass fisheries station near Page Springs in Oak Creek Canyon, about 40 miles south of Flagstaff, Ariz., and supplement the facilities of this new hatchery by further developing the Williams Station for necessary incubation of trout eggs, as recommended in its report.

60. The Grazing Service has outlined the objectives of its range improvement program and the benefits that will result from potential projects in stabilization of the livestock industry and conservation of natural resources. Results of the proposed Reclamation program in the Colorado River Basin will be favorable from a Grazing Service viewpoint.

61. The Bureau of Mines has probed the minerals of the basin to discover how they might best be mined, proc-

essed, and utilized to support the metallurgical and industrial economy that is envisioned. "The mineral industries in the Colorado River Basin constitute one of the most obvious outlets for power generated at multiple-purpose dams."

62. The Office of Indian Affairs has outlined projects that will benefit the Indians of the basin.

63. The General Land Office, which administers about 6 million acres of public land in the Colorado River Basin, has outlined a program to obtain optimum use of these public lands and to coordiate their utilization with the development of water resources.

64. The Forest Service has emphasized the need for careful management of water on the national forest lands to insure adequate safeguarding of the water yields.

65. The Federal Power Commission has furnished data upon which power utilization and market trends are based and has commented generally on the power resources of the basin.

66. The interest and cooperation of State and local groups, as well as other Federal agencies in the basin, are reflected throughout the report.

Conclusions

67. Future development of the water resources of the Colorado River Basin is needed to relieve economic distress in local areas, to stabilize highly developed agricultural areas, and to create opportunities for agricultural and industrial growth and expansion throughout the Colorado River Basin. Such development should be comprehended in a basin-wide plan for ultimate development of all water resources of the basin. The potential projects outlined in this report will form the basis for future detailed investigations and the selection and construction of sound projects. Considered as a group, these projects are an index of the over-all results and benefits to be expected from the development and utilization of all the available waters of the Colorado River system. They indicate also the engineering feasibility and economic justification of an over-all plan for basin development. Planning has progressed sufficiently to make possible a selection from among the potentialities of a group of projects to comprise a construction program for the next stage of basin development. These projects should be key features of or should fit into the final comprehensive plan to be developed through continued investigations and planning.

68. There is not enough water available in the Colorado River system for full expansion of existing and authorized projects and for all potential projects outlined in the report, including the new possibilities for exporting water to adjacent watersheds. The need for a determination of the rights of the respective States to deplete the flow of the Colorado River consistent with the Colorado River Compact and its associated documents therefore is most pressing.

69. It is concluded that future development of the water resources of the Colorado River Basin would benefit the National and local economies and a plan for development of all the water resources of the basin should therefore be effectuated, that the selection of a group of projects comprising the next stage of development would represent a logical step in effecting that plan, and that detailed investigations to develop the succeeding stages should be continued.

Recommendations

70. The following recommendations are made in view of the fact that there is not enough water available in the Colorado River system to permit construction of all the potential projects outlined in the report and for full expansion of existing and authorized projects, and that there has not been a final determination of the respective rights of the Colorado River Basin States to deplete the flow of the Colorado River:

(1) That the States of the Colorado River Basin, acting separately or jointly, recommend for construction, as the next stage of development, a group of projects, the stream-flow depletions of which will assuredly fall within ultimate allocations of Colorado River water which may be made to the individual States.

(2) That the States of the Colorado River Basin determine their respective rights to deplete the flow of the Colorado River consistent with the Colorado River Compact.

(3) That additional investigations, summarized below, and appropriations to the Department of the Interior for use by the various agencies within that Department for these investigations, be approved.

(*a*) The Bureau of Reclamation to continue and expand its detailed investigations of potential projects within the States of the Colorado River Basin to obtain adequate information by which the Department of the Interior in cooperation with the basin States can formulate a comprehensive plan for use of all the water resources of the basin and select and recommend projects for successive stages of development.

(*b*) The Geological Survey, National Park Service, Fish and Wildlife Service, Grazing Service, Bureau of Mines, Office of Indian Affairs, and General Land Office to initiate or continue to conduct such investigations and studies as required by the Secretary of the Interior to formulate and carry out the comprehensive plan.

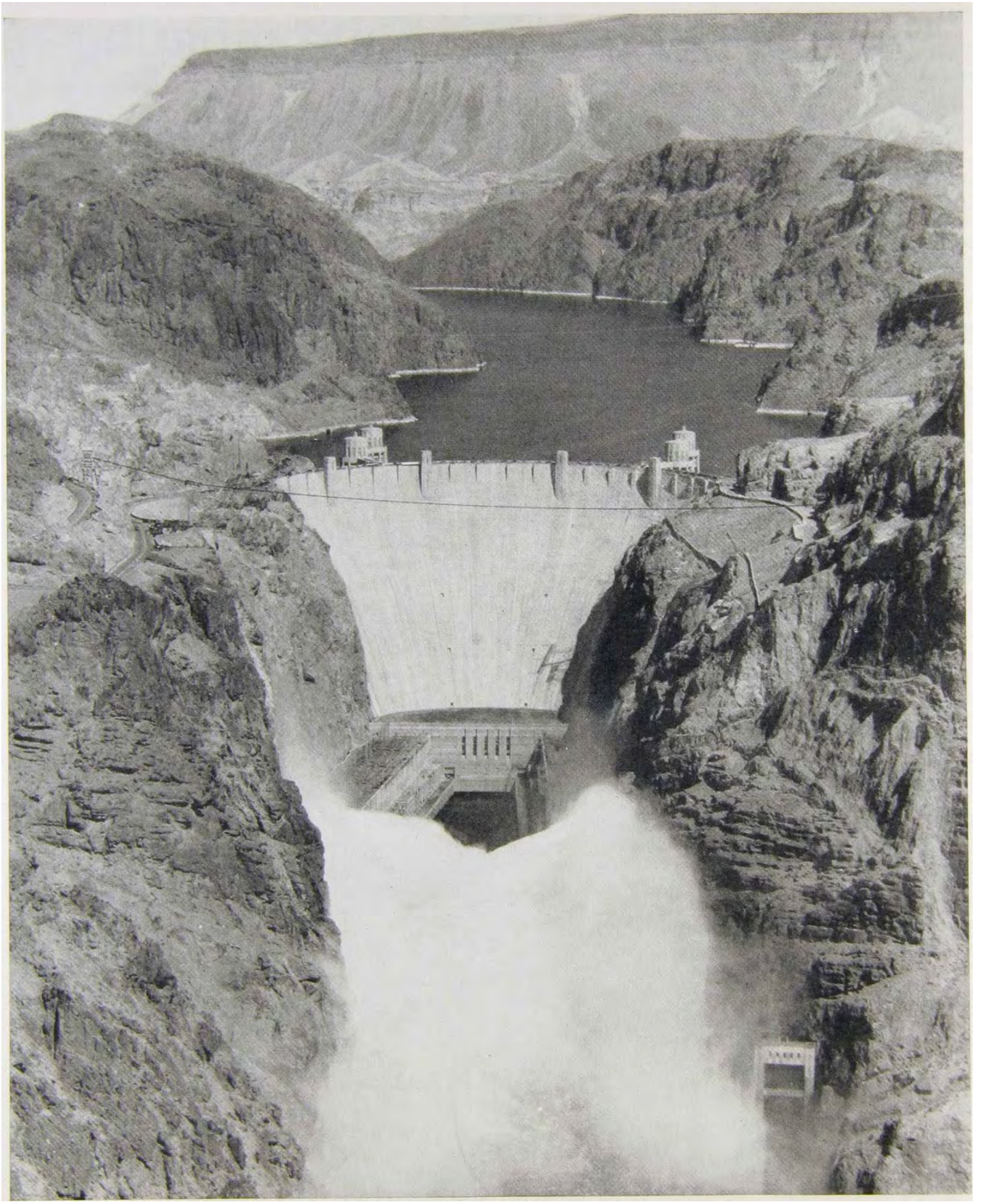
E. A. MORITZ,
Regional Director, Region III.
E. O. LARSON,
Regional Director, Region IV.

Substantiating Material

"Yesterday the Colorado River was a natural menace. . . .

"Today this mighty river is recognized as a national resource. . . .

"Tomorrow the Colorado River will be utilized to the very drop. Its water will convert thousands of additional acres of sagebrush desert to flourishing farms and beautiful homes for servicemen, industrial workers, and native farmers who seek to build permanently in the West."



BOULDER DAM

World's highest dam only partly harnesses the wild Colorado River

Foreword

Yesterday the Colorado River was a natural menace. Unharnessed it tore through deserts, flooded fields, and ravaged villages. It drained the water from the mountains and plains, rushed it through sun-baked thirsty lands, and dumped it into the Pacific Ocean—a treasure lost forever. Man was on the defensive. He sat helplessly by to watch the Colorado River waste itself, or attempted in vain to halt its destruction.

Today this mighty river is recognized as a national resource. It is a life giver, a power producer, a great constructive force. Although only partly harnessed by Boulder Dam and other ingenious structures, the Colorado River is doing a gigantic job. Its water is providing opportunities for many new homes and for the growing of crops that help to feed this nation and the world. Its power is lighting homes and cities and turning the wheels of industry. Its destructive floods are being reduced. Its muddy waters are being cleared for irrigation and other uses.

Tomorrow the Colorado River will be utilized to the very last drop. Its water will convert thousands of additional acres of sagebrush desert to flourishing farms and beautiful homes for servicemen, industrial workers, and native farmers who seek to build permanently in the West. Its terrifying energy will be harnessed completely to do an even bigger job in building bulwarks for peace. Here is a job so great in its possibilities that only a nation of free people have the vision to know that it can be done and that it must be done. The Colorado River is their heritage.

In 1902, Congress established a fund, "known as the Reclamation Fund, to be used in the examination and survey for and the construction and maintenance of irrigation works for the storage, diversion, and development of waters for the reclamation of arid and semiarid lands in the" public-land States, and authorized and directed the Secretary of the Interior "to make examinations and surveys for, and to locate and construct * * * irrigation works for the storage, diversion, and development of waters, including artesian wells, and to report to Congress at the beginning of each regular session as to the results of such examinations and surveys, giving estimates of the cost of all contemplated works, the quantity and location of the lands which can be irrigated therefrom, and all facts relative to the practicability of each irrigation project; also the cost of works in process of construction as well as of those which have been completed." (Act of June 17, 1902, 32 Stat. 388.)

Responsibility for planning the control, improvement, and utilization of the Colorado River was assigned specifically to the Secretary of the Interior in the Boulder Canyon Project Act of December 21, 1928, which authorized and directed the Secretary "to make investigations and public reports of the feasibility of projects for irrigation, generation of electric power, and other purposes in the States of Arizona, Nevada, Colorado, New Mexico, Utah, and Wyoming for the purpose of making such information available to said States and to the Congress, and of formulating a comprehensive scheme of control and the improvement and utilization of the water of the Colorado River and its tributaries." (Sec. 15, 45 Stat. 1065.)

The Boulder Canyon Project Adjustment Act of July 19, 1940, further directs the continuation and extension, under the Secretary of the Interior, "of studies and investigations by the Bureau of Reclamation for the formulation of a comprehensive plan for the utilization of waters of the Colorado River system for irrigation, electrical power, and other purposes, in the States of the upper division and the States of the lower division, including studies of quantity and quality of water and all other relevant factors." (Sec. 2, 54 Stat. 774.)

In compliance with the law and in fulfillment of the public trust the Bureau of Reclamation sponsored the preparation of this report. With a view to determining how the people in the basin and in the Nation can be benefited by further development of water resources, the report surveys the resources and traces the economic development in the basin. It includes a discussion of present water resources development and descriptions of many potential projects. These projects indicate potentialities for ultimate development of all the water resources of the basin. Alternative projects are included in order that relative merits of all possibilties can be weighed, and those projects most likely to yield the greatest good to the

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greatest number of people can be selected for construction. All beneficial uses, including the irrigation of land, the production of hydroelectric power for the development of mineral resources and other industrial purposes, the furnishing of domestic and municipal water supplies, the preservation of fish and wildlife, and the enhancement of recreational areas, together with the control of floods and silt, and the restoration of ground-water levels were taken into account in formulating the potential projects.

This comprehensive report provides a basin-wide perspective for planning coordinated development on a sound basis. From time to time as additional detailed investigations of particular projects are completed and as various intrastate, interstate, and international problems are solved, modifications and changes will be indicated to assist in the selection of projects and the shaping of the ultimate development plan. Intrastate and interstate problems, to be solved by the citizens and States of the Colorado River Basin, and international problems, to be solved by the United States and Mexico, are interrelated, the solutions of some being dependent on the previous solutions of others and on additional investigations and construction in the basin. Such problems are being and will be solved in an orderly manner as needs arise. Further investigations and construction in the basin will be undertaken as authorization is given and appropriations made by the Congress.

Although the water supply available for potential projects for exportation of water outside the natural basin of the Colorado River is discussed in this report, no attempt is made to evaluate the costs or benefits of such projects. They will be evaluated separately or in connection with basin reports of importing watersheds.

In the preparation of this report various agencies of the Department of the Interior that are involved in the development of the Colorado River Basin cooperated with the Bureau of Reclamation to assure that cooperative planning for water development would be keyed to the welfare of the people of the basin. Their cooperation is reflected throughout the report and their specific contributions included in chapter VIII entitled "Cooperating Interests in the Basin." The Bureau of Reclamation is the agency of the Department of the Interior authorized to plan, construct, and operate projects for the reclamation of arid land, the production of hydroelectric power, and other beneficial purposes through the development of water resources. The Geological Survey has supplied valuable information on water supply, classification of mineral lands, mineral resources, and mapping. The National Park Service, concerned primarily with the preservation of parks and areas of historic and scenic interest for enjoyment of the American people, has indicated and evaluated possible benefits of the potential projects to recreation. The Fish and Wildlife Service has jurisdiction over Federal game refuges and is the Federal custodian of the fish and wildlife resources in the basin. The Grazing Service, administering the Federal grazing lands in the basin, is protecting watersheds from overgrazing, erosion, and other abuses, and is interested not only in securing adequate water supplies for stock but in the production of more irrigated crops to supplement range forage. The Bureau of Mines is engaged in the exploration and development of mineral resources and has a vital interest not only in flowing streams as a source of water necessary for mining, milling, and extracting metals or minerals from ores but in the availability of low-cost hydroelectric power for further development of mineral resources. Guarding the interests of the Indians in the basin is the Office of Indian Affairs which manages all Indian matters, including economic development, forestry and grazing, irrigation, education, and other activities. The General Land Office, which has jurisdiction over unappropriated and unreserved public domain, has outlined a program for the Colorado River Basin that consists largely of land classification, cadastral surveys, and investigation of mineral claims.

Other Federal agencies that have an interest in development of the basin also have made substantial contributions which are included as a part of chapter VIII. The Federal Power Commission has assisted in the study of power resources of the Colorado River Basin. Close cooperation with the Forest Service of the United States Department of Agriculture is important because increased irrigation development will require intensified watershed management on the National forest lands to insure adequate safeguarding of their water crop. The Corps of Engineers, United States Army, has submitted plans and suggestions for some flood-control projects, such information being included in the supporting data for the report.

Throughout the preparation of this report the Bureau of Reclamation cooperated with the various States and local agencies concerned with development in the basin. A tentative draft of the report was submitted to the Committees of 14 and 16, which committees represent the Colorado River Basin States and the Boulder Dam Power allottees, for their review and suggestions for revisions. Financial assistance has also been received from the States.

Eleven maps showing water resources development in each of the seven Colorado River Basin States, existing and potential power developments, conservation areas and facilities, and mineral resources are an appendix to this report.

Following is a list of terms that appear in the report, and their definitions:

Irrigable land.—Land suitable for irrigated farming included within an existing project or within a potential development that reasonably could be furnished a water supply.

New lands.—Irrigable lands which could be irrigated after project development.

Stream flow.—The flow in a stream channel. The volume of flow is measured in acre-feet. The rate of flow is measured in second-feet.

Acre-foot.—A unit of measure of volume. It is equivalent to the quantity of water that will cover 1 acre (43,560 square feet) 1 foot deep.

Second-foot.—A unit of measure of the rate of stream flow. It is the flow of 1 cubic foot (7.48 gallons) of water passing a given point per second of time.

Discharge.—The rate of flow; commonly expressed in second-feet, gallons per minute, acre-feet per day, etc.

Run-off.—The precipitation that appears as flow in streams. It is usually measured in volume per unit of time, such as acre-feet per day, month, or year.

Return flow.—That part of diverted stream flow returning to the stream.

Stream depletion.—The reduction in stream flow due to man-made improvements as they affect the virgin water supply of the Colorado River at Lee Ferry and at the International Boundary.

Silt.—The solid matter or sediment transported by a flowing stream.

Active storage capacity.—That space in the upper part of a reservoir normally utilized in regulating stream flow for purposes of irrigation, power, flood control, etc. Sometimes referred to as live storage.

Inactive storage capacity.—That space in the lower part of a reservoir not emptied in normal operation. It may be provided for a sedimentation pocket, to develop and maintain a power head, to establish a permanent lake for fish culture, recreation, etc. Sometimes referred to as dead storage.

Firm power.—Power that can be made available at any time to meet load demands. Production of firm power by hydroelectric plants is limited by water supply during years of low stream flow.

Kilowatt.—A unit of measure of rate of producing electrical energy.

Kilowatt-hour.—A unit of measure of quantity of electrical energy.

The Natural Setting

"The Colorado River rises high in the snow-capped Rocky Mountains of north central Colorado, flows nearly 1,400 miles southwest, and empties into the Gulf of California in Mexico far to the south. . . . This mighty river has gouged the rock of the mesas into gorges and chasms, most spectacular of which is the world-famous Grand Canyon in Arizona. . . .

"The Colorado River drains a vast area of 244,000 square miles, 242,000 square miles in this country—one-twelfth of the area of continental United States—and 2,000 square miles in northern Mexico. Tributaries extend into seven of the large Western States, including Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming."

CHAPTER I

The Natural Setting

The Colorado River rises high in the snow-capped Rocky Mountains of north central Colorado, flows nearly 1,400 miles southwest, and empties into the Gulf of California in Mexico far to the south. It is the second longest river in the United States outside the Mississippi River system. This mighty river has gouged the rock of the mesas into gorges and chasms, most spectacular of which is the world-famous Grand Canyon in Arizona, a titanic cleft over 200 miles long, as much as 12 miles wide, and a mile deep.

The Colorado River drains a vast area of 244,000 square miles, 242,000 square miles in this country—one-twelfth of the area of Continental United States—and 2,000 square miles in northern Mexico. The basin from Wyoming to below the Mexican border is some 900 miles long and varies in width from about 300 miles in the upper section to 500 miles in the lower section. It is bounded on the north and east by the Continental Divide in the Rocky Mountains, on the west by the Wasatch Range, and on the southwest by the San Jacinto Mountains, a range of the Sierra Nevada. Tributaries extend into seven of the large Western States including Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

The Salton Sea Basin, an additional area of 7,800 square miles which includes the Coachella and Imperial Valleys in southeastern California, is discussed as part of the Lower Colorado River Basin. It is, however, to be distinguished from other lower Colorado River areas because whatever Colorado River water reaches it cannot return by gravity flow to the parent stream.

Physical Characteristics

The upper or northern portion of the Colorado River Basin in Wyoming and Colorado is a mountainous plateau, 5,000 to 8,000 feet in altitude, marked by broad rolling valleys, deep canyons, and intersecting mountain ranges. Hundreds of peaks in these mountain chains rise to more than 13,000 feet above sea level and many exceed 14,000 feet. There are many picturesque mountain lakes in these headwater sections. The southern portion of the basin is studded with rugged mountain peaks interspersed with broad, level, alluvial valleys and rolling plateaus.

The main stream and its principal tributaries in Colorado flow, for the most part, in deep canyons. The Green River, primary tributary of the Colorado River, flows in similar canyons in Wyoming, Colorado, and Utah and its chief tributaries, Yampa and White Rivers from the east, and Duchesne, Price, and San Rafael Rivers from the west, flow through rolling hills and canyons to reach the Green.

The San Juan River, a large tributary of the Colorado River from the east, drains mountain slopes and plateaus in southwestern Colorado, northwestern New Mexico, and northern Arizona and flows through a formidable canyon in southeastern Utah, joining the Colorado in Glen Canyon. The Glen Canyon section of the main stream and tributaries thereto are in deep canyons, draining a series of plateaus and mesas.

Below Glen Canyon is the awesome Grand Canyon where the Colorado has carved an unparalleled chasm. This canyon yawns above an inner gorge, rising in gigantic cliff-steps to the Colorado plateau, a mile above the stream bed. This great central plateau is a rolling expanse of brightly hued crags and cliffs, huge canyons, painted deserts, and extensive almost inaccessible barren areas. Elevations on the mesas of the plateau section generally range from 4,000 to 6,000 feet. The principal tributaries in this section are the Little Colorado River on the east and the Virgin River on the west.

Emerging from the canyon country at the southeast corner of Nevada, the Colorado River courses through broad valleys bordered by mesas. The Gila River, main tributary in this section, rises in the mountainous region of southwestern New Mexico and drains most of southern Arizona.

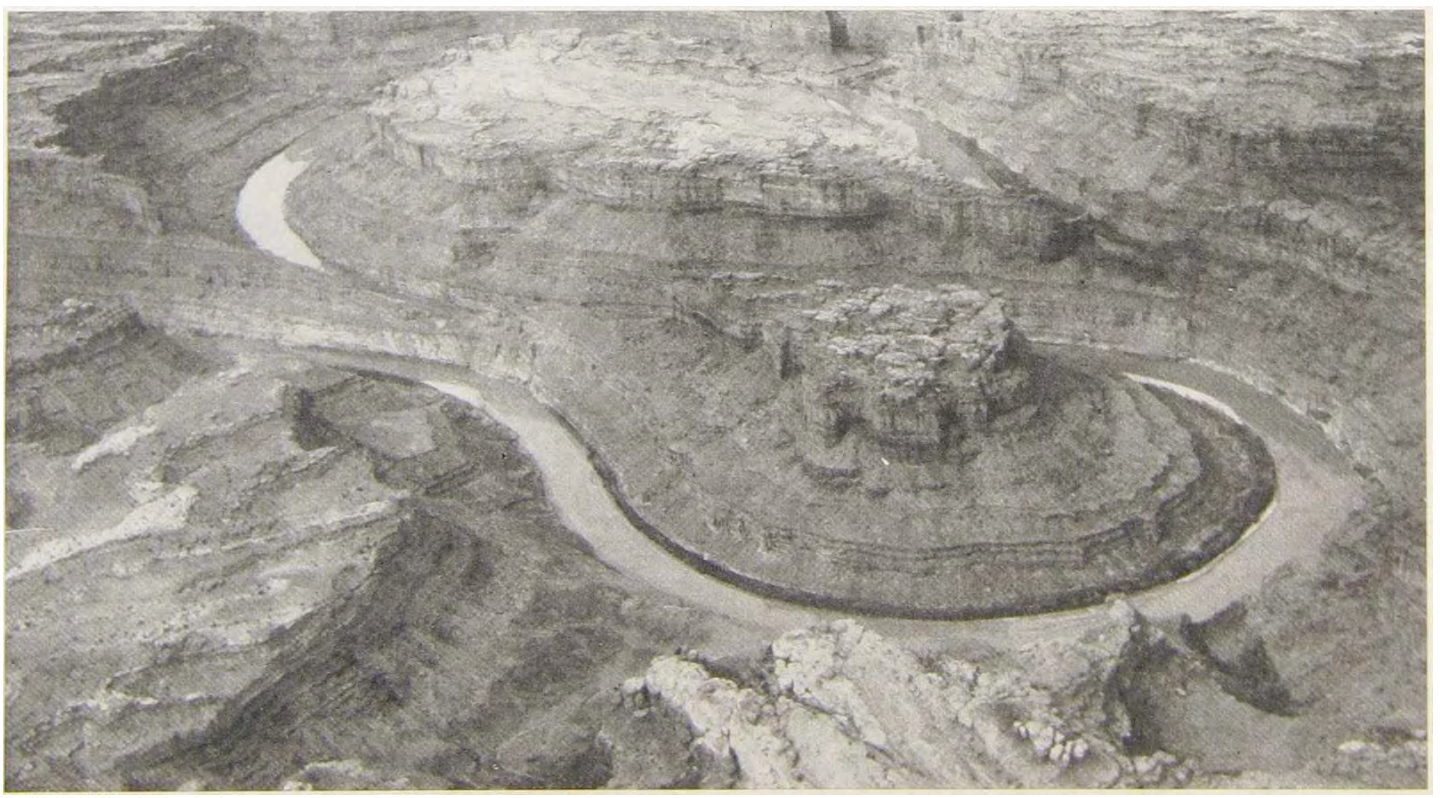
Southwest of the Gila Basin the Colorado River continues through its great delta area to the Gulf of California.

Physical characteristics suggest seven main divisions of the Colorado River Basin in the United States, three in the upper basin, or the drainage area above Lee Ferry, Arizona, and four in the lower basin, or the drainage



JUNCTION OF GREEN AND COLORADO RIVERS

The Colorado (left) is joined by the Green (right), its largest tributary



BOW-KNOT OF THE COLORADO RIVER

The Colorado meanders hundreds of miles through deep canyons in Utah and Arizona



COLORADO RIVER BASIN
Divisions of upper and lower basins

area downstream from Lee Ferry to the Mexican border. The *Green division* includes that part of Wyoming, Colorado, and Utah drained by the Green River. The *Grand division* is that part of Colorado and Utah drained by the Colorado River above the mouth of Green River. The *San Juan division* takes in that part of Utah, Colorado, New Mexico, and Arizona drained by that section of the Colorado River between the mouth of the Green River and Lee Ferry. The *Little Colorado division* includes that part of Arizona and New Mexico drained by the Little Colorado River, excluding that part below Moenkopi Wash. The *Virgin division* covers that part of Utah, Arizona, and Nevada drained by Kanab Creek and the Virgin and Muddy Rivers. The *Boulder division* includes the Imperial and Coachella Valleys in southeastern California and that part of Arizona, Nevada,

and California tributary to the Colorado River below Lee Ferry, excluding that part of those States tributary to the Little Colorado River above Moenkopi Wash, Kanab Creek, Virgin River, Muddy River, and the Gila River above Sentinel. The *Gila division* comprises that part of Arizona and New Mexico drained by the Gila River above Sentinel and small independent drainage areas in Arizona and southwestern New Mexico.

For convenience in presenting some of the data and information in this report, reference is made to these seven divisions, detailed descriptions of which follow.

Green Division

From glacier-capped peaks on its Rocky Mountain rim to the barren wastes of its lower valleys and plateaus, the Green River Basin is one of great contrasts in topography. Wooded upland slopes are flanked with fertile grass-covered valleys, which in turn give way to dry and eroded badlands and deserts.

Rising in western Wyoming in the Wind River Mountains on the Continental Divide, the Green River also drains the northwest corner of Colorado and discharges into the Colorado River in southeastern Utah, 350 miles south of its origin, its meandering length totaling 730 miles. It drains 45,000 square miles, an area as large as the State of Pennsylvania, 39 percent of which is in Wyoming, 37 percent in Utah, and 24 percent in Colorado. Elevations in the Green River Basin range from 3,876 feet above sea level at the mouth of the Green River to 13,785 feet at Gannet Peak in the Wind River Mountains. Large areas of desert plateau contribute practically no water to the stream. Numerous small glacial lakes head the Green River and its higher tributaries.

The Yampa and White Rivers, tributaries from the east, both originating in Colorado on the western slope of the Rocky Mountains, flow westward and generally parallel. Much of the drainage area consists of rolling hills, but several prominent peaks rise within and between the basins of the two streams.

Duchesne, Price, and San Rafael Rivers, tributaries from the west, head on the eastern slope of the Wasatch Mountains and flow southeast to Green River.

Grand Division

The Colorado River above the mouth of the Green River was known to earlier generations as the Grand River. For that reason the area drained by the upper Colorado River is called the Grand division. A 200-mile strip of the Continental Divide through central Colorado forms the eastern boundary of the division, which includes the basin of the upper Colorado River and its tributaries down to the junction of the Colorado and Green Rivers in Utah.

The Colorado River rises among lofty peaks in the northwest portion of Rocky Mountain National Park, 70 miles northwest of Denver. Flowing southwest to Green River, it has an air-line length of 265 miles and a meandering length of 420 miles. It drains 26,500 square miles an area larger than West Virginia. Only 11 percent or 4,300 square miles of the area are in Utah while 22,200 square miles are in Colorado. Elevations range from 3,876 feet above sea level at Green River to more than 14,000 feet at mountain peaks. On this western slope of the Continental Divide are rugged mountains and high plateaus where the river and its numerous tributaries have become deeply entrenched in steep rugged canyons and relatively narrow valleys.

Main tributaries in the first 160-mile length of the Colorado River's southwest course, above Grand Junction, are Fraser, Williams, Blue, Eagle, and Roaring Fork Rivers from the south and Willow, Troublesome, and Muddy Creeks from the north. Gore Canyon, 80 miles above Glenwood Springs, is of special interest. Here the river tumbles through vertically walled canyons, dropping 360 feet in 5 miles in the steepest fall on the river.

Gunnison River, principal tributary of the upper Colorado River, has its headwaters draining the Continental Divide, and flows northwest to meet its parent stream at Grand Junction. North Fork and Uncompahgre River are the largest tributaries of the Gunnison.

Dolores River, rising on the western slope of the San Juan Mountains, flows generally southwest and is joined by the San Miguel River and other lesser tributaries before flowing alternately through canyons and narrow valleys to the Colorado River in Utah.

San Juan Dvision

This area is rich in prehistoric Indian ruins, in natural wonders, and in spectacular scenic beauty. The area, with an elevation difference of more than 2 miles between the lowest and highest points, is one of extreme contrasts in topography. High tree-clad mountain areas with numerous clear, fish-stocked streams and small lakes rapidly give way to fertile foothill valleys, which merge into a vast, broken and barren, but picturesque and highly colored, plateau.

Deeply entrenched in this plateau the Colorado River meanders southwestward for 220 miles from the mouth of the Green River to Lee Ferry, an air-line distance of 130 miles. This section of the river, together with its tributaries, drains 39,000 square miles, an area almost as large as Ohio. Forty-three percent of this area is in Utah, 25 percent in New Mexico, 17 percent in Arizona, and 15 percent in Colorado.

The main tributary to this stretch of the Colorado River is the San Juan River. Second largest tributary of the Colorado, the San Juan River heads on the western slope



BLACK CANYON OF THE GUNNISON RIVER

The river has cut through crystalline rock to a depth of 3,000 feet

of the Continental Divide in southwestern Colorado and flows west, entering the main stream from the east 80 miles upstream from Lee Ferry.

Three small rivers, Fremont, Escalante, and Paria, rising on the Wasatch and Escalante mountainous plateaus, join the Colorado from the west. The streams in this division are erratic with violent fluctuations of flow in their lower reaches. In the deep canyons cut through the plateau areas these streams turn into raging silt-laden torrents during periods of heavy or continued downpours.

Little Colorado Division

A region of spectacular beauty with a wealth of scenic splendor, the Little Colorado division embraces an area of 25,000 square miles, 81 percent of which is in northeastern Arizona and the remainder in west-central New Mexico. Barren stretches of arid wasteland, petrified forests, painted deserts, rolling ranges, stately timber, and lofty mountains characterize the area.

The Little Colorado River rises among the evergreen forests of the White Mountains at elevations above 9,000 feet, flows through canyons that widen at intervals into valleys, enters a generally broad, sandy channel with low, steep, side walls, then cascades into a deep rock canyon and continues to the Colorado.

Northern tributaries of the river head in canyons in the Kaibab and Fort Defiance Plateaus and Black Mesa. As they approach the main valley floor, the channels widen to broad, flat sandy washes with low vertical side walls. Creeks draining the southern part of the basin rise as crystal mountain streams in the wooded highlands of the Mogollon Rim and flow through steep-walled canyons in their lower reaches.

South and west of the river the basin is dominated by the Mogollon Rim and the volcanic features of the peaks and cones near Flagstaff. Most of this area is a gently sloping plain with a few prominences and canyons to break the continuity.

North and east of the river at higher elevations lie forested plateaus, isolated mountains, mesas, and sloping plains broken by volcanic plugs. Painted deserts and badlands predominate in the lower altitudes.

Elevations in the basin range from 4,100 feet above sea level below Moenkopi Wash to 12,611 feet on the lofty San Francisco Peaks.

Virgin Division

Virgin—new, fresh, untouched—a significant name aptly applied by the early explorers. It is an area beautified by the forces of nature and only slightly touched by man. This typical mountain-desert country with its characteristic stretches of sand and sagebrush, its cloudless sky and scorching sun, is the center of volcanic eruptions and geologic displacements.

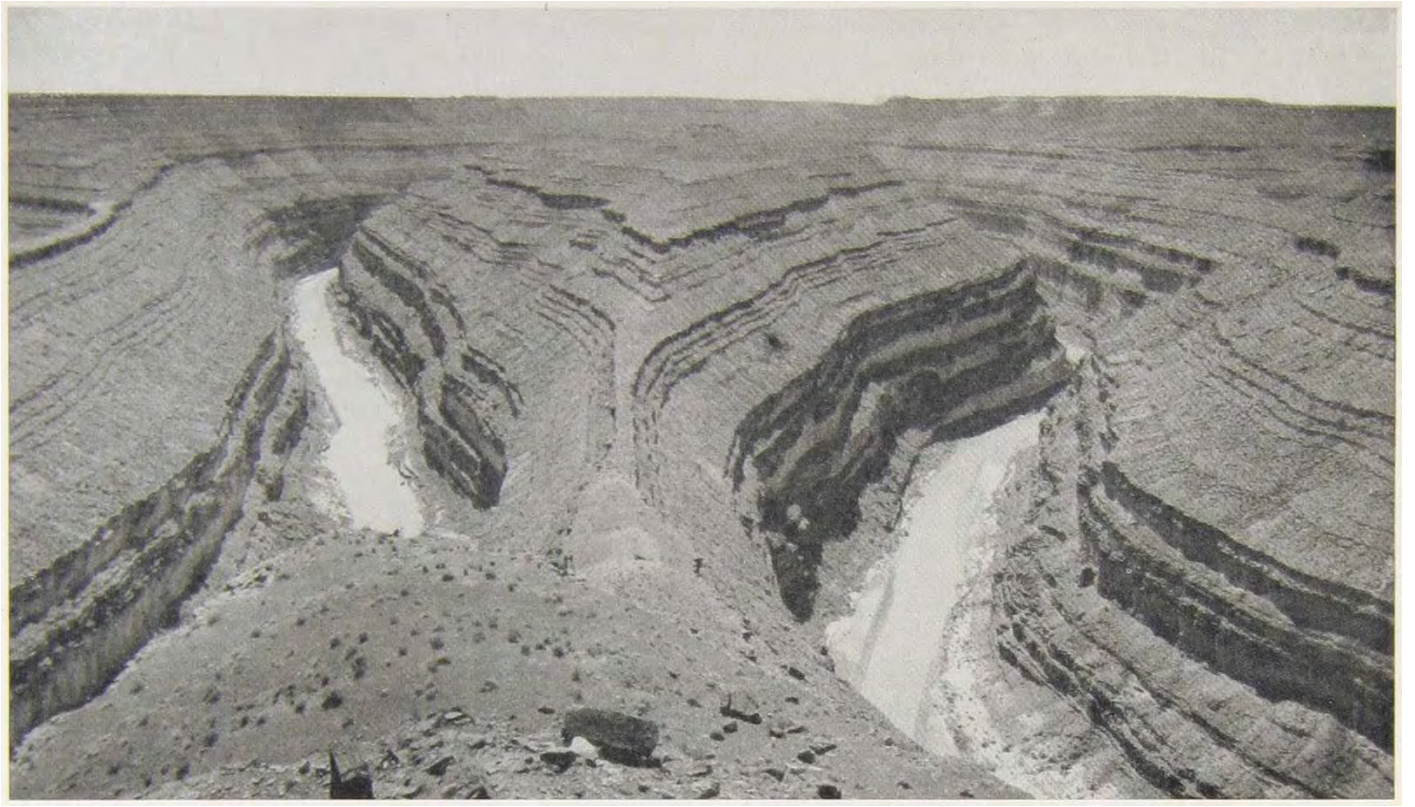
The Virgin division totals approximately 12,700 square miles, of which 3,600 square miles are in southwestern Utah, 3,600 square miles in northwestern Arizona, and 5,500 square miles in southeastern Nevada. Elevations range from 1,200 feet above sea level at Lake Mead to 10,000 feet at the headwaters of the Virgin River.

The terrain is extremely rough and broken. The dominating structural feature is the Hurricane Fault escarpment which marks the western boundary of the high plateau region. From a point near Beaver, Utah, it extends south for a distance of some 200 miles, crosses through the Virgin River Basin at Hurricane, Utah, and extends beyond the Colorado River. Deep gorges and rugged, massive erosional forms make up the striking and colorful attractions of Zion National Park and Monument located in the area. Comparatively recent lava flows and volcanic cones are salient features in parts of the division.

Kanab Creek heads in the Pink Cliffs along the southwestern rim of the Paunsaugunt Plateau in Utah at an elevation of 9,000 feet and flows 90 miles south to the lower end of Grand Canyon, where it joins the Colorado at elevation 1,880 feet. Johnson Creek, its principal tributary, heads in the same locality and roughly parallels Kanab Creek until it enters Arizona, where it turns southwest to join the main stream 5 miles southwest of Fredonia, Ariz. Above Kanab, Utah, the drainage area is rough and hilly and is covered with sagebrush and junipers. Streams are confined to narrow valleys and gorges. Below the confluence of the two creeks the stream plunges into the Colorado River through a deepening gorge cut into the north-sloping Kaibab and Uinkarat Plateaus.

Virgin River, heading along the southern rim of the Markagunt Plateau in Utah, flows across the southwest corner of Utah, crosses the northwest corner of Arizona, and discharges into Lake Mead in southeastern Nevada. The length of the river from its headwaters to its mouth is about 200 miles. Perennial tributaries, of which the Santa Clara River is the most important, head in the high plateaus and mountains to the north and flow south to the main stream. The river and main tributaries generally are confined in deep gorges or narrow valleys. Bench or mesa lands fringe the main stream and tributaries in some places.

Muddy River, originating in the Sheep Mountains, flows southeast for some 60 miles to enter Lake Mead near the settlement of Overton, Nev. Prior to the formation of Lake Mead by construction of Boulder Dam, Muddy River was tributary to Virgin River about 25 miles upstream from the confluence of Virgin and Colorado Rivers. Now, however, the two streams flow separately into Lake Mead. Meadow Valley Wash, the principal Muddy



GOOSENECKS OF THE SAN JUAN

A favorable site for a dam has been found on San Juan River below Bluff, Utah



LONG-RANGE VIEW OF GRAND CANYON

This panorama was photographed from Navajo Watch Tower

River tributary, flows from its headwaters south about 130 miles to its confluence with Muddy River near Moapa, Nev.

Boulder Division

The Colorado River enters the northeast corner of the Boulder division at Lee Ferry, weaves its way west and south for 350 river miles to empty into Lake Mead, then flows south 358 miles to the Mexican border. The division embraces an area of 48,600 square miles, including the Salton Sea drainage basin of 7,800 square miles. Of this area 32,900 square miles are in Arizona, 11,300 square miles in California, and 4,400 square miles in Nevada. Throughout the division great blocks of land have been lifted, forming plateaus and mountainous ridges. Other blocks have been depressed, forming valleys which later filled with material washed from the elevated areas. Elevations range from below sea level to more than 12,000 feet above sea level.

For the upper 280 miles, from Lee Ferry to Grand Wash Cliffs, the Colorado has cut through an elevated area. As the plateau rose slowly during geologic time, the river wore its course progressively deeper through the rock, forming Grand Canyon, a region of scenic grandeur. The most impressively beautiful part of this canyon is the 105-mile stretch set aside as Grand Canyon National Park.

Grand Wash Cliffs at the west end of Grand Canyon is one of the major escarpments in the United States. Here the plateau drops abruptly and is succeeded by alternating mountains and valley fills to the upstream end of Black Canyon. Through this stretch the Colorado dug its channel across the Virgin and Black Mountain ranges on a grade of 3.2 feet a mile, compared with 8 feet a mile in Grand Canyon. The narrowness and depth of Black Canyon afforded a favorable site for a high dam. Upstream from Black Canyon the river channel together with the Virgin River and Las Vegas Wash side valleys formed an ample basin for water storage and silt detention. The upstream end of Black Canyon was the site chosen for Boulder Dam.

Williams River, a flashy discharge tributary of the Colorado, comes in on a steep grade from the east just above Parker Dam, falling 500 feet in 32 miles. This stream is formed by two branches coming together some 36 miles above the mouth, the north branch, Big Sandy River, and the east branch, Santa Maria River.

From Headgate Rock to the Mexican border, the Colorado River falls an average of 1.4 feet a mile. The flood plain is several miles wide near Parker, Ariz., Blythe, Calif., and Yuma, Ariz. Bench lands, as those near Blythe and Yuma, are at moderate elevations (500 feet or less) above the Colorado River.

Across a range of sand hills west of Yuma is the Salton Sea Basin, a depression below sea level about 85 miles long and 20 miles wide. In the deepest part is the Salton Sea, 20 miles long and 10 miles wide. The surface of the sea is 241 feet below sea level. The Imperial Valley is considered as the delta sloping from the Colorado north to the Salton Sea. Coachella Valley lands slope south to the Salton Sea. The Imperial and Coachella Valleys are in large part alluvial deposits from the Colorado River. On the east, west, and north, however, the river deposits are overlaid on the edges of the valleys by coarser detrital material washed from surrounding mountains.

Gila River, the lower reaches of which are in this division, enters the Colorado River just east of Yuma.

Gila Division

Broad, smooth valleys, mountain chains, desert wastes, flowing water—this is the Gila division, a land of extremes and contrasts. It covers an area of 53,000 square miles, 47,380 of which are in south-central Arizona, and 5,620 square miles in western New Mexico. Run-off from the high mountains of eastern Arizona and western New Mexico forms the perennial flows of the Gila River and its tributaries. No lakes of any appreciable size are found in the basin. Elevations range from 530 feet at Sentinel to 12,600 feet at Humphrey's Peak in the San Francisco Mountains, near Flagstaff, Ariz.

Gila River flows for half of its course in steep, precipitous canyons alternating with relatively flat valleys. Both canyons and valleys are flanked by mountain ranges rising 7,000 to 10,000 feet above sea level.

San Francisco River, most important tributary of the Gila River before its confluence with Salt River, drains mountainous regions of southwestern New Mexico and southeastern Arizona.

San Pedro River rises in Sonora, Mexico, and flows north to join the Gila River some 20 miles below Coolidge Dam. Although most of its course is in open valleys, its tributaries drain several small but high mountain ranges.

Santa Cruz River, heading in the Patagonia and Huachuca Mountains of southern Arizona, flows into Sonora, Mexico, back into Arizona at a point near the border city of Nogales, and from there northward some 130 miles, spreading over the desert, with only occasional large flood flows reaching the Gila.

Salt River, largest tributary of the Gila River, is formed by the junction of Black River and White River, which rise in the high, timbered White Mountains of east-central Arizona. After being joined by Verde River, its principal tributary which rises in the northern Arizona plateau, the Salt River flows for 40 miles through fertile, open plains to the Gila.

Other tributaries of the Gila include the Agua Fria River, rising in the timbered Mingus Mountains of central Arizona, and the Hassayampa River, heading in Prescott National Forest near Prescott, Ariz.

Geologic History

Rocks of all ages from those of the Archean Age, the oldest known geological period, to the recent alluvial deposits, including igneous, sedimentary, and metamorphic types, are found in the Colorado River Basin. The high Rocky Mountains which dominate the topography of the region are composed of granite, schists, gneisses, lava, and sharply-folded sedimentary rocks. Many periods of deposition and erosion have played a part in the present structure of these mountains. Ancient seas settled in the basin countless times, depositing beds of limestone, sandstone, and shale. Each time crustal forces of the earth elevated the region above sea level, erosion again began cutting it down.

During a relatively late geological period, called the Pleistocene or Glacial Age, glaciers occupied the high watershed of all the mountains in Colorado, Wyoming, and Utah. The Rocky Mountains in Colorado, the Wind River Mountains in Wyoming, and the Uinta and Wasatch Mountains in Utah, all have been materially affected topographically by these ancient bodies of ice.

In contrast to the folded rocks of the mountains which fringe the basin, the plateau country of southwestern Wyoming, eastern Utah, and northern Arizona is composed principally of horizontal strata of sedimentary rocks. Many formations of hard sandstone and limestone separated by softer shale, often highly colored, have resulted in topographic and geological formations found in no other locality.

Slow but constant elevation of the land area has allowed the Colorado River and its tributaries to cut narrow deep canyons into the flat-topped mesas. This unique type of erosion reaches its culmination in the famous Grand Canyon. Here a broad area has been arched several thousand feet higher than the surrounding country, but the horizontal structure of the rock largely has been maintained. The river has cut through all the sedimentary rocks down to the oldest Archean granites.

The topography of the southern part of the basin is characterized by broad flat valleys separated by low ranges. The valleys are filled by large accumulations of alluvial gravels which all but bury the mountains. The ranges are mainly of igneous origin with granites and lava predominating. These rocks are part of the oldest known formation, the younger sedimentary rocks having been removed by erosion. Many mountain ranges are undoubtedly buried beneath the detrital material.

The present Gulf of California once extended much farther north than at present and filled what is now the Imperial Valley of California. The silt of the river was distributed far and wide in this sea which was partially cut off from the broad Pacific by a chain of islands. During and after the Glacial Period, when precipitation is believed to have reached its peak, the river had its greatest volume and transporting power. The stream then, as now, laden with the silts from the slopes of the Rocky Mountains and the Grand Canyon of Arizona, gradually built up a great delta which finally completely cut off a vast inland sea of brackish water. This ancient sea, known by geologists as Lake Cahuilla, covered an area of about 2,100 square miles.

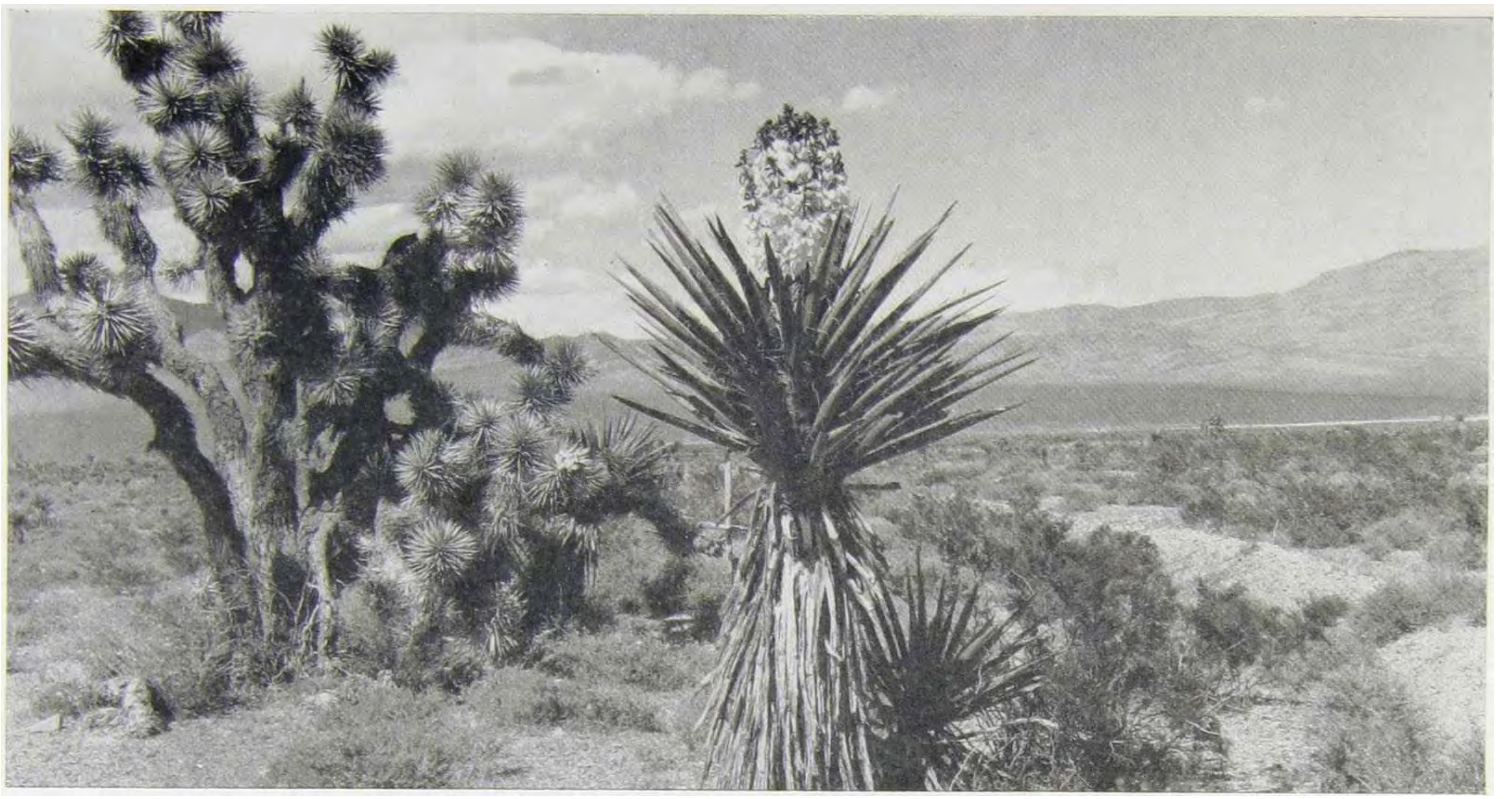
After shifting channels countless times, sometimes discharging into the gulf and sometimes into the lake, the river finally became better stabilized in channels emptying into the gulf. With the loss of a water supply Lake Cahuilla gradually decreased by evaporation to remain as the present Salton Sea.

Native Plant and Animal Life

The flora and fauna of the Colorado River Basin are many and varied, including typical desert and alpine species.

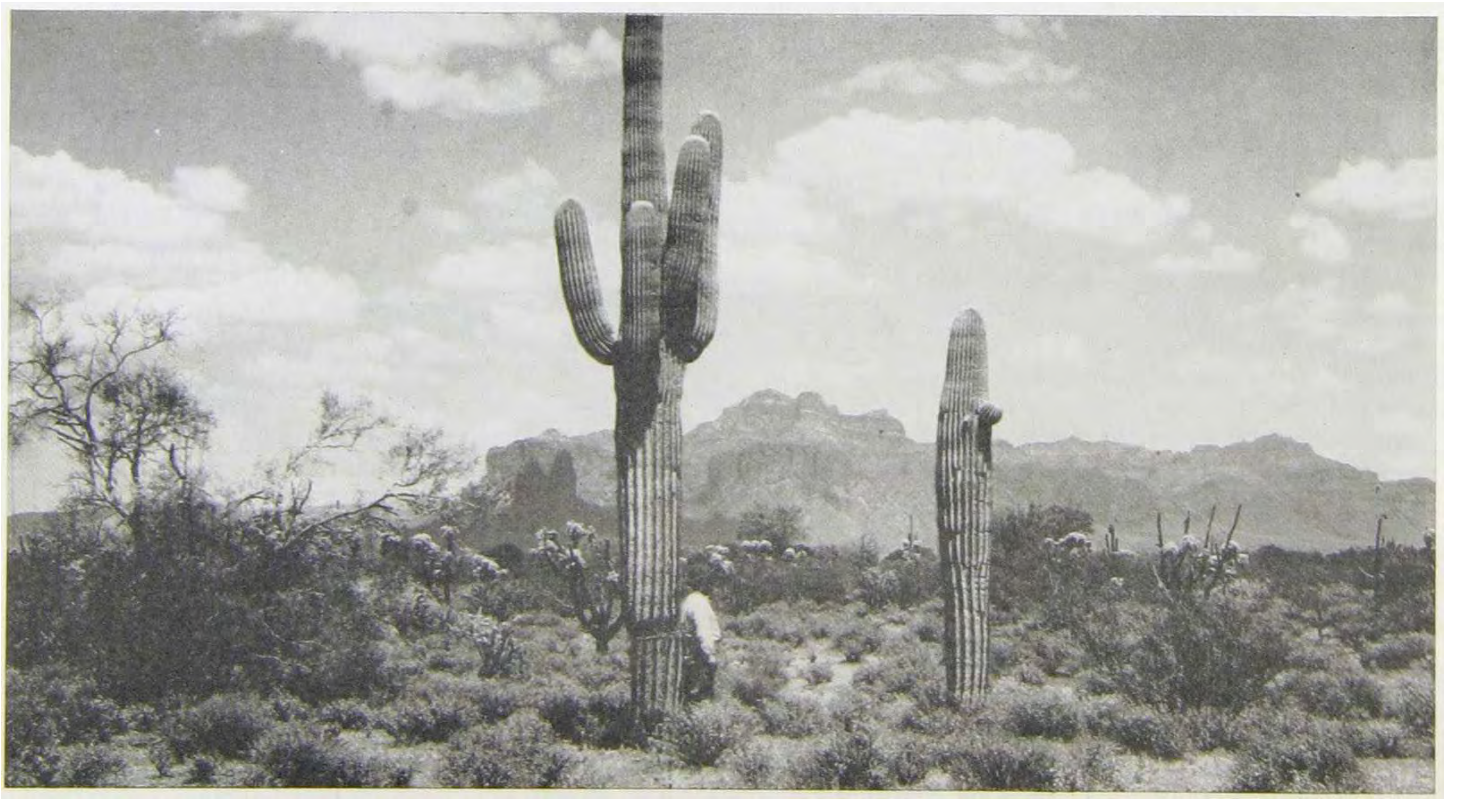
The higher areas are covered with forests of pine, fir, spruce, and silver-stemmed aspens, broken by small glades and mountain meadows. Pinon and juniper trees, interspersed with scrub oak, mountain mahogany, rabbit brush, bunch grasses and similar plants grow in the intermediate elevations of the mesa and plateau regions. Scattered cottonwoods and chokecherries grow in the canyons with the cliff rose, the redbud, and blue columbine. A profusion of wild flowers carpet many mountain "parks." In the lower region large areas are almost completely devoid of plant life while other sections are sprinkled with desert shrubs, Joshua trees, other Yucca plants, and saguaro cacti, some of the latter giant plants reaching 40 feet in height. Occasionally cottonwoods or desert willows are found along desert streams with mesquite and creosote bush or catclaw and paloverde.

The Colorado River Basin is the natural habitat of the bighorn sheep, ptarmigan, and wild turkey. Deer, elk, and antelope are found in the forested and more primitive areas. Mountain lions, wild cats, lynx, and other predatory animals are fairly common in remote areas. Coyotes inhabit the plains country where they prey upon gophers, cottontails, jackrabbits, and other smaller mammals. Fur-bearing animals in the mountains include beaver, fox, badger, ermine, muskrat, skunk, and mink. Ducks, geese, snipe, white-wing pigeons, quail, dove, and other birds are numerous. Snakes and lizards with other reptiles and amphibians are frequently found in the desert areas.



DESERT FLORA

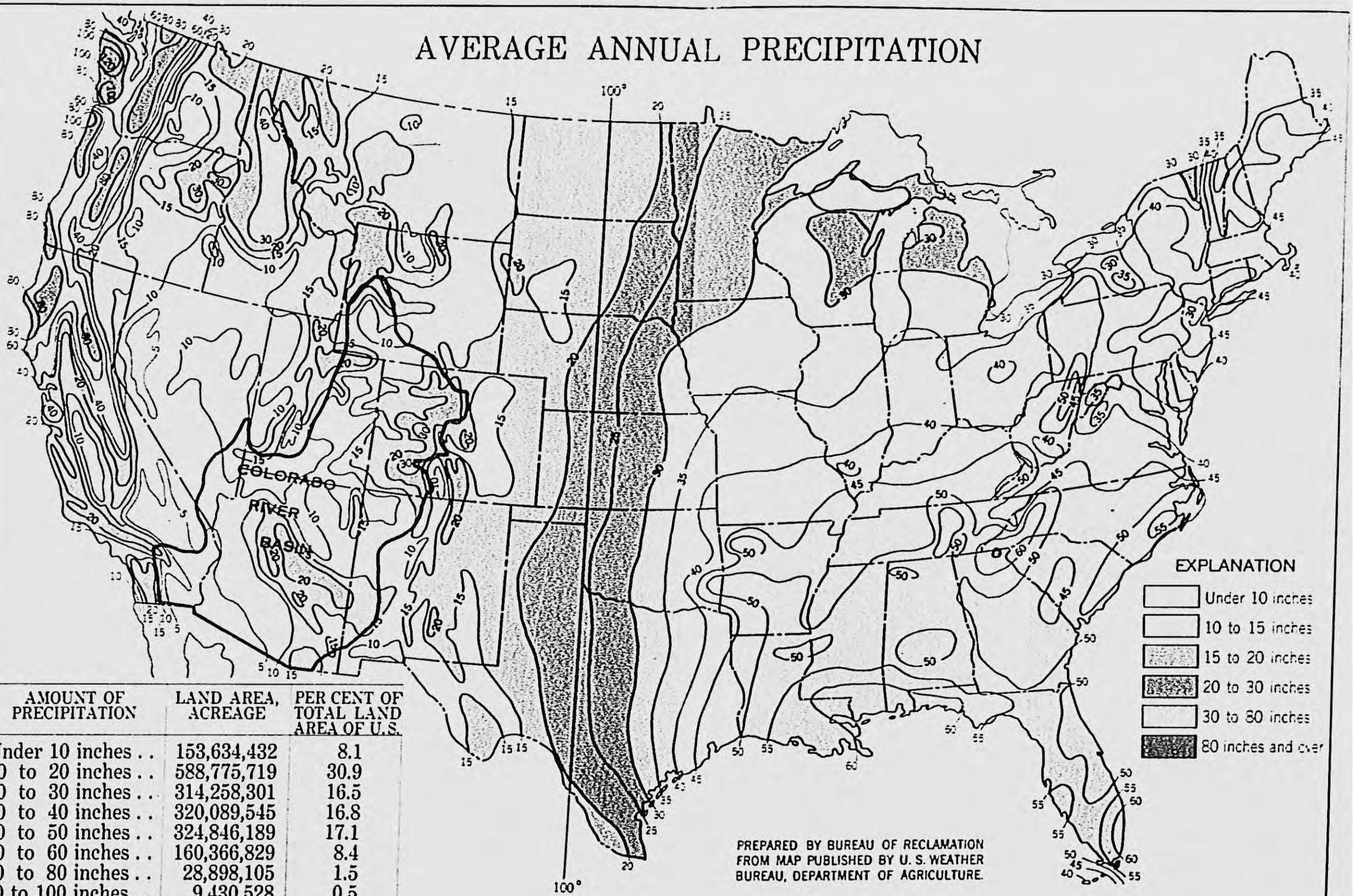
Vast areas are sprinkled with Joshua trees, Yucca plants, and desert shrubs



DESERT SCENE

A view of Superstition Mountains with typical sage brush and cactus lands in the foreground

AVERAGE ANNUAL PRECIPITATION



AMOUNT OF PRECIPITATION	LAND AREA, ACREAGE	PER CENT OF TOTAL LAND AREA OF U.S.
Under 10 inches . .	153,634,432	8.1
10 to 20 inches . .	588,775,719	30.9
20 to 30 inches . .	314,258,301	16.5
30 to 40 inches . .	320,089,545	16.8
40 to 50 inches . .	324,846,189	17.1
50 to 60 inches . .	160,366,829	8.4
60 to 80 inches . .	28,898,105	1.5
80 to 100 inches . .	9,430,528	0.5
Over 100 inches . .	2,915,712	0.2

PREPARED BY BUREAU OF RECLAMATION
FROM MAP PUBLISHED BY U. S. WEATHER
BUREAU, DEPARTMENT OF AGRICULTURE.

MAP NO. 44-1 - JAN. 1944 - A.N.S.

The cold, clear mountain streams abound in trout, the most common varieties being rainbow, eastern brook, native, and Loch Leven. Bass, crappie, and bluegill prefer the lakes and reservoirs to the moving waters of the streams.

Climate

Climatologically, the Colorado River Basin has the extremes of year-round snow cover and heavy precipitation on the high peaks of the Rockies, snow-capped 8 to 10 months a year, and truly desert conditions with very little rain in the southern area around Yuma, Ariz. The wide range of climate in the basin is caused largely by differences in both altitude and latitude and to a lesser extent by topographic features.

Extremes of temperatures in the basin range from 50° below zero to 130° above zero. The northern portion of the basin is characterized by short, warm summers and long, cold winters, many mountain areas being blanketed by deep snow all winter. A peculiar climatic condition exists in the Grand division in Colorado where high mountains tend to divert east-bound storms either to the north or to the south over lower passes in the Continental Divide. The southern portion of the basin has long hot summers, practically continuous sunshine and almost complete absence of freezing temperatures. Summer heat is not so oppressive as temperatures would indicate because of the low humidity. Summer nights, typical of the desert, are seldom too warm for comfort. The little Colorado River Basin is noted for its high percentage of sunshine—about 80 percent of the total possible.

The entire basin is arid except in the extreme high altitudes of the headwater areas. Rainfall is insufficient for the profitable production of crops without irrigation. See map "Average annual precipitation." Along the Mexican border the annual precipitation averages only about 2.5 inches while in the higher mountains in Colorado, Wyoming, and Utah, the average is around 40 inches. In the northern part of the basin most precipitation falls in the form of winter snows and spring rains. Summer storms are infrequent but sometimes of cloudburst intensity in localized areas. Winds of high velocity are common in some sections. In the more arid southern portion the principal rainy season is in the winter months with occasional localized cloudbursts in the summer and fall.

Climatological data for representative stations in the basin are summarized in table I.

The length of the growing season varies from about 80 days in the higher elevations of the northern mountainous sections to year-round in the lower semitropical southern areas. In the northern sections hailstorms and late spring and early fall frosts occasionally damage crops. Although the growing season of the higher agricultural areas in the Grand division is short, air drainage in localized sections along the foothills of the lower valleys is favorable for the growing of such fruits as peaches, pears, cherries, apricots, and berries. Because of the long growing season in the lower regions of the southern portion of the basin double-cropping is commonly practiced in the principal farming districts. Crops in some southern areas are seldom damaged by frost, by hail and by warm, dry summer winds.

TABLE 1.—*Weather records at representative stations, Colorado River Basin* [1]

Division and station	Elevation above sea (feet)	Years of record	Precipitation		Temperature			Average frost-free period (days)	Average growing season (days)
			Average annual (inches)	Average May–September (inches)	Mean annual (degrees)	Maximum (degrees)	Minimum (degrees)		
Green									
Kendall, Wyo	7,600	20	17.2	6.94	33.3	103	−52	53	91
Green R., W[illegible]	6,083	39	7.7	3.54	43.5	103	−40	104	155
Vernal, Utah	5,266	43	8.93	3.82	45	106	−38	118	179
Meeker, Colo	6,500	42	15.9	7.23	43.1	103	−43	117	143
Green R., Utah	4,087	43	6.1	3.03	52.5	112	−42	156	203
Grand									
Gunnison, Colo	7,683	48	10.1	5.29	37	105	−47	95	114
Collbran, Colo	6,200	46	15.7	6.74	46	100	−30	160	178
Norwood, Colo	7,017	13	16.6		46	99	−29	119	
Grand Junction, Colo	4,587	51	8.7	3.91	52	105	−21	190	185
Moab, Utah	4,000	54	9.4	3.83	54.7	113	−24	172	228
San Juan									
Pagosa Spgs., Colo	8,150	16	26.1	9.63	41.2	98	−39	84	115
Ignacio, Colo	6,425	30	16.1	8.49	45.7	101	−38	110	155
Northdale, Colo	6,482	14	14.8		44.8	103	−42	118	
Shiprock, N. Mex	4,950	16	8.1	5.72	52.5	109	−18	157	202
Escalante, Utah	5,258	35	12.2	5.96	45.7	102	−22	136	183
Little Colorado									
Winslow, Ariz	4,880	36	18.10	7.38	54.9	107	−19	172	216
Holbrook, Ariz	5,069	52	9.13	4.88	54.6	106	−21	169	209
St. Johns, Ariz	5,650	36	11.60	6.67	52.3	104	−22	159	194
Tuba City, Ariz	4,593	40	6.73	2.98	55.1	110	−15	181	232
Flagstaff, Ariz	6,922	51	21.12	8.89	45.7	102	−30	123	159
Gallup, N. Mex	6,785	19	11.94		48.5	98	−20	158	
Virgin									
St. George, Utah	2,880	54	8.66	3.27	59.7	116	−11	194	243
Springdale, Utah	4,048	36	14.91	5.14	60.0	112	−15	199	279
Kanab, Utah	4,925	36	13.03	4.36	52.6	106	−20	153	207
Alton, Utah	7,000	29	16.31	6.62	44.8	94	−20	114	170
Logandale, Nev	1,400	36	5.21	1.59	65.4	120	6	235	350
Caliente, Nev	4,407	21	7.16	0.96	53.0	110	−31	160	180
Boulder									
Yuma, Ariz	138	74	3.37	1.13	72.2	120	22	331	365
Kingman, Ariz	3,435	40	11.14	3.83	61.5	117	6	213	320
Grand Canyon, Ariz	6,930	37	16.71	7.58	48.3	103	−22	141	181
Las Vegas, Nev	2,033	37	4.75	1.81	23.2	118	8	229	305
Needles, Calif	480	50	4.72	1.61	71	125	18	302	365
Brawley, Calif	−119	35	2.62	0.42	72	121	19	322	365
Gila									
Phoenix, Ariz	1,107	47	7.76	2.84	70.2	118	16	301	365
Prescott, Ariz	5,022	73	18.76	8.22	52.9	110	−21	144	202
Tucson, Ariz	2,423	74	11.51	6.36	37.2	118	0	240	365
Gila Bend, Ariz	737	49	5.96	2.30	72.2	123	11	288	365
Globe, Ariz	3,510	42	16.60	7.32	62.6	110	10	231	365
Wickenburg, Ariz	2,072	42	10.39	4.15	64.9	115	11	231	317

[1] Data from records of U. S. Weather Bureau.

Claiming the Basin

"Man's claiming of the Colorado River Basin has provided a colorful chapter in American history—and one which is not closed. . . . It taxed the courage and resourcefulness of the people themselves. . . .

"This chapter deals with the people—who they are, why they came, where they settled, what towns and cities they established. . . . A study of the human resources is fundamental to an understanding of the problems, the needs, and the opportunities for future development of this great basin."

CHAPTER II

Claiming the Basin

Man's claiming of the Colorado River Basin has provided a colorful chapter in American history—and one which is not closed. Whether people came as missionaries to the Indians, seekers of gold, trappers and traders, explorers, immigrants crossing to more attractive areas, or as pioneers and settlers, the basin presented a challenge. It taxed the courage and resourcefulness of the people themselves. Those who survived to claim the basin as their home are vigorous Americans, who earned their "stake" in the land and its future. To them and to their children and to others who will elect to make this land their home, the challenge remains. What further use will be made of the basin, rich in resources of land, water, minerals, power, and recreational opportunities, is for them to determine. They are the empire builders.

Accumulating evidence shows the basin to have been widely populated thousands of years ago and here and there to have been intensely cultivated under irrigation systems. Spaniards came as early as the sixteenth century seeking gold or bringing the gospel to the Indians, but most of them failed to establish a lasting civilization. The immigrant waves which started rolling to the Pacific in the gold rush of 1849 hurried through the bleak plains of Wyoming to the north and avoided the hostile Indians and scorching deserts of the south. Permanent occupation of the basin by American settlers dates from the middle of the last century. Although settlement and development of the basin have slowly and steadily progressed, today it is still one of the most sparsely settled regions of the United States. It has a total population still below a million people, an average density of fewer than four persons to a square mile, and only two cities of more than 20,000 people.

This chapter deals with the people—who they are, why they came, where they settled, what towns and cities they established, and other related factors. A study of the human resources is fundamental to an understanding of the problems, the needs, and the opportunities for future development of this great basin.

Primitive Peoples

Archeological evidence indicates that the southern part of the Colorado River Basin was inhabited by ancient peoples—cave, cliff, and mud-house dwellers—eight to ten thousand years ago. Indian legends relate that these people were forced to leave the region because of volcanic eruptions in the vicinity of the San Francisco Peaks near Flagstaff, Ariz.

Ruins of dwellings and storehouses, and the remains of pottery, arrowheads, and other artifacts scattered throughout the Colorado River Basin bear mute evidence of the existence of scattered Indian tribes, many of whom had disappeared before the coming of the white man. Some of these, like the present-day Hopi, developed a simple agriculture and lived in permanent compact villages adjoining their cultivated fields. Some, like the Pima-speaking tribes of southern Arizona, harvested seeds and fruits, irrigated their lands and had small village settlements. Others, like the Utes and Paiutes of the plateaus to the north, lived an open, roving life, depending for a livelihood on hunting animals and collecting herbs. They built crude shelters of bark or skins, and seldom resided permanently in large settlements. Dwellings in the valleys were mostly of adobe but other pueblos near and on the cliffs were made of stone. Virtually four-storied apartment houses containing hundreds of rooms have been found.

The present Navajos and Apaches entered the basin as roving bands about 600 years ago and established a civilization which has persisted to the present day. The Pimas, Maricopas, and Papagos of the lower Gila Valley are among the most advanced Indian tribes found in the United States. The Chemehuevi ("Digger Indians") of west-central Arizona are among the least progressive. (See chapter VIII, Office of Indian Affairs.)

Farming by irrigation as now practiced in the Gila and Salt River Valleys may be a modern revival of an ancient agricultural development. Present canals are found to follow closely the route of an ancient canal system and the valleys contain numerous ruins of the villages and storehouses used by a people whose history is still in doubt. Extensive remains of the old agricultural development are found throughout almost the entire Gila River Valley. The ancient canals probably were capable of serving as much as 250,000 acres in all, though the area actually under cultivation at any one time may have been comparatively small. Primitive construction tools restricted the size of irrigation works. All irrigation was

done by direct diversion. As the low-lying irrigated lands became waterlogged, the community moved to another location and developed new land. The numerous ruins are believed to be the evidence of those successive migrations. The cause of the final exodus of the original tribes from the region is not known, but is believed to have been severe drought. The present modern irrigation works are simply making more efficient use of the same streams which at one time made possible the agriculture which supported a primitive people.

Explorations

The deep canyons, obstructing cliffs, and desert wastes long hindered travelers in penetrating the Colorado River Basin. The Spanish conquistadors, exploring north from Mexico, were the first white men to enter the basin. In 1539 the Spanish explorer Francisco de Ulloa sailed to the head of the Gulf of California and because of the turbid water inferred that a stream entered the gulf in that vicinity. He did not see a river, but drew a rough map showing its supposed location.

The Colorado River actually was discovered in 1540 by Hernando de Alarcon, who explored the stream from its mouth to a point near the present site of Ehrenberg, Arizona, about 100 miles above the mouth of the Gila River. Two years later Lopez de Cardenas discovered the Grand Canyon but was unable to descend its sheer walls. To traverse the country and to obtain food and supplies seemed so hopeless to early explorers and missionary priests that 2 centuries elapsed before a crossing was made in the canyon section.

In the sixteenth century, Spanish explorers forded the Little Colorado River near the present site of Holbrook, Ariz. They named the river "Rio Alameda" or "River of the Groves," which would indicate that the stream flow characteristics at that time must have been materially different from the erratic flow of the present.

Father Escalante's expedition crossed the Virgin River in 1776 near St. George, Utah, after an unsuccessful search for an overland route from Santa Fe, N. Mex., to Monterey, Calif.

As time passed, stories of these early Spanish explorers combined with Indian legends grew into fabulous tales of this unknown land. It was said that the Colorado had great falls and whirlpools and that it ran underground for hundreds of miles. So formidable were the actual conditions that the Colorado River was long considered a dangerous obstacle to be circumtoured.

Spanish explorations continued to the beginning of the nineteenth century, the region being covered rather thoroughly. During this period two missions were built along the Colorado River, both of which were later destroyed by Indians. Some encouragement was given to Indian agriculture, but the Spaniards' main interest in the area lay in the exploitation of its mineral resources.

Venturesome traders, trappers, and explorers entered the area during the period 1820–1840. Beginning in 1824 General William Henry Ashley with a large band of expert trappers explored part of the Green River canyons. Other trappers and explorers who visited the basin during this period were James O. Pattie (1825), R. W. H. Hardy (1826), Jedediah Smith (1826), Kit Carson (1826), Ewing Young (1827), William Wolfskill (1830), Capt. Benjamin L. E. Bonneville (1832), and Thomas J. Farnham (1839). By the year 1840 this wilderness had been traversed throughout by white men except for the deep canyons of the Colorado.

The trapping of wild animals for their pelts was the first exploitation of the resources of the basin by Americans. From 1824 to 1840 General Ashley's fur company and its successors, eventually the Rocky Mountain Fur Co., met other trappers and Indians at annual rendezvous on the Green River. The trappers traded furs to Ashley's company for ammunition, whiskey, and various supplies and trinkets. The trapper's life was extremely arduous and hazardous, and few trappers survived for many years the attacks of hostile Indians. After 1840 the beaver was so depleted that trapping was no longer profitable.

In 1843 Jim Bridger established a trading post on a branch of the Green River. John C. Fremont's explorations of the Colorado and the West covered the period 1842–46.

The historic march of the Mormon Battalion, a group of 500 officers and men mustered by the Mormon Church for service in the war with Mexico, crossed the southern part of the basin in 1846, marking a wagon road from Santa Fe to San Diego.

The treaty of Guadalupe-Hidalgo, signed in 1848 at the end of the war with Mexico, and the Gadsden Purchase in 1853 gave to the United States much of the territory now included in the seven Colorado River Basin States.

In 1849 after gold was discovered in California at Sutter's Mill, adventurers began to pour across the Colorado River at two main points, one near Yuma, Ariz., and the other at "The Needles" about 200 miles farther north. The gold seekers also used a northern route which crossed the Green River in Wyoming. At the same time the Mormons were crossing the upper part of the basin en route to the Salt Lake Valley in Utah, and many emigrants following the Oregon Trail traversed the Green River country.

With the establishment of Fort Yuma on the lower Colorado River in 1851 steamboating on the river began. Navigation was the first use made of the main Colorado River.



CANYON COUNTRY

Deep narrow canyons of the Colorado afford excellent power sites

Before the coming of the railroads, all freight for the interior of Arizona was carried by sea-going ships to the head of the Gulf of California; there it was transferred to the river boats of the Colorado Steam Navigation Co. and shipped to various points along the lower river whence it was carried overland by wagon train to its final destination.

In 1857 the War Department dispatched Lt. J. C. Ives to proceed up the Colorado River by boat as far as navigation was possible. He ascended in his steamboat only as far as Fort Callville near the head of Black Canyon, about 400 miles above the mouth of the river. It took him 5 days to navigate the last 20 miles.

In his report to the War Department, Lieutenant Ives said:

> The region last explored is, of course, altogether valueless. It can be approached only from the south, and after entering it, there is nothing to do but leave. Ours was the first, and doubtless will be the last, party of whites to visit this profitless locality. It seems intended by nature that the Colorado River along the greater portion of its lone and majestic way shall be forever unvisited and unmolested.

In 1869, Maj. J. W. Powell succeeded in leading a river expedition down through the canyons of the river. In traveling by boat from Green River, Wyoming, to the mouth of the Virgin River in Nevada, a few miles above where Lieutenant Ives had been stopped, he achieved the hitherto impossible feat of traversing a thousand miles of unknown rapids and formidable canyons. He became the first white man to gaze up the sheer walls of the Grand Canyon throughout its entire length and live to tell the tale.

Subsequently, Major Powell and others made additional voyages to explore the canyons. With the river explored, active investigation began to make it useful for man.

Settlement

Settlement of the Colorado River Basin has slowly but steadily progressed. Rural settlements have been scattered along streams. Towns and cities have grown up mainly near farms and mines and at important railroad points.

The early settlers endured many hardships in carving homes from the wilderness—the rigors of an arid climate, the depredations of Indians and wild beasts, and the arduous and wearisome existence of frontier life.

Missionaries influenced early settlement in the basin. Father Kino, a Spanish priest, founded the first settlements subsequent to his visit to the region in 1691. Spaniards established resident fathers in the Santa Cruz River Valley as early as 1700, and soon after several missions were constructed on the banks of the stream.

Among the early colonizers of the basin were Mormon pioneers, who settled in small agricultural communities along river valleys, cultivated the more favorable farming lands adjacent to streams where irrigation water was readily accessible, and grazed livestock on nearby range lands. Old Fort Supply in Wyoming and Santa Clara, Utah, were established by Mormons in 1854. Mormon settlements spread into other parts of Utah, and in Arizona and Nevada in the 1860's and '70's.

The lure of gold was a chief factor influencing early settlements. Many a pioneer settler came seeking his fortune in the gold rushes, but, finding that his dreams of easy riches would never materialize, stayed to raise livestock or to farm.

Several rich mines were discovered throughout the basin by transient prospectors and these discoveries were responsible for a temporary population influx. Miners and prospectors pushed over the mountains from older mining districts on the eastern slope of the Continental Divide. The placer ground at Breckenridge, Colorado, near the crest of the divide attracted the first settlers to this region in 1859. Within the next decade other mining camps were established near the mountain tops. Some miners turned to farming and found a lucrative business in supplying agricultural products to the mining communities. Settlement grew downward from the mountains into the valleys in this western slope section of Colorado, the advance being slowed somewhat by the hostility of the Indians who occupied the territory.

The greater part of the Uinta Basin in Utah was established as an Indian reservation in 1861.

Mining was active in southeastern Arizona from 1847 to 1860 under protection of the Federal Government, but during the Civil War hostile Indians caused nearly all of the early mining settlements to be abandoned. After the Civil War mining was resumed.

The establishment of amicable relations with the Indians and the construction of railroads through the basin finally made permanent settlement possible. The Union Pacific Railroad was completed to Green River, Wyo., in 1869. The Southern Pacific Railroad reached the Colorado River at Yuma, Ariz., in 1877, and the Atlantic and Pacific Railroad crossed the river at Needles, Calif., in 1883. With the coming of the railroads, navigation soon declined. Other than by railroad, early transportation was by horse and mule, pack train, or freight wagon traversing trails and primitive roads.

For many years mining was the leading industry in the Colorado River Basin but declined in relative importance with the development of irrigated agriculture. Many rich gold and silver lodes pinched out. Aspen, Telluride, and Silverton in Colorado, once prosperous cities pouring out gold and silver, became dozing towns. Production of copper, lead, and zinc became more important, and

Arizona displaced Colorado as the leading producer of minerals in the basin. Where valuable mines were discovered, towns sprang up in their immediate vicinity, and where possible, irrigated agriculture was practiced nearby to supply the demands of local markets.

Cattlemen were attracted to the expansive grazing areas of the basin and in many sections were the first settlers.

Colonization in the basin has been accompanied by a continual search for a satisfactory irrigation water supply. Settlers migrated to areas more readily irrigated and concentrated along river courses. A few small settlements were made in favored isolated areas.

The history of early settlement along the lower reaches of the Colorado River is a story of community struggles with destructive floods. Many towns were established only to be abandoned later when it became evident to the settlers that it was impossible for them to control the rivers. Dams were repeatedly washed out, crops withered and died in time of drought, and flash floods ravaged the fields and towns.

Private and community efforts were responsible for the establishment of early settlements. Some present-day settlements, however, followed in the wake of Federal Reclamation developments. These projects, making available new areas of fertile farm land and attracting many new settlers, have been the nuclei around which farming communities and trade centers have evolved.

Population

Referred to as an area of "wide open spaces", the Colorado River Basin is sparsely populated. On the basis of the 1940 census, which reported fewer than a million people in the basin, the average population density of the entire area, including urban centers, was 3.6 persons a square mile, as compared with a national average of 44.2 persons a square mile.

Population Growth

Except for short-lived surges resulting from mining, the population of the Colorado River Basin has steadily increased since its colonization. At the beginning of the Twentieth Century the basin supported only 261,197 persons, or little more than an average of one person a square mile. The population has more than tripled in the first 40 years of this century.

The first settlements which grew into permanent communities were largely the result of farming. But farming was slow to develop into a stable industry, and in the early stages it was not adapted to the support of sizable centers of population. Urban communities began to rise with the development of federally financed irrigation projects. The city of Phoenix, Ariz., grew rapidly in the decade 1910–20 when great strides were taken in the development of irrigation in the immediate vicinity.

The relatively high rate of natural increase, the improvement in transportation facilities, the opening of scenic features of the country to tourists, the accessibility of outside markets, and migrations from the Middle West have been largely responsible for the increase in population during the 1930–40 period.

Population growth has not been uniform throughout the basin. Between 1900 and 1940 the Lower Basin increased its population five times while during the same period the upper basin little more than doubled. A phenomenal growth was experienced by the southern California area where the population increased more than 12 times in the same 40-year period.

The people of the Colorado River Basin are predom-

TABLE II.—*Population growth in the Colorado River Basin*

Division	1900	1910	1920	1930	1940
Upper basin					
Green	42, 110	59, 450	85, 320	93, 330	99, 710
Grand	57, 050	84, 590	84, 380	84, 050	105, 450
San Juan	32, 340	47, 890	53, 450	66, 920	81, 290
Total	131, 500	191, 930	223, 150	244, 300	286, 450
Lower basin					
Little Colorado River	19, 057	34, 631	44, 146	60, 986	75, 341
Virgin	9, 569	10, 305	11, 706	13, 879	17, 213
Boulder	10, 414	33, 871	79, 899	111, 558	127, 568
Gila	90, 657	161, 969	275, 433	363, 466	411, 497
Total	129, 697	240, 776	411, 184	549, 889	631, 619
Colorado River Basin	261, 197	432, 706	634, 334	794, 189	918, 069
Southern California	282, 090	703, 675	1, 253, 800	2, 791, 927	3, 524, 860
United States	75, 994, 575	91, 972, 266	105, 710, 620	122, 775, 046	131, 669, 275

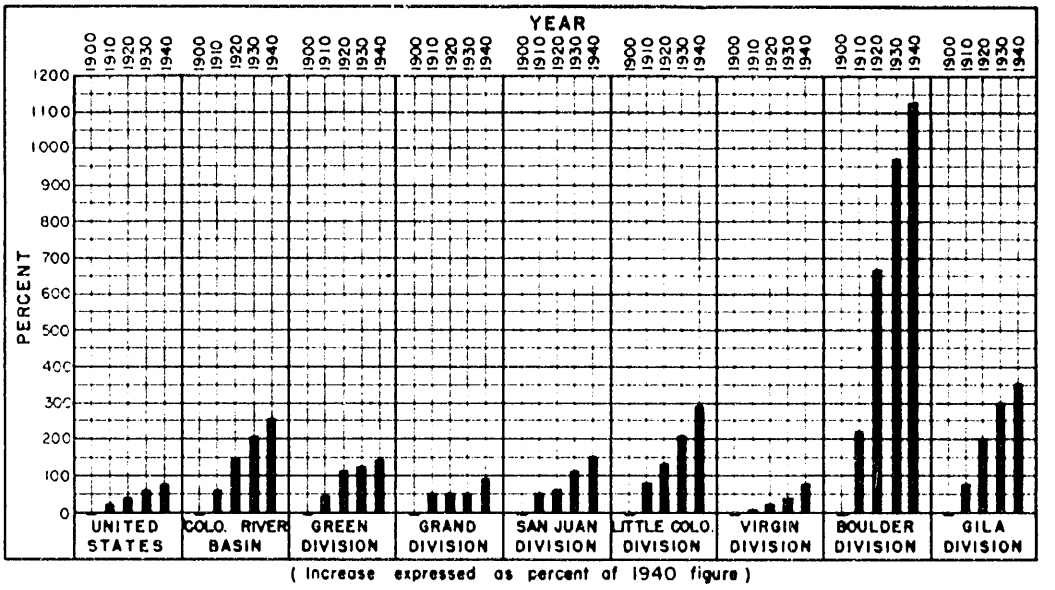


FIGURE 1.—*Population Growth, 1900–1940.*

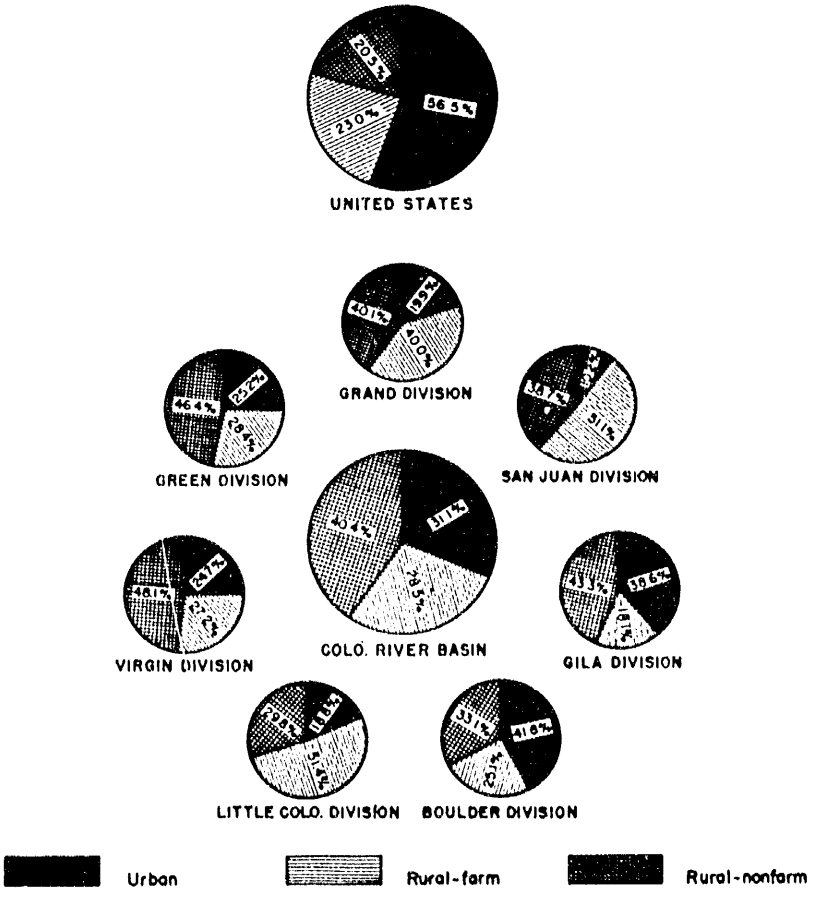


FIGURE 2.—*Distribution of Population, 1940 Census.*

inantly white, almost 90 percent of the population being so classified in 1940. Of the nonwhite races, Indians are in greatest number, both in the upper and lower basins, and are concentrated in vast Indian reservations scattered throughout this area. Indian and Negro populations are increasing.

Distribution of Population

Approximately 69 percent of the 1940 population of the Colorado River Basin was classified as rural. This means that approximately 630,000 people lived either in the open country or in towns and villages of fewer than 2,500 population. Only 28 percent of the total population lived on farms and approximately that proportion was directly dependent upon agriculture for a livelihood.

Urban centers are scattered throughout the basin. Largest settlements in the upper basin are mining, agricultural, and railroa dcenters. In the lower basin concentration of population is mainly where irrigation is extensive, although recreational and scenic attractions have been responsible for the location and growth of many cities. Conforming to a National trend, there is an increasing concentration of population in urban centers. Principal towns and cities in the basin are:

Division	Population (1940)	Division	Population (1940)
Green		**Little Colorado—Con.**	
Rock Springs, Wyo	9,827	Winslow, Ariz	1,577
Price, Utah	5,214	Holbrook, Ariz	1,181
Helper, Utah	2,843		
Green River, Wyo	2,640	**Virgin**	
Craig, Colo	2,123		
Vernal, Utah	2,119	St. George, Utah	3,591
Kemmerer, Wyo	2,026	Hurricane, Utah	1,521
		Callente, Nev	1,500
Grand		Kanab, Utah	1,365
		Pioche, Nev	1,182
Grand Junction, Colo	12,479		
Montrose, Colo	4,764	**Boulder**	
Delta, Colo	3,717		
Glenwood Springs, Colo	2,253	Brawley, Calif	11,718
Gunnison, Colo	2,177	El Centro, Calif	10,017
Fruita, Colo	1,466	Las Vegas, Nev	8,422
Rifle, Colo	1,373	Yuma, Ariz	5,325
		Williams, Ariz	2,622
San Juan		**Gila**	
Durango, Colo	5,887	Phoenix, Ariz	65,414
Farmington, N. Mex	2,151	Tucson, Ariz	36,818
Shiprock, N. Mex	2,131	Douglas, Ariz	8,625
Escalante, Utah	1,106	Prescott, Ariz	6,018
		Bisbee, Ariz	5,853
Little Colorado		Nogales, Ariz	5,135
		Silver City, N. Mex	5,011
Gallup, N. Mex	7,041	Safford, Ariz	2,266
Flagstaff, Ariz	5,080		

Population Movement

The towns first established in the basin were little more than temporary camps, and a look at a map of 40 or 50 years ago will reveal names of communities which are today but memories of a romantic past.

From the beginning the population possessed a high degree of mobility, particularly in the lower basin. Although the number and size of permanent communities have increased since the turn of the century the population has not lost its trait of mobility. The University of Arizona found from a recent study of population trends in Arizona that while the decade 1930–40 brought 134,000 people into the State, the net population gain was only 63,000 persons, of which 32,000 could be attributed to the natural increase in the resident population. Some 103,000 people had claimed Arizona as a place of residence during that decade but had failed to become permanently established.

Economic depressions and disasters in other States have dislodged many people from permanent moorings, and those thus affected have moved aimlessly about the country. The droughts and dust storms which occurred in the Middle West in the 1930's resulted in such migrations. Hearings before the House of Representatives Committee of the Seventy-Seventh Congress investigating migratory labor problems revealed that 63 percent of all migrants into Arizona and southern California during this period came from the Middle West. The committee found that while 66 percent of the group investigated had been farm operators or owners prior to migration, less than 15 percent became owners or operators of farms in their new locations. The majority of the migrants from the Middle West became farm laborers or joined the ranks of the semiskilled or unskilled workers, depending on seasonal or other temporary employment.

The population of the upper basin has been less affected by immigration than that of the lower bsin. Instead of growing from migration, Utah lost by outward movement of its residents from 1920 to 1940. Many young people left the State to seek work and opportunities in larger industrial centers and metropolitan areas. Despite its outward migration, Utah has had a net population gain each decade because of its high birth rate. In 1930 Utah had the highest rate of natural increase in the Nation.

The rise of war industries during World War II brought to the area its most rapid influx of people. The most significant movements were to southern Nevada and central Arizona. Las Vegas, Nevada, tripled in population during the war period, and the city of Phoenix, Arizona, increased approximately 130 percent. At the same time, thousands of young men left the area to join the Nation's armed forces. Thus, the war induced movements into and out of the basin.

The relatively undeveloped state of the basin and its store of natural resources indicate that by no means has the population reached its peak growth.

Dividing the Water

"In this chapter the history of irrigation development is traced to this critical period and problems are presented that pressed for solution in the development and use of the Colorado River for irrigation, flood control, power production, and other beneficial uses.

"The Colorado River Compact which divided the water between the upper and lower basins, other legislative acts pertaining to the development of the Colorado River, and the Mexican treaty allocating certain of the waters of the Colorado River to the sister republic are briefly outlined with no attempt at legal interpretation."

CHAPTER III

Dividing the Water

As more people claimed the Colorado River Basin for their home, they came to realize that the extent of the ultimate habitable area was determined by the limitations of the dependable water supply and that the Colorado River was increasingly important as a national resource.

How to divide the waters of the Colorado River for beneficial use presented complications. Because the watershed reached into seven States in this country interstate problems required solution before any comprehensive development could be undertaken. Since the river's lower delta and its mouth extend into Mexico international problems also were presented.

In the history of the development of the Colorado River the early 1920's was a significant period. By that time the use of water in the lower river area had reached the maximum possible without extensive storage regulation, and demands for additional water had created a critical situation which finally resulted in the Colorado River Compact, the Boulder Canyon Project Act, and subsequent acts pertaining thereto.

In this chapter the history of irrigation development is traced to this critical period and problems are presented that pressed for solution in the development and use of the Colorado River for irrigation, flood control, power production, and other beneficial uses. The Colorado River Compact which divided the water between the upper and lower Basins, other legislative acts pertaining to the development of the Colorado River, and the Mexican treaty allocating certain of the waters of the Colorado River to the sister republic are briefly outlined with no attempt at legal interpretation.

Fundamental to a division of the water is a knowledge of the quantity, quality, and flow characteristics of the water available. Virgin conditions of the Colorado River are considered for this purpose.

Virgin Conditions

The Colorado River, draining 242,000 square miles in this country, has the largest watershed of any stream in the United States outside of the Mississippi River Basin. Beginning high on the Continental Divide it empties into the Gulf of California at sea level.

Rain and snow fall in abundance on the Rocky Mountains rimming the upper part of the Colorado River Basin, but great expanses in the lower areas are comparatively dry. The average annual precipitation for the entire drainage area of less than 15 inches is near the lowest for the major river basins of America. Nearly 90 percent of the moisture that falls returns again to the atmosphere through evaporation, and only about 10 percent flows in the river channel. Yet about 10 percent of the scanty precipitation on so vast an area makes up the flow of the mighty Colorado River. The river grows almost to its full size from contributions of tributaries in the upper half of its drainage area, above Lee Ferry in Arizona. Below that only minor contributions are made by the Little Colorado and Virgin Rivers, and between Black Canyon (site of Boulder Dam) and the entry of the Gila River near the Mexican border inflow is insufficient to offset evaporation losses in the desert region. From an analysis of all available data, average virgin flows at various points are estimated as follows:

TABLE III.—*Estimated Virgin flows in the Colorado River Basin*

Stream	Location	Average annual flow (acre-feet)
Green River	At mouth	5, 903, 000
Colorado River	Above mouth of Green River.	7, 289, 000
Do	Lee Ferry in Arizona	[1] 16, 270, 000
Little Colorado River	Near the mouth	338, 000
Virgin River	Littlefield	310, 000
Colorado River	Boulder Dam	[1] 17, 330, 000
Do	Laguna Dam	[1] 16, 450, 000
Gila River	Dome	[1] 1, 270, 000
Colorado River	International boundary	[1] 17. 720, 000

[1] See appendix I, "Water supply, Colorado River."

Before man built the existing structures providing partial river control, seasonal flows of all streams fluctuated greatly. In the spring the Colorado River fed by melting

snow was a mighty, raging torrent, reaching flood peaks of 250,000 second-feet or more. Below the canyon section it overflowed its banks and inundated the country for miles around. In summer in years of low run-off its flow became a mere trickle by comparison, sometimes dropping to 2,500 second-feet. The only sustained summer flow of most tributaries was the outflow from numerous mountain lakes fed by the melting of perpetual snow banks. The northern tributaries had greater sustained flows than those in the southern region, but they too were subject to great fluctuations.

The flow of the river also fluctuated greatly from year to year. At Lee Ferry, under virgin conditions, annual flows probably ranged from as little as 5,500,000 acre-feet to as much as 25,000,000 acre-feet. Flows of tributary streams were characterized by even greater variations, especially those of the lower region. Under virgin conditions the average annual flow of the Gila near Phoenix is estimated to have been 2,282,000 acre-feet, of which probably only about 1,270,000 acre-feet reached the Colorado because of losses in the lower river area.

The creeks and streams at higher elevations generally bring clear, pure water into the main Colorado River, although they become roily during the spring run-off. Soluble salts in quantities damaging to plant growth occur in isolated tributaries but the injurious effects are local and generally unimportant. Diluted by larger streams of the system, these soluble salts of tributary streams cease to be harmful. Water of the main river becomes progressively more saline as it moves downstream and receives return flows from irrigation and drainage from basin lands but is considered suitable for irrigation at the lowest diversion. (See Ch. VIII, Geological Survey "Quantity and Quality of Water.")

Tributaries entering the middle and lower sections of the Colorado River, notably the San Juan, Little Colorado, and Virgin Rivers, have highly erosive watersheds and hence contribute great quantities of silt to the main stream. At normal flow stages little silt is carried, but more is picked up in spring and early summer when flows become high and turbulent. Occasional summer cloudbursts cut into unstable earth sections, flushing large amounts of mud and silt into the streams.

Early Development of the River

Irrigation

The first white irrigators in the Colorado River Basin were the Jesuits who established themselves at the old missions of Cuevavi and San Xavier in Arizona in 1732. In the period 1768 to 1822, considerable irrigation was practiced along the Santa Cruz River near the missions and the Spanish presidios of Tubac and Tucson.

After the Gadsden Purchase in 1854, a number of Americans—military followers, stragglers from the immigrant stream to California, and others, pioneers by instinct—began to settle and develop irrigation in Arizona. Thomas H. Blythe moved to the Palo Verde Valley in 1856 and commenced the first recorded use of the Colorado River in California. In 1877 he made the first filing on Colorado River water in California. About the same time the first modern irrigation works were being constructed in Wyoming, Utah, and Colorado. In 1854 Mormon pioneers began to irrigate from Blacks Fork, a tributary of Green River, in Wyoming. Irrigation in the basin in Colorado began in the 1860's and 1870's when prospectors and miners came over the Continental Divide from the older mining districts on the eastern slope of the Rockies. The Federal Government first attempted to reclaim arid lands on the Colorado River Indian Reservation in 1867. In 1883 the Grand Valley Canal, a private development, was started to irrigate a relatively large area in Grand Valley on the western slope of the Rockies in west-central Colorado.

The possibility of exporting water from the Colorado River to the Imperial Valley of California by a simple diversion canal passing in part through Mexico was recognized even before the Civil War. In 1876 Lt. Eric Bergland made surveys on the lower river for the War Department for the purpose of investigating flood conditions and to determine the feasibility of diverting water from the Colorado River to the Imperial Valley through a canal wholly within the United States. He reported unfavorably on such a canal but efforts continued for a water supply to the Imperial Valley. Despite the difficulties and undesirability of a canal through Mexico for the irrigation of Imeprial Valley from the Colorado River, construction of an international canal was finally begun in 1902 by the California Development Co. By September 1904 nearly 8,000 people had settled in the valley; 700 miles of canal were in operation; and 75,000 acres of land were cropped.

After passage of the Reclamation Act by Congress in 1902, the Reclamation Service (Bureau of Reclamation since 1923) of the United States Department of the Interior began investigations to determine the feasibility of constructing large irrigation works in the West. Some of the early projects constructed in the Colorado River Basin by the Reclamation Service were the Uncompahgre and Grand Valley projects in Colorado, the Strawberry Valley project in Utah, and the Yuma and Salt River projects in Arizona.

Irrigation continued to expand in both the Upper and Lower Basins. In 1922 the approximate irrigation development in the entire Colorado River Basin, according to a report by F. E. Weymouth, then Chief Engineer of the Reclamation Service, was as follows:

TABLE IV.—*Irrigation Development in the Colorado River Basin. (1922)*

	Area irrigated (acres)	Area irrigable (acres)	Total (acres)
Upper Basin	1, 450, 000	2, 750, 000	4, 200, 000
Lower Basin	950, 000	1, 350, 000	[1] 2, 300, 000
Total in United States	2, 400, 000	4, 100, 000	6, 500, 000
Mexico	200, 000	800, 000	1, 000, 000
Total	2, 600, 000	4, 900, 000	[1] 7, 500, 000

[1] Includes 430,000 acres irrigated and 970,000 irrigable in the Gila River Basin.

Irrigation in the upper basin was mainly in scattered small developments on the main stream and many tributaries. General farm crops predominated, and in a large portion of the irrigated area, particularly in much of the Green River country, wild hay for livestock feed was the principal crop. At that time a total of 115,000 acre-feet of water annually was being exported from the Upper Basin for irrigation in adjoining basins. The Strawberry Valley project was diverting water from Strawberry River, a tributary of Duchesne River, to Spanish Fork in the Bonneville Basin in Utah. Several other small diversions were being made into the South Platte and Arkansas watersheds in Colorado. Additional large diversions, amounting to over 400,000 acre-feet, were being considered for development in these States, including transmountain diversions for the municipal water supply of Denver.

Topography and the high cost of projects, as well as climate and lower crop values, were limiting the rate of irrigation expansion in the upper basin.

Development in the lower basin, with its climatic conditions favorable to intensive cultivation of semitropical fruits, cotton, lettuce, and melons, was being hampered by limited low-season stream flows. Irrigation on the Gila was well advanced by 1922. The Imperial Valley, which then had over 400,000 acres under irrigation by direct diversion from the Colorado River without storage regulation, suffered a water shortage in each low-water



YUMA PROJECT

This early reclamation development on the Colorado illustrates how irrigation water conveyed in canals like that shown in the picture transforms desert (foreground) into citrus grove (background)

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year. The canal serving Imperial Valley lands also supplied water for the irrigation of 200,000 acres or more in Mexico, thus exporting some 3,000,000 acre-feet annually out of the basin for use in both countries.

Flood Control

Uncontrolled the Colorado River was a natural menace. Before the construction of Boulder Dam, the lower stretches of the river were annually subject to long sustained floods from the melting snows of the high mountains in Colorado, Wyoming, and Utah. Floods originating in the lower tributaries were of shorter duration but extremely erratic and perhaps not less damaging. The tragic menace from floods, however, was not fully realized until 1905. Then the Colorado, swollen by flood waters from the Gila, broke through a cut which was made 4 miles below the international boundary by the California Development Co., operators of the Alamo Canal. For 16 months the Colorado poured its entire flow into Imperial Valley's sunny fields and flourishing communities. It enlarged the Salton Sea to a lake 76 feet deep and 488 square miles in area, and threatened permanently to engulf the entire valley. The break was finally closed with great difficulty and expense, but about 30,000 acres of arable land had been inundated, farms ruined, homes destroyed, highways washed away, and railroad tracks wrecked. Miles of mainline track of the Southern Pacific Railroad had to be moved to higher ground, and tangible damage into the millions of dollars was sustained. Here, in the need for flood control, was the prime motivating reason for the construction of Boulder Dam.

Protection of the delta lands lying principally below the level of the Colorado had required the building of levees in both United States and Mexico. Each year these were lashed by silt-laden floods. The levees were built higher and stronger. Maintenance of the levees was an expensive burden and was complicated by international problems.

Levees constructed to protect the Yuma project on the Colorado just north of the international boundary line had broken several times with disastrous local results. Another similar flood occurred in 1922 when the levees along the Palo Verde Valley in California were broken. To protect the lands on the lower river, 150 miles of levees were maintained. Although many additional breaks occurred, the major levees were intact in the early 1920's. Defensive measures, however, became more and more burdensome. From 1906 to 1924, 10¼ million dollars were spent by various agencies on levee construction and maintenance on the lower Colorado River, including protection for Imperial Valley. Even this large expenditure did not eliminate the menace. The continued threat of a major break from some unexpected river change still remained and 100,000 people lived in fear that the river might overwhelm them.

Silt Problems

The difficulty of maintaining an adequate levee system was aggravated by siltation. Each year the Colorado River was depositing over 100,000 acre-feet of silt in the delta region, lifting itself higher and higher and making a larger and continuous expenditure necessary to maintain levees protecting the Imperial Valley. In 1923 and 1924 the Imperian irrigation district was spending over $500,000 annually to remove silt from its canal systems. In addition, it was estimated that Imperial Valley farmers expended about $1,000,000 to repair damages from silt deposits on their farms.

Hydroelectric Power

In the early 1920's the existing hydroelectric power developments in the Colorado River Basin were largely confined to the tributaries of the Colorado River. Thirty-six plants with a combined capacity of about 37,000 kilowatts were in operation, the largest being the Shoshone plant of the Colorado Power Co. on the main stream above Glenwood Springs, Colo., and the plant built by the Bureau of Reclamation at Roosevelt Dam on the Salt River in Arizona. Each of these plants had an installed capacity of approximately 10,000 kilowatts.

In 1922 the Salt River Valley Water Users' Association plains centering around the Los Angeles metropolitan area Roosevelt Dam on the Salt River for irrigation storage and power production to help supply the needs of the Phoenix area.

In the early 1920's the southern California coastal plains centering around the Los Angeles metropolitan area were experiencing a phenomenal growth, the population more than doubling from 1920 to 1930. A great potential power market thus was being created. Serious consideration was also being given to the electrification of railroads in the Colorado River Basin. Although the power uses within the basin at that time were small in the aggregate and the sparse population needed little power development for ordinary local uses, the rapidly growing market in the southern California area combined with advancement in electric power transmission had created a demand for a large amount of additional power. The growth of the power load was rapidly exhausting the available hydroelectric resources of southern California and an additional source of power was much needed for its growing industrial development.

Municipal Water Supply

With no large cities in the basin, the needs and developments for municipal water supply within the area had been small, but in the early 1920's it was becoming increasingly evident that the rapidly growing southern California metropolitan area would soon demand a new source of

water. Los Angeles was utilizing fully its Owens Valley water and had studied other sources from which water could be obtained. The only adequate practical source appeared to be the Colorado River, whose floodwaters, if properly conserved, could be made available for such use.

The need for a source of domestic water supply became an additional and potent reason for urging the development of the Colorado River. In 1923 the first reconnaissance for an adequate route from the Colorado River to the southern California area was undertaken by the city of Los Angeles. The general feasibility of such an aqueduct was soon established, and on June 28, 1924, the city of Los Angeles made a filing with California State authorities on a flow of 1,500 second-feet of water from the Colorado River, or 675,000 gallons per minute.

Summary of Conditions in the Early 1920's

By 1920 the population of the Colorado River Basin was 634,334 persons, with the lower basin growing more rapidly than the upper basin. In the early 1920's mining was being replaced by irrigated agriculture as the leading industry in the basin. Livestock grazing was important, lumbering was a lesser industry, and the tourist trade was just starting to develop.

Several important national parks had been found in the basin, the most important being the Rocky Mountain National Park, established in 1914, and the Grand Canyon National Park established in 1919. The Fall River Road over the Continental Divide in Rocky Mountain National Park was completed in 1920. By that time health resorts and scenic attractions in the basin along the transcontinental railroads long had been enjoyed by the traveling public, but automobiles and the rapid development of a network of good highways were just beginning to make accessible generally the basin's more remote areas.

Large sections of land in the basin had been set aside as Indian reservations. Over 17,000,000 acres in Arizona alone were under the jurisdiction of the Office of Indian Affairs. The Indian population, which was about 80,000 in 1920, had remained practically constant for years, but began to increase materially during the 1920's.

Livestock grazing continued to be an important industry in the basin. By 1920 control of large grazing areas by the Forest Service was stabilizing and making more profitable the livestock industry.

Irrigation development in the upper basin was considered to be lagging behind that in the lower basin, where rapid progress was being made in the Gila River Basin. Main stream developments on the lower river, however, were being impeded by lack of storage facilities; existing developments were suffering frequent shortages and, moreover, were being threatened by continued flood hazards aggravated by silt problems.

Thus by 1920 the situation with respect to the Colorado River had become very tense. Increasing upstream depletions were accompanied by increased requirements for irrigation development in California and Mexico. The constant threat of an unmanageable break of the river into Imperial Valley during flood stages was also becoming more serious with the rising level of the river and its flood plains within the levees protecting the Imperial Valley. Meanwhile the rapid growth of the metropolitan district of the southern California coastal region was creating a great demand for a large block of power and for additional municipal water supplies. Similar demands for municipal water for the growing city of Denver in the adjacent Platte River Basin were anticipated.

About the same time a keen interest in the Colorado River was displayed by various public and private agencies, seeking the right to develop hydroelectric power but proposing to provide storage and flood control incidentally.

An extensive investigation by the Bureau of Reclamation to develop ways and means of meeting all of the various needs resulted in the recommendation for the construction of a dam either in Boulder Canyon or Black Canyon for flood control, navigation improvement, irrigation storage, silt control, and power development. The long standing need for a canal wholly within the United States also was recognized and it was recommended that such a canal connecting the river at Laguna Dam with the Imperial Valley be constructed and thus eliminate all international complications.

Between the Upper and Lower Basins

Forces Activating Interstate Agreement

For a number of years prior to 1922 the lower basin area, growing more rapidly in population than the upper basin, had pressed for development of the lower river and the upper basin and objected. In 1919 and again in 1920 bills were introduced in Congress for Federal assistance in building an all-American canal. In April 1922 a third bill had proposed not only the building of an all-American canal, but also the building of a storage dam on the main river below the mouth of the Green River.

It was rapidly becoming apparent that the normal flow of the Colorado River would not be adequate to supply all of the uses envisioned by the Colorado River Basin States. The proposals for storage in the lower basin without guaranties to the upper basin States were regarded by the latter as threatening to establish priorities which would preclude later use of the water in the upper basin.

The law respecting rights to the use of waters of interstate streams was not well settled. Each of the various

States claimed exclusively the right to regulate the appropriation of water within its boundaries. At the same time claims were made that the Federal Government had jurisdiction over the waters of interstate streams. It was argued that no reasonable regulation of the flow of the Colorado River by storage appeared to be feasible except with the approval and the control of some authority higher than the States and that the Federal Government logically should effect the regulation of Colorado River development. The lower part of the stream was or had been navigable and, therefore, was subject to jurisdiction by the United States. At the same time the desire prevailed to obtain Federal aid in the financing of the huge multiple-purpose development considered necessary for the utilization of the stream flow of the lower Colorado River.

Some form of an agreement between the various factions was essential before comprehensive development of the Colorado River could proceed. Each State approached the problem individually. The conception of a division of water as between the upper and lower basins, which was finally adopted, instead of an apportionment among the individual States, crystallized slowly. The common desire for a solution gained momentum and finally resulted in an interstate compact.

The lower basin States favored a compact because they wished to enlist the support of the upper basin States in securing legislation by the Congress for main stream developments which were urgently needed for further expansion in the lower basin. States in the upper basin favored a compact because they desired to feel secure in their rights to further development of water uses, believing that they would be deprived of such rights by prior appropriations and uses downstream if they did not enter into a special agreement.

The States of both areas desired to retain control of water rights within their respective boundaries and thus were willing to enter into an interstate agreement to avoid the complete Federal control of the Colorado River that otherwise possibly would result.

Another significant motivating factor leading up to the Colorado River Compact was the desire of the people in the Colorado River Basin to give agriculture priority over power in the use of water.

Negotiations Leading to the Compact

In 1920 at a meeting of representatives of governors of Western States, a novel proposal by Delph E. Carpenter of Colorado that the States exercise their treaty-making powers was endorsed as a means of extricating the Colorado River Basin States from their perplexing predicament. After this proposal was approved by the governors, the respective legislatures of the seven Colorado River Basin States adopted appropriate legislation authorizing the appointment of compact commissioners, and on August 19, 1921, the Congress approved this proposal. The Colorado River Commission was organized in Washington, D. C., on January 26, 1922, with Herbert Hoover, then Secretary of Commerce, representing the United States and serving as chairman, and commissioners representing each of the seven basin States, as follows:

Commissioner	*State*
W. S. Norviel	Arizona.
W. F. McClure	California.
Delph E. Carpenter	Colorado.
J. G. Scrugham	Nevada.
Stephen B. Davis, Jr	New Mexico.
R. E. Caldwell	Utah.
Frank C. Emerson	Wyoming.

Following its organization meeting and numerous executive sessions held in Washington, the Commission met for public hearings in Phoenix, Los Angeles, Salt Lake City, Grand Junction, Denver, and Cheyenne in 1922. Final sessions, held at Santa Fe during November of the same year, culminated on November 24 in the signing of the Colorado River Compact by the commissioners of each of the seven basin States and the representative of the United States. The compact, however, was subject to ratification by the legislative bodies of the States involved and by the United States.

The compact was approved during the following year (1923) by six of the seven basin States, Arizona declining. As the compact provided that it would become binding only upon approval by the legislatures of each of the signatory States and by the Congress of the United States, it became necessary for the six approving States and the United States to enact laws waiving the provision of the compact requiring approval by all seven States and providing that the compact would become effective as to approving States if six States, including California, concurred. Such legislation was enacted and in 1929 the compact became binding upon all of the basin States except Arizona by a provision of the Boulder Canyon Project Act. Arizona did not ratify the compact until February 24, 1944.

The Colorado River Compact

The Colorado River Compact provides principally for a division of the available water of the Colorado River system between the "Upper Basin" and the "Lower Basin" at Lee Ferry, which is defined as a point on the Colorado River 1 mile below the mouth of Paria River. The nearest stream gage to this point on the Colorado River is at Lees Ferry, which is above the mouth of the Paria River. Lee Ferry, a few miles below the Arizona-Utah boundary, is a natural point of demarcation. Here all the waters of the entire upper system, including the Paria River and return flow from irrigation diversions, converge to form a single stream. The total stream flow



NEAR LEE FERRY—*The dividing point*

at Lee Ferry is computed by adding the flow of the Paria River to the flow of the Colorado at Lees Ferry.

The compact (art. IIIa) apportions to each of the upper and lower basins in perpetuity a total of 7,500,000 acre-feet for beneficial consumptive use annually and (art. IIIb) grants the further right to the lower basin to increase its beneficial consumptive use by 1,000,000 acre-feet annually. This division does not apportion the total annual water yield of the system, but (art. IIIc) establishes the basis for supplying any right later recognized in Mexico and (art. IIIf) leaves the apportionment of any excess among the States after October 1, 1963.

The compact also divides the basin States into two divisions: the "States of the Upper Division," including Colorado, New Mexico, Utah, and Wyoming; and the "States of the Lower Division," including Arizona, California, and Nevada. By the terms of the compact (art. IIId), the States of the Upper Division cannot cause the flow of the Colorado River at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years. Since the State boundaries do not conform to the actual drainage basin boundaries of the upper and lower basins, two of the States of the Upper Division, New Mexico and Utah, have a part of their territory in the lower basin. Arizona, one of the States of the Lower Division, also had a part of its territory in the upper basin.

By a provision in the compact, the Colorado River Basin includes "All the drainage area of the Colorado River system and all other territory within the United States of America to which the waters of the Colorado River system shall be benficially applied." Other provisions limit the use of Colorado River water to the seven basin States. Thus the exportation of waters from the actual drainage basin to adjoining areas is authorized "if such diverted water is to be used within the boundaries of the States



THE COLORADO RIVER BASIN STATES

. . . within the boundaries of which the waters of the Colorado River System shall be beneficially applied

through which the Colorado River system extends and if such use is not in excess of that allowed by the compact."

The compact recognizes the Colorado River as a navigable stream, but (art. IVb) holds that its use for navigation shall be subservient to its use for domestic and agricultural water supply and for power purposes.

• • • water of the Colorado River system may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

In addition, the compact (art. VII) provides that:

Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes.

With respect to Mexico the compact (art. III) reads:

(c) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River system, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then the burden of such deficiency shall be equally

borne by the Upper Basin and the Lower Basin, and whenever necessary the States of the Upper Division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d).

The Colorado River Compact cleared the way for legislation authorizing the construction of major projects. It removed the cause for rivalry in the development of the upper and lower basins. Prior development in the lower basin would create no prior right to the use of water in that basin as against the use in the upper basin. This left the upper basin free to develop in the manner and time required.

Events Leading to the Boulder Canyon Project Act

Long strenuous efforts were involved in obtaining congressional approval and authority to undertake major developments on the Colorado River. In 1914 Congress made a special appropriation for more intensive study of Colorado River problems by the Reclamation Service and followed this with additional allotments. Reconnaissance studies were made of reservoir sites, irrigation projects, and water rights within the basin. Engineer John T. Whistler in Reclamation Service reports, made in 1918 and 1919, concluded that there was sufficient water in the river to supply all future irrigation requirements within the drainage basin if storage capacity of 10,000,000 to 12,000,000 acre-feet were provided, and that proposed storage for irrigation also would provide a large degree of flood protection and would be of material benefit to water power development. The principal reservoir sites considered were on the Colorado River in the upper basin.

In 1918 two agreements were made between the Imperial Irrigation District, successor to the California Development Co., and the United States, providing for surveys and the appointment of a joint board (All-American Canal Board) to plan the construction of an All-American canal from Laguna Dam. The first Kettner bill, to authorize construction of such a canal, was introduced in Congress in June 1919. Neither this bill nor its successor, introduced in the second session of the same Congress, was enacted.

The Kinkaid Act in May 1920 authorized and directed the Secretary of the Interior to make an examination and report on the condition and possible irrigation development of Imperial Valley. One-half of the cost of this examination and investigation was to be paid by the United States and the other half by local interests.

The principal reservoir sites discussed in the Whistler reports, being located above Grand Canyon, would not provide the flood protection which was the essential and most urgent need of Imperial Valley. Accordingly, investigations by the Reclamation Service were transferred to the lower basin. Topographic surveys were made of the Colorado River upstream from Bulls Head by the Geological Survey. The Reclamation Service made a detailed survey of dam sites in Black and Boulder Canyons, and because of their interrelation with the problems of the Imperial Valley, a general review of the conditions and water resources of the entire Colorado River Basin was also undertaken.

A report by A. P. Davis, director of the Reclamation Service, to the Secretary of the Interior in July 1921 gave the results of investigations demonstrating the feasibility of Boulder Dam from the construction standpoint and presented studies on flood control, water supply, and hydroelectric power showing conclusively that the development of a reservoir of such capacity as would be possible by the construction of a dam at one of these sites was the key to the problem of proper and orderly development of the water resources of the Colorado River Basin. This report was the first to propose a dam of such unprecedented height as 600 feet.

The Secretary of the Interior in transmitting his report, popularly known as the Fall-Davis report, to the Senate on February 28, 1922, included among his proposals the following two recommendations:

> It is recommended that through suitable legislation the United States undertake the construction with Government funds of a highline canal from Laguna Dam to the Imperial Valley, to be reimbursed by the lands benefited.
>
> It is recommended that through suitable legislation the United States undertake the construction with Government funds of a reservoir at or near Boulder Canyon on the lower Colorado River to be reimbursed from leasing the power privileges incident thereto.

Two months after the Fall-Davis report was transmitted to the Senate, Congressman Phil D. Swing and Senator Hiram Johnson, both of California, introduced bills seeking to authorize the construction of a project for Colorado River development which would embody the recommendations of that report. These were the first of four Swing-Johnson bills introduced successively in the Sixty-seventh, Sixty-eighth, Sixty-ninth, and Seventieth Congresses, the last of which became the Boulder Canyon Project Act.

Meanwhile, influential groups of lower basin citizens urged construction by the United States of Boulder Dam and the All-American Canal. There was also considerable opposition to these proposals, especially from those who were against public power development.

In February, 1924, the results of 2 years' additional work under the Kinkaid Act were embodied in a report made by Chief Engineer F. E. Weymouth of the Bureau of Reclamation, which stressed the immediate need of flood protection and for storage to prevent shortage of water and crop losses in the Imperial Valley. He concluded that the urgent problems of river control and utilization in the Colorado River Basin could be solved by (a) construction of a dam in Black Canyon to raise the water

605 feet and form Boulder Canyon Reservoir with a capacity of 34,000,000 acre-feet; (b) reservation of 8,000,000 acre-feet of capacity at the top of the reservoir for flood control with the provision for a decrease of 4,000,000 acre-feet, dependent on adequate upstream development; (c) provision for irrigation to receive priority over power in the use of remaining storage; (d) construction of a powerhouse with 1,200,000 horsepower installed capacity; and (e) construction of an All-American canal from Laguna Dam to Imperial Valley. The report submitted preliminary designs for a dam in Black Canyon and fully demonstrated advantages of this site.

In 1924 late summer flow in the Colorado River was so low that the Imperial Valley in California for a few weeks received barely enough water for domestic and stock-watering purposes and suffered severe crop losses. The immediate construction of Boulder Dam was then demanded.

Preliminary surveys indicated the practicability of an aqueduct from the Colorado River to supply municipal water to the Los Angeles metropolitan area. In 1925 the electorate of the city of Los Angeles authorized the issuance of $2,000,000 in bonds to provide funds for a more intensive and detailed study of the possible use of Colorado River water for a municipal supply, having in mind a plan that would benefit metropolitan southern California.

In the committee hearing on the third Swing-Johnson bill in 1926, congressional consideration for the first time was given to this proposal to use the Colorado River for a domestic water supply for southern California. As additional engineering work for a Colorado River aqueduct was performed, it became evident that any practicable diversion from the river would involve pumping, which would would require a large amount of low-cost power. This created at once a potential market for a substantial part of the power from a major river development. When these facts were laid before the Congress, support for the Swing-Johnson measure became more general.

After long debate the Boulder Canyon Project Act (Swing-Johnson bill, H. R. 5773) was passed by the House on May 25, 1928. Four days later the Congress, by joint resolution, authorized the appointment of a Colorado River Board and directed it to report on several vital questions concerning the proposed Boulder Canyon project. Thereupon the Secretary of the Interior appointed to this board Charles P. Berkey, Daniel W. Mead, Warren J. Mead, Robert Ridgeway, with Major General William T. Sibert, as chairman, all eminent engineers and geologists.

On November 24, 1928, the board submitted its report which declared that a proposed dam across the Colorado River at Black or Boulder Canyon was feasible, that the Black Canyon site was preferable to the Boulder Canyon site, and "that a growing demand for power in southern California when considered on a conservative basis will be sufficient to absorb the probable power output of the proposed hydroelectric plant."

In its report the board prescribed changes in plans which increased the estimated cost of the dam, but it had satisfied the Congress of the feasibility of the project. Many of the recommendations were incorporated in amendments to the bill, finally becoming a part of the Boulder Canyon Project Act.

The bill as finally amended was passed by the Senate and the House and signed by President Coolidge on December 21, 1928, thus ending the long campaign for legislation providing for the first major Colorado River development.

Boulder Canyon Project Act

The Boulder Canyon Project Act (sec. 1) provides:

> That for the purpose of controlling the floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters thereof for reclamation of public lands and other beneficial uses exclusively within the United States, and for the generation of electrical energy as a means of making the project herein authorized a self-supporting and financially solvent undertaking, the Secretary of the Interior, subject to the terms of the Colorado River Compact hereinafter mentioned, is hereby authorized to construct, operate, and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon adequate to create a storage reservoir of a capacity of not less than 20 million acre-feet of water and a main canal and appurtenant structures located entirely within the United States connecting the Laguna Dam, or other suitable diversion dam, which the Secretary of the Interior is hereby authorized to construct if deemed necessary or advisable by him upon engineering or economic considerations, with the Imperial and Coachella Valleys in California, the expenditures for said main canal and appurtenant structures to be reimbursable, as provided in the reclamation law, and shall not be paid out of revenues derived from the sale or disposal of water power or electric energy at the dam authorized to be constructed at said Black Canyon or Boulder Canyon, or for water for potable purposes outside of the Imperial and Coachella Valley: *Provided, however,* That no charge shall be made for water or for the use, storage, or delivery of water for irrigation or water for potable puposes in the Imperial or Coachella Valleys; also to construct and equip, operate, and maintain at or near said dam, or cause to be constructed, a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from said reservoir; and to acquire by proceedings in eminent domain, or otherwise, all lands, rights-of-way, and other property necessary for said purposes. (45 Stat. 1057.)

The Boulder Canyon Project Act (sec. 2a) also set up the Colorado River Dam fund as a special fund to carry out provisions of the act. An appropriation not to exceed $165,000,000 was authorized to be repaid with 4 percent interest except $38,500,000 to be used for the construction of the All-American canal. Before any money could be appropriated or any construction work done the Secretary of the Interior (sec. 4b) was required to make pro-

vision for revenues, by contract or otherwise, which in his judgment would be adequate to pay all expenses of operation and maintenance and repay with interest at 4 percent within 50 years of the completion of the project all money advanced by the Federal Government for the construction of the dam and incidental works.

The contract between the United States and the Imperial Irrigation District, entered into on October 23, 1918, for the construction of the All-American canal entirely at the expense of the district, was recognized in the act (sec. 10) but the Secretary was given authority to modify such agreement with the consent of the district.

The Secretary (sec. 15) is authorized and directed to make investigations and public reports on the feasibility of projects for irrigation, power, and other multiple uses, for the purpose of formulating a comprehensive scheme of control and the improvement and utilization of the water of the Colorado River and its tributaries. A sum of $250,000 was authorized to be appropriated from the Colorado River Dam fund for such purposes.

The Boulder Canyon Project Act also (sec. 4a) provides that the act shall not take effect, and that no work shall be begun and no moneys expended nor water rights claimed thereunder, unless and until, within 6 months all seven of the basin States had ratified the Colorado River Compact or, as an alternative, unless and until six of the seven States, including the State of California, had ratified the compact, and the State of California, "as an express covenant and in consideration of the passage of" the Boulder Canyon Project Act, had agreed to limit its annual consumptive use of Colorado River water to not to exceed "4,400,000 acre-feet of the waters apportioned to the lower basin States by paragraph (a) of article III of the Colorado River Compact, plus not more than one-half of any excess or surplus waters unapportioned by said compact, such uses always to be subject to the terms of said compact." Wyoming, Colorado, New Mexico, and Nevada had ratified the compact on a 6-State basis in February and March of 1925. In March of 1929 California unconditionally ratified the compact as a 6-State compact, and Utah's ratification followed immediately. On June 25, 1929, President Hoover issued a proclamation pursuant to the provisions of the act, stating that all prescribed conditions under the second alternative mentioned had been fulfilled and that the Boulder Canyon Project Act was effective as of that date.

Contracts for Power and Water

Negotiations for power contracts were started by the Secretary of the Interior in 1929, and the next year two contracts, carrying an obligation to take and pay for all of the firm energy to be generated at Boulder Dam, were signed at Los Angeles. The first was a lease of power privileges to which the United States, the city of Los Angeles (through its department of water and power), and the Southern California Edison Co. were parties. The second was a contract for the purchase of electric energy to which the United States and the Metropolitan Water District of Southern California were parties.

On July 3, 1930, President Hoover signed an act, carrying an appropriation of $10,660,000 for starting construction of the Boulder Canyon project which automatically placed the power contracts in effect. Preparations for construction of Boulder Dam were started immediately as the first step in the actual carrying out of the primary intent of the Boulder Canyon Project Act—"To convert a natural menace into a national resource" by harnessing the mighty Colorado River. The dam was completed and the first water stored in Lake Mead in 1935.

Under the terms of a contract between the United States and the Metropolitan Water District of Southern California made in 1930 and amended on September 28, 1931, the United States undertakes to deliver to the district 1,100,000 acre-feet of water annually from storage in Lake Mead. Delivery is made in accordance with the priorities fixed in a schedule agreed to in August 1931 by the Metropolitan Water District of Southern California, Palo Verde Irrigation District, Imperial Irrigation District, Coachella Valley County Water District, the city of Los Angeles, and the city and county of San Diego. The agreement defined the rights of the parties named and also those of the portion of the Yuma project in California. A charge of $0.25 per acre-foot is made for water delivered to the Metropolitan Water District of Southern California and to the city and county of San Diego.

The Metropolitan Water District of Southern California is a public corporation organized in December 1928. The original organization included Los Angeles and 10 other cities. The district now includes 14 cities.

Under the terms of another contract between the United States and the Metropolitan Water District of Southern California, signed February 10, 1933, the United States built Parker Dam on the Colorado River below Boulder Dam with funds provided by the district. The dam is owned and operated by the United States and provides regulation for diversion of water into the Colorado River Aqueduct which was constructed by the district to carry Colorado River water to the southern California coastal plain.

Beginning with 1930, numerous contracts were made by the United States with California, Arizona, and Nevada interests for the use of water stored by Boulder Dam and the power produced at Boulder and Parker Dams. Each such contract, including the one with the Metropolitan Water District, makes the delivery of water and power subject to availability under the terms of the Colorado River Compact and the Boulder Canyon Project Act.

Boulder Canyon Project Adjustment Act

The Boulder Canyon Project Adjustment Act, signed by President Franklin D. Roosevelt on July 19, 1940, removed competition as the basis for rates and charges for power from the Boulder Canyon project and specified that power income must be sufficient to operate and maintain the project; to provide certain specified annual sums for payment to the States of Arizona and Nevada and into the Colorado River Development fund; and to repay to the United States with interest at 3 percent during a 50-year period the advance made to the Colorado River Dam fund, less $25,000,000 allocated to flood control and deferred beyond 50 years.

This act set up the Colorado River Development fund and provided for the transfer from the Colorado River Dam fund

> the sum of $500,000 for the year of operation ending May 31, 1938, and the like sum of $500,000 for each year of operation thereafter, until and including the year of operation ending May 31, 1987. * * * Receipts of the Colorado River Development fund for the years of operation ending in 1938, 1939, and 1940 * * * are authorized to be appropriated only for the continuation and extension, under the Secretary of studies and investigations by the Bureau of Reclamation for the formulation of a comprehensive plan for the utilization of waters of the Colorado River system for irrigation, electrical power, and other purposes, in the States of the upper division and the States of the lower division, including studies of the quantity and quality of water and all other relevant factors. The next such receipts up to and including the receipts for the year of operation ending in 1955 are authorized to be appropriated only for the investigation and construction of projects for such utilization in and equitably distributed among the four States of the upper division. Such receipts for the years of operation ending in 1956 to 1987, inclusive, are authorized to be appropriated only for the investigation and construction of projects for such utilization in and equitably distributed among the States of the upper division and States of the lower division. * * * Such projects shall be only such as are found by the Secretary to be physically feasible, economically justified, and consistent with such formulation of a comprehensive plan. Nothing in this act shall be construed so as to prevent the authorization and construction of any such projects prior to the completion of said plan of comprehensive development; nor shall this act be construed as affecting the right of any State to proceed independently of this act or its provisions with the investigation or construction of any project or projects. 54 Stat. 774.)

Between United States and Mexico

At the time of the Gadsden Purchase, the Colorado River was considered to be valuable for navigation only. But as time passed and the West was settled, thriving communities were established in the United States and in Mexico, wholly dependent upon diversion of Colorado River water for irrigation. Their continued existence and future growth were limited strictly to the extent water might be diverted and consumed for irrigation purposes. This irrigation development had been made without any international agreement or treaty providing for irrigation use of the water of this important international river and without either country insisting upon the maintenance of navigability in the border regions of the Colorado River envisioned in early treaties between the two countries. Both Mexico and the United States now recognize that the best interests of the peoples concerned were promoted by diversion of water for irrigation rather than by maintenance of the river as a navigable stream.

The All-American Canal system has replaced the Alamo Canal diversions to California lands and also for the most part Laguna Dam diversions to the Yuma project. Mexico, however, continues to use the Alamo Canal, which diverts from the Colorado River at a point 1½ miles within the United States, and also makes a number of diversions from the Colorado River farther downstream.

The Colorado River compact, as previously quoted, provides that if the United States recognizes that Mexico has any right to the use of any waters of the Colorado River system that such an amount shall be supplied from water which is surplus over 16,000,000 acre-feet per annum and in case such surplus water should be insufficient that each basin from its apportioned share shall supply one-half of the deficiency.

The Treaty with Mexico

A treaty between the United States of America and the United Mexican States relating to the division of the waters of the Colorado and Tijuana Rivers and of the Rio Grande, was signed by representatives of the respective Governments at Washington on February 3, 1944. The treaty (Executive A, 78th Cong., 2d sess.) the protocol (Executive H, 78th Cong., 2d sess.) signed November 14, 1944, and clarifying reservations to the treaty were ratified by the United States Senate on April 18, 1945. The treaty was ratified by the Mexican Senate on September 27, 1945.

By its provisions (art. 2) the general administration of the treaty is entrusted to the International Boundary and Water Commission, designated to be the successor of the International Boundary Commission created by the convention of the two countries on March 1, 1889.

> The Commission shall in all respects have the status of an international body, and shall consist of a United States section and a Mexican section. The head of each section shall be an engineer commissioner. Wherever there are provisions in this treaty for joint action or joint agreement by the two governments, or for the furnishing of reports, studies, or plans to the two governments, or similar provisions, it shall be understood that the particular matter in question shall be handled by or through the Department of State of the United States and the Ministry of Foreign Relations of Mexico.

Each government is to accord diplomatic status to the commissioner and certain other officers of the section of the other government.

The treaty (art. 10) allots to Mexico from the waters of the Colorado River:

(a) A guaranteed annual quantity of 1,500,000 acre-feet to be delivered in accordance with certain conditions and specifications as to point and rate.

(b) Any other quantities arriving at the Mexican points of diversion, with the understanding that in any year in which, as determined by the United States section, there exists a surplus of waters of the Colorado River in excess of the amount necessary to supply users in the United States and the guaranteed quantity of 1,500,000 acre-feet annually to Mexico, the United States undertakes to deliver to Mexico * * * additional waters of the Colorado River system to provide a total quantity not to exceed 1,700,000 acre-feet a year. Mexico shall acquire no right * * * by use of the waters of the Colorado River system for any purpose whatsoever, in excess of 1,500,000 acre-feet annually.

In the event of extraordinary drought or serious accident to the irrigation system in the United States, thereby making it difficult for the United States to deliver the guaranteed quantity of 1,500,000 acre-feet a year, the water allotted to Mexico under subparagraph (a) of this article will be reduced in the same proportion as consumptive uses in the United States are reduced.

The water of the Colorado River to be furnished Mexico by the United States under the treaty (art. 11) "shall be made up of the waters of the said river, whatever their origin," and shall be delivered by the United States in the boundary portion of the Colorado River, except that until 1980 Mexico may receive 500,000 acre-feet annually, and after that year 375,000 acre-feet annually through the All-American canal as part of the guaranteed quantity.

Other provisions (art. 12) of the treaty provide that the two governments agree to construct the following works:

Mexico shall construct at its expense, within a period of 5 years from the date of the entry into force of this treaty, a main diversion structure below the point where the northernmost part of the international land boundary line intersects the Colorado River. The Commission shall thereafter maintain and operate the structure at the expense of Mexico. Regardless of which such diversion structure is located, there shall simultaneously be constructed such levees, interior drainage facilities, and other works, or improvements to existing works, as in the opinion of the commission shall be necessary to protect lands within the United States against damage from such floods and seepage as might result from the construction, operation, and maintenance of this diversion structure. These protective works shall be constructed, operated, and maintained at the expense of Mexico by the respective sections of the commission, or under their supervision, each within the territory of its own country.

The United States, within a period of 5 years from the date of the entry into force of this treaty, shall construct in its own territory and at its expense, and hereafter operate and maintain at its expense, the Davis storage dam and reservoir, a part of the capacity of which shall be used to make possible the regulation at the boundary of the waters to be delivered to Mexico in accordance with the provisions of article 15 of this treaty * * *

and

shall construct or acquire in its own territory the works that may be necessary to convey a part of the waters of the Colorado River allotted to Mexico to the Mexican diversion points on the international land boundary line referred to in this treaty. Among these works shall be included: the canal and other works necessary to convey water from the lower end of the Pilot Knob Wasteway to the international boundary, and, should Mexico request it, a canal to connect the main diversion structure * * * with the Mexican system of canals * * * Such works shall be constructed or acquired and operated and maintained by the United States section at the expense of Mexico. Mexico shall also pay the costs of any sites or rights-of-way required for such works.

The Commission shall construct, operate, and maintain in the limitrophe section of the Colorado River, and each section shall construct, operate, and maintain in the territory of its own country on the Colorado River below Imperial Dam and on all other carrying facilities used for the delivery of water to Mexico, all necessary gaging stations and other measuring devices for the purpose of keeping a complete record of the waters delivered to Mexico and of the flows of the river. All data obtained as to such deliveries and flows shall be periodically compiled and exchanged between the two sections.

Another provision (art. 13) of the treaty directs that:

The commission shall study, investigate, and prepare plans for flood control on the lower Colorado River between Imperial Dam and the Gulf of California, in both the United States and Mexico * * * The two Governments agree to construct through their respective sections of the commission, such works as may be recommended by the commission and approved by the two governments, each government to pay the costs of the works constructed by it. The commission shall likewise recommend the parts of the works to be operated and maintained jointly by the commission and the parts to be operated and maintained by each section. The two governments agree to pay in equal shares the cost of joint operation and maintenance and each government agrees to pay the cost of operation and maintenance of the works assigned to it for such purpose.

The protocol, which is an integral part of the treaty as ratified, provides that:

Wherever * * * specific functions are imposed on, or exclusive jurisdiction is vested in, either of the sections of the International Boundary and Water Commission, which involve the construction or use of works for storage or conveyance of water, flood control, stream gauging, or for any other purpose, which are situated wholly within the territory of the country of that section, and which are to be used only partly for the performance of treaty provisions, such jurisdiction shall be exercised, and such functions, including the construction, operation, and maintenance of the said works, shall be performed and carried out by the federal agencies of that country which now or hereafter may be authorized by domestic law to construct, or to operate and maintain, such works. Such functions or jurisdictions shall be exercised in conformity with the provisions of the treaty and in cooperation with the respective section of the commission, to the end that all international obligations and functions may be coordinated and fulfilled.

Ratification of the treaty is a step forward in international cooperation. A 98-year point of dispute over allocation of the waters of the Colorado River and other rivers rising in the United States and flowing into Mexico should be settled.

Developing the Basin

"Present developments are indicative of future possibilities. A growing Nation . . . is demanding full development and use of all its resources . . . .

"Millions of acres of dry fertile lands yet are idle and most irrigated areas are not producing maximum yields because of water shortages, . . . flood waters still uncontrolled flow destructively to the Pacific Ocean and are lost for beneficial use. Control of these waters will require cooperative planning and systematic development involving construction of huge structures, mostly beyond the financial range of private enterprise. . . .

"Prosperity in the Colorado River Basin brought by full development of water and land resources will have a stimulating beneficial effect on the economy of the entire country."

CHAPTER IV

Developing the Basin

Water holds a key position in developing the resources of the Colorado River Basin. It is the "critical material" because of its limited supply and great demand. Development and utilization of other resources in this arid land depend upon the availability of water. Crops must be irrigated; cattle on the vast ranges must be partially fed from hay produced on irrigated land; towns and cities must be located within distance of dependable domestic and municipal water supplies; and mining and many other industries depend to an extent on the availability of hydroelectric power.

The use that has been made of the basin's resources by those people who have claimed this land as their home and the needs and problems confronting them must be understood before any solution or plan can be suggested to improve present conditions and create additional opportunities. For that purpose this chapter includes a survey and appraisal of the basin's resources and economic activities.

The Colorado River Basin is a part of America's frontier. It is, perhaps, as little developed as any comparable area in the United States. Yet it is known that here lie buried one-sixth of the entire world's coal reserves, billions of barrels of oil in shale and sand (equivalent to many times the known petroleum reserves in all the oil fields of the United States) and vast treasures of other minerals including petroleum, natural gas, copper, lead, zinc, gold, silver, rare hydrocarbons, vanadium, molybdenum, phosphates, and many others. For only a few of these can it be said that development has had even a good beginning.

Crop production in the basin is dependent almost wholly on irrigation. More than 2½ million acres—much with an inadequate late season supply—are now irrigated. Development of the basin's land and water resources is little beyond the half-way mark toward ultimate potentialities. Livestock raising is the basin's principal agricultural pursuit, but the numerous herds of cattle and sheep that graze the vast ranges and forests are dependent on supplemental feed from irrigated farms.

Only in the last two decades has a good start been made in exploiting the possibilities of the Colorado River for generating hydroelectric power. Construction of Boulder Dam to control the flow of the lower river was the first big development. Even with completion of all present and authorized construction which will give to the river system installed generating capacity of 2 million kilowatts, only a little more than a third of the basin's water power will be harnessed.

Extending more than two-thirds the distance across the Nation, from Mexico to Canada, the Colorado River Basin is crossed in an east-west direction by several transcontinental railroads and highways. North-south transportation is dependent very largely on a few highways. The improvement of highways and transportation facilities characterizing this generation has bettered living conditions in the basin and has increased the basin's economic contributions to the Nation. Some important agricultural and mineral areas, however, are today a hundred miles or more from railroads. Further improvement and expansion of transportation facilities within the basin would be a national asset.

Practically the only manufacturing in the basin is the processing of farm and forest products on a limited scale. Most of the food, fiber, and minerals produced or mined in the area is shipped away in raw state. In recent years the Los Angeles metropolitan area has become one of the Nation's principal manufacturing areas due in large measure to low-cost power produced at Boulder Dam.

The spectacular natural beauty, shrouded in the romantic aura of frontier adventure, delights the tourist and health seeker. The basin is fast becoming a national playground. Rocky Mountain, Mesa Verde, Bryce Canyon, Zion, and Grand Canyon National Parks, the Painted Desert, Petrified Forest and Boulder Dam National Recreational Area as well as many national monuments lie wholly or partly within the basin. Unmatched trout fishing in mountain streams and lakes, big-game hunting, and Indian reservations add to the basin's outstanding attractions.

The people on the basin's irrigated farms and those in the cities and towns that rise on the commerce created by irrigated agriculture and by mining exercise purchasing power that establishes markets for automobiles, farm machinery, and other products manufactured and grown in all parts of the country.

Permanent settlement of this frontier region is approaching the end of a century, but only in small measure have the basin's bounties been applied to man's use. Present developments are indicative of future possibilities. A growing Nation and a world power is demanding full development and use of all its resources.

UPPER BASIN

Agriculture, particularly livestock raising, and mining are the principal industries of the upper basin. Oil refining, lumbering, transportation, trade, recreation, and construction are of lesser but growing importance.

Growth and distribution of population were discussed in chapter II. With its 1940 population of 286,450 distributed over 110,500 square miles, the upper basin's average of 2.6 persons per square mile is only one-seventeenth of the national population density. Sparse settlement and great distances between communities create special economic and social problems. Goods and services are more difficult to obtain and more costly than in thickly populated areas. A few ranch homes are 100 miles from medical, dental, and hospital facilities. Many families are located long distances from schools, churches, and trading centers. Opportunities for many forms of recreation and social and educational activity are restricted.

In such a large, sparsely settled area difficult problems arise in providing and maintaining roads and other public services. Many local roads are poor and during parts of the year impassable by motor vehicles. Some rural homes are without electric service, but power lines are being extended to small communities, farms, and ranches, thereby adding to the convenience and comfort of the people.

Labor Force

The economy of a region is affected more by the labor force, employed workers and those actively seeking work, than by any other segments of the population. It is this group that is the highest in both production and consumption of goods.

The labor force expands or contracts with changing economic conditions. In good times its ranks are swelled by young people leaving school before completing their courses and by housewives, retired persons, and others who normally are not employed. The size of the labor force also is influenced by the composition of the population. Where the percentage of children or old people is above average the labor force is likely to be small. Employable persons who make up the labor force are most likely to migrate to areas where economic opportunities are greater. The percentage of the total population in the labor force generally is an index to the economic prosperity of a region.

The United States census for 1940 shows a male labor force, over 14 years of age, of 72,317 in the upper basin, equivalent to 25 percent of the total population, compared with 40 percent for the Nation as a whole. Thirty-four percent of the upper basin's workers were employed in agriculture, 13 percent in mining, and 35 percent in other regular occupations. The other 18 percent were either employed on Government "relief" projects or were seeking work, the proportion of the labor force in this group being larger than for the average of the Nation.

Table V.—*Labor force in selected employment groups in upper basin (1939)*[1]

State area	Percent of labor force					Number in labor force
	Gainfully employed			Employed on emergency work	Seeking work	
	Agriculture	Mining	All other jobs			
Wyoming	18	28	41	4	9	9, 890
Colorado	35	10	38	6	11	43, 329
Utah	36	15	27	10	12	14, 720
New Mexico	61	2	22	6	9	4, 378
Upper basin	34	13	35	7	11	72, 317
United States	20	2	63	5	10	39, 944, 240

[1] Male persons over 14 years of age.

The income from many farms was insufficient to support the farm operator, making it necessary for him to find supplemental employment. In 1939, a year of average farming conditions, about one-third of the farmers worked away from their farms for pay an average of about a third of their time. Mining and public work provided most of the outside employment, which required many farmers to leave their families. Most of the farmers who worked away were no doubt the operators of small part-time farms.

Table VI.—*Supplemental employment of farmers in upper basin (1939)*

State area	Farmers working away from their farms		Average days per year each farmer worked away from his farm
	Number	Percent of all farmers in labor force	
Wyoming	369	38	123
Colorado	3, 683	29	138
Utah	2, 084	45	129
New Mexico	392	16	151
Upper basin	6, 528	32	131

Additional irrigation water would expand and stabilize farming and create greater agricultural opportunities for upper basin people. Fewer farmers would be

required to find other employment, and in periods of economic distress fewer workers would be seeking "emergency work."

Land Ownership and Use

Of the land in the upper basin only about 22 percent is privately owned, 78 percent is owned by either county, State, or Federal Governments or by Indians and yields no tax revenues. The pattern of land use in the upper basin is approximately as follows:

	Acres	Percent of total area
Irrigated land	1,325,000	1.9
Cultivated without irrigation	272,000	.4
Grazing land:		
Publicly owned	29,221,000	41.4
Privately owned	8,775,000	12.4
State and county owned	2,860,000	4.0
Indian reservations	8,775,000	12.4
National forests	13,378,000	18.9
National parks and monuments	586,300	.8
Miscellaneous areas	5,503,700	7.8
Total	70,696,000	100.0

About 70 percent of the total land area is classed as grazing land in the tabulation. Grazing is also extensive on national forest lands and on other areas so that much more than 70 percent of the total area is actually grazed. The 1940 United States Census reported 285,000 acres of irrigated land used as pasture.

The better grazing lands are in the higher stream valleys and on the mountains and foothills. These lands are used for summer grazing of cattle and sheep, and the scanty vegetation in the lower desert areas provides winter range for sheep.

Crop land, both irrigated and dry-farmed, comprised only 2.3 percent of the total acreage in 1939 and only 1.9 percent was actually cropped.

Farming without irrigation is generally unsuccessful in the Upper Basin because of the uncertain rainfall. It is practiced, however, to some extent in the Yampa and White River Basins, and favorable climatic conditions in the past few years together with high prices have encouraged expansion of dry farming in the Dry Side area of the La Plata River Basin and on the upland mesa between Cortez, Colo., and Monticello, Utah. In general, at altitudes where rainfall is sufficient during the summer to grow crops without irrigation, the season is too short for crops to mature.

Soils

The entire upper basin is underlain with sandstones, limestones, and shales composing the parent rock from which the soil forming material has been derived. Four types of soil are found: (1) alluvial soils made up from stream-deposited materials; (2) glacial soils in the form of glacial deposits or out-wash plains derived partly from granites and other igneous material of the higher mountains; (3) residual soils formed in place by the weathering of surface rocks but altered in places through deposition from higher residual lands; and (4) aeolian, or wind deposited soils, appearing in a few places as sand dunes and other formations.

In the upper valleys lands suitable to agricultural development are largely composed of alluvial soils and are confined to the bottom lands, terraces, and valley fills. These soils are high in organic matter and are inherently fertile. They are generally of sandy loam to loam in texture. Most of these soils have good natural drainage provided by light textured soil over gravelly subsoil and a moderate slope. With the exception of small localized areas the soils in the upper valleys are free from harmful accumulations of alkali. The depth of the soil and the amount of rock on the surface usually determine the suitability of the lands for agriculture.

Mesas, plateaus, basin-like depressions caused through erosion, and narrow valleys along the various streams characterize the lower sections of the upper basin. The broader valleys and depressions that have been covered with alluvial soils are more suitable for cultivation where soil is of sufficient depth. Vast areas of residual soils are too shallow or too alkaline for agricultural development. Extensive drainage is often necessary in the lower valleys where irrigation is practiced.

Wind formed soils are not extensive. Some are found in small areas south of the San Juan River along the northeastern sides of ridges or other topographic uplifts which break the winds and harbor the deposited materials. The largest area of arable aeolian soil is east of Chaco River on the high benches south of Farmington, New Mexico.

Agriculture

Types of farming.—All farms are classified by the Bureau of Census into types according to the major source of income. In the upper basin livestock farms predominate.

Table VII.—*Types of farms in upper basin (1939)*

State area	Types of farms according to major source of income (percent of total number of farms)				
	Livestock and livestock products	Field crops	Other crops	Products used in household	Total
Wyoming	77.8	7.8	0.3	14.1	100
Colorado	35.7	32.3	9.8	22.2	100
Utah	39.8	19.2	1.1	39.9	100
New Mexico	27.9	21.0	5.5	45.6	100
Upper basin	37.6	26.9	6.9	28.6	100

In 1939, livestock and livestock products accounted for 75 percent of the total value of the products sold and traded in the upper basin. Livestock alone amounted to 55 percent and wool to 10 percent of the total. Compared with the Nation as a whole the upper basin farm income from animals and wool was greater, while income from dairy products, poultry, poultry products, and crops was less. A considerable part of the crop income was from the sale of feed to local livestock men for winter feed of breeding stock.

TABLE VIII.—*Value of farm products sold or traded in upper basin (1939)*

State area	Percent of total value of farm products					
	Livestock	Dairy products	Poultry and poultry products	Wool and other livestock products	Crops	Total
Wyoming	66	5	1	25	3	100
Colorado	53	6	2	8	31	100
Utah	53	9	5	17	16	100
New Mexico	40	3	2	15	40	100
Upper basin	55	6	3	11	25	100
United States	26.6	16.8	8.4	1.6	46.6	100

In the Wyoming portion of the basin only 3 percent of the income was from crops while in the New Mexico area 40 percent was from crops.

The farms of the upper basin produce primarily meat, hides, and wool, supplies of which are inadequate to meet the Nation's needs.

The livestock industry in the upper basin is based upon vast areas of grazing land unsuited to more intensive agriculture. Much of this land belongs to the Federal Government and is in either forest reserves or grazing districts. The rest is privately owned or belongs to the States. By reason of differences in elevation and climate some of these lands can be grazed only during summer months and others only during the winter, spring, and fall. By moving livestock with the changing seasons of the year, sometimes long distances, some animals are grazed the year around. This is particularly true of sheep. The carrying capacity of range lands varies. The summer grazing lands normally carry more stock per acre than do the spring, fall, and winter lands. Because of this and the necessity of providing supplemental feed from crop lands to carry stock over extremely severe winter periods and abnormally dry summer periods, the use of crop and range lands is interrelated. Maximum use of grazing lands is not possible without forage from crop lands, and much of the crop lands would have little value except in conjunction with the use of grazing lands.

Range lands of the basin have been stocked at the maximum for a long time and in local areas damage has resulted from over grazing. Much of the damage resulted from a lack of sufficient forage from irrigated crop lands to balance natural range production. Although corn and other concentrated feeds are shipped into the basin each winter to carry sheep through severe storms and other critical periods, these imports do not eliminate the need for local forage from irrigated crop lands for cattle.

An increase in the production of farm produced forage would avoid damage to range lands by over grazing and by keeping livestock off grazing land until vegetation has a good start in the spring; enable livestock men to feed breeding stock through drought periods without losses, and thus avoid liquidation of breeding stock because of inadequate local feed supplies; and permit, in many cases, more liberal feeding of breeding stock and calves to increase the calf and lamb crops and reduce losses from death.

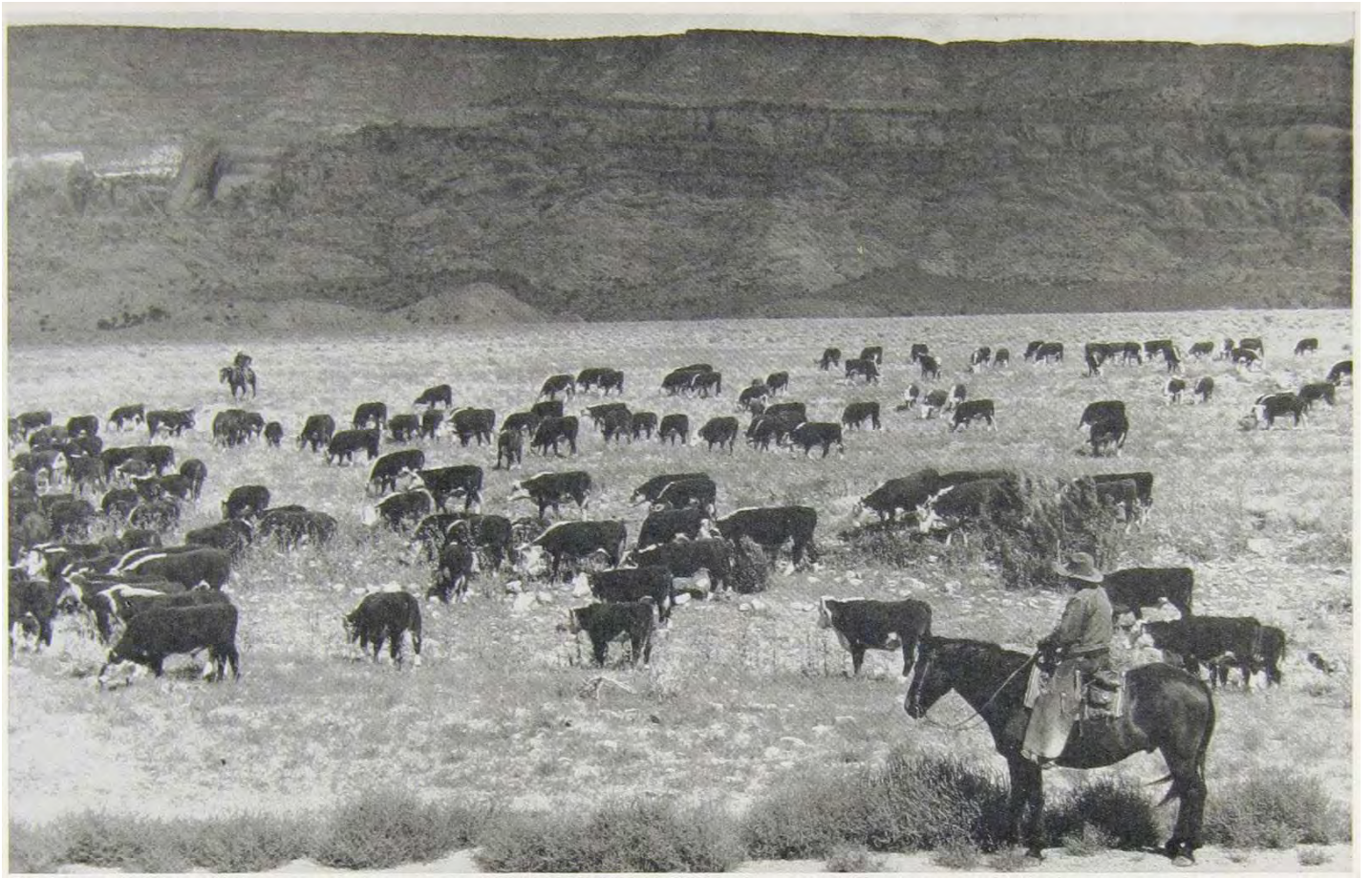
Livestock.—With such a large proportion of the upper basin lands usable only for grazing livestock, range livestock production has become the dominant industry. Although the number of farms has continued to increase in the area, the grazing resources were fully utilized prior to 1910. Since that time the total number of cattle and sheep has remained about the same, increasing and decreasing slightly as a result of livestock cycles and climatic conditions. The number of dairy cows, however, has increased proportionately with the number of farms. Many of the cows classified as dairy cows are of beef breeding and hence the average milk production per cow is low. Trends in the number of cattle and sheep in the upper basin for the period 1890–1940 are shown on an accompanying chart (fig. 3).

Compared with the average farm in the United States in 1940 the average farm in the upper basin had about 12 times as many sheep, and 2.5 times as many cattle, but fewer dairy cows, swine, and chickens. While livestock production is the dominant enterprise not all livestock farms are operated on a large scale. In the Utah area most of the cattle operations are small, but in Wyoming cattle ranches are generally large.

TABLE IX.—*Livestock in upper basin (1939)*

State area	Average number of livestock per farm					
	Horses	Dairy cows	Other cattle	Sheep	Swine	Chickens
Wyoming	13.1	5.8	83.0	440.6	1.5	35.5
Colorado	4.7	3.2	22.0	53.1	3.2	35.7
Utah	4.0	3.6	15.0	86.7	3.4	32.9
New Mexico	3.5	.8	3.6	55.2	1.0	12.4
Upper Basin	4.8	3.1	21.2	79.0	2.9	32.4
United States	3.2	3.9	6.0	6.6	5.6	55.4

The livestock enterprise in the basin is largely restricted to the production of feeder cattle, feeder lambs, and sheep



HEREFORDS ON THE RANGE NEAR MOAB, UTAH

Range lands have been stocked at the maximum and overgrazed



HAY HARVEST ON EDEN PROJECT, WYOMING

Production of more hay on irrigated land will permit optimum use of the range

and wool. Most of the animals are sent to the Corn Belt, where they are finished for market. Livestock operations in the basin thus complement those of the Middle West. A few grass-fattened cattle, lambs, and sheep are shipped directly to slaughter markets. Except in favorable years, however, forage is inadequate to fatten more than a small proportion of the animals.

Crops and yields.—Of the total cropped acreage harvested in the upper basin in 1939 about 83 percent was irrigated and 17 percent was dry-farmed. Most of the dry-farmed crops were produced in Colorado and consisted mainly of wheat and dry beans.

The land harvested totaled only 1,073,130 acres. Alfalfa hay, the most important crop, amounted to 28 percent and all hay 64 percent of the total. Other crops, including corn, oats, barley, and some wheat, raised the total amount of the harvested land used for feed crops to more than 80 percent. Row crops grown for cash income included potatoes, sugar beets, and dry beans. The beans are grown largely on dry land in the San Juan River area and make up a considerable part of the cash crop acreage. The Grand Junction area and other smaller areas of Colorado are important fruit producing areas.

Compared with most irrigated areas and with many nonirrigated regions, the average yields per acre of many crops in this basin are low. This is due partly to the fact that much of the land has an inadequate irrigation supply and precipitation is insufficient for satisfactory yields without irrigation. The growing season is short for most crops. Often two cuttings of hay per season and sometimes only one are obtained. Some lands with soils too poor to produce high yields are now being cultivated.

TABLE X.—*Yields of major crops in upper basin (1939)*

State area	Average yield per acre				
	Tons		Bushels		
	Alfalfa	Wild hay	Dry-land wheat	Irrigated wheat	Barley
Wyoming	1.2	0.9	11.6	20.0	28.5
Colorado	1.8	1.1	12.7	22.2	26.0
Utah	1.6	1.2	17.1	25.6	32.6
New Mexico	2.8	.7	10.6	30.0	13.9
Upper basin	1.7	1.0	13.1	25.1	28.0

Number of farms.—By 1910 range lands of the upper basin were being fully utilized and irrigation had been developed so far as possible by private enterprise, yet since then the number of farms has continued to increase (fig. 4). The rate of increase, however, has slowed down materially. New farm units have provided only for the natural increase of local populations and not for new settlers moving into the area. Recently many new farms have been established in areas where the acreage and other resources per farm are smallest, forcing in some instances a change to a more intensive type of farming. With grazing privileges on public lands fully utilized, new farmers in most cases have had to follow a type of farming for which the area is not well adapted. Especially is this true in areas of high elevation and where the irrigation water supply is uncertain and inadequate. This has also resulted in a large number of part-time farms in localities with little opportunity for supplemental work away from the farm.

TABLE XI.—*Number of farms in the upper basin (1939)*

State area	Year			
	1880	1900	1930	1940
Wyoming	90	556	885	966
Colorado	230	5,699	13,021	12,668
Utah	122	1,759	3,969	4,660
New Mexico	...	192	874	2,383
Upper Basin	142	8,306	18,752	20,677

Size of farms.—Although the number of farms has been increasing without a corresponding increase in available farm land, census reports paradoxically show the size of the average farm in the upper basin to be increasing also (fig. 5). The apparent but largely unreal expansion of the farm area has resulted in part from the transfer of public grazing land into private ownership. The average size of farms in the basin is relatively large as would be expected from the type of farming practiced, but there are also some small farms. According to the 1940 census, 27 percent of all farms consisted of less than 50 acres. With some types of farming, 50 acres would constitute a large farm but in this basin 50 acres are entirely inadequate except in a few localities such as those where fruits and vegetables are grown successfully. There were 1,304 farms of less than 10 acres, nearly all operated, no doubt, on a part-time basis. Farms are largest in the Wyoming portion of the basin where stock raising is dominant and smallest in Utah, where a high population pressure results from a birth rate near the highest in the Nation.

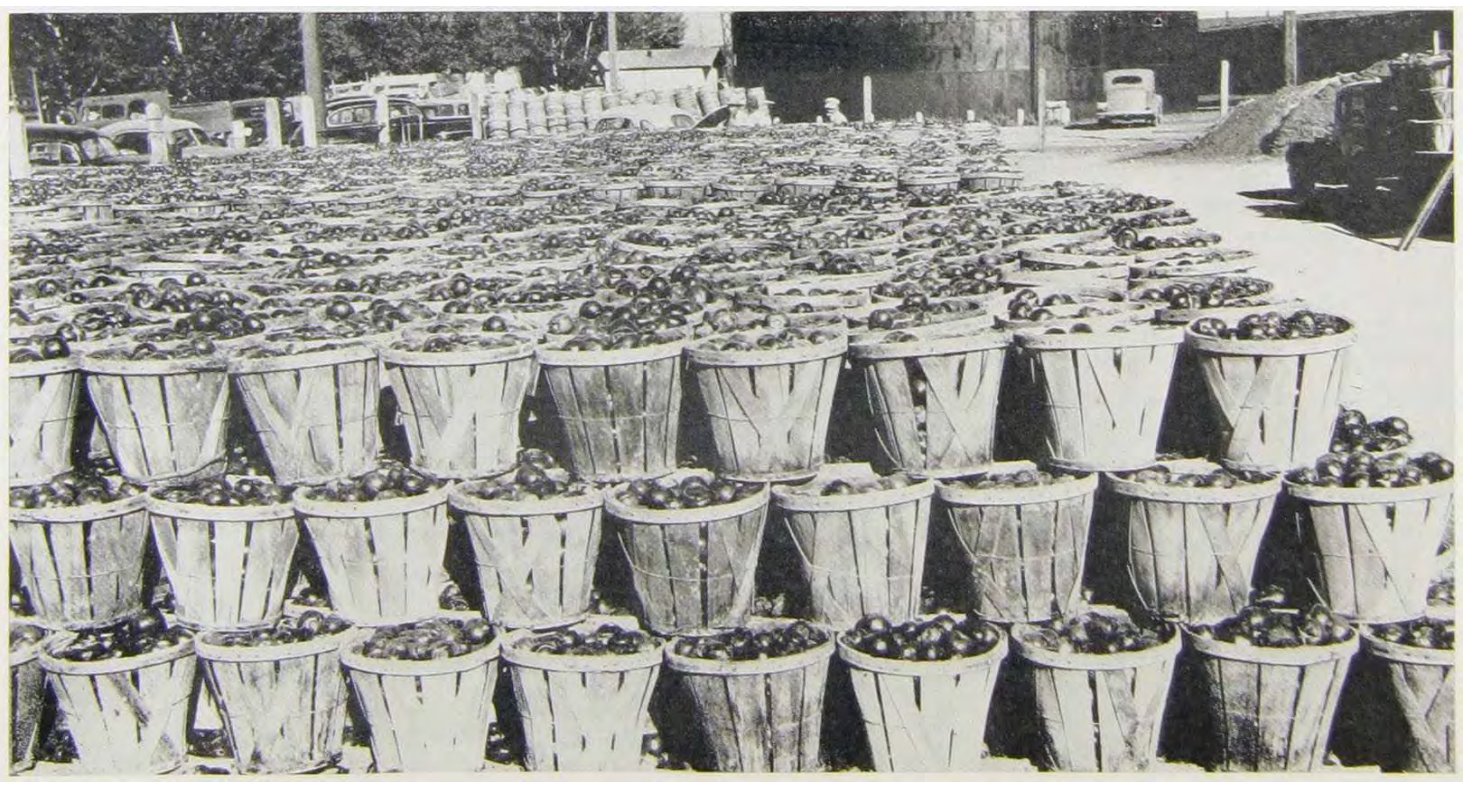
TABLE XII.—*Sizes of farms in upper basin (1939)*

State area	Percent of total number of farms in various size groups						
	Less than 50 acres	50-99 acres	100-179 acres	180-379 acres	380-699 acres	700 or more acres	Total
Wyoming	8.3	6.1	15.9	17.0	17.9	34.8	100.0
Colorado	28.1	15.4	18.3	16.2	9.8	12.2	100.0
Utah	28.3	19.2	21.4	14.6	6.6	9.9	100.0
New Mexico	26.9	9.4	9.9	14.2	12.9	26.7	100.0
Upper basin	27.1	15.2	17.9	15.6	9.8	14.4	100.0



PEACH ORCHARD NEAR GRAND JUNCTION, COLO.

Grand Valley is an important fruit-producing area



TOMATOES FROM GRAND VALLEY PROJECT

Additional irrigation will make possible more intensive agriculture

UPPER COLORADO RIVER BASIN

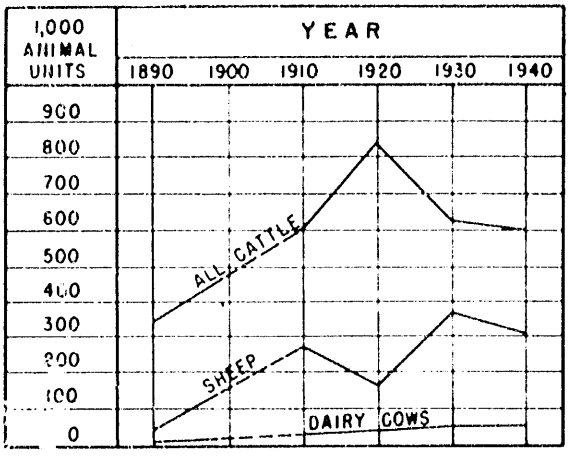


FIGURE 3.—*Trends in animal units, 1890–1940.*

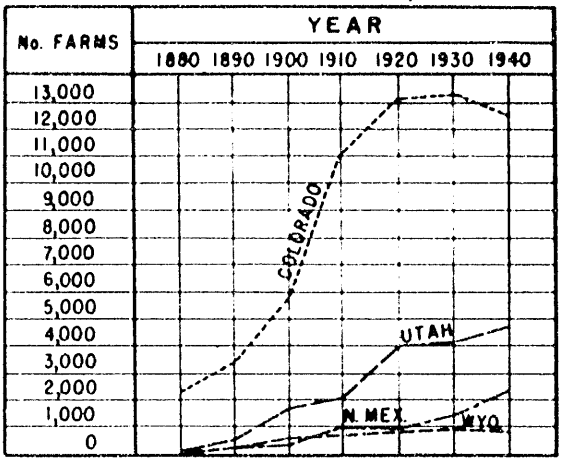


FIGURE 4.—*Number of farms, 1880–1940.*

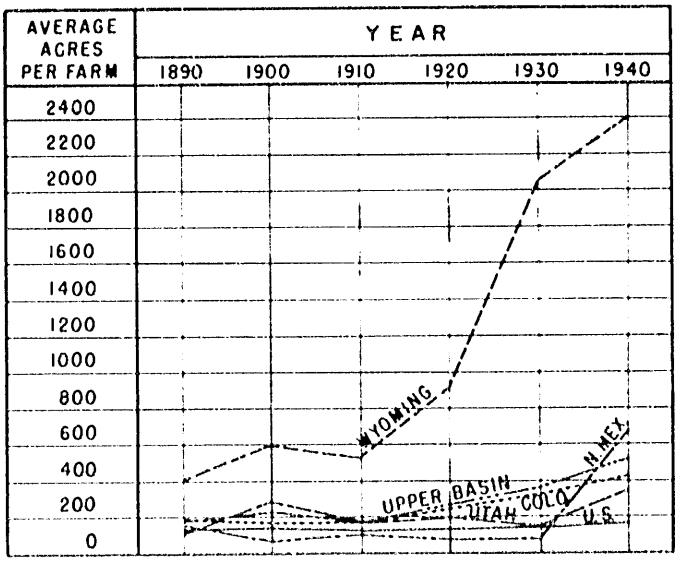


FIGURE 5.—*Size of farms, 1890–1940.*

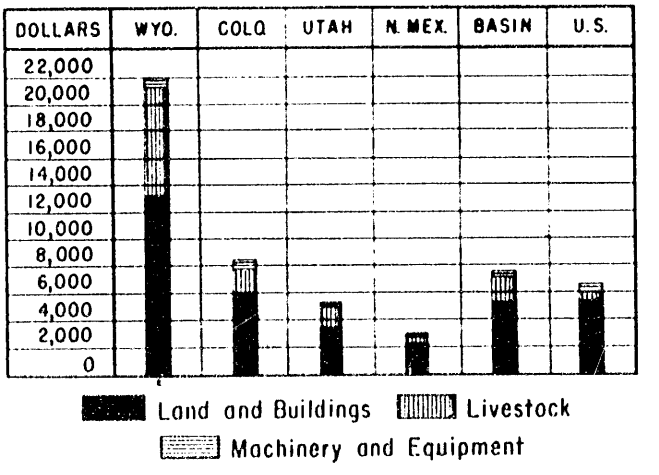


FIGURE 6.—*Value of farm property, 1939.*

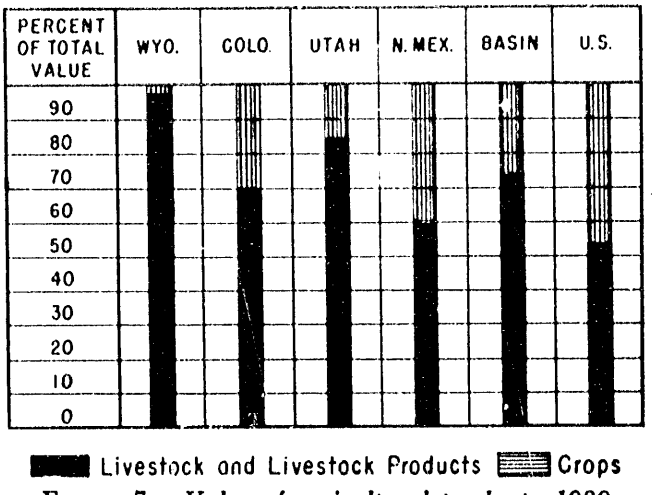


FIGURE 7.—*Value of agricultural products, 1939.*

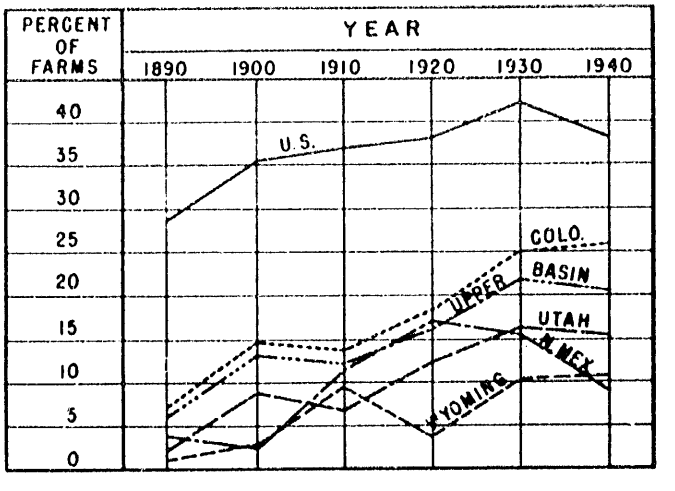


FIGURE 8.—*Farm tenancy, 1890–1940.*

The 27 percent of farms with less than 50 acres per farm contained but 1.1 percent of the total land area and harvested but 5.9 percent of the cropped acres in the upper basin. At the other extreme 14 percent of the farms had 75 percent of the total land and 36 percent of the harvested acres. Farmers of small tracts do not have enough land to make a living from livestock and in most instances water is insufficient to enlarge and intensify their farming operations. The small farmers in the area would benefit greatly from irrigation development. More intense farming through irrigation would develop small economic farm units.

TABLE XIII.—*Farm land available in upper basin (1939)*

State area	Type of farm land available (average number of acres per farm)				
	Irrigated crop land harvested	Total crop land	Irrigated land	Grazing land [1]	All agricultural land [1]
Wyoming	181	194	276	10, 204	10, 398
Colorado	43	65	53	1, 551	1, 616
Utah	30	45	44	3, 469	3, 514
New Mexico	11	19	11	1, 315	1, 334
Upper basin	43	52	57	2, 360	2, 412

[1] Includes public land used for grazing.

Value of farm property.—The average value per farm in the upper basin as reported in the 1940 United States census was $7,805. This was about $1,000 more than the average for all farms in the United States. As compared with the average of all farms in the Nation the average basin farm has a little more invested in land, has less in buildings, and more than twice as much in livestock. Many of the livestock operators in the upper basin use land belonging to the Federal or State Governments in which they have little or no investment (fig. 4).

TABLE XIV.—*Value of farm property in upper basin (1939)*

State area	Average value per farm				
	Land	Buildings	Livestock	Implements and machinery	Total
Wyoming	$11, 142	$2, 013	$7, 778	$898	$21, 832
Colorado	4, 777	1, 366	1, 712	626	8, 481
Utah	2, 759	720	1, 618	360	5, 457
New Mexico	1, 809	509	593	208	3, 120
Upper basin	4, 278	1, 152	1, 846	530	7, 805
United States	3, 811	1, 707	747	502	6, 767

The average farm valuation in Wyoming is much higher than in other States because practically all of the farms in the Wyoming area of the Colorado River Basin are specialized livestock ranches involving large acreages. In the other States there are more crop farms and many livestock farms that are too small for efficient operation.

Farm income.—The total value of agricultural products sold or traded in the upper basin in 1939 amounted to $40,000,000 according to the 1940 United States census. Livestock and livestock products accounted for three-fourths of this amount (fig. 8).

TABLE XV.—*Average income from farms in upper basin (1939)*

State area	Income per farm	Income per capita of farm population	Income per acre of harvested land	
			Total farm income	Crop income
Wyoming	$4, 392	$954	$23. 80	$0. 72
Colorado	1, 699	360	30. 71	9. 60
Utah	1, 127	264	34. 56	5. 43
New Mexico	555	107	37. 64	15. 17
Upper basin	1, 564	335	30. 13	7. 65
United States	1, 089	217	20. 68	9. 63

These statistics of farm income strikingly show the importance of the livestock industry in this region. The income per farm and per capita population is about 50 percent higher than the average for the entire United States. This is because livestock operations are conducted in large-scale units for greater efficiency, and the farm labor requirement is low. The total farm income per acre of crop land harvested was also higher than the average of the Nation, but the crop land income per acre was lower because of the relatively large acreage of livestock and grazing lands. Wyoming, where livestock raising is of greatest relative importance in the upper basin, is in marked contrast with New Mexico where farmers are dependent to a larger extent upon crops.

Farm tenancy.—The upper basin in common with all of the Mountain States has relatively few tenant-operated farms (fig. 8). In 1940 there was slightly more than half as many tenant-operated farms in the upper basin as in the United States as a whole, mainly because livestock farming is not well adapted to a tenancy. The economic age of the upper basin also may be a contributing factor. The risks to the livestock farm owner are too great with tenancy. Most of the tenancy that does exist is in the nonlivestock types of farming.

Part-owner-operated farms are more common in this area than in the country as a whole. This has resulted from the frequent ownership by inheritance, homesteading, or unwise purchase of tracts too small for an economic unit. Because these cannot be economically operated independently they are often leased to livestock men to supplement their own holdings.

Minerals and Mining [1]

The most extensive and commercially most important mineral resources of the upper basin are coal, oil, and natural gas. The upper basin is the leading domestic source of vanadium, uranium, and radium ore, and also molybdenum. Zinc, lead, silver, and gold are commercially important. Metals of minor interest include copper, manganese, bismuth, and antimony. Among the nonmetallic or industrial minerals and rocks, gypsum, salt, and limestone are abundant and accessible but have not been developed extensively. Potash and magnesium deposits are possible future sources of supply. See appendix, maps entitled "Mineral Resources, Colorado River Basin."

The remoteness of large portions of the upper basin from established industrial and transportation centers has been responsible for the restricted character of industrial developments based on minerals and has also retarded intensive exploration for new mineral deposits. The important discoveries of carnotite ores and carnallite made during the war period are indicative of new developments that can be expected with continued intensive exploration. Recent success in an expanded oil drilling program is highly encouraging. Some of these mineral resources may not be developed to a large extent immediately, but with improved technological processes together with increased demands and the depletion of more economical sources of supply, the time may not be far away when large scale developments will take place in the upper basin.

Mineral fuels and other hydrocarbons

Coal.—The upper basin contains enormous reserves of coal, mostly of bituminous and subbituminous grade. Reserves here are much larger than those in any other section of comparable size in the world and amount to approximately one-third of all of the coal deposits in the United States and one-sixth of those in the entire world. Some of this coal is below present mineable depths, but mineable reserves alone are nearly one-fourth of the Nation's total deposits. Coal reserves within the upper basin are roughly estimated at 400 billion tons.

The importance of these vast reserves is enhanced by the almost complete absence of any coal deposits in the States west of this region. The only exception of any consequence is the coal deposits of the State of Washington, but this coal is inferior in quality and more difficult to mine than the coals of the upper basin. Large quantities of coal from the upper basin are now shipped west, north, and sometimes east. These coals can be mined more cheaply than those in most other regions and may provide the basis for much of the future industrial development of the western part of the United States.

Mine entries above ground level are possible for a large portion of the deposits. Thick beds, ranging from 8 feet to a maximum of 90 feet and virtually horizontal, can be mined with comparative ease.

Bituminous coals from the upper basin are considered the highest quality bituminous coals on the western market. They are low in ash and moisture, extremely low in sulphur and highly volatile with a high heat value. Largest coal mines in the upper basin are in the Rock Springs and Kemmerer districts in Wyoming, served by the Union Pacific Railroad, and near Price, Utah, on the Denver & Rio Grande Western Railroad. Most of the coal mined in the Colorado area is bituminous but some good grade anthracite is mined in Gunnison County.

Coal production in the upper basin increased more than 50 percent in the period 1940–43. Part of the increase was in coking coals mined near Sunnyside, Utah, for new steel plants at Geneva, Utah, and Fontana, Calif. The new completely mechanized mine located near Sunnyside has a capacity to produce 8,000 tons of coking coal per day. Other important deposits of coking coal are located near Crested Butte, Durango, and Norwood, Colo. Coal in the Willow Creek area, Wyo., was found recently to be suitable for blending with other coal in the manufacture of metallurgical coke.

The increased coal production to meet war demands is indicative of future expansion in the industry, which no doubt will be accompanied by additional heavy investments in modern mining equipment. As coal is used more economically, especially through effective utilization

[1] Based in part on information supplied by Geological Survey.

Table XVI.—*Coal production in upper basin*

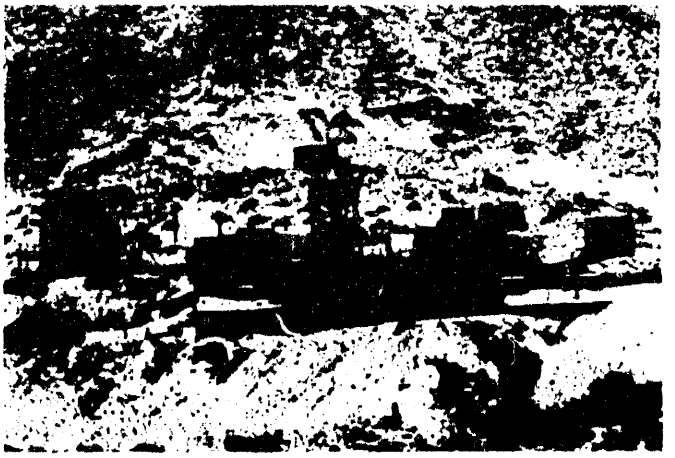
State area	Tons mined				
	1929	1930	1935	1940	1943 [1]
Wyoming	6, 212, 000	4, 577, 000	3, 800, 000	4, 660, 000	2, 446, 125
Colorado	2, 037, 000	1, 641, 000	1, 491, 000	1, 827, 000	5, 699, 837
Utah	5, 881, 000	4, 168, 000	2, 919, 000	3, 504, 000	6, 896, 817
New Mexico	3, 000	7, 000	7, 000	34, 000	73, 717
Upper basin	14, 133, 000	10, 393, 000	8, 217, 000	10, 025, 000	15, 116, 496

[1] Estimated



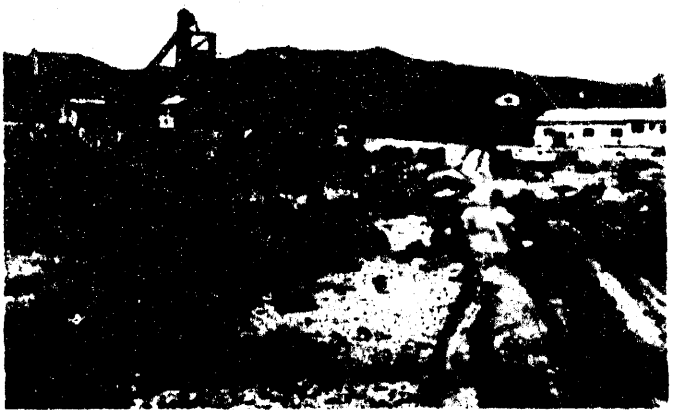
COAL MINE NEAR SUNNYSIDE, UTAH

Coking coals are mined here for western industries



LEAD-SILVER MINE

Power is supplied from Boulder and Parker Dam power plants on Colorado River



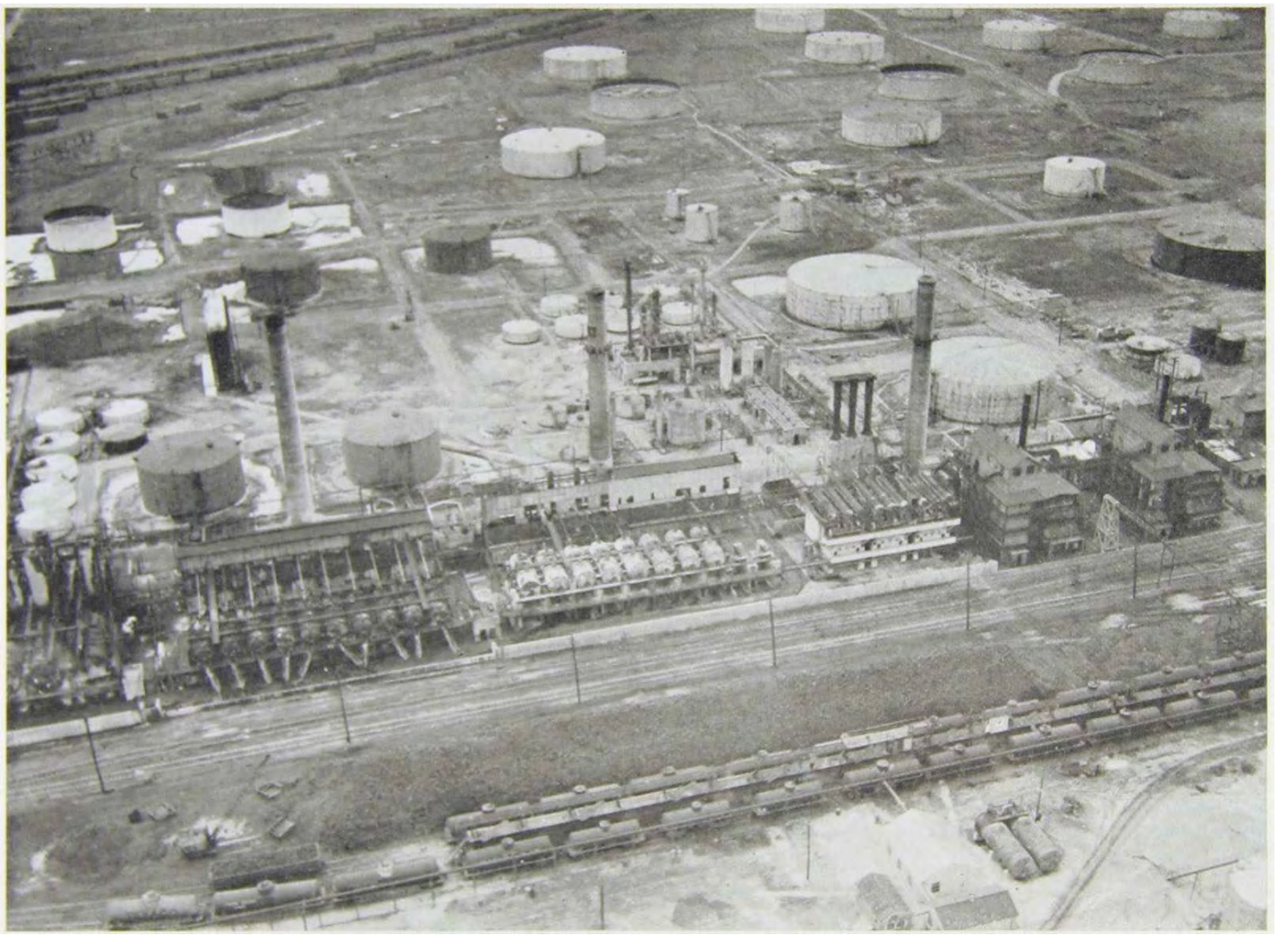
GOLD MINE

Additional low-cost power is needed to develop vast mineral resources

of the volatile substances, satellite industries are expected to increase.

Petroleum and natural gas. Oil and gas have been discovered in 10 widely distributed fields in the upper basin. Most of the fields, however, are located in northwestern Colorado and in an area in southwestern Colorado and northwestern New Mexico. Wells now being drilled near Vernal, Utah, may prove to be the beginning of the first major oil field in Utah. Proved reserves of petroleum in the upper basin were estimated at 43,200,000 barrels as of October 1, 1943. Production in 1943 exceeded 3,250,000 barrels of oil and 21 billion cubic feet of gas, 60 and 70 percent respectively coming from northwestern Colorado.

Oil from Wyoming wells and from wells in the Rangely field in Colorado is piped to refineries at Salt Lake City. Other Colorado crude oil is refined at Craig and Denver. Gas from both the Baxter Basin field in Wyoming, one of the largest in the world, and from the Hiawatha field in Wyoming and Colorado is piped to Salt Lake City, Ogden, and other places in Utah as well as to several towns in Colorado and southwestern Wyoming. Oil from wells in the San Juan River Basin is refined at Farmington and Bloomfield, N. Mex. Natural gas from this area is piped to Durango, Colo., and Shiprock, Farmington, Bloomfield, Albuquerque, Santa Fe, Belen, and Bernalillo, N. Mex.



UTAH OIL REFINING COMPANY

Oil from Colorado and Wyoming is piped to refineries in Salt Lake City

Oil shale. The upper basin also contains the largest deposits of oil shale in the United States. The reserves of this potentially important mineral fuel account for approximately 82 percent of the 75 billion barrels of recoverable oil in shale in the United States, which is equal

to four or five times the known reserves of petroleum in all the oil fields of the Nation. The extraction of the oil from shale will require the establishment of plants near the deposits. Whether oil shale or coal or both are utilized to meet future needs for oil and gasoline, these mineral fuels are of great potential importance.

Bituminous sandstone and rare hydrocarbons. Another oil-bearing material of great potential importance is bituminous sandstone. At the present time it is being used as a road surfacing material. Large deposits are worked near Vernal and Sunnyside, Utah. The Vernal deposit contains about 2 billion tons averaging between 8 and 15 percent bitumen by weight, but most of it can be recovered only by underground mining. The deposit near Sunnyside is also very large; a sample of it averaged 11 percent bitumen by weight.

The only known deposits of gilsinite, elaterite, wurtzilite, and ozocerite are in the upper basin. In normal times these materials are mined from veins and shipped to all parts of the world for use in the manufacture of roofing, insulating materials, and such articles as ink and switch handles.

The gilsonite deposits occur mainly in the Uinta Basin in Utah. Annual output during the 10-year period 1934–43 averaged 35,996 tons valued at $852,636. Reserves have been estimated at 25 million tons. The annual output of ozocerite and wurtzilite in Utah amounts to only a few hundred tons.

This array of mineral fuels and carbonaceous materials is not approached by any region in any other part of the world. The extent to which these materials may provide the basis for future mining and mineral processing within the basin and in contiguous areas cannot be foretold definitely, but it is certain that their effect on future industrial development will be important.

Nonferrous metals

The upper basin has contributed more than 8,000,000 ounces of gold, 300,000,000 ounces of silver, 1,000,000 tons of lead, 500,000 tons of zinc, and 160,000 tons of copper to the total mineral production of the Nation.

The production of these nonferrous metals for typical years since 1920 has been as follows:

TABLE XVII.—*Mineral production in upper basin*

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gold, oz.	162,370	91,970	55,370	61,920	93,620	53,000
Silver, oz.	3,374,000	2,501,000	2,[illegible],000	3,762,000	8,[illegible],000	1,706,000
Copper, tons	1,469	1,072	4,175	7,165	11,724	865
Lead, tons	16,275	22,[illegible]	13,742	2,731	8,410	9,941
Zinc, tons	14,[illegible]	26,157	24,726	272	4,720	27,838

The limited production and reserves of gold, silver, copper, lead, and zinc are confined to several small areas, mainly in southwestern Colorado. The production of these metals will increase in the future, no doubt, with advancement in operational techniques. At present nearly all of the metal ores mined in the basin must be shipped to outside mills and smelters.

Gold and silver.—A number of districts in the San Juan Mountains, Colo., have been important sources of gold and silver derived from ores relatively near the surface, but deeper ores in the same districts are now contributing lead, zinc, and copper as well as gold and silver. Large quantities of gold and silver have also come as byproducts of base-metal ores in the zinc-lead districts.

Copper.—Copper has been mined in substantial quantity along with zinc and lead at Gilman, Colo., and has been a byproduct of zinc, lead, and precious metal ores elsewhere. Substantial reserves of ore, mostly of low grade, are present in sandstone in the Colorado Plateau, but only small quantities of high-grade ore have been shipped.

Zinc and lead.—Deposits of zinc and lead in the upper basin are practically confined to western Colorado. The leading district is at Red Cliff and Gilman in Eagle County, from which 170,000 tons of zinc and 66,000 tons of lead, together with some silver and gold, have been mined. Its reserves of zinc are estimated to be about 525,000 tons and those of lead 105,000 tons.

Other districts that have contributed substantial quantities of zinc and lead are the Breckenridge and Kokomo districts in Summit County, Aspen district in Pitkin County, Rico district in Dolores County, Telluride district in San Miguel County, closely spaced districts in Ouray County, and the Eureka district in San Juan County.

Ferro-alloy metals.

Molybdenum.—The Climax molybdenum district, the largest single metal-mining operation in Colorado and the largest molybdenum district in the world, is situated close to the Continental Divide in northeastern Lake County, Colo. Mining there began in 1918, and from then until 1943 the total output has amounted to 268,618,190

pounds of metallic molybdenum contained in concentrates. The quantity of ore mined daily during 1942 and 1943 ranged from 15,000 to 20,000 tons.

Molybdenum-tungsten deposits in the Gold Hill district, Gunnison County, Colo., first became productive during World War I, when a few hundred tons of ore containing 4.5 percent of molybdenum sulphide and 100 tons of ore containing 11 percent tungstic oxide were mined. They have been worked for tungsten during World War II. Reserves include 60,000 tons of relatively high-grade molybdenum ore and from 100,000 to 200,000 tons of ore containing not more than 0.5 percent molybdenum sulphide. No estimate of tungsten reserves has been made.

Vanadium, uranium, and radium.—Deposits of vanadium-bearing sandstone are widely distributed in western Colorado and eastern Utah, and are also present in northern Arizona and New Mexico, but output thus far has come principally from those in Colorado and Utah, which constitute the leading domestic source of vanadium, uranium, and radium. Vanadium from Paradox Valley in Colorado and Utah was a source of bombastic uranium, used in the manufacture of the atomic bomb. Deposits near Placerville, Colo., were discovered in 1899. From 1911 to 1923 the ores of the region were intensively mined for their radium and uranium, but from 1915 to 1923 some vanadium was produced as a byproduct. Mining practically ceased in 1923 when pitchblende from the Belgian Congo began to supply radium. Since 1937 the ores have been mined for vanadium. From 1909 to 1943 the output amounted to 23,000,000 pounds of elemental vanadium contained in mill products. From 1907 to 1920 about 202 grains of radium were recovered, equivalent to about 1,000 tons of uranium oxide.

Reserves of inferred ore total many million tons, but because of spotty distribution and high cost of development only a small fraction of these reserves could be considered commercially available under conditions prevailing in 1943. The indicated and measurable reserves do not exceed 500,000 tons of ore. The region, however, should continue to be an important source of vanadium, and contains the largest domestic reserves of uranium and vanadium.

Manganese.—Although small bodies of manganese ore are widely distributed throughout much of the upper basin, particularly in Utah, they do not constitute an important resource. A manganese ore body, estimated at over a million tons and containing 16.8 percent manganese and 11.3 percent iron is located on the northern slope of the Uinta Mountains in Utah. Estimated reserves include about 15,000 tons of 30-percent ore, only a part of which can be profitably mined even at wartime prices; about 100,000 tons of 10- to 30-percent ore, and about 350,000 tons of 4- to 10-percent ore. Since 1901, when the first shipment was made, about 12,000 tons of ore containing 40 to 45 percent manganese have been shipped.

Tungsten.—Tungsten deposits in the upper basin occur only in western Colorado and are of very little commercial interest. Output has been extremely small, even when wartime prices prevailed. Estimated reserves are as follows:

County, Colorado	Indicated ore		Inferred ore	
	Tons	Units[1]	Tons	Units[1]
Gunnison	1,000	2,400	1,900	3,850
Ouray			500	750
San Juan	100	400	800	1,650
San Miguel			250	500
Summit	150	950	175	900
	1,250	3,750	3,625	7,550

[1] A unit amounts to 20 pounds of tungstic oxide (WO_3).

Minor metals

Antimony.—Antimony is present in small deposits in Dolores, Gunnison, Ouray, Pitkin, San Juan, and San Miguel Counties, Colorado, but not in commercial quantities as an ore of antimony. Lead-antimony deposits have been mined but owing to the penalty for high antimony content in lead ore, these ores are generally avoided. Many of the complex base- and precious-metal ores in the San Juan region contain some antimony, part of which is recovered as a smelter or refinery byproduct.

Bismuth.—Bismuth is also found in many districts in western Colorado, but not in commercial deposits of bismuth ore. Part of it is recovered in the smelting and refining of base- and precious-metal ores.

Nonmetallic (industrial) minerals

Though there is almost no industrial utilization of industrial minerals in the basin, there are potential resources that are either known to be large or, if adequately explored, may prove to be large. These include phosphate, potash, and sodium carbonate deposits in Wyoming, salt and associated potash deposits in southeastern Utah, and salt and associated gypsum in southwestern Colorado. Limestone and dolomite are present at several places in Colorado, Wyoming, and northwestern New Mexico. Deposits of helium and carbon dioxide gases also occur in the upper basin.

Phosphate rock.—Only a relatively small portion of the great western field of phosphate rock is in the upper basin. It occurs in the Salt River and Wyoming ranges and around the flanks of the Uinta Mountains in Utah. The beds in Wyoming are mainly thin and comparatively inaccessible but of moderately high grade. Those in Utah are generally of low grade and vary greatly in thick-

ness. The nearness of large hydroelectric power sites, however, and the possibility of mining the rock by open pit methods may lead to extensive development of this rock as a fertilizer. Estimated reserves of phosphate rock amount to 1,616,000,000 long tons averaging 40 to 50 percent calcium phosphate.

Potash.—Large deposits of leucite, a mineral containing potash and alumina, in the Green River Basin in Wyoming may eventually prove to be a feasible source of potash. The possibility of its development would be greatly enhanced by the production of fertilizer materials, especially phosphates, in nearby areas. Reserves of potash rock in this area amount to 1,900,000,000 tons which contain an estimated 190,000,000 tons of potash. Reserves of potash and magnesium salts in southeastern Utah occur at a depth of 3,000 feet and cannot be estimated from available data, but the known deposits are sufficiently widespread and of sufficiently high grade to be regarded as an important potential resource.

Recent exploration near Thompson, Utah, has proved the presence of extensive deposits of carnallite, a chemical combination of potassium chloride and magnesium chloride, and of other potash-bearing minerals. Further development may lead to the utilization of these minerals for the production of potash separately or as a joint or byproduct with magnesium. Had these explorations for carnallite been made at an earlier date, they probably would have led to the construction of a processing plant to supply in part the war needs for metallic magnesium. These western resources present one of the most favorable raw material basis for a concentrated mixed fertilizer industry in the world.

The availability of large supplies of cheap electricity would be an important factor in promoting the utilization of these abundant fertilizer minerals.

Salt.—The exploration for carnallite also revealed the presence of much larger beds of sodium chloride. Wells drilled in widely sparated areas in southeastern Utah have cut through beds of common salt 2,000 feet or more in thickness. Possibilities of future production of iodine and other important substances are also indicated. Salt deposits in Paradox Basin, Colorado, amount to billions of tons, but they are nearly all at depths of more than 1,000 feet. Salt is being mined only at Bedrock, Montrose County, Colorado, for use in the production of vanadium. Estimates of possible reserves of sodium carbonate (trona) in Sweetwater County, Wyoming, range from 158,000,000 to 7,000,000,000 tons. Brine containing sodium carbonate has served intermittently as the raw material for production of a small amount of sal soda.

Gypsum—Gypsum ores outcrop along the west flank of the San Rafael Swell in east-central Utah. Reserves in this section are estimated at 9,701,600,000 tons. The tonnage of large reserves in western Colorado has not been estimated. Gypsum reserves constitute a large source of supply for future use when market conditions are favorable for their development.

Helium.—Helium is produced from natural gas in the Rattlesnake field, New Mexico, and is known to occur with natural gas in the Woodside and Harley Dome fields, Utah. Figures of output and reserves are not available.

Carbon Dioxide.—Carbon dioxide gas, obtained from the Farnham anticline, is manufactured into liquid and solid carbon dioxide at Wellington, Utah. The output in 1943 amounted to 160,972,000 cubic feet.

Building Stones.—The only building or monumental stone worthy of note in the upper basin is Colorado Yule marble, a product of high quality quarried intermittently at Marble, Gunnison County, Colo. The high cost of quarrying and the long distance from the large markets have been obstacles in the development of this industry. Crushed stone is produced for local use at several places, and limestone has been burned into lime at scattered places. Only one lime plant, at Glenwood Springs, Colo., was operated in 1943.

Other industrial minerals.—Other industrial minerals in the basin include sulphur in Emery County, Utah; pyrite in large quantities in several mining districts; analcite (a zeolite), of possible usefulness in water-softening, in eastern Uintah County, Utah, and adjacent parts of Colorado; pumice, used locally at Durango, Colo.; amorphous graphite, derived through the intense alteration of coal, near Pitkin, Gunnison County, Colo.; vermiculite, which has been exploited in a small way in Gunnison County, Colo.; and fluorspar, which occurs as a gangue mineral in certain metalliferous veins, and has been shipped from the Barstow mine in Ouray County, Colo. Past shipments of fluorspar slightly exceed 10,000 tons; known reserves are negligible, but a total of 10,000 tons is inferred for the two or three deposits that have any commercial promise.

Lumbering

The high mountain areas of the upper basin support extensive stands of timber, much of which is suitable for various building and industrial uses. Timber stands are quite widely distributed over the basin but are most heavily concentrated in western Colorado. In 1939 saw and planing mills gave employment to 560 workers. With two exceptions these mills are small and supply only a limited local trade. Much lumber is shipped in from mills outside the basin that are better equipped to process the lumber in the forms required for a variety of uses. Because of the inaccessibility and the scattered nature of timber stands, lumber from this area cannot compete at present on National markets, but as other timber reserves are depleted and local needs increase the timber resources of this region no doubt will be utilized more fully and will support important lumbering industries.

Manufacturing

The processing of agricultural products on a small scale is practically the only manufacturing in the upper basin. At present there are three factories that process fruits and vegetables and two beet sugar factories. In several main farming areas small grain mills produce flour and other grain products, largely for local use. A few small creameries and cheese plants also operate in the area. Only a small portion of the ore mined receives preliminary milling before it is shipped outside the basin. The remoteness of the area, the newness of its economy, and the widely scattered production of the small quantity of raw materials suitable for processing have all tended to restrict manufacturing in the basin.

Table XVIII.—*Manufacturing census data—upper basin*

	Number of employees engaged	Value of raw materials	Value of processed products	Value added by processing
1919	3,319	$9,977,000	$17,369,000	$7,392,000
1929	2,940	19,523,000	28,230,000	8,707,000
1939	2,025	9,584,000	14,311,000	4,727,000

The limited amount of manufacturing in the upper basin is indicative of undeveloped nature of the economy of the region. Practically all of the fabricating industries that are established process products produced in the basin. The reason may be partly that Denver and Salt Lake City are both close and provide large portions of the manufactured commodities consumed in the region.

Transportation and Markets

Low-cost transportation is vital to the economy of the upper basin because of its scattered population, expansive area, and long distance from eastern centers of production and consumption. Residents of the region pay freight on manufactured articles which are shipped in. They also indirectly absorb freight charges on shipments of their raw materials to outside markets because they must sell their products at delivered prices in competition with producers closer to market centers.

The main east-west lines of the Union Pacific and the Denver and Rio Grande Western Railroads cross the central part of the upper basin. The few important trading and shipping centers in the Green River Basin limit convenient outlets for crops and livestock. The Union Pacific Railroad extends through the southern part of Wyoming. The Denver and Rio Grande Western Railroad has shipping points at Price and Green River, Utah, and at various places along the Colorado, Gunnison, and Uncompahgre Rivers in Colorado. A narrow-gauge branch of The Denver and Rio Grande Western connects with the standard-gage line at Alamosa, Colo., and extends west to Durango, Colo., and thence south to Farmington, N. Mex. Another narrow-gage line of the Rio Grande Southern Railroad connects Durango and Mancos with Montrose, Colo., to the north. The Denver and Salt Lake Railroad enters the upper basin from the east but terminates at Craig, Colo.

Pinedale, Wyo., in the extreme north of the upper basin must transport its livestock and crops 102 miles to the nearest railroad point at Rock Springs. Closest rail centers to Vernal, Utah, are Helper, Utah (105 miles), and Craig, Colo. (123 miles). Other important areas in southern and eastern Utah and in the Dolores River Basin in Colorado are many miles from rail connections.

United States highways 6, 30, 40, 50, and 160 also extend east and west across the basin. North-south highways are fewer but U. S. Nos. 187 and 189 serve the Wyoming portion of the basin and Nos. 160 and 550 extend from Crescent Junction, Utah, and Grand Junction, Colo., respectively into the San Juan River Basin. Many Federal, State, and local highways are interconnected. Good roads have fostered the trucking system that serves the area. All but the remote and mountainous areas can be reached by all-weather roads. A few unimproved roads traverse parts of the area, but much of the barren and badland regions is inaccessible by the road.

High transportation costs have restricted development in the upper basin. The Bank of Vernal, Utah, is constructed of brick sent from Salt Lake City by parcel post. It was erected in 1919 when freight was $2.50 a hundred pounds and parcel post only $1.05.

The urban population within the upper basin provides a local market for whole milk, fruits, and vegetables, but considerable quantities of potatoes, vegetables, fruits, and processed foods are imported. Large quantities of grain and other livestock feeds also are imported normally. Only high-value-per-pound products can be exported profitably. These include livestock, wool, butter, cheese, eggs, poultry, seeds, vegetables, fruit, and honey. Livestock are sent to Denver, Kansas City, Omaha, Salt Lake City, and Ogden, and wool is shipped to Boston.

Most minerals are shipped in raw ore form out of the basin for refining, although in recent years some milling and reducing of ores have been done near the mines before shipment. Main ore markets are Leadville, Colo., Midvale and Tooele, Utah, Amarillo, Tex., and Coffeyville, Kan. Coal is shipped to eastern Colorado, central Utah, and southern Idaho for domestic and industrial purposes and to Denver and Pueblo, Colo., Provo, Utah, and Fontana, Calif., for use in iron ore reduction.

In general the Wyoming and Utah portion of the upper basin is a part of the Salt Lake City-Ogden trade area and the Colorado and New Mexico portion is connected with the Denver trade area.

TABLE XIX.—*Value of trade in upper basin (1939)*

Division	Wholesale	Retail
Green	$9, 303, 000	$29, 668, 000
Grand	14, 453, 000	31, 040, 000
San Juan	6, 000, 000	15, 000, 000
Upper basin	29, 756, 000	75, 708, 000

RECREATION

The upper basin with its lofty snow-capped mountains, clear trout-stocked streams and lakes, beautiful forests and cool but sunny weather in the mountain country attracts vacationists from all pars of the Nation. In the San Juan Basin is the world's largest natural bridge, brilliantly colored rock formations, some of the best preserved Indian ruins and cliff dwellings, and "Four Corners," the only point in the United States where four States join. The largest and most complete deposits of dinosaur fossils yet discovered have been unearthed near Vernal, Utah.

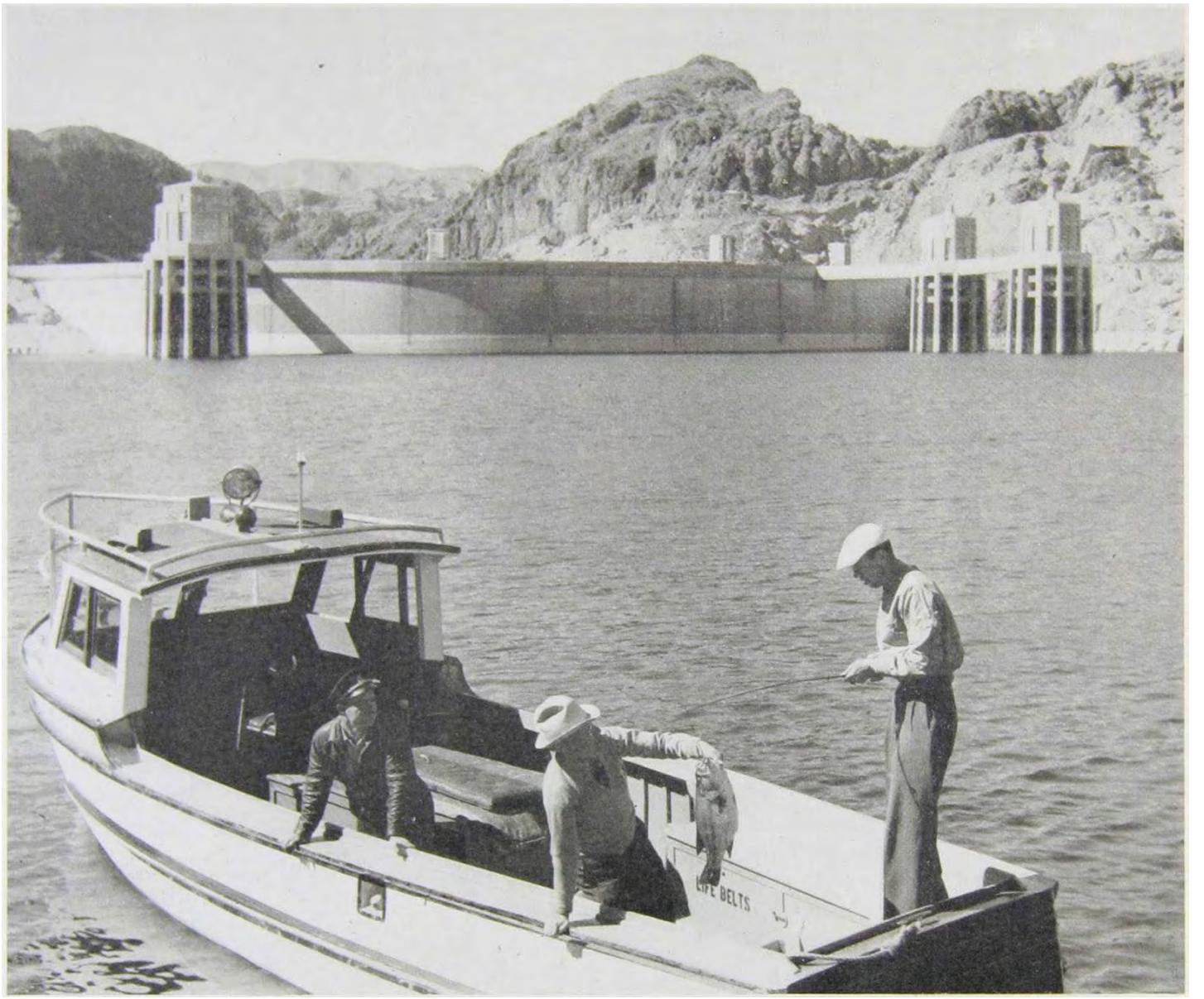
Bryce Canyon and Mesa Verde National Parks and part of Rocky Mountain National Park are within the upper basin. There are also 13 national monuments, including Yucca House, Navajo, Capital Reef, Arches, Natural Bridges, Hovenweep, Canyon de Chelly, Chaco Canyon, Aztec Ruins, Rainbow Bridge, Dinosaur, Colorado, and Black Canyon. The San Juan wilderness area of a quarter million acres has been set aside as a primitive preserve in the San Juan National Forest along the Continental Divide. Other primitive preserves have been established in different parts of the basin. National Parks, monuments, and forests are shown on a map entitled, "Conservation Areas and Facilities" included in an appendix of this report. (See Chapter VIII, National Park Service.)

Game is in abundance in most all parts of the upper basin. Sportsmen find excellent fishing in mountain streams and lakes. Trout are plentiful in the clear, cold water of upper Green River and its tributaries. In the upper Colorado River Basin 318 streams totaling 2,327 miles and 273 lakes furnish plentiful fishing. The Colorado State Department of Game and Fish and the Forest Service cooperate in keeping the streams and lakes well stocked with fish. The varieties of trout most common are eastern brook, native, rainbow, and Loch Leven. Val-



OUTDOOR LIFE

Visitors enjoy the cool breezes on Lake Mead aboard the Grand Canyon Boulder Dam tours cruiser "Hualapai." This trip to the Grand Canyon and return is offered daily



ROD AND REEL

Fishermen displaying their catch, a 9-pound, 1-ounce bass taken from Lake Mead

lecito Reservoir and Fish Lake offer good fishing in the San Juan Basin.

Hunters are attracted particularly by deer, elk, and antelope herds, now increasing under protective measures. Mountain sheep, black and brown bear, beaver, fox, badger, ermine, muskrat, skunk, mink, wildcat, lynx, coyote, martin, weasel, rabbit, porcupine, grouse, sage chickens, and ducks also are found. Chinese pheasants, introduced into the Green River Basin in the early 1920's are now numerous near irrigated lands.

Private summer homes and commercial camps and resorts which offer accommodations to sportsmen are ideally situated near more accessible streams and lakes. Grand Lake in Rocky Mountain National Park is noted for its beauty.

Steamboat Springs, Colo., with its warm mineral baths is a popular resort area. Berthoud Pass and West Portal (Moffat Tunnel), Colo., favored because of their high altitudes and nearness to Denver, are noted winter sports areas. They offer good accomodations and ideal ski runs. The Hot Sulphur Springs ski tournament has been an annual event since 1911.

The many recreational advantages of the upper basin will be more fully enjoyed as they become more accessible through improved transportation. Their value will be enhanced through development of other resources.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	**I-2_pgs 89-219**	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

LOWER BASIN

Agriculture and mining compete for first place in economic importance in the lower basin. Since agriculture employs a much larger percentage of the population, it is ranked generally as the most important industry in the area. The gross annual income from mining, however, is greater than that from agriculture. Livestock raising is an important agricultural enterprise, although not dominant as in the upper basin. Crops bring slightly higher returns than livestock. The warm climate permits both summer and winter cropping where irrigation water is available and high-value crops, such as citrus fruits and winter vegetables, are produced.

In 1940, 631,620 people were living within the 140,000 square miles of the lower basin. This average density of 4.5 persons per square mile is almost double that of the upper basin but is barely more than one-tenth of the national average.

The building of Boulder Dam and its appurtenant works to control and utilize the waters of the Colorado River has done much to increase the lower basin's economic contribution to the Nation. Agricultural lands near the river have been spared the ravages of destructive floods, and nearly a million acres have now been provided a dependable water supply, with further expansion in prospect. Low-cost electric energy from the project has stimulated industrial growth in the lower basin and the surrounding territory. War industries of practically every type and on substantial scale sprang up suddenly.

Within the basin lie some of the scenic masterpieces of Nature's handiwork. These, together with man-made attractions, draw millions of tourists to the area annually. Catering to these visitors has become a well-defined industry. Establishments such as auto courts, hotels, guest ranches, tourist bureaus, and curio stores are almost wholly dependent upon this trade. Countless other businesses are affected by tourist travel. The value of this industry is increasing.

Land Use

The lower basin, including the Salton Sea drainage area, comprises an area two and one-half times the size of New York State. Land in the area is grouped, according to use, as follows:

	Acres	Percent of total area
Farm land:		
Irrigated land	1, 351, 000	1. 5
Other farm land	29, 291, 000	32. 4
Indian reservations	16, 193, 000	17. 9
National forests	14, 934, 000	16. 5
National parks, monuments and recreational areas	3, 607, 000	4. 0
Other land	41, 073, 000	45. 6

Some of the areas as presented are overlapping and consequently the total exceeds the basin area. For instance part of the farm land is included also in the area in Indian reservations. A very large portion of the basin area is used for grazing. Included in the area grazed are part of the irrigated land and most of the "other farm land," also substantial parts of Indian reservations, National forests, and "other land." Limited grazing is permitted on National parks and monuments. Only 1.5 percent of the entire area is irrigated, yet this small portion is the base for the total crop production. Dry farming is practiced to a limited degree in a few of the higher agricultural areas, particularly in the Virgin and Little Colorado divisions, but is almost negligible in the economy of the lower basin.

Soils

Soils of the lower basin have developed in a climate where low rainfall and high temperatures prevail, with the result that they are very low in organic material and have lost little of their soluble plant nutrients through leaching. Soil colors vary from gray to red, with pinks and reds prominent. Practically all agricultural soils are of alluvial formation but vary rather widely in composition, texture, and fertility.

Valley bottom soils are generally derived from the more recent alluvial materials, and range in texture from sands to clays. They are best suited to agriculture because of high fertility, smooth topography, and proximity to irrigation supplies.

Bench and terrace soils make up the largest acreage of irrigable soils in the lower basin. Surface soils of this type vary from rather coarse and sandy to fine textured, and contain abundant quantities of the mineral elements of fertility. The subsoil is usually finer textured and in places is composed of heavy clay. Quite frequently a zone of lime accumulation occurs in the subsoil and in some areas a definite lime hardpan has been formed at various depths below the surface.

Extensive areas of desert soils in the lower basin usually grade from coarse sands and gravels near the base of mountains to fairly heavy clay loams and clays near the center of the valleys. Many areas are high in soluble salt content, but where good drainage can be provided, salts can be leached easily from the soils and the land made highly productive. These desert soils are stratified and the various horizons grade from coarse, raw sand to heavy, plastic clay. Where medium-textured soil occurs in sufficient depth at the surface or near enough to the surface to insure adequate water-holding capacity, the land merits agricultural development if the total salt content is low, or if leaching and drainage can be provided.

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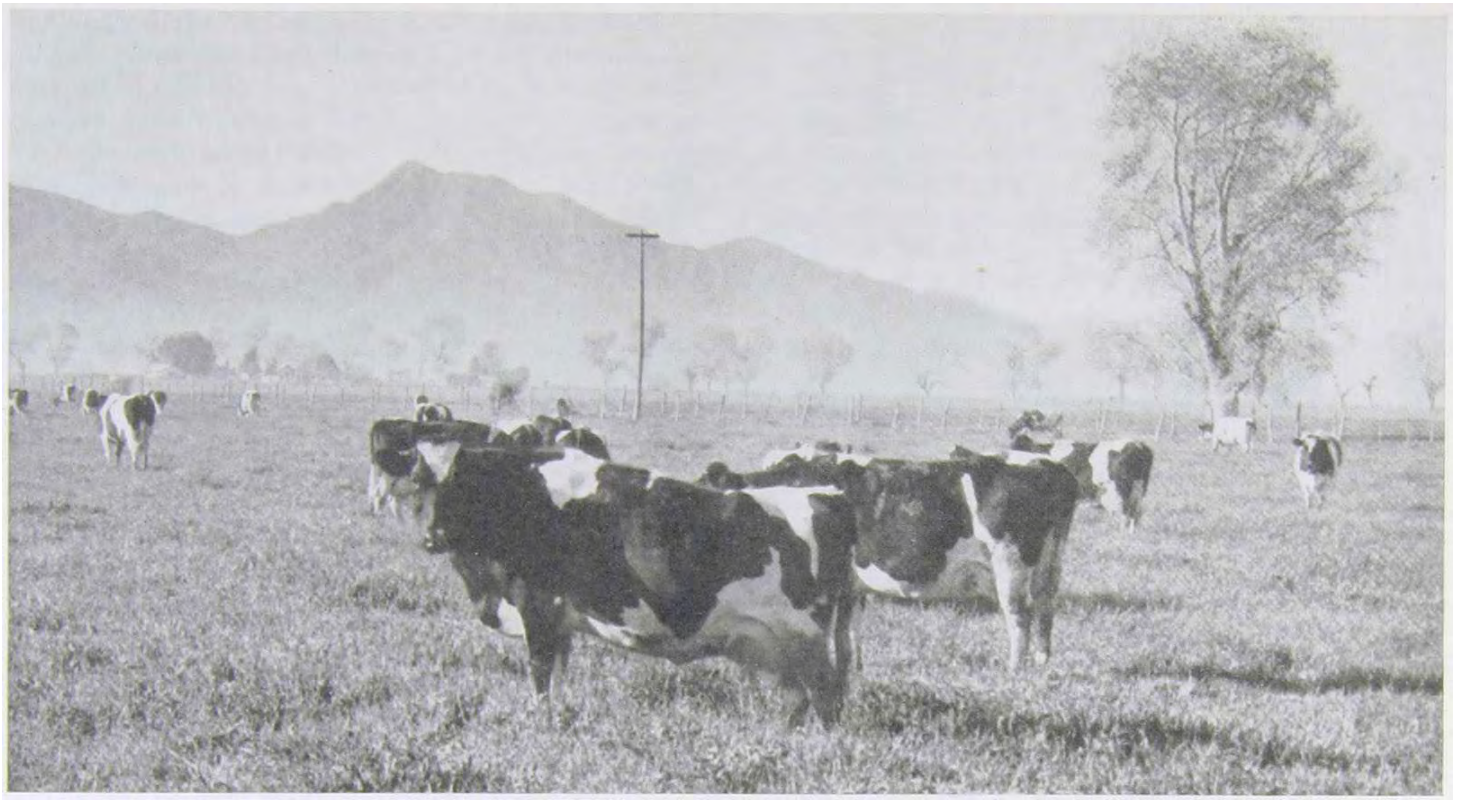


MILCH COWS IN IRRIGATED PASTURE

All-year pasturing produces higher grade milk and assures plentiful winter supply



IRRIGATED SUGAR BEETS GROWN FOR SEED

Seed production is an important contribution to the Nation

AGRICULTURE

Crops were grown in the lower basin hundreds of years before any other part of what is now the United States was settled. Agriculture has been and always will continue to be dependent on a satisfactory supply of irrigation water. The area is favored with an all-year growing season. Many crops, such as small grains and vegetables, grown in most parts of the Nation only in summer are produced here in winter. These combined with perennial crops such as alfalfa and pasture and semitropical crops in warmer parts of the basin result in a high degree of cropland occupancy. Crop failures are rare, but when they occur it is possible for another planting to be growing on the land within a short time, provided an adequate water supply is available.

Double-cropping of the same land with both winter and summer crops is a common practice where irrigation water supplies are adequate. This practice brings a high annual income per acre. Double-cropping, however, causes a heavy drain on soil fertility and necessitates either the rotation of soil-building crops or the use of commercial fertilizers, or both.

Because of the wide variety of crops that can be grown successfully in the lower basin the pattern of crop production is continually changing. New crops are being introduced and varieties of other crops developed. In recent years a number of crops new to the region have been tested and are now in commercial production. Among these are guar, a drought-resistant forage bean; psyllium, a seed used for medicinal purposes; mung beans, valued for food and forage; and many varieties of sorghum.

Alfalfa, grown on approximately 30 percent of the irrigated land, covers a larger acreage than any other crop. It is an important cash crop both for local sale and for shipment to southern California, the world's largest hay market. The production of alfalfa seed is also important. The extensive range lands of the lower basin together with adjacent areas in Mexico and New Mexico furnish a great number of feeder stock. These animals can be pastured on alfalfa fields and finished on hay, silage, and grain before being processed locally or shipped to markets. Alfalfa is of fundamental importance as a soil-building crop, and its use in the rotation system is partly responsible for high yields of other crops.

All-year pasturing is possible in the area. Cows so pastured produce more and higher grade milk, richer in fool value and vitamin content, than do cows fed otherwise.

Seed production is one of the lower basin's most important agricultural contributions to the Nation. With excellent growing conditions, water for irrigation, and virtual freedom from rain during the harvest season, seeds are plump, of strong germination, and excellent color. Twenty to 25 percent of the sorghum seed used in the United States and more than 40 percent of the sugar beet seed are produced here. Bermuda grass seed, grown largely in the Lower Colorado and Gila River Valleys, is used extensively in the development of pastures, erosion-control plantings, and lawns throughout most of the Southern States. Flaxseed yields are high in the Yuma and Imperial Valleys and bring good prices because of the high iodine content of the seed which gives a drying quality to the oil extracted.

The Coachella Valley has become the principal source of the Nation's domestic date crop. The dates grown in this region are of exceptionally high quality.

Range livestock are dependent on irrigated areas for winter feed. Sheep are brought from mountain ranges to irrigated valleys during the late fall and lambed during November. The lambs are fed on alfalfa and grain pastures and marketed in the early spring.

Agriculture in the region can expand only to the extent more water can be made available. Much more land is suitable for crop production than is in cultivation. Water is the limiting factor.

Types of farms

Types of farms in the lower basin classified according to the major source of income are shown in the accompanying chart (fig. 9). The percentage is of the total number of farms.

Livestock and dairy farms.—Approximately 36.6 percent of the farms are livestock and dairy farms. The vast areas of grazing land have led to extensive ranching operations. The percentage of livestock farms will probably remain high, but with more feed produced on irrigated land in the future the percentage of finished cattle and dairy products is likely to increase. An increase of population in rural areas and the continued growth of urban centers will be accompanied by an increase in the demand for the products of the dairy and the feeder livestock farm.

Field-crop farms.—In an area where ranch livestock is so important, the production of feed crops on irrigated lands is likewise important. Such crops as alfalfa, small grains, and sorghums are grown principally as an adjunct of the livestock industry. Cotton has been the most important field crop, but its relative importance is decreasing.

Fruit and truck farms.—Fruit and vegetable or truck farms are much more important in the irrigated areas of the lower basin than either the percentage of such farms or their acreage would indicate because gross returns per acre are very high and a large amount of labor is required.

Subsistence farms.—The highest percentage of farms is classified as subsistence farms, so called because most of the farm products are consumed by the farm household. In certain localities within the basin inheritance has resulted in farms being divided into very small individual holdings which are operated as subsistence farms. Many



WINTER VEGETABLES FOR EASTERN MARKETS

Irrigated lands produce tons of carrots and provide a livelihood for many growers and handlers

Indian farms are subsistence units. Subsistence farms produce very few products for sale, unless they are handled in conjunction with range land. The development of new lands and the provision of supplemental water supplies for lands now inadequately irrigated will improve present farming conditions.

Number and Size of Farms

Arizona is representative of the lower basin with reference to the size of farms. In 1940 Arizona with an

TABLE XX *Number of farms ...*

	Percent of farms ...					
Under 50 acres	27.2	7.0	4.1	23.1	5.0	4.2
50–99 acres	25.0	11.1	25.3	16.9	11.2	23.7
100–179 acres	8.9	17.1	17.6	12.9	17.1	8.3
Subtotal	61.1	35.2	37.1	47.9	33.3	47.9
180–499 acres	26.3	36.0	32.2	22.2	28.2	21.7
500–999 acres	7.8	14.8	13.8	13.8	21.9	16.1
Over 1,000 acres	4.8	14.0	16.9	16.1	16.6	14.3
Subtotal	38.9	64.8	62.9	52.1	66.7	52.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
	Number of farms					
Under 500 acres	5,643	5,500	4,554	6,238	20,936	8,574
Over 500 acres	3,584	3,909	4,018	3,830	7,046	3,614
Total	9,227	9,409	8,572	10,068	27,982	12,188

average of 5.6 acres per farm, had larger farms than any upper basin State or Wyoming. Livestock ranching was the major farming activity on large farms. Between 1930 and 1940 the number of large farms (those over 500 acres in the lower basin) increased 7 times, while the per cent of the total area in such farms increased only 3 times. The increase in the number of large farms took place between 1935 and 1940. During that period the number of farms of 1,000 acres or more almost doubled.

The general trend is toward larger farms. The increase in the size of farms is the result of the increase in the number of livestock on the public range and upper Crop farms are increasing in size as increasing acreages of grain crops are put into the pattern to keep pace with other objectives in farm operations.

Irrigated farms. The average number of irrigated acres per farm in the lower basin increased slightly during the period 1935–1940. The increase was due largely to the increase in number of irrigated farms, with a lesser response in the increase in irrigated acreage. The Little Colorado division had the smallest irrigated farm units as well as the greatest increase in irrigated acreage per farm. The number of irrigated farms in that division increased from 554 in 1935 to 1,045 in 1940, but the total irrigated acreage increased only 5 percent. The small size of these units results from the high percentage of Indian farms and the large number of subsistence white farms.

Farm operators. Full owners operate or manage 74 percent of all farms operated and farm 64 percent of the cultivated land in 1940. Owner-operators or

LOWER COLORADO RIVER BASIN

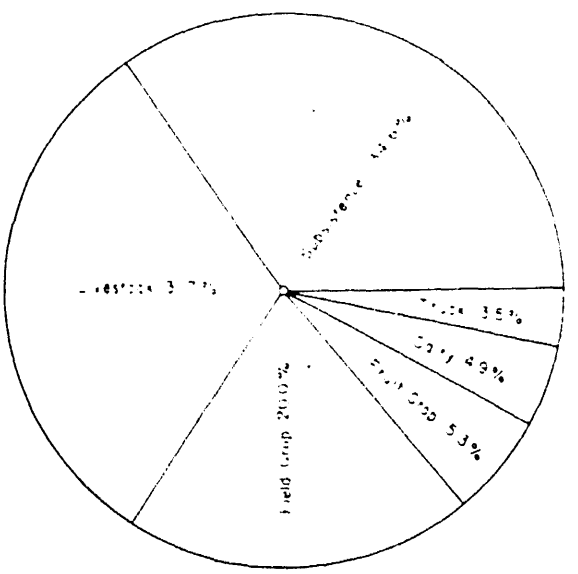


FIGURE 9.—*Types of crops.*

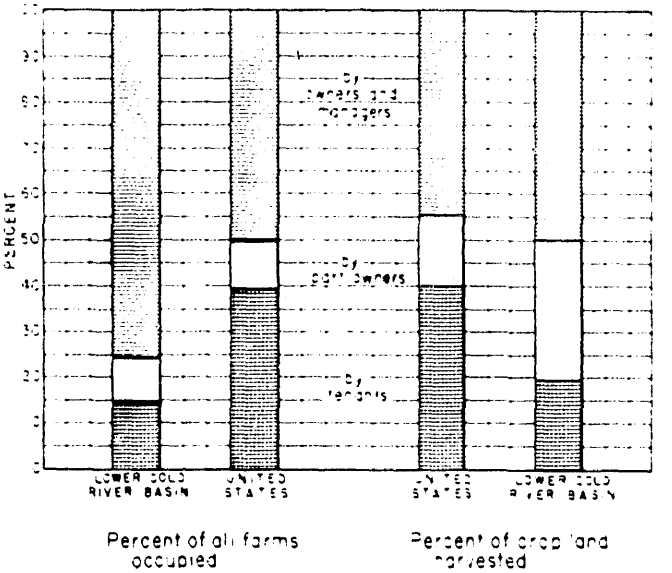


FIGURE 10.—*Farm operation, 1940.*

TABLE XXI.—*Irrigated farm acreage in lower basin*

Division	Average irrigated acreage per irrigated farm (acres)			
	1910	1920	1930	1940
Little Colorado	32.6	37.6	18.2	12.6
Virgin		31.7	31.9	28.6
Boulder	108.6	126.6	115.0	132.4
Gila	79.1	69.8	71.7	69.3
Lower basin	82.2	84.0	78.8	75.2

part owners (those renting a portion of the farm lands they harvest), operated only one-tenth of all farms, but farmed more than one-third of all the crop land harvested in 1940. Owner-operators made up the rest of the farmers and represent the largest group, harvesting nearly 50 percent of the crop land in 1940 (fig. 10).

While the extent of farm leasing in the lower basin is below the national average, it presents a problem in certain irrigated sections of the basin, mainly because the terms of the individual leases fail to make provision for preserving the productivity of the soil and for the upkeep of improvements on the farms. Land that has been in alfalfa for a number of years, however, is often leased to vegetable growers for a period of 1 to 3 years, the plan being to replant to a soil-building crop after the lease has expired.

Value of farm lands and buildings.—Land values vary widely depending upon location, soil quality, topography, water supply and other factors. Raw land, without prospective irrigation possibilities usually sells for $1 to $10 an acre. Irrigated land sells for $100 to $250 an acre with the higher prices more common in the Boulder and Gila divisions.

The decrease in the total value of all farm land and farm buildings from 1930 to 1940 was 24.2 percent, as compared with 29.7 percent for the entire country. The average value per farm of all land and buildings in the basin is 50 percent above the average for the United States, while in the Gila and Boulder divisions, the average farm value is twice that of the entire country.

TABLE XXII.—*Value of farm lands and buildings in lower basin*

Division	Average value of lands and buildings					
	1930		1935		1940	
	Per farm	Per acre	Per farm	Per acre	Per farm	Per acre
Little Colorado	$2,446.00	$3.00	$1,831.00	$2.97	$2,090.00	$1.39
Virgin	6,036.00	20.57	4,169.00	12.68	4,770.00	7.97
Boulder	18,457.00	70.29	10,346.00	41.98	11,057.00	12.43
Gila	15,593.00	16.92	8,478.00	9.12	11,644.00	9.91
Lower basin	13,474.00	19.33	7,246.00	10.56	8,389.00	7.07
United States	7,614.00	48.52	4,823.00	31.16	5,518.00	31.71

The decrease in the per-acre land values during the 1930 to 1940 period is attributed to a number of factors. Agricultural prices declined during this period which was one of the major economic depressions. Considerable land of much lower value than that previously farmed was purchased. The acreage of farm land doubled during this period, whereas the total number of farms increased from 21,193 to 25,795, an increase of only 17 percent; consequently the value per acre of farm improvements was not in proportion to the increase in acreage.

Land values have risen since the 1940 census was taken, and in many sections of the lower basin a land boom is under way. Lands in financial distress 10 years ago now are selling generally at double and treble the prices of 1933 to 1935.

Farm products and value.—The basin is favored by a climate ideal for producing winter crops. Citrus fruits and winter vegetables returned $3,800,000 and $7,300,000 respectively to the farmers of the basin in 1939. During the months of December and January the country is largely dependent for its supply of lettuce on Arizona and the Imperial Valley of southern California. In 1943 the Salt River and Yuma Valleys in Arizona shipped 6,600 carloads of winter lettuce, shipments being consigned to 45 of the 48 States. In 1939 the per capita value of farm products of the basin was $97, as compared with $75 in the Nation.

Livestock and livestock products sold in 1939 made up 36.7 percent of all agricultural production in the basin, as compared with 35.5 percent for the entire Nation. Feeder cattle, sheep, and goats are the predominating livestock. Only a few hogs are raised in the area. An increase in production of feed crops may result in a considerable increase in the proportionate value of livestock and livestock products.

The sale of dairy products is important in some irrigated areas. Dairying probably will increase, but it is doubt-

ful that it will ever assume the importance in the agriculture of the basin that it does in agriculture of the Nation as a whole.

Farmers and stockmen of the lower basin consume in their homes only half as much of their farm products as do the average farmers of the Nation. Agriculture is less diversified here and a smaller variety of products is suitable for home consumption.

TABLE XXIII.—*Value of agricultural products in lower basin 1929*

Items	Lower basin		United States	
	Value	Percent of total	Value	Percent of total
Sold:				
Livestock and livestock products	$22,835,000	36.7	$2,429,289,000	31.3
Dairy products	4,295,000	6.9	1,118,193,000	14.4
Crops	31,506,000	50.7	3,094,947,000	39.8
Farm products used by farm household	3,534,000	5.7	1,132,063,000	14.5

MINERALS AND MINING

The first white settlers in the lower basin were adventurers, many of whom originally had set out to seek gold in California. It was natural that they should prospect the region through which they traveled. Significant gold and silver strikes were made in the 1880's. These strikes led to booms with their attendant influx of people. But the mining industry, as developed in the last century, was a precarious business. There was no orderly development, no scientific method of locating ore deposits, or any attempt at establishing this major resource as the basis of a stable industry. Numerous ghost towns throughout the entire area give mute testimony to the feverish and impetuous exploitation of the ore resources.

Today, mining and mineral resources are of vital importance to the region, but attitudes and methods have changed. Emphasis is now upon sound planning and development with full utilization of modern scientific knowledge and methods.

Valuable minerals are well distributed, and important mining operations are found in many parts of the lower basin. (See appendix, maps entitled "Mineral Resources, Colorado River Basin.") Mining camps are markets for farm crops, and mines consume large quantities of the lumber produced by local lumber mills. The transportation of ore, metals, and mining supplies is one of the main sources of revenue for railroads and trucking companies. Mining properties furnish one of the principal tax sources for State and local governments. Mining enterprises provide employment for many of the residents and have made possible the development and improvement of many isolated and remote areas.

Of all minerals mined in the lower basin, copper is most important. Each year, since 1910, Arizona has ranked first among the States in copper production, and probably will continue to hold such rank for many years. Large mines are operated at Bisbee, Morenci, Superior, Globe, Miami, Ray, Ajo, and Jerome, Ariz. The remaining copper deposits have been estimated to contain about 23 billion pounds which could be recovered at costs ranging from 6 to 18 cents per pound. The largest reserve of ore in the basin is found at Morenci, Ariz., where proven future supplies total 300 million tons of ore containing from 20 to 25 pounds of copper per ton. (See figs. 11 and 12.)

Gold ranks second in annual gross income from mining in the lower basin. About 50 percent of the gold produced is recovered as a byproduct of copper ores. The largest known reserves of gold are found in ores primarily valuable for their base metals. Mines in high-grade ore districts have been sporadic in production, their output fluctuating with prevailing market conditions. The Delmar, Nev., district, the largest of the straight gold-and-silver-producing areas, produced in 1940 minerals valued at $130,700. Little commercial grade ore remains in any of the known gold-ore deposits.

Silver is third in importance as a source of income from mining. About 75 percent of the silver produced comes from copper ores, and a large part of the remainder is produced as a byproduct of the lead and zinc mining industry.

Zinc production is handicapped by the distance to zinc smelters. High shipping costs make the development of low-grade ore deposits difficult and sometimes impossible. Zinc deposits are generally associated with lead or copper. The largest zinc ore reserves are in copper deposits but these are low-grade, and mining and milling costs are high. From the standpoint of production costs, the most important zinc reserves are those associated with lead. One of the largest of these is found in Mojave County near Boulder Dam. The construction of an electrolytic treatment plant in this district, using low-cost power developed at Boulder Dam, would greatly stimulate zinc production. Considerable amounts of zinc ore are produced in the Superior, Patagonia, Nogales, Bisbee, Iron King, Mammoth, Hillside, and San Xavier districts of Arizona, and the San Simon and Lordsburg districts of New Mexico.

LOWER COLORADO RIVER BASIN

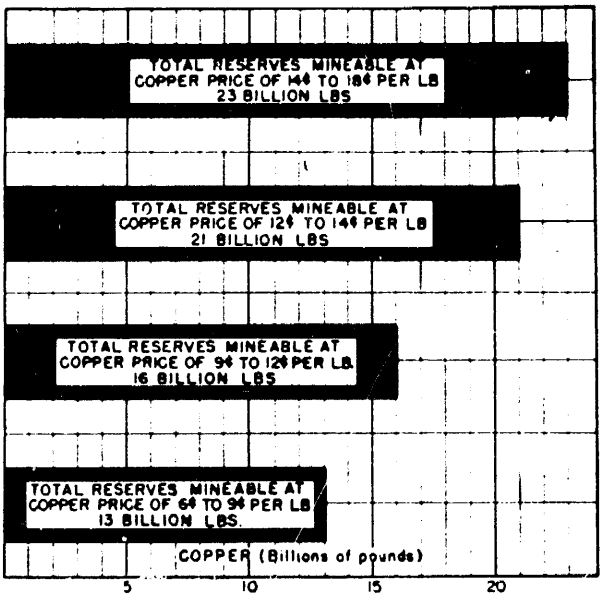


FIGURE 11.—*Estimated reserves of copper in the major mining districts.*

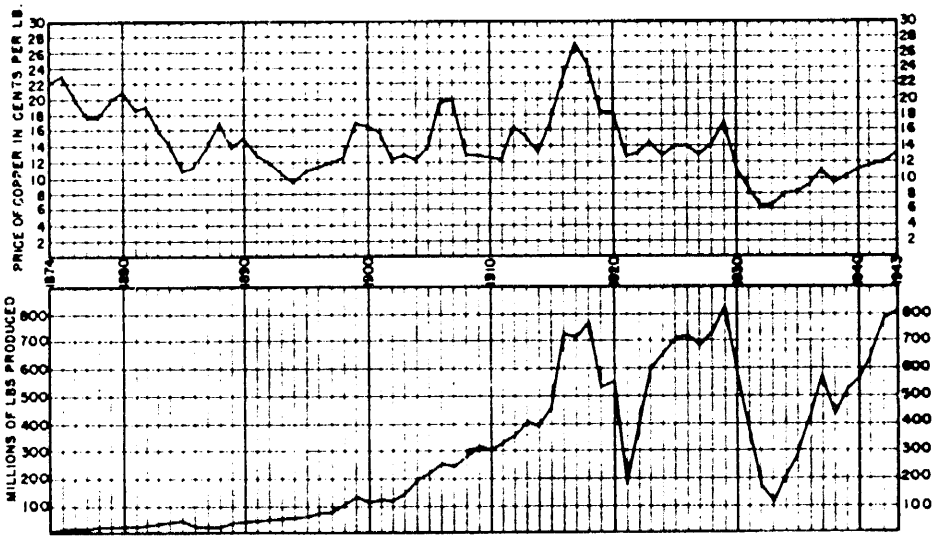


FIGURE 12.—*Copper production from principal mining districts.*

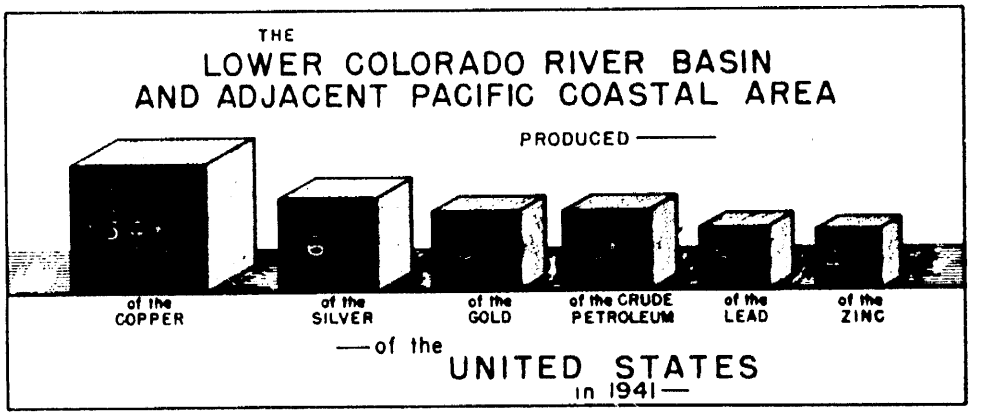


FIGURE 13.—*Mineral production in lower basin and southern California.*

Lead is produced in moderate quantities at various districts, notably Patagonia, Mammoth, Iron King, Bisbee, Cerbat Mountain, Hayden, and San Xavier in Arizona; Pinos Altos, Steeple Rock, Lordsburg, and San Simon in New Mexico; and the Goodsprings district in Nevada. (See fig. 13.)

TABLE XXIV.—*Gross value of principal metals mined in lower basin*

Metal	1941 production	Total production
Copper	$77, 910, 000	$2, 840, 000, 000
Gold	11, 652, 000	247, 550, 000
Silver	5, 904, 000	198, 450, 000
Zinc	2, 562, 000	19, 140, 000
Lead	1, 804, 000	32, 500, 000
Total	99, 832, 000	3, 337, 640, 000

Production of cobalt, mercury, manganese, vanadium, molybdenum, and asbestos was greatly stimulated by war conditions. Cobalt is mined in the Tombstone, Ariz., area; mercury in the Ord district of the Mazatzal Mountains, Ariz.; manganese in the Bisbee, Ariz., region; vanadium in the Mammoth district of Arizona; molybdenum in the Mammoth and Globe-Miami districts of Arizona; and asbestos in Gila County, Ariz.

Several manganese ore bodies are found in the area, the most extensive being located in the Artillery Peak district of Arizona and in the Three Kids mine near Las Vegas, Nev. Both of these areas were large producers during World War II. This country's largest manganese mine is located near Las Vegas.

Coal is known to occur at several locations. Small amounts are mined for local consumption, but deposits have proved too poor in grade to compete with the higher grade coals mined in New Mexico and Colorado. Subbituminous grade coal is found in the Kolob-Kanab district of Iron and Kane Counties, Utah. To date, coal mining has been on a very small scale, and development work has not been extensive enough to determine the reserves available.

Limestone and gypsum are mined in the lower basin. Important deposits of various salts are found in many of the dry lake beds of Nevada and California. Deposits of silica sand near Overton, Nev., are mined and shipped to the west coast for use in glass manufacturing. Numerous other minerals, including alunite, magnesite, clay diatomite, bentonite, borates, calcium chloride, and petroleum, are mined commercially on a comparatively small scale in the basin.

Adjacent to the lower basin are southern California's petroleum and natural gas fields, among the largest in the country. The gross value of production from these fields during 1942 is shown in the following table:

TABLE XXV.—*Natural gas and petroleum produced in southern California (1942)*

County	Value of total production		
	Natural gas	Gasoline	Crude oil
Los Angeles	$6, 186, 796	$11, 598, 193	$90, 620, 837
Orange	1, 293, 338	2, 048, 105	25, 457, 382
Ventura	2, 180, 252	2, 602, 076	20, 148, 305
Total	9, 660, 386	16, 248, 374	136, 228, 524

Recently developed electrometallurgical processes should greatly stimulate the mining industry of the region if sufficient low-cost power becomes available. Large and important ore deposits of various grades are yet to be mined. Development of the lower grade deposits, hitherto economically impracticable, will become feasible with low-cost power. Several large zinc deposits of medium or better grade, which are not at present being worked because of high transportation costs to distant ore treatment plants, could be developed with low-cost power.

The possibility of discovering new ore deposits should not be overlooked. Technical advances in prospecting methods are continually being made. Vast areas underlying the numerous alluvium-filled basins and valleys of the region are impossible to prospect by present methods and offer a promising field for the discovery of new deposits of valuable ores.

Industrial research organizations are discovering and developing new uses for mineral products and other petroleum products and derivatives.

MANUFACTURING AND OTHER INDUSTRIES

The lower basin has been almost totally dependent upon outside areas for manufactured goods. In the last thirty years a rapid growth in population and an increase in transportation facilities and supplies of low-cost electric energy have been conducive to industrial development.

In 1940 one-half of the manufacturing establishments were engaged in processing food products. These included meat packing, poultry packing, flour milling, ice-cream making, fruit packing, fruit and vegetable canning, and dairy processing plants. Cotton gins, cottonseed-oil mills, and breweries also operated in the region.

Twenty-two plants were dependent upon the forest for raw materials. In this group were 12 sawmills, 5 planing mills, and 5 veneer mills. Twenty-four establishments manufactured household furniture and furnishings. Twenty-five plants manufactured brick, hollow tile, cement, and concrete products. Three plants processed cotton products and three plants manufactured machine tools. Various other smaller manufacturing plants were operating.

World War II was responsible for the development of large industries in the lower basin. Las Vegas, Nev., was the center of much such activity. The world's largest magnesium plant was located within the trading area of that city. The manufacture of industrial tools and implements for war increased greatly during the war period. Several manufacturing industries were established near Phoenix, Ariz., including an aluminum fabricating plant and an airplane factory. An airplane assembly plant was located at Tucson. Construction of an arsenal near Flagstaff created a temporary boom. Small military establishments, such as the naval training air base at Holbrook, caused local temporary prosperity. The wartime demand for wood increased the tempo of lumbering operations. War prices for food increased the farm income.

Very little industrial utilization of the metallic minerals produced in the lower basin is made within the area. Practically all metals mined locally are shipped for refinement and fabrication to plants located in other States. Some of the nonmetallic minerals producer, however, are treated and utilized by local industries. Plaster is manufactured at Douglas, Ariz., from gypsum mined in the Sulphur Springs Valley. Limestone is roasted at several plants, and the lime produced is marketed throughout the region. Much of the common brick used by the construction industry is manufactured at various local brickyards.

Lumbering operations are important in the vicinity of Flagstaff, where 1,500 persons are thus employed. A lumber mill with an annual capacity of one hundred million board feet is located at McNary, Ariz. Forests in this region are practically all under the jurisdiction of the United States Forest Service, and therefore, the available resources can be expected to remain fairly constant.

Indian arts, such as weaving and silversmithing, furnish an important source of income to the native craftsmen and to curio shops.

Another industry of considerable importance, which depends on and assists with the marketing of the fruit and vegetable crop, is the manufacture of ice. Within the lower basin several ice plants, including one specializing in dry ice, furnish refrigeration for produce en route to market.

The few factories normally located in the region produce chiefly either materials used in agriculture or mining or commodities for local markets. These manufactured products include dynamite, boxes and crates, saddles and harnesses, concrete pipe, fabricated steel, auto radiators, storage batteries, paint and varnish, and air-conditioning equipment.

Probably one reason for the lack of extensive industrial development in the lower basin is its proximity to numerous factories in the southern California coastal region where natural advantages such as seaports and low-cost fuel supplies have aided the development of extensive industries.

In the last two decades the nearby Los Angeles metropolitan area has become one of the Nation's principal manufacturing centers. The six counties which comprise the southern California area are engaged in virtually every line of manufacturing. In 1940 this region had 6,254 manufacturing establishments and employed 139,287 wage earners. In number of establishments the processing of food ranks first, there being more than 1,200 such plants. Nearly 500 factories manufactured household furnishings and appliances.

The Nation's largest airplane factories were located in southern California during the war.

The refining of petroleum is by far the most important of the industries related to or dependent on mining. The many crude oil derivatives obtainable by refining have made the petroleum business an activity of considerable scope. Petroleum products produced in southern California include gasoline, synthetic rubber, tar, asphalt, toluene, phenol, paint bases, solvents, fertilizers, alcohols, acetic acid, formaldehyde, ammonia, and many others.

Another important mineral industry in the southern California region is the manufacture of Portland cement. During 1942 the 5 cement mills operating in the area shipped a total of 11,582,051 barrels to markets scattered throughout southwestern United States.

Large quantities of hollow tile and brick are produced in southern California plants. Varieties of brick are manufactured and sold throughout the State and in contiguous areas of the lower basin. Other construction materials produced include lime, sand, gravel, and crushed rock.

Many industries found in the coastal region of southern California are based on raw materials from the lower basin.

Markets and Transportation

Trading and shipping centers are well distributed throughout the agricultural areas of the lower basin and provide convenient outlets for crops and livestock.

Forage crops such as alfalfa generally cannot be shipped out of the basin economically because of the transportation charges. The extensive local livestock-raising industry creates a great demand for these crops and prices are generally based on the prevailing price at Phoenix plus trucking costs. Alfalfa hay not fed locally to livestock is sold in Los Angeles and in San Diego.

Livestock is marketed mostly on the hoof and shipped to feeding pens located either in the southern part of Arizona or in States outside the basin. Finished feeders are shipped to Los Angeles and San Diego.

Larger towns such as Flagstaff, Holbrook, and Winslow, Ariz., provide a limited market for vegetables and prod-

TABLE XXVI.—*Manufacturing census data—Lower basin and Southern California (1939)*

Division	Number of employees engaged	Value of raw materials	Value of processed products	Value added by processing
Little Colorado	976	$587,000	$1,665,000	$1,078,000
Virgin	16	37,000	92,000	55,000
Boulder	1,151	4,864,000	9,869,000	5,005,000
Gila	4,630	16,448,000	27,031,000	10,583,000
Lower basin	6,773	21,936,000	38,657,000	16,721,000
Southern California	139,287	758,716,000	1,325,803,000	567,087,000
Total	146,060	780,652,000	1,364,460,000	583,808,000
United States		32,160,107,000	56,823,025,000	24,662,918,000
Percent lower basin is of United States total		0.07	0.07	0.07
Percent lower basin and Southern California is of United States total		2.43	2.40	2.37

uce. Additional markets for summer vegetables can be found in the southern portions of the State where the climate is too warm to permit successful truck gardening during the hotter months. Local mining districts provide valuable markets for dairy and poultry products and vegetables. Winter and summer vegetables are shipped mostly to the east and west coasts, with Los Angeles and San Francisco as the chief outlets. Bermuda and alfalfa seeds are shipped to the Southern States. Flaxseed is sent to Los Angeles to be processed for oil. Citrus fruits are marketed throughout the country. Small fruits, of which the date is the most important, are sold mainly in the Los Angeles area, but part of the crop has a ready market in the midwestern and eastern cities. Dairy products not consumed locally are shipped to the Los Angeles area. Before World War II, much of the short-staple cotton produced in the region was shipped to Japan.

East and west railroad transportation throughout the basin is handled well considering the vast, sparsely settled area involved. The basin is crossed by the Atchison, Topeka & Santa Fe Railway and in the extreme southern part by the main line of the Southern Pacific Railroad. Branch lines of each of these railroads serve the major mining and irrigated areas. The main line of the Union Pacific Railroad connecting Salt Lake City and Los Angeles crosses the basin in a north and south direction, with branch lines extending from Caliente to Pioche and from Moapa to Overton.

A system of United States highways and State roads connects the more important population centers. Highways for east and west travel in general follow the railroads: U. S. 66 crosses the northern part; U. S. 60 and 70 cross the central part; and U. S. 80 serves the southern part. These are paved, well maintained, and open to travel the year round. North-south highways include U. S. 91 extending from Salt Lake City through the basin to Los Angeles and U. S. 89 from Salt Lake City to southern Arizona. U. S. 666 south of Springerville, Ariz., is one of the most scenic roads in the world and is known as the Coronado Trail. A network of unimproved roads leads to ranches and smaller population centers, but many are impassable during wet weather, and sandy stretches make automotive travel difficult during droughts. A great part of the basin is accessible only by foot travel or by horseback. Transcontinental truck and bus lines, American Air Lines, and Transcontinental Western Air Lines pass through or over various farming districts and towns in the lower basin.

WHOLESALE AND RETAIL TRADE

In 1939 the lower basin and southern California together had 4.29 percent of the Nation's retail and 3.47 percent of the Nation's wholesale trade. In all of the divisions retail trade exceeded wholesale trade, but in the southern California area wholesale trade exceeded retail trade.

TABLE XXVII.—*Wholesale and retail trade—Lower basin and Southern California (1939)*

Division	Wholesale trade		Retail trade	
	Value	Percent of United States	Value	Percent of United States
Little Colorado	$6,079,220	0.011	$16,396,298	0.039
Virgin	1,657,969	.003	6,306,269	.015
Boulder	41,449,230	.075	39,519,283	.094
Gila	88,425,024	.160	137,056,235	.326
Lower basin	137,611,443	.249	199,278,085	.474
Southern California	1,780,106,264	3.221	1,603,053,452	3.813
United States	55,265,640,000		42,041,790,000	

The lower basin and each division show a higher per capita expenditure in retail than in wholesale trade. In the southern California area the per capita wholesale expenditures exceed retail trade expenditures. The Little Colorado was the only division in the lower basin which did not exceed the national average per capita expenditure in retail trade.

TABLE XXVIII.—*Expenditures in trade—Lower basin and Southern California (1939)*

Division	Per capita expenditure	
	Wholesale trade	Retail trade
Little Colorado	$81.68	$218.80
Virgin	104.80	363.68
Boulder	246.85	409.47
Gila	214.38	333.02
Lower basin	202.10	331.93
Southern California	505.30	454.84
United States	419.57	319.29

RECREATION

The scenic beauty of the lower basin had been recognized long before its other resources were developed or stabilized. This region of high mountains, deep canyons, colorful deserts, and thousands of square miles of scenic wilderness has drawn millions of tourists to view its natural majesty and to enjoy its delightful climate in winter. Twenty-one national parks and monuments and 13 national forests are located in the area. The Grand Canyon, Petrified Forest, and Zion Canyon, to mention only a few, enjoy world renown.

Within the last decade the area has acquired a man-made attraction—Boulder Dam with its recreational area—which rivals all of its natural wonders and which symbolizes man's conquest of nature's fickleness. This dam impounds the world's largest man-made lake. Lake Mead extends 115 miles upstream from the dam, through canyons, cliffs, and scorching deserts into the lower reaches of Grand Canyon and opens to the tourist scenic beauty hitherto inaccessible. The Boulder Dam National Recreational Area, located hundreds of miles from any large metropolitan center, has become a tourist mecca and before World War II ranked sixth among the national parks and monuments in the United States in the number of visitors.

Zion National Park attracts tourists from all parts of the country. The unique colorful scenery in this area is used by the moving-picture industries as a setting for "Western" and other pictures. Through technicolor films, the matchless desert beauty near Kanab, Utah, has become familiar wherever motion pictures are shown.

The Little Colorado River Basin is almost entirely within a spectacular scenic area locally known as "The Enchanted Circle." The fantastically-colored Painted Desert and Petrified Forest are within this basin, and tourist travel is heavy to these wonderlands. Other popular attractions in this vicinity are the Sunset Crater, an extinct volcano which becomes a riot of color at sunset; the San Francisco Peaks, frequently snow-capped, which tower over the surrounding countryside; and the Meteor Crater, formed by the impact of a meteorite during some past age. At Grand Falls, when the Little Colorado River is in flood stage, one may see a chocolate-colored river plunge 185 feet into the canyon below.

In the Gila River Basin popular attractions include Casa Grande, Montezuma Castle, Tonto, Tuzigoot, and Gila National Monuments; saguaro and organ pipe cacti; spectacular rock formations at Chiricahua, New Mexico; and the early Spanish mission church at Tumacacori, Ariz. Prescott, Tonto, Apache, Crook, Gila and Coronado National forests are located in this area.

Trips to the Indian reservations yield a glimpse into the lives of a people who have carried many of the ways of their prehistoric ancestors down to the present day. The various ceremonial dances of these natives are especially interesting to the eastern visitor. Wupatki National Monument and Walnut Canyon, Ariz., are sites of numerous, fascinating, prehistoric Indian ruins. El Morro National Monument, the great rock where early Spanish explorers carved their names is located near Gallup, New Mexico. Prehistoric dinosaurs have left their tracks in stone 60 miles north of Flagstaff.

The waters of the Colorado River, detained at intervals in man-made lakes, teem with fish of many types. Bass, crappie, and bluegills abound in the reservoirs while trout and catfish prefer the moving waters of the main channel. Lake Mead is a fisherman's paradise. Reservoirs on the Gila River and its tributaries are kept well stocked with fish from numerous fish hatcheries in the region and most of the clear, cold streams in the mountain areas contain rainbow, Loch Leven, and other trout. Upper reaches of certain small tributaries of the Virgin River provide suitable environment for trout and offer limited fishing for recreation, but the main stem of the Virgin River, Kanab Creek, and Muddy River do not contain fish because of intermittent flow, silt-laden freshets, or the mineral content of the waters.

Game abound in both the valley and mountain regions. The sportsman finds a plentiful supply of such big game as deer, elk, and bear in the forested and more primitive areas, and all of these animals may be hunted legally during certain seasons. Mountain lions, coyotes, and other predatory animals are fairly common in remote areas and may be hunted the year round. Numerous species of small game attract many local hunters. Game birds found in the basin include the wild turkey, duck, goose, snipe, white-wing pigeon, quail, and dove. Five national game refuges are located partly or wholly within

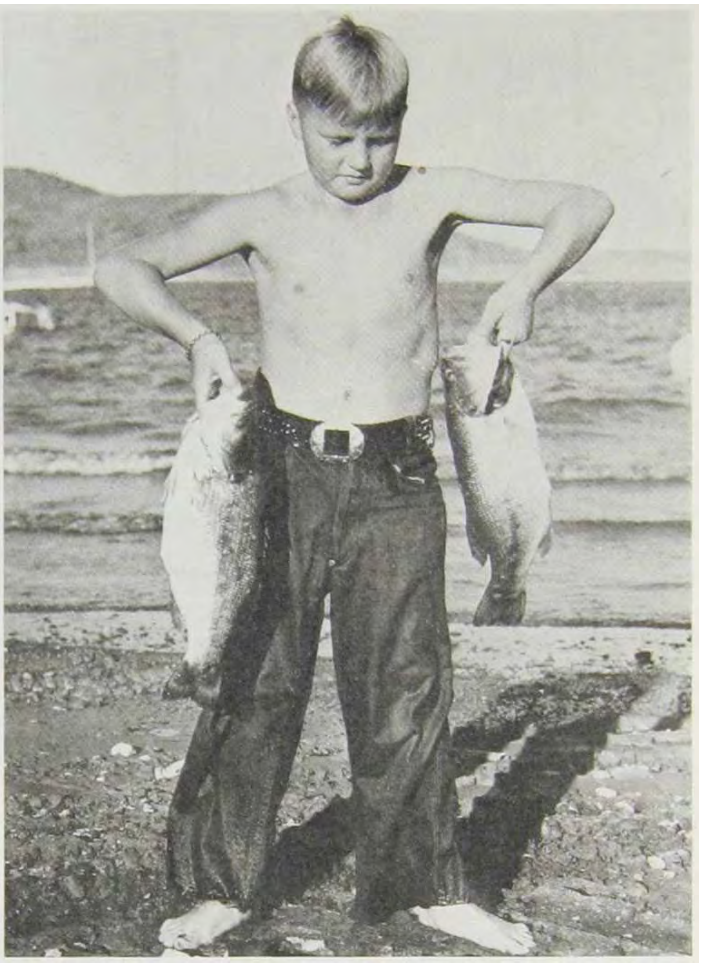
the lower basin for the protection and propagation of wild-life.

The National Park Service has done a great deal toward preservation of the natural and artificial wonderlands for the education and enjoyment of future generations. The Forest Service is improving lakes in the vicinity of Flagstaff to enhance their value for boating, fishing, and swimming.

Recreation is a major industry of growing importance in the lower basin. Numerous hotels, auto courts, restaurants, dude ranches, and curio shops depend almost wholly on tourist trade. Gasoline and service stations, automotive accessory stores, and similar establishments are partially dependent upon the touring public. Airlines, railroads, bus lines, and highways derive much of their annual traffic from tourist travel. In 1938, an average year, the Governor of Arizona placed a value of $80,000,000 on the State's tourist industry. The same year tourist trade in southern California was valued at $194,684,000.

SUMMARY—COLORADO RIVER BASIN

This review of present economic developments in the Colorado River Basin points to the serious need for additional development of water and land resources. In some regions nature provides water in such abundance that it is taken for granted, but here in the Colorado River Basin people look to the fluctuating annual supply as the most accurate index to their prosperity.



ANGLER'S PRIDE

Lake Mead is called the "Eden of all bass fishermen"



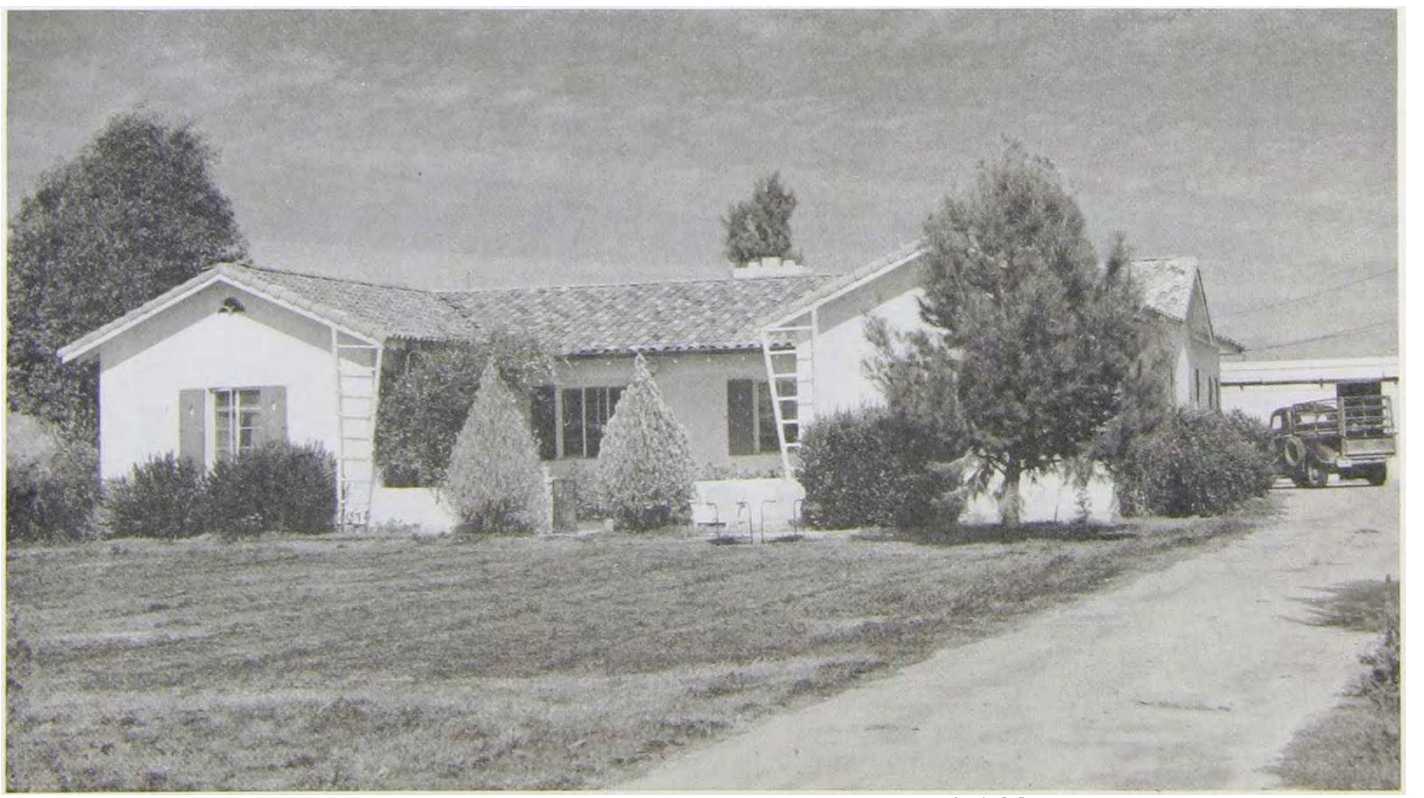
SKIING ON SURVEYOR PEAK

High snow-capped mountains provide excellent winter sports areas



HIVES OF BEES IN DATE GROVE

An irrigated date grove is a sweet setting for honey bees



ATTRACTIVE HOME ON IRRIGATED FARM

Opportunities will be provided for many new farm homes for veterans and others

Agriculturally the basin has advanced to the limit of its controlled water supply with only about 1.7 percent of its total area, or 2,670,000 acres, under irrigation. Of this irrigated area 1,325,000 acres are in the upper basin and slightly more, 1,351,000 acres, are in the lower basin. Millions of acres of dry fertile lands yet are idle and most irrigated areas are not producing maximum yields because of water shortages, while at the same time flood waters still uncontrolled flow destructively to the Pacific Ocean and are lost for beneficial use. Control of these waters will require cooperative planning and systematic development involving construction of huge structures, mostly beyond the financial range of private enterprise.

Much of the vast range can never be irrigated but its sparse vegetation will always be a major base of the basin's economy. Over-grazing and unseasonal use of the range are preventing optimum utilization of range land and are causing destructive floods and wasteful erosion of top soil. The production of more hay and other forage on irrigated land for pen and winter feeding will permit maximum utilization of the range, protect livestock against severe winters, permit expansion of dairying and livestock operations, and, in general, increase and stabilize the livestock industry. More people thus could obtain a prosperous livelihood from the industry, and the Nation would be rewarded with more beef and mutton, hides, wool, and dairy products.

Lack of sufficient water is responsible for crop failures and low yields. In areas where cash crops are grown, increased and dependable water supplies will make possible higher yields on lands now irrigated, prevent crop failures, make possible an increase in the cropped acreage and permit farmers to diversify and intensify farming operations. The products of these farms—peaches, apples, citrus fruits, summer and winter vegetables, seeds, sorghums, and other crops—will be readily absorbed in the American market. As a result farm income will be increased and farmers will enjoy security, stability, greater prosperity, and a higher standard of living.

Many farms in the basin are too small for efficient operation. This condition has resulted mainly from subdividing holdings through inheritance, and from the purchase of tracts too small for economic units. An increase in the irrigated acreage will make possible larger farm units and thus reduce the number of part-time farmers in the upper basin forced to seek supplemental employment away from the farms and the number of subsistence farms in the lower basin.

At present there is not enough irrigated land to provide agricultural opportunities to those in the basin who would like to farm. Of the 39,145 farms in the basin, 20,677 are in the upper basin and 18,468 are in the lower basin. The irrigation of desert lands will provide many new farms for servicemen, industrial workers, and others who wish to establish themselves in the basin. Consequently fewer young people will be forced to migrate elsewhere, and to some degree the temporary population influx into the lower basin and southern California areas during the war period will be absorbed permanently into the economic structure of the basin.

Development of vast mineral resources of the Colorado River Basin is awaiting low-cost power. In mineral wealth—coal, oil, oil shale, natural gas, copper, gold, silver, phosphate, magnesium and numerous others—the basin is unsurpassed. The need for these buried treasures is growing. Power necessary for additional mineral development can be supplied by the construction of multiple-purpose dams that will serve irrigation and other beneficial uses.

Need for improvement in domestic water facilities is becoming pressing in some areas and additional water supplies are needed also for expansion of many existing industries and the development of new industries.

Lack of transportation facilities, particularly in the upper basin, is hampering the livestock industry. With the expansion of agriculture and other industries in the basin, transportation facilities will be extended to serve areas now remote and isolated.

It is apparent that full control and utilization of the water of the Colorado River system is necessary for additional and continual growth in the basin. It will bring greater prosperity to people living within the basin and provide opportunities for others who are yet to come. Living conditions will be bettered, a broader tax base will be established, and at the same time, the need for public expenditures for relief of unemployment will diminish. A greater population in the basin will bring a solution of many of the economic and social problems now resulting from extremely sparse settlement.

It is well established in this day when goods and services are freely interchanged among the many parts of the Nation and the world, that prosperity cannot be isolated. Prosperity in the Colorado River Basin brought by full development of water and land resources will have a stimulating beneficial effect on the economy of the entire country.

Using the Water

"This chapter describes the nature and extent of present water uses in the Colorado River Basin and outlines potential projects for beneficial use of all of the water of the entire river system.

"All beneficial uses, including the irrigation of land, the production of hydroelectric power, the preservation of fish and wildlife, and the enhancement of recreational areas, together with the control of floods and silt, and the restoration of ground-water levels were taken into account in formulating the potential projects."

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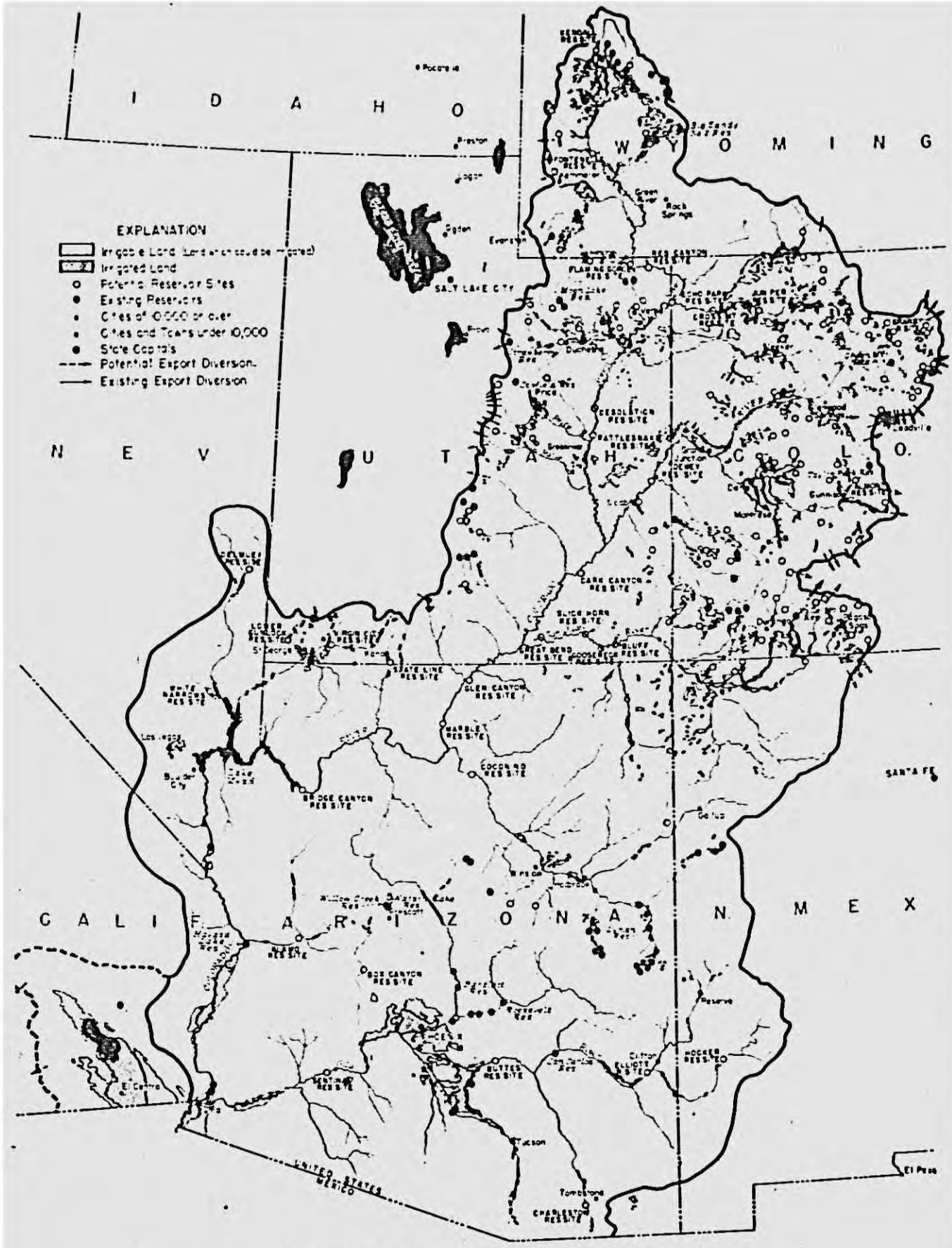


Irrigation development, Colorado River Basin

CHAPTER V

Using the Water

More water—water from the Colorado River—is the hope of the future. Man cannot govern the amount of water that falls as rain and snow, but he can prevent its needless waste by careful planning and building of dams, canals, power plants, and other works that will so control and conserve it that more water will be available for his use.

A survey of the basin's resources and economic activities not only establishes water as the critical material—the most important natural resource—but focuses attention on what present use is being made of that precious material and how it can best be used in the future to serve man's various needs.

This chapter describes the nature and extent of present water uses in the Colorado River Basin and outlines potential projects for beneficial use of all the water of the entire river system. Such a basin-wide perspective of ultimate potentialities will provide for planning coordinated development on a sound basis. All beneficial uses, including the irrigation of land, the production of hydroelectric power, the preservation of fish and wildlife, and the enhancement of recreational areas, together with the control of floods and silt, and the restoration of groundwater levels were taken into account in formulating the potential projects. Domestic, municipal, and industrial water supplies are planned for a few areas where demands are now established, and adaptations for other such uses may be made as needs arise.

The construction of all potential projects described and their operation, added to present water uses, would create a demand for more water than normally is available in the river system. Certain of the projects are key units or for other reasons hold initial preference in the plan of ultimate development. Those could be constructed at once as the next phase of river control and utilization. Later selection of projects will be influenced by more complete surveys, cost estimates, stream flow records, and by agreement among the respective States as to the allocation of the water which has already been apportioned between the upper and lower basins.

Estimates of present depletions of the water supply of the Colorado River and of future depletions from construction of potential projects are based on average flows during the long-time period of record, 1897 to 1943 inclusive. Depletions are considered to be the reductions in virgin stream flow of the Colorado River at Lee Ferry and at the international boundary resulting from man-made improvements.

The upper and lower basins are discussed separately and each is further divided, to permit more detailed treatment of specific areas, into the divisions suggested by physical characteristics: the Green, Grand, and San Juan divisions in the upper basin, and the Little Colorado, Virgin, Boulder, and Gila divisions in the lower basin. (See chapter I.)

State maps, one for each of the seven Colorado River Basin States, entitled "Water Resources Development, Colorado River Basin," showing the location of irrigated and irrigable lands, existing and potential reservoir sites, main canals, and other features of existing and potential projects for the development of water resources, are included as an appendix of this report.

UPPER BASIN

An area larger than New York, Pennsylvania, and New Jersey combined, is tributary to the Colorado River above Lee Ferry. This is the Upper Colorado Basin. It includes parts of five Rocky Mountain States. Rimmed by some of the highest mountains in America, snowcapped throughout the year, it is the source of the greater part of the water reaching the Colorado River.

Within the basin 1,325,000 acres are now irrigated. Much of this irrigated acreage produces pasture grasses and hay and serves as a home base for livestock grazing on the vastly larger areas of range and forest land. Some irrigated lands, however, are devoted to more intensive farming with vegetables and fruits as chief crops. The construction of potential projects outlined in this chapter would practically double the upper basin's irrigated area and bring supplemental water to half a million acres now lacking a full supply. These potential projects would bring water to lands determined by land classification to be arable. Vast areas of native pasture lands, mostly at high elevations, were not so classified, but would become more productive under irrigation. These lands have not



Green division of the Colorado River Basin

been surveyed, nor have works been designed by which they might be irrigated, which accounts for their exclusion from specific project plans. To provide for the eventual irrigation of these lands and miscellaneous areas of arable lands not otherwise covered in the basin plan an ultimate depletion in the flow of Colorado River at Lee Ferry of 500,000 acre-feet each year is reserved. It is not possible to divide this potential depletion among the divisions or States of the upper basin.

Scarcely a start has been made in developing the hydroelectric power resources of the upper basin. Present generation of 330 million kilowatt-hours annually could

be increased 28 times with full development of water resources in the basin.

The exportation of water for use in adjoining basins, now averaging only about 184,000 acre-feet annually, is only 6 percent of ultimate potentialities, if it were not for limitations of the Colorado River Compact. In presenting possible exportations of water from the upper basin to the adjoining North Platte, South Platte, Arkansas, Rio Grande, and Bonneville Basins it is contemplated that appropriate understandings will be reached between representatives of both the exporting and importing basins concerning the manner in which such projects shall be constructed and operated to safeguard within the upper basin the vested and future rights in irrigation; to preserve fishing and recreational facilities and scenic attractions; to maintain conditions of river flow for the benefit of local domestic uses and sanitary purposes; and to utilize the waters for irrigation, power, industrial development and other purposes, in such a manner that the greatest benefits are realized.

Green Division

The Green River drains 45,000 square miles in Wyoming, Utah, and Colorado. Its drainage area is 70 percent larger than that of the Colorado River above their junction, but its average annual contribution to the Colorado River is only 44 percent of the combined flows of the two streams at their confluence.

Average annual flows of the Green River and its principal tributaries for the longest period of record and for the 1931-40 decade, the driest period of record, are shown in the following table:

TABLE XXIX.—*Average annual stream flows in the Green division*

Station	Period of record	Average annual flow (acre-ft.)	
		For period of record	For 1931-40 period
Green River at Daniel, Wyo. (Warren Bridge)	1934-43	339,000	[1] 320,000
New Fork at Boulder, Wyo.	[2] 1915-43	281,000	225,000
Henrys Fork at Linwood, Utah	1929-43	54,000	44,000
Green River at Linwood, Utah	1929-43	1,234,000	1,066,000
Yampa River at Maybell, Colo.	1917-43	1,065,000	952,000
Brush Creek at Jensen, Utah	1940-43	16,000	[1] 15,000
Ashley Creek at Vernal, Utah	[2] 1915-43	75,000	58,000
White River at Watson, Utah	1924-43	549,000	452,000
Green River at Green River, Utah	1906-43	4,902,000	3,370,000
San Rafael River at Tidwell, Utah	1911-18	190,000	[1] 132,000

[1] Estimated.
[2] Records not complete

Flows of the Green River and its tributaries are greatest in the spring when mountain snows are melting. About 60 percent of the annual run-off occurs during April, May, and June. Late summer flows are extremely low. Storage is necessary for regulation of the flood run-off to furnish supplemental water to lands lacking a dependable supply, to provide irrigation water to lands still undeveloped, to permit diversion of surplus water to adjoining basins, and for the production of firm power.

The streams emerge from canyons relatively clear and pure but pick up some alkali in the valleys, especially in late summer when return flows from irrigation are high. Run-off from raw shale beds along LaBarge, Fontenelle, Big Sandy, and Bitter Creeks and Strawberry River carries a fairly high salt concentration, a danger that must be recognized and studied further in planning future development. Heavier concentration may result from expanded irrigation, from increased exportation of pure water from the stream heads, and from reservoir evaporation. Silt is not prevalent enough in streams of the Green River Basin to constitute a serious problem.

Development of ground water resources in the Green River Basin has been limited to a few small wells for stockwatering and domestic uses. Some water obtained from wells is heavily charged with minerals. Neither the quality nor the quantity of ground water now developed is indicative of any substantial use of water from wells for irrigation in the future. Hot springs at Steamboat Springs, Colorado, are the largest of three spring areas in the Yampa River Basin.

PRESENT DEVELOPMENT OF WATER RESOURCES

Irrigation accounts for the greatest use of Green River water at present. Homes, cities, livestock, and industries consume necessary but comparatively small quantities. Five small hydroelectric power installations on tributary streams serve rural areas. Streams and lakes are natural spawning waters for fish, and the mountains and valleys are habitat for wildlife; but little has been done to improve natural conditions.

Irrigation within the Green River Basin commenced in 1854 when Mormon pioneers established old Fort Supply in Wyoming on their immigrant trail and diverted water from Blacks Fork onto adjacent land. From this humble beginning progress has been slow. The short growing season, particularly in the upper Green River Basin in Wyoming, limits the kinds of crops that can be grown successfully. The greater part of the Uinta Basin was established as an Indian reservation in 1861 and lands unoccupied by Indians were not opened to settlement until 1905. The remoteness of much of the basin from railroads has also slowed agricultural progress, but with the growth of highway transportation this disadvantage may largely be overcome.

Approximately 571,000 acres in the Green River Basin are now irrigated and 11,470 acres more will be provided water through works now being constructed. Most of the present use is by simple diversions and easily constructed canals. A large part of these lands suffer late-season water shortages. Some water from tributaries of the Duchesne, Price, and San Rafael Rivers in the Green River Basin is exported westward to the Bonneville Basin in Utah.

Present development of water resources in the Green River division is discussed in more detail under four subdivisions: (1) Upper Green River Basin, (2) Yampa and White River Basins, (3) Uinta Basin, and (4) Price and San Rafael River Basins.

Upper Green River Basin.—This area extends from the headwaters of the Green River down to the Yampa River which enters the main stream from the east in Colorado. It is about 90 percent in Wyoming, with the remainder in Utah and Colorado.

Irrigation development in this area includes numerous community or privately owned ditches and small reservoirs. Ditches divert at frequent intervals along the streams. Most of them have been constructed and are maintained at minimum expense. It is common for farmers to have individual ditches, and in some cases single farms are served by several ditches diverting from a stream at different points. In addition to many small irrigation reservoirs and stock-watering ponds, 17 reservoirs with capacities of 1,000 acre-feet or more, all constructed by private interests, are distributed throughout the basin. Private holdings of irrigated land are large. Most are hay-producing ranches, varying from a few acres to several thousand acres.

The Eden project, being rehabilitated and extended by the Bureau of Reclamation, is the only Federal irrigation project in the upper Green River Basin. As authorized in 1940, the project will furnish a full or supplemental irrigation supply for 20,000 acres. Surplus flows of Big Sandy Creek will be stored in Big Sandy Reservoir No. 2, to have a capacity of 35,000 acre-feet, for use on project lands. With completion of the Eden project, 245,660 acres in the upper Green River Basin will be irrigated.

The seven existing power plants in this subdivision include only one small hydroelectric development with a capacity of 150 kilowatts. Most of the energy is generated at four steamplants and is used largely for coal mining. There are no interconnections with outside systems.

Yampa and White River Basins.—The Yampa and White Rivers, flowing westward and generally parallel, drain the eastern arm of the Green River Basin. The greater part of their drainage basins is in northwestern Colorado and the remainder is in southern Wyoming and eastern Utah.

Within the two basins 117,230 acres are now irrigated. Most of the irrigated lands are along river or creek bottoms, with only a few small areas on benches from 20 to 40 feet above stream beds. Diversions are made through numerous community or privately owned ditches. Water is stored in several small reservoirs, capacities of which total 14,500 acre-feet. These reservoirs have been built at minimum expense to serve lands belonging to only a few operators. Some of the reservoirs have not been used in recent years because their dams were considered unsafe.

A 200-kilowatt power plant at Meeker, Colo., is the only hydroelectric development in these basins. A 4,250-kilowatt plant at McGregor and a 375-kilowatt plant at Meeker, both steam-electric, furnish most of the power used in the area.

Uinta Basin.—The Uinta Basin, as considered in this report, includes areas drained by the Duchesne River, and Ashley, Brush, Willow and Minnie Maud Creeks. The drainage area is entirely in northeastern Utah, and except for the Willow Creek drainage is west of Green River. The Green River channel from the Yampa River to Minnie Maud Creek is considered to be within the Uinta Basin.

Irrigated lands within the Uinta Basin amount to 165,600 acres, most of which is short of late-season water. Indians once owned 77,000 acres of irrigated land in this basin but have sold 25,300 acres. Present regulations prevent sales and limit leases. In 1942 Indians leased 26,200 acres, cultivating only 11,800 acres themselves.

Sixteen Government-built main canals and six small ditches make up the Indian irrigation system, totaling 162 miles of canal and 633 miles of laterals and sublaterals. Indian water rights were established before unoccupied lands in the reservation area were opened to outside settlers. Consequently their primary rights consume all late-season water of the Duchesne River and its tributaries, leaving white-owned lands critically short. In normal years Indian lands receive enough water, but they would profit by storage regulation to provide better seasonal distribution. No storage reservoirs have been constructed for Indian lands.

Throughout the basin white settlers have organized mutual irrigation companies for the purpose of building irrigation works and distributing water. Private diversions are largely limited to tributary streams and springs.

Serving Uinta Basin lands are 28 reservoirs, some very small, with a total storage capacity of 74,000 acre-feet. More than half of this was provided by the Bureau of Reclamation with the construction of the Moon Lake project (1935–38), which includes Moon Lake and Midview Reservoirs. Water from Strawberry Valley Reservoir, constructed in 1913 on Strawberry River as one of the earlier Bureau of Reclamation developments, is exported westward by tunnel to lands in the Bonneville

Basin. The Duchesne Tunnel, to divert water from the Duchesne River to the Bonneville Basin, is now under construction as a unit of the Provo River project. When completed it will export annually an average of 32,000 acre-feet of flood water from the Colorado River Basin.

The four existing power developments include one Diesel and three small hydroelectric plants, with combined capacities of 2,050 kilowatts. There are no connections with plants outside the Uinta Basin.

Price and San Rafael River Basins.—Adjacent to each other, these two basins are in east central Utah. Both the Price and San Rafael Rivers originate on the eastern slope of the Wasatch Mountains and flow southeast in parallel courses to Green River. The Green River channel from Minnie Maud Creek to the Colorado River, for convenience, is considered as a part of the Price and San Rafael Basin area.

Within this area 15,970 acres are irrigated from Price River, 35,250 from San Rafael River and 2,820 acres from Green River, thus aggregating 54,040 acres. At one time 25,000 acres were irrigated from Price River, but poor soil, erosion, and alkali have caused the irrigated area to be reduced to its present size. Any future expansion of irrigation to new areas is expected to be accompanied by abandonment of a less productive area now irrigated.

Natural flows of Price River are supplemented for irrigation by releases from the Scofield Reservoir on Price River. Scofield Dam, constructed by private interests in 1926 to impound 61,000 acre-feet of water, partially failed 2 years later. For safety, storage has since been restricted to 30,000 acre-feet. The Bureau of Reclamation was authorized to replace this dam and in 1943 began construction of a new dam 800 feet downstream. The reservoir formed by this new dam will have a capacity of 73,000 acre-feet of water, 30,000 acre-feet of which will replace the usable capacity behind the old dam, and 8,000 acre-feet will be reserved for fish propagation. The remaining 35,000 acre-feet will be held for a time by the United States and ultimately used to store water for irrigating Price River lands in exchange for other water exported from high tributaries of the Price River to the Bonneville Basin.

Huntington, Cottonwood, and Ferron Creeks are the sources of irrigation supply in the San Rafael Basin, each serving independent areas with irrigation companies distributing the flow of each stream. Storage capacity aggregates 5,875 acre-feet on Huntington Creek and 1,310 acre-feet on Ferron Creek. Late-season water shortages are most acute in the Huntington Creek area where the acreage irrigated is greatest in proportion to the available water. Eleven small projects, including the Sanpete project (Ephraim and Spring City tunnels) constructed by the Bureau of Reclamation, divert flood water westward to the Bonneville Basin.

The lands irrigated directly from Green River are in the vicinity of Green River, Utah, and are served mostly by pumping.

Water piped from tributary streams and springs supplies larger municipalities in the Price and San Rafael River Basins. No electric power is produced. Transmission lines carry power into the area from the Bonneville Basin to the west.

Summary.—The following tables summarize present irrigation developments in the Green division showing the more important reservoirs, areas irrigated, estimated stream depletion by water consumed within the basin, and amounts exported to adjacent basins.

TABLE XXX.—*Irrigation reservoirs in the Green division* [1]

Subdivision and reservoir	Source of water	Location	Capacity (acre-feet)
Upper Green River Basin:			
New Fork Lake	New Fork River	Wyoming	22,700
Willow Lake	Lake Creek	do	15,120
Boulder Lake	Boulder Creek	do	12,820
Eden No. 1	Big and Little Sandy Creeks	do	12,300
Big Sandy No. 2 [2]	Big Sandy Creek	do	35,000
Fremont Lake	Pine Creek	do	10,760
Sixty-seven	North Piney Creek	do	4,330
Middle Piney Lake	Middle Piney Creek	do	4,200
Hoop Lake	Beaver Creek	Utah [3]	3,930
Uinta No. 3	Blacks Fork	Wyoming	2,000
Patterson Lake	do	do	1,870
Beaver Meadows	Lost Creek	Utah [3]	1,790
Elkhorn	Little Sandy Creek	Wyoming	1,450
Pacific No. 2	Pacific Creek	do	1,400
Silver Lake	Silver Creek	do	1,220
Black Joe Lake	Big Sandy Creek	do	1,100
Piedmont	Big Muddy Creek	do	1,090
Kemmerer	Hams Fork	do	1,060
Yampa and White River Basins:			
Upper Yampa No. 1	Yampa River	Colorado	5,500

See footnotes at end of table.

TABLE XXX.—*Irrigation reservoirs in the Green division* [1]—Continued

Subdivision and reservoir	Source of water	Location	Capacity (acre-feet)
Uinta Basin:			
Strawberry	Strawberry River	Utah	283, 000
Moon Lake	Lake Fork River	do	35, 800
Oaks Park	Brush Creek	do	6, 730
Midview	Duchesne River	do	5, 790
Twin Potts	Lake Fork River	do	3, 950
Kidney Lake	do	do	3, 920
Paradise Park	Whiterocks River	do	3, 140
Lake Atwood	Uinta River	do	2, 700
John Starr	do	do	2, 370
East Park	Brush Creek	do	1, 300
Montez Creek	Uinta River	do	1, 260
Fox Lake	do	do	1, 200
Price and San Rafael River Basins:			
Scofield [2]	Price River	do	73, 000
E. K. Olson	do	do	3, 500
Erickson Flat	Huntington Creek	do	2, 460
Cleveland	do	do	2, 315
Ferron	Ferron Creek	do	1, 200

[1] Includes only reservoirs with capacities of more than 1,000 acre-feet.
[2] Project under construction.
[3] Water used in Wyoming.

TABLE XXXI.—*Present irrigated areas in the Green division by States*

Subdivision	Acres irrigated			
	Colorado	Utah	Wyoming	Total
Upper Green River Basin	1, 840	9, 430 [1]	234, 390 [1]	245, 660
Yampa and White River Basins	104, 030	50	13, 150	117, 230
Uinta Basin	0	165, 600	0	165, 600
Price and San Rafael River Basins	0	54, 040	0	54, 040
Total	105, 870	229, 120 [1]	247, 540 [1]	582, 530

[1] Includes 11,470 acres of new land in Eden project, under construction.

TABLE XXXII.—*Estimated present average annual water consumption in Green division*

Subdivision	Water consumed (acre-feet)			
	Colorado	Utah	Wyoming	Total
Upper Green River Basin	2, 000	18, 000 [1]	372, 000 [1]	392, 000
Yampa and White River Basins	113, 000	0	19, 000	132, 000
Uinta Basin	0	243, 000	0	243, 000
Price and San Rafael River Basins	0	97, 000	0	97, 000
Total	115, 000	358, 000 [1]	391, 000 [1]	864, 000

[1] Includes 17,000 acre-feet for Eden project, under construction.

TABLE XXXIII.—*Estimated present average annual water exports from Green division*

Subdivision and project [1]	Exporting stream, Green River Basin	Importing stream, Bonneville Basin	Acre-feet
Uinta Basin:			
Daniel Creek	Strawberry River	Daniels Creek	3, 500
Strawberry Valley [2]	do	Spanish Fork River	66, 000
Provo River [3]	Duchesne River	Provo River	32, 000
Price and San Rafael River Basins:			
Sampete [2]	Cottonwood Creek	Oak Creek	4, 000
Do	do	Ephraim Creek	4, 000
Miscellaneous projects, No.:			
1	Huntington Creek	Tributaries of Sanpitch River	4, 000
1	Price River		
6	Cottonwood Creek		
2	Ferron Creek		
Total			113, 500

[1] All projects are in Utah.
[2] Constructed by Bureau of Reclamation.
[3] Under construction by Bureau of Reclamation.

Potential Development of Water Resources

Thirty-three potential projects are outlined for use of water in the Green division. These projects would be primarily for irrigation and power production, but would have incidental value for flood control, silt retention, river regulation, recreation, and fish and wildlife conservation.

In addition eleven projects, including two alternative schemes, are mentioned which would export an average of 1,137,700 acre-feet of water annually from the Green River Basin to adjoining basins for irrigation and incidental power production.

Potential irrigation development in the division could provide a full supply of water for 639,650 acres of new land and a supplemental supply for 270,730 acres now inadequately irrigated. The present irrigated area thus would be more than doubled and about 50 percent of the lands now irrigated would receive supplemental water.

Eleven power plants could be constructed in the division having a total installed generating capacity of 460,000 kilowatts. Large reservoirs on the main stream would regulate the flow for power production and would help stabilize the flow of the Colorado River at Lee Ferry.

Upper Green River Basin

Six potential projects, one having nine separate units, are outlined for use of water in the upper Green River Basin; four of these would provide an increased water supply for irrigation and would be primarily for power production. Two additional projects which would export surplus water to adjoining basins are also described.

Sublette project.—This project includes all of the potential developments for irrigation and power production within the Green River Basin upstream from Green River, Wyo. The nine units comprising the project are interrelated. Return flows from irrigation of the units at higher elevations would augment the water supplies for the lower units. In all 251,080 acres of dry land, and 46,260 acres now inadequately irrigated would receive water. Only one small power plant is included in this project (Elkhorn unit).

West Side unit would provide irrigation water for the northern part of the basin adjacent to Beaver, Horse, Cottonwood, and Piney Creeks, all tributaries of the Green River. A canal heading at a reservoir (capacity 340,000 acre-feet) at the Kendall site and extending south and west 105 miles could serve 66,050 acres, of which 37,000 acres are now inadequately irrigated and 29,050 acres are new land in need of a full water supply.

Daniel unit would irrigate small patches of river bottom land, amounting to 5,160 acres of new land between Kendall reservoir site and the mouth of New Fork River. Enlargement and extension of existing ditches would be required. A reservoir at the Kendall site would provide necessary storage.

Elkhorn unit would irrigate 134,030 acres of new land on the east side of Green River between Kendall reservoir site and Pacific Creek near Eden, Wyo., by a 160-mile main canal heading at Kendall Reservoir and collecting surplus flows from Green River, New Fork River, and Big Sand Creek. Storage would be provided by Kendall, Burnt Lake (capacity 25,000 acre-feet), and Boulder Lake (180,000 acre-feet) reservoirs. A tunnel 1,800 feet long would tap Burnt Lake Reservoir and deliver the water to a penstock where a head of 530 feet would be utilized at a 1,500-kilowatt plant, capable of producing 9,000,000 kilowatt-hours of energy annually. Water used for energy generation would be reregulated at Boulder Lake Reservoir for irrigation purposes.

Paradise unit would involve pumping water from New Fork River to irrigate 4,490 acres of new land along the river below the mouth of Boulder Creek. Seasonal power from the Burnt Lake power plant (Elkhorn unit) would be sufficient for a 32-foot pumping lift. Natural and return flows would be ample without providing reservoir storage.

Eden project extension unit would bring into cultivation 20,250 acres in addition to the 11,470 acres of new land and 8,530 acres of insufficiently irrigated land near Eden, Wyo., that will be served when the Bureau of Reclamation completes the construction of the Eden project. This additional acreage of new land could be irrigated by constructing 12 miles of new canal and extending laterals planned in the present construction program. Return flows to Big Sandy Creek from upstream irrigation would provide a full water supply.

Lower Big Sandy unit would furnish a full water supply to irrigable lands totaling 11,850 acres on both sides of Big Sandy Creek near its confluence with Green River by gravity diversion of irrigation return flows reaching the creek.

LaBarge unit could bring water to 3,370 acres of new land and 5,540 acres of land now insufficiently irrigated near LaBarge, Wyo. A reservoir of 10,000 acre-feet capacity at the LaBarge Meadows site on LaBarge Creek, together with some new canals and laterals would be required.

Fontenelle unit would require a 5,000 acre-foot reservoir at the Minnie Holden site on Fontenelle Creek with enlargements and extensions of the present distribution system in order to provide water for 2,050 acres of new land and 3,720 acres now lacking an adequate supply along both sides of Fontenelle Creek.

Seedskadee unit would serve 40,830 acres of rich irrigable lands located along both sides of Green River below its confluence with Fontenelle Creek. With the exception of 4,500 acres which would have to be reached by a 33-foot pump lift, the lands could be irrigated by gravity

diversions from the Green River. No reservoir storage would be required. If Fontenelle Dam, a feature of the potential Green River-Bear River Diversion project, is constructed, diversion of water for this unit could be greatly simplified by canals heading in Fontenelle Reservoir at high elevations.

Opal project.—To serve 16,020 acres of new land and 5,400 acres now insufficiently irrigated in the Hams Fork area, two new canals diverting southward from Hams Fork and a reservoir with 60,000 acre-feet capacity at the Middle Hams Fork site would have to be provided.

Lyman project.—Storage in an off-stream reservoir of 30,000 acre-feet capacity at the Bridger site would furnish supplemental water to 20,910 acres along Blacks Fork River. The reservoir could be fed by canals from Blacks Fork and the West Fork of Smiths Fork. Downstream from these lands are 3,100 acres which could be irrigated from return flow if an additional new canal were constructed. Also in the vicinity of the Lyman project lands are 7,950 acres under present canals but not now irrigated. Water for these lands could be obtained by the construction of a canal to bring water from the Henrys Fork project.

Henrys Fork project.—This project would serve 21,090 acres of irrigated land and 9,190 acres of new land in the Henrys Fork and Sheep Creek areas and in addition the 7,950 acres of new land in the Lyman area. Full development would require utilization of the Big Basin natural reservoir site for the storing of 107,000 acre-feet of water. This reservoir could be formed by the construction of only a small dike, water being supplied from the tributaries of Henrys Fork through a feeder canal. An outlet canal from the reservoir to Henrys Fork lands and the enlargement and extension of the present interstate canal would be required. To serve the new lands in the Lyman area a 30-mile canal extending west from the reservoir would be needed.

Flaming Gorge project.—Flaming Gorge and Horseshoe Canyon on the Green River, 3 to 4 miles south of the Wyoming-Utah boundary, present several alternative sites for a dam to provide for power production and stream regulation. A dam at a point on the river where the water surface elevation is about 5,840 feet above sea level could raise the water surface to elevation 5,995 feet, forming a reservoir with a total capacity of 1,500,000 acre-feet and an active capacity of 1,050,000 acre-feet. The reservoir would be 55 miles long and would reach to within 10 miles of Green River, Wyo., and transcontinental highway U S 30. From the reservoir a tunnel could be driven 4 miles to the point where Skull Creek joins the Green River 17 miles downstream from the dam by river route. A short penstock from the tunnel portal would carry water to a power plant at the mouth of Skull Creek, where the tailwater elevation would be 5,700 feet and the maximum static power head 295 feet. With an installed capacity of 30,000 kilowatts this power plant could produce 158 million kilowatt-hours of firm energy annually.

Red Canyon project.—The Red Canyon dam site on Green River is 8 miles east of the mouth of Skull Creek where the Flaming Gorge power plant would be located. In meandering between the two locations the river flows 13 miles and drops 131 feet. This full drop could be utilized for power production by means of a dam at the Red Canyon site and a power plant with an installed capacity of 12,000 kilowatts. The annual firm power production would amount to 68 million kilowatt-hours. The reservoir, confined within near-vertical canyon walls, would have a capacity of 50,000 acre-feet. Stream regulation would have to be provided from the Flaming Gorge development.

South Pass diversion project.—With a 31-mile collecting canal, 8 miles of which would be in rock, to divert flows of East Fork River (tributary to New Fork), Big Sandy Creek, and Little Sandy Creek to Landor Creek an annual average of 50,000 acre-feet of water could be exported from the Green River Basin for use in the Missouri River Basin. The water would supplement flows of North Platte River for irrigating lands in Wyoming.

Green River-Bear River diversion project.—This project would consist of two separate units which would export approximately 337,000 acre-feet of water annually from the Green River Basin to Bear River in the Bonneville Basin for irrigation of lands in Wyoming and Utah and for the production of power. Allowing 20,000 acre-feet for reservoir evaporation the total depletion to the Green River by construction of both units would amount to 357,000 acre-feet.

Hams Fork-Twin Creek unit would export 37,000 acre-feet annually from Hams Fork and LaBarge and Fontenelle Creeks to Twin Creek, tributary of Bear River. The construction of 41 miles of canal, including three tunnels with combined lengths of 5.1 miles, would be required. Collected flows from all three streams would be regulated by Middle Hams Fork Reservoir, also a feature of the Opal project. To regulate the additional flows for export the reservoir capacity would have to be enlarged from 60,000 to 170,000 acre-feet.

Green River-Smiths Fork unit would export 300,000 acre-feet of water annually from the Green River to Smiths Fork, a tributary of Bear River, by means of a 37-mile tunnel heading near LaBarge, Wyo., at the potential Fontenelle Reservoir (capacity 400,000 acre-feet). Because of reservoir evaporation the actual depletion to the Green River by construction of this unit would be 320,000 acre-feet annually.

Yampa and White River Basins

Twelve projects for ultimate development of water resources within these basins are outlined. Ten are pri-

marily for expansion of irrigation and two are mainly for power production. In addition two plans, one of which is an alternative, to export surplus water to the adjoining North Platte Basin are described as possibilities.

Little Snake River project.—With the development of this project 92,110 acres of new land and 15,710 acres now partially irrigated would be furnished irrigation water and 43,000,000 kilowatt-hours of firm power would be produced annually. A reservoir of 15,000 acre-feet capacity at the Savery site on Savery Creek could supplement natural flows in irrigating lands both along the Little Snake River below the point where Savery Creek enters from the north. The enlargement and extension of present canals and the construction of a new canal diverting from Savery Creek would be needed to serve lands on Dolan Mesa, north of Little Snake River.

Two reservoirs would be provided on Slater Creek, which flows northward into the Little Snake River. The higher reservoir at Columbus Mountain site, with a capacity of 125,000 acre-feet, would receive most of its water by feeder canals from the Middle Fork of the Little Snake River and from Elk River, a tributary of the Yampa River. Water released from this reservoir would be diverted just above Slater Falls and carried by a canal 3½ miles long to a 7,500-kilowatt power plant where a power head of 454 feet could be utilized. Tailwater in summer would be diverted into the potential Great Divide canal and carried to 31,000 acres of new land. Twelve miles downstream from the power plant is the Pot Hook reservoir site. A reservoir at this site with a capacity of 85,000 acre-feet would store winter power releases and spring inflow to Slater Creek below the Columbus Mountain Reservoir. Water from the Pot Hook Reservoir would be conveyed by the potential Pot Hook canal, heading at the junction of Slater Creek and Little Snake River, to 44,000 acres of new land south of the Little Snake River and below lands served from the Great Divide canal.

Upper Yampa project.—The irrigation of 11,140 acres of cultivated land and 3,460 acres of new land along the upper Yampa River both above and below the town of Yampa, Colo., would be possible with storage in the Yampa River Reservoir No. 4, with a capacity of 14,000 acre-feet, to supplement natural flows and existing storage.

Wessels project.—This project would serve 6,010 acres of new land on benches above present canals and 380 acres now irrigated but in need of a supplemental supply near Steamboat Springs, Colo. The natural flow of the Yampa River augmented by releases from a 15,000 acre-foot reservoir at the Upper Bear site on the Yampa River would provide sufficient water for irrigation.

Mount Harris project.—Supplemental water would be furnished to 1,450 acres of cultivated land and a new supply to 16,600 acres of dry land with the development of this project. These lands, covering rolling benches south of the Yampa River between Steamboat Springs and Craig, Colo., are mostly on the Hayden Mesa with only a small part in the Twenty Mile Park area. Dunkley Reservoir on Fish Creek with a capacity of 30,000 acre-feet could store water delivered by feeder canals from Williams Fork River and Trout, Middle, and Foidel Creeks. Canals would have to be built to carry the water released for irrigation to the project area.

Great Northern project.—Full irrigation service for 16,010 acres of dry land and 3,260 acres of irrigated land in need of more water along and between Elkhead and Fortification Creeks, northern tributaries to the Yampa River, is possible. A reservoir of 30,000 acre-feet capacity at the California Park site on Elkhead Creek could be fed in part by a feeder canal from Elk River. Water stored in the reservoir would supplement natural flows of the two creeks. A new canal system would be required to carry the water to the lands.

Yellow Jacket project.—Water for irrigating 31,820 acres of new land and 5,950 acres of land requiring supplemental water would be furnished with the development of this project. Most of the land lies on benches south of the Yampa River between the mouth of Williams Fork and Maybell, Colo., but 11,790 acres are along northern tributaries of the White River, north and east of Meeker, Colo. The irrigation supply would come from White River and Milk Creek, a tributary of the Yampa River. A reservoir of 30,000 acre-feet capacity at the Thornburgh site on Milk Creek could serve project lands in the Yampa River drainage area. A canal to carry the unregulated flow of the White River could partly supply the reservoir and could serve adequately project lands along White River tributaries.

Deadman Bench project.—This multiple-purpose project would bring irrigation water to 89,720 acres of new land, 28,540 acres of which are in Colorado and 61,180 acres in Utah. It would also produce 87 million kilowatt-hours of firm energy annually and provide stream regulation, flood control, silt control, and recreational opportunities. A dam across the Yampa River at the Juniper site, 24 miles west of Craig, Colo., raising the water level 185 feet, from the present river elevation of 5,945 feet up to 6,130 feet, would create a reservoir 20 miles long with a capacity of 1,250,000 acre-feet. Of the total reservoir capacity 60,000 acre-feet would be used for irrigation, 740,000 acre-feet for power production and flood control, and 450,000 acre-feet reserved as inactive, but useful for silt control, fish propagation, and recreational purposes. The power plant at the base of the dam would have an installed capacity of 15,000 kilowatts. The irrigation canal would divert from the reservoir 120 feet above stream bed and would carry water to new lands on Deadman Bench between the Yampa and White Rivers.

Maybell project.—Water released from Juniper Reser-

voir through the power plant into the Yampa River could be conveyed by a canal to 8,540 acres of dry land along the Yampa River below the reservoir and near the mouth of Little Snake River.

Cross Mountain project.—The Yampa River below the Juniper reservoir site flows into Maybell Valley. Cross Mountain blocks the lower end of the valley except for a narrow chasm through which the river escapes. By driving a tunnel 2.3 miles through the mountain and constructing a low diversion dam at the canyon head to divert the river into the tunnel, a fall of 175 feet could be utilized. The dam at river elevation 5,810 feet would be only 15 feet high and the backwater would flood only a few acres. The power plant would have an installed capacity of 18,000 kilowatts, and with stream regulation provided by the upstream Juniper Reservoir, would have an annual firm production of 99 million kilowatt-hours.

Lily Park project.—The Little Snake River unites with the Yampa River in Lily Park. A few miles below the confluence of the rivers the valley narrows. Here where the river enters a canyon is the Lily Park power site. The present river surface at the site is at elevation 5,580 feet above sea level. A dam could be constructed to raise the surface 70 feet thus backing the water about 6 miles up the Little Snake River and 12 miles up the Yampa River to Cross Mountain. With the water surface at a maximum elevation of 5,650 feet the reservoir capacity would only be 75,000 acre-feet. Some hay land would be flooded. A larger reservoir is not needed for regulation of the stream below the Juniper Reservoir. Little Snake River would be partially regulated by upstream irrigation developments. A power plant installed at the dam would have a capacity of 10,000 kilowatts and be capable of producing 47 million kilowatt-hours of firm energy annually.

Josephine Basin project.—By the extension of the present Miller Ditch to carry the unregulated flow of the White River, 2,400 acres of new land located 4 miles southwest of Meeker, Colo., could be irrigated.

Piceance project.—Piceance Creek flows northwest to join the White River 20 miles west of Meeker. A 5,000 acre-foot reservoir on the creek 30 miles above its mouth could store water for the irrigation of lands along the creek channel, including 610 acres of new land and 2,380 acres of cultivated land in need of a supplemental supply.

Little Snake-North Platte diversion project.—The exportation of about 51,000 acre-feet of water annually from the North Fork of Little Snake River, Battle Creek, and Sandstone Creek to the North Platte Basin for irrigation of lands in Wyoming and by exchange in Colorado would be possible with the construction of a 60-mile canal.

Elk River-North Platte diversion project.— Under the tentative plan for development of the Little Snake River a canal would carry water out of the Little Snake River Basin (Little Snake-North Platte diversion project) and another canal would bring water into the basin from Elk River, a tributary of the Yampa River (Little Snake River project). An alternative plan would eliminate both of these transmountain canals and also the potential Columbus Mountain Reservoir and Slater Falls power development (Little Snake River project), which would be dependent largely upon water imported from Elk River. Additional main stream storage on the Little Snake River at either the Sheep Mountain or the Three Forks sites could furnish part of the water supply that would have been brought from Elk River to lands in the Little Snake River Basin. Approximately 75,000 acre-feet of the flow of Elk River thus would be available annually for diversion by tunnel to the North Platte River for use on lands in Colorado and Wyoming. Further field investigations and an allocation of water between Wyoming and Colorado are prerequisites to final adoption of a plan of development.

Uinta Basin

For the development of the water resources of Uinta Basin 10 projects are outlined for use of water within the basin; 8 of these would be primarily for irrigation and 2 for power production. Two projects, one an alternative, to export surplus water to the Bonneville Basin are also described. The irrigation developments would serve white- and Indian-owned lands. The Office of Indian Affairs is considering a few small projects to provide supplemental water for lands administered by that agency. Most of those are provided for in the plans for basin-wide development.

Moon Lake project extension.—North of the Duchesne River, extending from Rock Creek eastward through the Whiterocks River service area, are 86,200 acres of irrigated land including some owned by Indians that could be furnished supplemental water and 26,300 acres of new land that could be made productive with irrigation water if storage were provided in the following reservoirs: (1) Pelican Lake, 5,200 acre-feet capacity, supplied from Uinta and Whiterocks Rivers; (2) Halfway Hollow, 32,200 acre-feet capacity, also supplied from Uinta and Whiterocks Rivers; (3) Upalco, 12,300 acre-feet capacity, storing flows from Yellowstone Creek; and (4) one or more reservoirs at undetermined sites on Rock Creek or other streams capable of releasing an average of 23,000 acre-feet annually to arable lands on the Blue Bench and, if additional yields are provided to replace natural summer flows, exports of water to the Bonneville Basin through the potential Rock Creek tunnel could be increased accordingly. The first three reservoirs listed would be at offstream sites, but could be fed from existing canals with slight extensions. New construction required would include a service canal from Halfway Hollow Reservoir to Ouray Valley, which would also be usable as a feeder

canal for Pelican Lake Reservoir; a 6-mile extension of the present Yellowstone Canal, now serving the Moon Lake project, to Uinta River; a 3-mile canal from Lakefork River to Yellowstone Creek above the head of the Yellowstone Canal; and a canal from Rock Creek to the Blue Bench and Lakefork River.

Fruitland project.—A storage reservoir of 4,000 acre-feet capacity on Red Creek, a tributary of Strawberry River, with extensions of present service canals would provide water for the irrigation of 1,600 acres of new land and 400 acres lacking an adequate supply near Fruitland, Utah.

Castle Peak project.—A canal 34 miles long, heading at Duchesne River near Duchesne, Utah, could carry water to 21,700 acres of new land and 2,100 acres of land now insufficiently irrigated on south Myton Bench. Water could be stored for late season use in reservoirs at the Hades site (25,000 acre-feet capacity) on the North Fork of Duchesne River and at the Starvation site (65,000 acre-feet capacity) on Strawberry River, or at alternative sites on tributaries of the Duchesne River above the canal heading.

Mosby project.—Water from Whiterocks River imported by a canal into Deep Creek could be stored in a reservoir of 13,000 acre-feet capacity at the Crow Creek site on Deep Creek to irrigate 3,800 acres of new land and provide supplemental water for 400 acres located about 12 miles west of Vernal, Utah.

Vernal project.—Storage of Ashley Creek water in Stanaker Reservoir, a potential offstream reservoir of 34,000 acre-feet capacity, would be used to irrigate 1,900 acres of new land and furnish a supplemental supply to 22,300 acres of cultivated land near Vernal. In addition to a dam to impound water in Stanaker Reservoir short feeder and service canals would be needed.

Jensen project.—A reservoir of 6,000 acre-feet capacity at the Tyzack site on Brush Creek would provide sufficient storage to supply 3,600 acres of irrigated land with additional water and 800 acres with a full amount near Jensen, Utah. Existing canals could distribute the water.

Minnie Maud project.—A supplemental water supply could be furnished 800 acres of irrigated land bordering Minnie Maud Creek along the Duchesne-Carbon County boundary by storage in a small reservoir (550 acre-feet capacity) at the Minnie Maud site on Minnie Maud Creek.

Green River pumping project.—By pumping water from Green River with lifts of about 40 feet, 11,000 acres of dry land and 1,000 acres of irrigated land between Jensen and Ouray, Utah, could be adequately irrigated. With the present wide fluctuations in river flow, diversion dams cannot be maintained and occasionally part of the area is inundated. Future upstream power reservoirs would smooth out the flow and make pumping for irrigation practicable.

Echo Park project.—Three and one-half miles downstream from the confluence of the Green and Yampa Rivers is Echo Park dam site. It is in Colorado only 2 miles east of the Utah State line. The river elevation at the site is 5,048 feet above sea level. A dam to raise the water surface 500 feet would impound 5,560,000 acre-feet of water (4,710,000 acre-feet active capacity) and would control the flow at that point. The reservoir would extend up Green River 64 miles to Red Canyon and up Yampa River 44 miles to Lily Park. A number of suspected archeological sites along the Yampa River should be thoroughly explored prior to filling the reservoir. A power plant installed at the dam would have a capacity of 120,000 kilowatts and would be capable of producing annually 668 million kilowatt-hours of energy. In addition to power, this multiple-purpose project would provide hold-over storage, flood control, silt retention, and recreational opportunities. During a succession of dry years releases would help meet the stream flow requirements at Lee Ferry specified by the Colorado River Compact. Transcontinental highway US 40 is only 20 miles south of the site and would afford easy access to the area for vacationists.

Split Mountain project.—Below Echo Park, the Green River leisurely divides and unites several times to form large islands, giving rise to the name "Island Park." It then flows through Rainbow Park and Little Park to Split Mountain, so named because the river has split the mountain in half. A dam at the head of Split Mountain Canyon at river elevation 4,930 feet could raise the water surface 118 feet, backing water up to the Echo Park Dam and forming a reservoir with a capacity of 320,000 acre-feet (295,000 acre-feet active capacity). Stream flow would be regulated by the upstream Echo Park Reservoir. A power head of 200 feet could be utilized by means of a pressure tunnel in three sections extending from the dam 8.3 miles downstream to a power plant, 5 miles up the river from Jensen, Utah. With an installed capacity of 90,000 kilowatts, this plant could produce 846 million kilowatt-hours of firm energy annually.

Central Utah project.—An exportation of 625,000 acre-feet annually could be made from streams in the Uinta Basin to the Bonneville Basin in Utah. A collecting conduit would intercept flows of Brush Creek, Ashley Creek, and the Duchesne River and their tributaries, delivering the water by gravity flow to the Strawberry Reservoir which would be enlarged to a capacity of 1,300,000 acre-feet. Releases from the reservoir would be made through a tunnel into Diamond Fork of Spanish Fork River where a 2,900-foot drop could be utilized to generate electricity before the water is reregulated and used for irrigation in the Bonneville Basin.

Water could be pumped from the potential Echo Park Reservoir on Green River to replace irrigation supplies now used on lands in the Uinta Basin which would be

diverted to the Bonneville Basin under this project and to permit expansion of irrigation in the Uinta Basin.

The construction of this project would eliminate the Rock Creek Tunnel project and also would make unnecessary most of the structures otherwise required for the Moon Lake extension, Fruitland, Castle Peak, and Mosby projects.

Rock Creek Tunnel project.—Construction of this project would bring additional water from the Colorado River Basin watershed into the Bonneville Basin. By means of a 9-mile tunnel from Rock Creek, a tributary of Duchesne River, to upper Duchesne River, 45,000 acre-feet of water annually could be brought into the Duchesne River and thence carried by the Duchesne tunnel to Provo River. The Duchesne tunnel, a feature of the Provo River project, is a 6-mile tunnel under construction to bring 32,000 acre-feet annually from the Duchesne River to Provo River. It would be lined with concrete to reduce friction losses and accommodate the larger flow brought from Rock Creek. If replacement storage were provided for Uinta Basin lands, additional summer flows of approximately 8,000 acre-feet from Duchesne River and Rock Creek could be diverted into the tunnels.

Price and San Rafael River Basins

Five projects are outlined as possibilities for development of water resources in these basins. Four small transmountain diversions are also discussed.

Emery County project.—A reservoir of 57,000 acre-feet capacity of the Joes Valley site on Cottonwood Creek, a tributary of the San Rafael River, and a highline canal from Cottonwood Creek to Huntington Creek would provide ample irrigation service to all lands under present canals from the two streams, including 20,000 acres now insufficiently irrigated and 3,300 acres of dry land in the vicinity of Huntington and Castle Dale, Utah. By impounding spring run-off and thus providing compensating storage in late season for the irrigation of lands with appropriated water rights, this reservoir would make possible increased transmountain diversions from Huntington and Cottonwood Creeks through existing works.

Buckhorn project.—By the enlargement and extension of the Cleveland canal to carry surplus waters of Huntington Creek to a potential reservoir of 15,000 acre-feet capacity at the Buckhorn site, 3,800 acres of new land about 12 miles east of Castle Dale, Utah, could be made productive with irrigation.

Gunnison Valley project.—West of Green River, Utah, are 3,800 acres of irrigable land that could receive water from Green River with a 280-foot pump lift. East across the river are 430 acres requiring only a 50-foot pump lift, and 6,600 acres that could be reached by pumping a maximum of 370 feet. Inexpensive power for pumping could be obtained from the development of nearby power sites on the Green and Colorado Rivers.

Desolation Canyon project.—Of several dam sites in Desolation Canyon of the Green River suitable for power production the Upper Three Canyan Creek site appears to be the best. It is 50 miles by river upstream from Green River, Utah. A dam to raise the water surface from a present elevation of 4,400 feet up to 4,650 feet would back water upstream to a point just above the White and Duchesne Rivers, creating a reservoir with a total capacity of 900,000 acre-feet and an active capacity of 700,000 acre-feet. The reservoir would regulate the inflow to Green River below the Echo Park Dam with only occasional spills. A power plant in the dam with an installed capacity of 78,000 kilowatts could produce 433 million kilowatt-hours of firm energy annually.

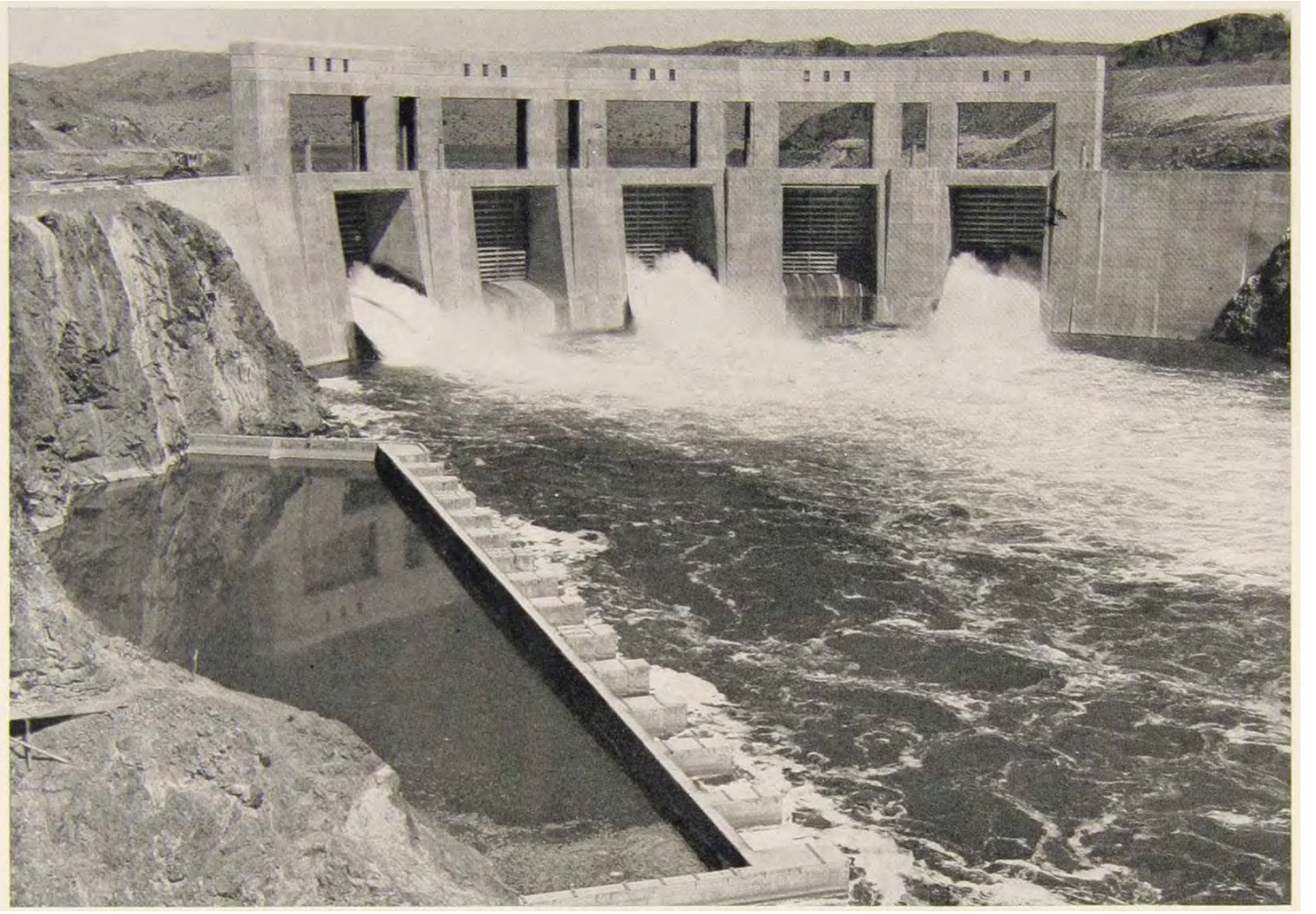
Rattlesnake Power project.—The Rattlesnake Dam site, lowest power site on Green River, is 22 miles upstream from Green River, Utah. A dam to raise the water surface 250 feet above its present elevation of 4,150 feet would create a reservoir with a capacity of 500,000 acre-feet, 370,000 acre-feet of which would be active capacity. The power plant would have an installed capacity of 78,000 kilowatts and an anual firm production of 434 million kilowatt-hours.

Gooseberry project.—From a 17,000 acre-foot reservoir at the Mammoth site on Gooseberry Creek, a tributary of Price River, about 11,500 acre-feet of water could be diverted anually westward through a tunnel 2.3 miles long to irrigate fertile lands in the Sanpete Valley of the Bonneville Basin.

White River diversion project.—The exportation of 2,700 acre-feet of water annually from the White River, a tributary of the Price River, to Spanish Fork River for irrigation of lands under the Strawberry Valley project in the Bonneville Basin would be possible by the reconstruction of an abandoned canal. Three small reservoirs on tributaries of the Price River could provide replacement storage for the Price River lands and thus increase the possible diversion to 4,200 acre-feet.

Ferron-Manti Creek diversion project.—This is one of the two tunnel diversion possibilities that exist to take water from the head of Ferron Creek, a tributary of the San Rafael River, to lands in southern Sanpete Valley in the Bonneville Basin. No stream flow records are available but it is estimated that an average of 15,000 acre-feet of surplus water may be exported through the two tunnels. One tunnel 2.2 miles long would bring water to Manti Creek. En route to irrigate lands this water could be used in two existing municipal power plants having combined heads of 2,974 feet.

Ferron-Twelve Mile Creek diversion project.—A tunnel extending 1.8 miles to Twelve Mile Creek would make possible the other diversion from Ferron Creek, thus help-



PARKER DAM

General view looking upstream and showing Parker Dam discharging about 10,000 second feet of water



MAIN CANAL

A section of the main canal of the Salt River project

ing to export the 15,000 acre-feet of water a year from the Colorado River Basin for use in the adjoining Sanpete Valley.

Summary

The following tables summarize the possibilities for ultimate development of water resources in the Green River Basin, showing the multiple purposes to be served by the various projects, estimated construction costs, potential reservoirs and their capacities, areas to be furnished full and supplemental supplies of irrigation water, and power plants with their potential capacities and annual production of firm energy. Most of the reservoirs would have incidental value for recreation and fish and wildlife conservation. Potential export diversions and stream depletions are also summarized.

TABLE XXXIV.—*Potential projects in the Green division*

Subdivision and project	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [2]
Upper Green River Basin				
Sublette	Wyoming	Green River	I, F, P	$36, 500, 000
West Side unit	do	do	I, F	
Daniel unit	do	do	I, F	
Elkhorn unit	do	do	I, P, F	
Paradise unit	do	New Fork River	I	
Eden unit	do	Big Sandy Creek	I	
Lower Big Sandy	do	do	I	
LaBarge	do	LaBarge Creek	I, F	
Fontenelle unit	do	Fontenelle Creek	I, F	
Seedskadee unit	do	Green River	I	
Opal	do	Hams Fork	I, F	3, 600, 000
Lyman	do	Blacks Fork, Smiths Fork	I, F	4, 330, 000
Henrys Fork	Wyoming, Utah	Henrys Fork	I, F	1, 470, 000
Flaming Gorge	do	Green River	P, F, H, S	10, 000, 000
Red Canyon	Utah	do	P, F	4, 100, 000
Yampa and White River Basins				
Little Snake River	Wyoming, Colorado	Little Snake River tributaries	I, P, F	21, 500, 000
Upper Yampa	Colorado	Yampa River	I, F	2, 300, 000
Wessels	do	do	I, F	1, 100, 000
Mount Harris	do	Tributaries of Yampa River	I, F	3, 300, 000
Great Northern	do	Elkhead Creek and Elk River	I, F	2, 700, 000
Yellow Jacket	do	White River and Milk Creek	I, F	4, 700, 000
Deadman Bench	Colorado, Utah	Yampa River	I, P, F, H, S	23, 800, 000
Maybell	Colorado	do	I	700, 000
Cross Mountain	do	do	P	5, 000, 000
Lily Park	do	do	P, F	1, 900, 000
Josephine Basin	do	White River	I	300, 000
Piceance	do	Piceance Creek	I, F	800, 000
Uinta Basin				
Moon Lake Extension	Utah	Duchesne River and tributaries	I, F	7, 900, 000
Fruitland	do	Red Creek	I, F	400, 000
Castle Peak	do	Duchesne River	I, F	5, 300, 000
Mosby	do	Deep Creek, Whiterocks River	I, F	1, 100, 000
Vernal	do	Ashley Creek	I, F	1, 500, 000
Jensen	do	Brush Creek	I, F	300, 000
Minnie Maud	do	Minnie Maud Creek	I, F	100, 000
Green River Pumping	do	Green River	I	400, 000
Echo Park	Colorado	do	P, F, H, S	43, 000, 000
Split Mountain	Utah	do	P, F, H, S	23, 000, 000
Price and San Rafael River Basins				
Emery County	do	Cottonwood Creek	I, F	2, 500, 000
Buckhorn	do	Huntington Creek	I, F	1, 200, 000
Gunnison Valley	do	Green River	I	1, 100, 000
Desolation Canyon	do	do	P, F, H	21, 000, 000
Rattlesnake Power	do	do	P, F, H	23, 000, 000
Total				259, 900, 000

[1] Symbols used: I=irrigation, P=power, F=flood control, S=silt retention, H=hold-over storage for river regulation.
[2] Preliminary estimates based on construction costs of Jan. 1, 1940.

TABLE XXXV.—*Potential reservoirs in Green division*

Subdivision and name of site	Source of water supply	Project served	Total capacity (acre-feet)
Upper Green River Basin			
Kendall	Green River	Sublette	340,000
Burnt Lake	Fall Creek	do	25,000
Boulder Lake	Boulder Creek	do	180,000
LaBarge Meadows	LaBarge Creek	do	10,000
Minnie Holden	Fontenelle	do	5,000
Fontenelle	Green River	Green-Bear diversion	400,000
Middle Hams Fork	Ham's Fork	Opal and Green-Bear diversion	170,000
Bridger [1]	Blacks Fork, West Fork	Lyman	30,000
Big Basin [1]	Tributary of Henrys Fork	Henrys Fork	107,000
Flaming Gorge	Green River	Flaming Gorge	1,500,000
Red Canyon	do	Red Canyon	50,000
Yampa and White River Basins			
Savery	Savery Creek	Little Snake River	15,000
Columbus Mountain	Slater Fork	do	125,000
Pot Hook	do	do	85,000
Reservoir No. 4	Yampa River	Upper Yampa	14,000
Upper Bear	do	Wessels	15,000
Dunkley	Fish Creek	Mount Harris	30,000
California Park	Elkhead Creek	Great Northern	30,000
Thornburgh	Milk Creek	Yellow Jacket	30,000
Juniper	Yampa River	Deadman Bench and Maybell	1,250,000
Lily Park	do	Lily Park	75,000
Piceance	Piceance Creek	Piceance	5,000
Uinta Basin			
Pelican Lake [1]	Whiterocks and Uinta Rivers	Moon Lake Extension	5,200
Halfway Hollow [1]	do	do	32,200
Upalco [1]	Lakefork River	do	12,300
Hades	Duchesne River	Castle Peak and Rock Creek tunnel	25,000
Starvation	Strawberry	do	65,000
Crow Creek	Deep Creek and Whiterocks River	Mosby	13,000
Stanaker [1]	Ashley Creek	Vernal	34,000
Tyzack	Brush Creek	Jensen	6,000
Red Creek	Red Creek	Fruitland	4,000
Minnie Maud	Minnie Maud Creek	Minnie Maud	550
Strawberry Enlargement	Brush and Ashley Creeks	Central Utah	1,300,000
Echo Park	Green River	Echo Park	5,560,000
Split Mountain	do	Split Mountain	320,000
Price and San Rafael River Basins			
Mammoth	Gooseberry Creek	Gooseberry	17,000
East Fork	White River	White River diversion	1,000
North Fork	do	do	1,000
Willow Creek	Willow River	do	1,000
Joes Valley	Cottonwood Creek	Emery County	57,000
Buckhorn [1]	Huntington Creek	Buckhorn	15,000
Desolation	Green River	Desolation	900,000
Rattlesnake	do	Rattlesnake	500,000
Total			13,360,250

[1] Offstream.

TABLE XXXVI.—*Potential irrigation development in Green division*

Subdivision and project	State	Area to be benefited (acres)		
		New land	Furnished supplemental water	Total
Upper Green River Basin				
Sublette:				
West side unit	Wyoming	29,050	37,000	66,050
Daniel unit	do	5,160		5,160
Elkhorn unit	do	134,030		134,030
Paradise unit	do	4,490		1,490
Eden project extension unit	do	20,250		20,250
Lower Big Sandy unit	do	11,850		11,850
LaBarge unit	do	3,370	5,540	8,910
Fonetnelle unit	do	2,050	3,720	5,770
Seedskadee unit	do	40,830		40,830
Opal	do	16,020	5,400	21,420
Lyman	do	3,100	20,910	24,010
Henrys Fork	Wyoming, Utah	17,140	21,090	38,230
Subtotal		287,340	93,660	381,000
Yampa and White River Basins				
Little Snake River	Wyoming, Colorado	92,110	15,710	107,820
Upper Yampa	Colorado	3,460	11,140	14,600
Wessels	do	6,010	380	6,390
Mount Harris	do	16,600	1,450	18,050
Great Northern	do	16,010	3,260	19,270
Yellow Jacket	do	31,820	5,950	37,770
Deadman Bench	Colorado, Utah	89,720		89,720
Maybell	Colorado	8,540		8,540
Josephine Basin	do	2,400		2,400
Piceance	do	610	2,380	2,990
Subtotal		267,280	40,270	307,550
Uinta Basin				
Moon Lake project extension	Utah	26,300	86,200	112,500
Fruitland	do	1,600	400	2,000
Castle Peak	do	21,700	2,100	23,800
Mosby	do	3,800	400	4,200
Vernal	do	1,900	22,300	24,200
Jensen	do	800	3,600	4,400
Minnie Maud	do		800	800
Green River pumping	do	11,000	1,000	12,000
Subtotal		67,100	116,800	183,900
Price and San Rafael River Basins				
Emery County	do	3,300	20,000	23,300
Buckhorn	do	3,800		3,800
Gunnison Valley	do	10,830		10,830
Subtotal		17,930	20,000	37,930
Total		639,650	270,730	910,380

TABLE XXXVII.—*Potential irrigation development in Green division by States*

State and subdivision	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total
Wyoming			
Upper Green River Basin	283,030	85,450	368,480
Yampa and White River Basins	8,300	9,910	18,210
Subtotal	291,330	95,360	386,690
Colorado			
Yampa and White River Basins	197,800	30,360	228,160
Utah			
Upper Green River Basin	4,310	8,210	12,520
Yampa and White River Basins	61,180		61,180
Uinta Basin	67,100	116,800	183,900
Price & San Rafael River Basins	17,930	20,000	37,930
Subtotal	150,520	145,010	295,530
Total	639,650	270,730	910,380

TABLE XXXVIII.—*Potential power development in Green division*

River basin and project	State	Stream	Power plant installed capacity (kilowatts)	Annual firm generation (kilowatt-hours)
Green River				
Sublette (Elkhorn unit)	Wyoming	Fall Creek	1,500	9,000,000
Flaming Gorge	Utah	Green River	30,000	158,000,000
Red Canyon	do	do	12,000	68,000,000
Echo Park	Colorado	do	120,000	668,000,000
Split Mountain	Utah	do	90,000	486,000,000
Desolation	do	do	78,000	433,000,000
Rattlesnake	do	do	78,000	434,000,000
Yampa River				
Little Snake River	Colorado	Slater Creek	7,500	43,000,000
Deadman Bench (Juniper)	do	Yampa River	15,000	87,000,000
Cross Mountain	do	do	18,000	99,000,000
Lily Park	do	do	10,000	47,000,000
Total			460,000	2,532,000,000

TABLE XXXIX.—*Potential export diversions from Green division*

Subdivision and project	State served	Estimated average annual diversion (acre-feet)
Upper Green River Basin		
South Pass diversion	Wyoming	50,000
Green River-Bear River diversion:		
Hams Fork-Twin Creek unit	do	37,000
Green River-Smiths Fork unit	Utah and Wyoming	320,000
Yampa and White River Basins		
Little Snake-North Platte	Wyoming and Colorado.	[1] 51,000
Elk River-North Platte	do	75,000

TABLE XXXIX.—*Potential export diversions from Green division*—Continued

Subdivision and project	State served	Estimated average annual diversion (acre-feet)
Uinta Basin		
Central Utah	Utah	625,000
Rock Creek Tunnel	do	[1] 53,000
Price and San Rafael River Basins		
Gooseberry	do	11,500
White River diversion	do	4,200
Ferron-Manti Creek	do	15,000
Ferron-Twelve Mile Creek	do	
Total		1,137,700

[1] Smaller of alternative projects not included in total.

TABLE XL.—*Present and potential stream depletions in Green division*

State and subdivision	Estimated average annual depletion (acre-feet)				
	Present depletion		Potential increase		Total ultimate depletion
	Consumed in basin	Exported	Consumed in basin	Exported	
Colorado					
Upper Green River	2,000				2,000
Yampa and White River	113,000		324,000	[1] 75,000	512,000
Subtotal	115,000		324,000	[1] 75,000	514,000
Utah					
Upper Green River	18,000		9,000	320,000	347,000
Yampa and White River			95,000		95,000
Uinta Basin	243,000	[2] 101,500	135,000	625,000	[2] 1,104,500
Price and San Rafael River	97,000	12,000	25,000	30,700	164,700
Subtotal	358,000	[2] 113,500	264,000	975,700	1,711,200
Wyoming					
Upper Green River	[3] 372,000		474,000	87,000	[3] 933,000
Yampa and White River	19,000		15,000		34,000
Subtotal	[3] 391,000		489,000	87,000	[3] 967,000
Total	[3] 864,000	[1] 113,500	1,077,000	1,137,700	[4] 3,192,200

[1] Return flow usable in Wyoming.
[2] Includes 32,000 acre-feet expected to be diverted by the Duchesne tunnel of the Provo River project.
[3] Includes 17,000 acre-feet expected to be consumed by the Eden project, authorized for construction.
[4] The Green division will share also in the depletion of 500,000 acre-feet annually allowed for pasture irrigation in the upper basin.

Grand Division

The drainage area of the Colorado River above the mouth of the Green River for convenience in this report is called the Grand division. Extending westward from the crest of the Continental Divide in central Colorado the division encompasses an area of 26,500 square miles, 89 percent of which is in Colorado and 11 percent in Utah. The division is larger than West Virginia and one-fourth the size of Colorado. Most of the run-off originates in the high mountainous eastern part of the region where rain and snowfall is heavy. The Grand division has a drainage area only three-fifths as large as that of the Green River, but its average annual run-off is 25 percent more than that of the Green division.

Average annual flows of the upper Colorado River and its principal tributaries for the long-time period of record and the critically dry decade (1931–40) are shown in table XLI.

The upper Colorado River and its tributaries are fed largely by melting snow. Even with the present depletions from irrigation 55 percent of the annual run-off occurs in May and June and 72 percent in the 4-month period, April through July. The river system produces more water than would be required to irrigate fully all arable land within its basin, but future expansion of irrigation is dependent on reservoir storage for proper seasonal distribution.

The upper tributaries of the Colorado River contribute clear water to the system. The Gunnison River below

TABLE XLI.—*Average annual stream flows in the Grand division*

Station	Period of record	Average annual flow (acre-feet)	
		For period of record	For 1931–40 period
Colorado River at Glenwood Springs, Colo	1900–43	2,140,000	1,704,000
Roaring Fork River at Glenwood Springs, Colo	1906–43	1,076,000	824,000
Colorado River at Cameo, Colo	1934–43	2,911,000	[1] 2,835,000
Gunnison River above Grand Junction, Colo	[2] 1897–1943	2,075,000	1,446,000
Dolores River at Dolores, Colo	[2] 1900–43	338,000	270,000
Dolores River at Gateway, Colo	1938–43	871,000	[1] 568,000
Colorado River near Cisco, Utah	[2] 1914–43	6,024,000	4,669,000

[1] Estimated.
[2] Records not complete.

North Fork and the Colorado below Glenwood Springs carry some silt but not generally in sufficient amounts to be harmful although greatly concentrated in summer cloudburst storms of short duration. Dissolved mineral salts increase with return flow from irrigation below an elevation of 7,000 feet but do not reach harmful proportions.

Little use is made of ground water in the Grand division. A few shallow wells supply some water for domestic and stock use. In the lower valleys, where shale bedrock predominates, most ground water is heavily charged with


COLORADO
Glenwood Springs
Aspen
Grand Junction
Palisade
Mack
Fruita
Loma
Clifton
Gateway
Delta
Paonia
Hotchkiss
Crawford
Somerset
Gunnison
Almont
Montrose
Uncompahgre
Uncompahgre River
Norwood
Placerville
Telluride
Dolores
Cortez
La Sal
Moab
Green River
Duchesne
Vernal
Price
Roosevelt
Myton
Ouray
Silverton
Durango
Pagosa Springs
Bayfield
Ignacio
Farmington
Aztec
Bloomfield
Kirtland
Shiprock
Gallup
Grants
Cuba
Thoreau
Crownpoint
Window Rock
Chinle
Ganado
Keams Canyon
Holbrook
Winslow
Flagstaff
Cameron
Tuba City
Kayenta
Monument Valley
Mexican Hat
Bluff
Blanding
Monticello
Hanksville
Green River
Moab
La Sal
Thompson
Grand Junction
Rifle
Meeker
Craig
Steamboat Springs
Hayden
Yampa
Oak Creek
Kremmling
Granby
Hot Sulphur Springs
Fraser
Winter Park
Idaho Springs
Georgetown
Central City
Golden
Denver
Boulder
Longmont
Fort Collins
Greeley
Loveland
Estes Park
Lyons
Nederland
Ward
Eldora
Rollinsville
Empire
Berthoud
Berthoud Pass
Granby
Grand Lake
Kremmling

irrigators in 1898, which was breached and failed during a flood in June 1937.

The neighboring San Juan River area in the Colorado River Basin receives water from the Dolores River. The exportation of surplus water eastward across the Continental Divide was commenced in 1880 when the small Ewing ditch for placer mining was constructed from the head of Eagle River to the Arkansas River watershed. Additional diversions either across mountain passes in canals or under them in tunnels followed. Construction has been started on other developments to take water out of the basin, including the Colorado-Big Thompson project of the Bureau of Reclamation.

Sixteen hydroelectric plants with combined capacities of 49,717 kilowatts are operating in the Grand diversion at present. Largest is the 21,600-kilowatt Green Mountain plant, recently completed as a unit of the Colorado-Big Thompson project. The Shoshone plant of the Publice Service Co. of Colorado, the second largest, has a capacity of 14,400 kilowatts. Thirteen small stream and internal combustion power plants have combined capacities of only 8,497 kilowatts. More power is generated than consumed in this area. Transmission lines carry large blocks of power over the mountains for use in eastern Colorado.

The amount of water used for domestic, municipal, industrial, and stock-watering purposes is small in comparison with the available supply. The mountain streams and lakes are kept well stocked with fish, making the Grand division one of the most popular fishing and summer recreational areas in the Nation.

Present development of water resources is discussed in more detail under three subdivisions.

Colorado River above Gunnison River.—The Colorado and its headwater tributaries above the Gunnison River irrigate 256,000 acres, and expansion of existing irrigation facilities will bring water to 15,670 acres more, bringing to 271,670 acres the total area that will be irrigated by diversions from the Colorado River above the Gunnison.

Upstream from Palisade, 186,000 acres are irrigated, nearly 60 percent of which is in the mountain valleys above Glenwood Springs, where ditches are small, averaging 3 miles in length and 8 second-feet in capacity. Water is plentiful during most of the growing season, being heavily applied in amounts varying from 5 to 8 acre-feet an acre annually. From this irrigation there is a large return flow to the river. About one-fourth of the irrigated land, however, suffers from the lack of water in late season. Supplemental water can be supplied in part by the construction of simple canals to divert water from larger streams, but storage in reservoirs will also be necessary. Expensive construction is prohibited by the low value of crops that are produced. Most land produces native grasses valued annually from $7 to $15 an acre.

Between Glenwood Springs and Palisade the climate is suitable for growing crops of higher value, such as fruits, vegetables, alfalfa, and sugar beets; consequently larger and more costly irrigation developments have been possible. The irrigated lands, being on mesas higher than the river, are served almost entirely from tributary streams. Some storage reservoirs have been provided, but about half of the area irrigated is in need of an additional late-season water supply. From 3.5 to 5 acre-feet of water is applied annually to each acre. Return flow from irrigation finds its way into the river channel and is usable for irrigation in Grand Valley and lower areas.

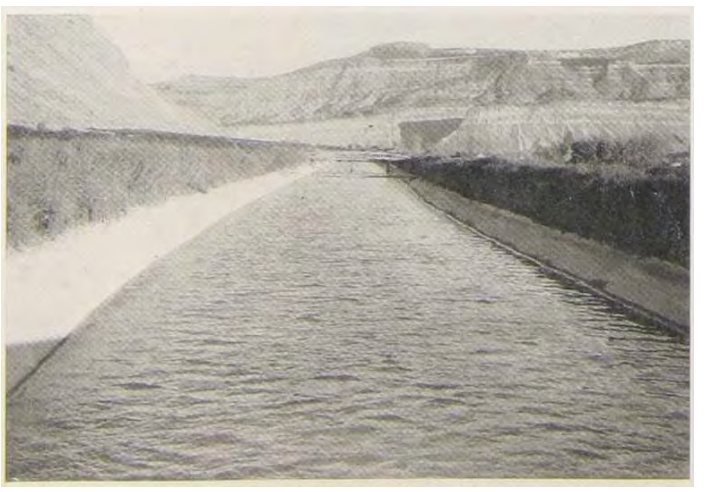
In the Grand Valley, which begins at Palisade and extends west almost to Utah, 70,000 acres are irrigated by diversions from Colorado River above its confluence with the Gunnison River, and 15,670 acres more will be reached with full expansion of existing irrigation systems. The Grand Valley Irrigation Co. built a 110-mile canal in 1883 which serves 30,000 acres. Other smaller developments followed. In 1912 the Bureau of Reclamation commenced construction of its Grand Valley project. With a diversion dam on the Colorado River 8 miles above Palisade, and a canal to serve lands above the existing Grand Valley Canal, this project now irrigates 40,000 acres, including some lands irrigated before 1912 but now supplied from the project canal. Additional small acreages are being reclaimed each year. All irrigated lands in Grand Valley receive an adequate supply of water.

Projects now in operation export about 96,000 acre-feet of water annually from the headwaters of the Colorado River across the Continental Divide to the South Platte and Arkansas Basins. Several of these projects, notably the Denver municipal system (Moffat tunnel) for diversion from Frazier River and its tributaries, have not yet been completed. Upon their completion average annual diversions will aggregate 197,000 acre-feet. A further exportation of 320,000 acre-feet to the Big Thompson River, a tributary of the South Platte, will be possible when the Bureau of Reclamation completes construction of the Colorado-Big Thompson project. This project will provide supplemental water for 615,000 acres of fertile farm land in northeastern Colorado, now insufficiently irrigated. Power will be generated at the newly constructed Green Mountain plant on Blue River, a tributary of the Colorado, and at five plants having combined heads of 2,800 feet to be constructed in the South Platte Basin. The Green Mountain Reservoir with a capacity of 154,600 acre-feet will provide replacement storage for use in the Colorado River Basin when export diversions would otherwise reduce Colorado River flows below irrigation requirements and will also provide water for power generation. The Granby Reservoir of 546,400 acre-feet will impound water on the upper Colorado River. From it the water will be lifted an average of 130 feet to a canal leading to Shadow Mountain and Grand Lakes from



COLORADO RIVER DIVERSION DAM

Bureau of Reclamation completed this dam in 1915 for Grand Valley Project



GRAND VALLEY CANAL

This 55-mile canal carries water to irrigate lands in Grand Valley



GRAND VALLEY POWER PLANT

This plant will furnish necessary energy for pumping irrigation water

which the water will flow in the 13-mile newly driven Alva B. Adams tunnel through the Continental Divide, thence through five power plants eventually to be constructed. Carter Lake, Horsetooth, and other reservoirs will regulate the water for irrigation.

Gunnison River.—The Gunnison River and its tributaries, including North Fork and Uncompahgre River, irrigate 238,000 acres of fertile lands in west central Colorado. About 17,000 additional acres will be served when present enterprises are fully developed.

Upstream from Sapinero, 61,600 acres are irrigated along the upper Gunnison River, where lands are high, the growing season is short, water is abundant, and crop values per acre are low.

Fertile soils, good air drainage, careful husbandry, and extensive irrigation developments combine to make the lands along the North Fork River among the most productive in the basin. To irrigate adequately the 56,200 acres now under cultivation an annual diversion of from 3.5 to 5 acre-feet of water for each acre would be required. Only about half of the land now irrigated has a full water supply. Reservoirs and canals have been provided at relatively high cost. Some alterations in the present systems and exchanges of water rights together with new construction will be required for maximum use of the available water resources.

In the valley of the Uncompahgre River 70,400 acres are irrigated by the Uncompahgre project of the Bureau of Reclamation, and an estimated 17,000 acres more will be added when lands that have been drained in recent years are placed in production. A 6-mile tunnel carries water diverted from the Gunnison River west to project lands. The natural flow of the river, supplemented when necessary by storage releases from the upstream Taylor Park Reservoir, provides a full water supply.

Lesser tributaries of the Gunnison, including Cimarron Creek, Crystal Creek, Smith Fork, and Forked Tongue Creek irrigate substantial areas. These areas do not receive an adequate supply, particularly in the late-growing season. Water is pumped from the lower Gunnison to about 3,100 acres of land in Grand Valley, southeast of Grand Junction.

Three small ditches export water from the Gunnison River Basin across the Continental Divide to the Arkansas River and Rio Grande Basins.

Colorado River between Gunnison and Green Rivers.—Little land is irrigated directly from the Colorado River between the Gunnison and Green Rivers, but tributary streams serve about 45,600 acres. More than 80 percent of these lands are within the Dolores River Basin and receive water from that stream and its tributaries. About 100,000 acre-feet of water also are diverted westward from the Dolores River to irrigate 30,000 acres of land in Montezuma Valley of the San Juan Basin, and 7,400 acre-feet are diverted from Lost Canyon, a tributary of the Dolores, to 4,600 acres in the Summit project, also in the San Juan Basin.

Summary.—Present irrigation development in the Grand division is summarized in the following tables:

TABLE XLII.—*Irrigation reservoirs in the Grand division* [1]

Reservoir	Source of water	Capacity (acre-feet)
Colorado River above Gunnison River		
Granby [2]	Colorado River	546, 400
Williams Fork	Williams Fork River	[3] 6, 300
Green Mountain	Blue River	154, 600
Ivanhoe	Ivanhoe Creek	1, 400
Missouri Heights	Cattle Creek	2, 800
Harvey Gap	East Fork Rifle	4, 800
Big Creek No. 1	Big Creek	2, 700
Big Creek No. 3	do	1, 800
Big Creek No. 7	do	1, 500
Leon Lake	Leon Creek	3, 000
Cottonwood Lake No. 1	Cottonwood Creek	2, 800
Gunnison River Basin		
Taylor Park	Taylor River	106, 000
Fruitland	Crystal Creek	4, 800
Overland	Cow Creek	2, 600
Fruitgrowers	Surface and Currant Creeks	4, 600
Park	Surface Creek	3, 200
Eggleston Lake	Kiser Creek	2, 700
Barron	do	1, 000
Deep Ward	Ward Creek	1, 400
Island Lake	do	1, 100
Cedar Mesa	Surface Creek	1, 000
Colorado River between Gunnison and Green Rivers		
Lake Hope	Lake Fork of San Miguel	2, 300
Trout Lake	do	2, 740
Lone Cone	Naturita and Brewster Creeks.	1, 830
Gurley	Beaver Creek	3, 200
Buckeye	Deep and Geyser Creeks	2, 000
Ground Hog	Beaver, Little Fish, and Ground Hog Creeks.	22, 000

[1] Includes only reservoirs with capacities of more than 1,000 acre-feet; all reservoirs are in Colorado.
[2] Authorized, dam not yet constructed.
[3] Enlargement planned by city of Denver.

TABLE XLIII.—*Present irrigated areas in the Grand division by States*

Subdivision	Acres irrigated		
	Colorado	Utah	Total
Colorado River above Gunnison River	[1] 271, 670	0	[1] 271, 670
Gunnison River	[2] 255, 000	0	[2] 255, 000
Colorado River between Gunnison and Green River	38, 000	8, 000	46, 000
Total	564, 670	8, 000	572, 670

[1] Includes 15,670 acres to be irrigated from existing projects in Grand Valley.
[2] Includes 17,000 acres of new land to be irrigated under the Uncompahgre project.



TAYLOR PARK DAM IN COLORADO

Reservoir releases supplement irrigation supplies for Uncompahgre project



FISHING AT GREEN LAKES RESORT

Sportsmen find excellent fishing in mountain streams and lakes

TABLE XLIV.—*Estimated present average annual water consumption in Grand division*

Subdivision	Water consumed (acre-feet)		
	Colorado	Utah	Total
Colorado River above Gunnison River	409,000	0	409,000
Gunnison River	367,000	0	367,000
Colorado River between Gunnison and Green Rivers	65,000	13,000	78,000
Total	841,000	13,000	[1] 854,000

[1] Includes allowance for undeveloped lands under existing projects estimated at 65,000 acre-feet. (See note following table XLIII.)

TABLE XLV.—*Estimated present average annual water exports from Grand division*

Exporting stream [1]	Importing stream	Acre-feet		
		Present	Future increase [2]	Total
Colorado River	South Platte	54,000	395,000	449,000
Do	Arkansas	42,000	26,000	68,000
Gunnison River	do	300	0	300
Do	Rio Grande	2,000	0	2,000
Total		98,300	421,000	[3] 519,300

[1] All exportations to Colorado.
[2] Future increase with full development of present and authorized projects.
[3] Does not include 108,000 acre-feet diverted from Dolores River for use in San Juan area of Colorado River Basin.

POTENTIAL DEVELOPMENT OF WATER RESOURCES

Thirty-five potential projects for development of water resources in the Grand division are outlined. The irrigation of 224,000 acres of dry arable land and 160,220 acres of cultivated land lacking a full irrigation supply would be possible.

Nine hydroelectric power plants with an aggregate installed capacity of 288,000 kilowatts would be capable of producing nearly 1.6 billion kilowatt-hours of firm energy annually. Several other favorable power sites probably will be located when detailed surveys are made.

Some of the projects would provide municipal and industrial water supplies and recreational opportunities and in addition would benefit fish and wildlife.

Three additional projects would increase by 160,400 acre-feet present diversions to the San Juan area in the Colorado River Basin.

Possibilities exist for exporting annually an average of 1,492,000 acre-feet across the Continental Divide to the Rio Grande, South Platte, and Arkansas Rivers.

Potential projects are discussed under the three subdivisions of the Grand division.

Colorado River Basin above Gunnison River

Of the 14 projects which would expand irrigation by diversion from the Colorado River above Grand Junction, 3 are upstream from Glenwood Springs, 4 are in the Roaring Fork River area, and 7 divert from the main Colorado River or its tributaries between Glenwood Springs and the mouth of the Gunnison River. Two of these projects would increase power production. The water available for export from this subdivision would probably amount to 639,000 acre-feet.

Troublesome project.—This project would serve lands located in Troublesome Creek Valley upstream from Glenwood Springs and northeast of Kremmling, Colorado. Two dams, one to impound 7,500 acre-feet of water at the Rabbit Ear site on Troublesome Creek and another to store 9,000 acre-feet on East Troublesome Creek, together with enlargement and extension of two service canals, would be required to provide water for irrigating 3,600 acres now inadequately supplied and 6,800 acres of new land. With the farm lands all above an elevation of 7,000 feet, a short growing season would limit crops to native grasses.

Muddy Creek project.—Muddy Creek flows south to join the Colorado River at Kremmling. Along its course are 2,520 acres of irrigated native grass land requiring supplemental water and 3,620 acres of irrigable land. A water supply could be provided by constructing a dam to store 7,000 acre-feet at the Barbers Basin site on Muddy Creek and a 17-mile canal to carry water from the reservoir to project lands.

Gore Canyon project.—Below Kremmling, Colo., the Colorado River flows through Gore Canyon where it falls 360 feet in 5 miles. This drop could be used to generate power by the construction of a low diversion dam at the head of the canyon and a tunnel to convey the water to a power plant at the lower end. Upstream regulation at the existing Green Mountain Reservoir on the Blue River and at other reservoirs that might be provided to furnish replacement water for transmountain diversions would help smooth out natural flows for greater firm-power production. With an installed capacity of 30,000 kilowatts, the plant would generate 177 million kilowatt-hours of firm energy annually.

Fourmile project.—Located 8 miles southwest of Glenwood Springs, this project would irrigate 500 acres of new land and 1,400 acres in need of supplemental water. Existing ditches along Fourmile Creek, a tributary of Roaring Fork, could distribute the water, but a dam to store 2,000 acre-feet of water at Fourmile No. 4 reservoir site on Fourmile Creek would be required.

Cattle Creek project.—Only storage would need to be provided to irrigate 900 acres of new land and to furnish 5,500 acres with supplemental water. The lands are located along Cattle Creek, which flows westward to join Roaring Fork, 9 miles above Glenwood Springs. The off-stream Missouri Heights Reservoir of 2,800 acre-feet capacity could be enlarged to a capacity of 9,000 acre-feet and filled by an enlargment of its 2-mile feeder canal from Cattle Creek.

Capitol Creek project.—A new service canal 10 miles long would be required to bring water from Snowmass Creek to 2,000 acres of grass lands now insufficiently irrigated from Capitol Creek. Both Snowmass and Capitol Creeks flow northeast and converge before joining Roaring Fork at Snowmass, 12 miles downstream from Aspen.

Woody Creek project.—Two thousand acres of irrigated land located near the junction of Woody Creek with Roaring Fork, 6 miles south of Aspen, could be furnished ample supplemental water by a new canal 13 miles long diverting from Roaring Fork at Aspen. Native grass is also the principal crop on these lands.

Silt project.—First of five potential developments downstream from Glenwood Spring, the Silt project would require construction of a dam at the Rifle Gap site on Rifle Creek to provide storage for 10,000 acre-feet of water. Reservoir water would be released to present users from Rifle Creek and in exchange an equivalent amount from East Rifle Creek, a tributary, would be diverted southeastward through an improved Grass Valley Canal to supply 1,100 acres of new land and 5,200 acres now partially irrigated near Silt, Colorado.

West Divide project.—This project, located south across the Colorado River from the Silt project, would supply water to 400 acres of new land and 7,700 acres now inadequately irrigated. A 7,000 acre-foot reservoir at the Haystack site on Middle Willow Creek would be provided but no new ditches would be required.

Hunter Mesa project.—On Hunter Mesa, located southwest of Rifle, Colo., and immediately west of lands of the West Divide project are 4,700 acres of dry land and 2,300 acres in need of supplemental water. An adequate water supply could be obtained from Buzzard Creek, a tributary of Plateau Creek, by means of a 10,000 acre-foot storage reservoir at the Owens Creek site on Buzzard Creek and a 27-mile canal to carry water to the lands.

Roan Creek project.—Along Roan Creek, which enters the Colorado River at Debeque, Colo., are 3,100 acres of irrigated land which could be furnished supplemental water by construction of a dam to impound 3,000 acre-feet of water at the Carr Creek site on Carr Creek, a tributary.

Collbran project.—In Plateau Valley in the vicinity of the towns of Collbran, Plateau City, and Mesa are 7,100 acres of new land and 18,900 acres irrigated with only a partial water supply. A 24,000 acre-foot reservoir at the Vega site on Plateau Creek, supplied by a 3-mile canal from Leon and Park Creeks, and two new distribution canals totaling 42 miles in length would provide water for these lands. An alternative plan would utilize part of the water for municipal purposes in the vicinity of Palisade, Grand Junction, and Fruita in Grand Valley.

Grand Valley project extension.—Five thousand acres of arable land above the highline canal of the Grand Valley project near Grand Junction could be supplied irrigation water by pumping from the canal with lifts ranging from 32 to 125 feet.

Cisco-Thompson project.—Scattered tracts of undeveloped arable land extend from Thompson, Utah, eastward across Grand County into Colorado. About 87,000 acres, of which all but 3,500 acres are in Utah, are situated below elevation 4,975 feet. Wedged between the Green and Colorado Rivers but high above both streams, these lands present a difficult problem to irrigation planers. From a reconnaissance investigation a gravity diversion from the Colorado River appears most practicable. The canal would head about three miles upstream from the town of Grand Valley, Colo., and continue on the south side of the river for 34 miles; thence crossing the river by siphon it would continue through a 13-mile tunnel and 140 miles of canal to the land, making its total length nearly 190 miles. High lands in Grand Valley could also be irrigated from this canal making unnecessary the pumping outlined in the Grand Valley project extension. Summer flow of the river would be insufficient to supply both this project and irrigation demands in Grand Valley. To make up deficiencies in Grand Valley, replacement storage could be provided at the Whitewater site 6 miles above the mouth of the Gunnison River, where, without detailed surveys, it is estimated that a dam 200 feet high would impound 1½ million acre-feet. The upper 50 feet of storage would provide full stream regulation. With reservoir outlets 150 feet above the stream, a canal could run to the northeast, delivering water by gravity flow to the existing Grand Valley canal near Paliside, but a 45-foot pump lift would be required to serve the Highline canal. Water released through an outlet in the west abutment of the Whitewater Dam would irrigate 4,700 acres of land in the Redlands area south of Grand Junction. Power could be generated under a minimum head of 150 feet by release of surplus storage water from the reservoir. The power plant would have an installed capacity of 18,000 kilowatts and the annual output would amount to 100 million kilowatt-hours.

Colorado River-Yampa River diversion project.—By diverting surplus waters of the Colorado River at Kremmling, Colo., through a tunnel to the headwaters of the Yampa River, this project would substantially increase the power potentialities of the Yampa and Green Rivers (Green division) and reduce in a lesser amount the potential power output of the Colorado River in the Grand division. It presents an alternative possibility and merits further study.

Potential export diversions.—Surplus water of the Colorado River above the entry of the Gunnison River could be exported eastward across the Continental Divide for use in the South Platte and Arkansas River Basins. With adequate diversion works and replacement storage reservoirs for supplying irrigation requirements in the Colorado River Basin, and either replacement water for power

generation or replacement power for the Shoshone plant of the Public Service Co. of Colorado at Glenwood Springs, it is estimated that water would be available for export as follows:

TABLE XLVI.—*Potential export diversions from Colorado River above Gunnison River*

Exporting stream	Importing basin	Estimated average annual amount available for export (acre-feet)
Eagle River and Piney Creek	South Platte	160, 000
Blue River	do	290, 000
Williams River	do	50, 000
Frying Pan River	Arkansas	64, 000
Crystal River	do	75, 000
Total		639, 000

Gunnison River

Future developments outlined for Gunnison River Basin include thirteen projects to irrigate 91,530 acres, produce 176 million kilowatt-hours annually, and serve other purposes. Transmountain diversion projects would export 853,000 acre-feet of water annually to the Rio Grande and Arkansas Rivers.

Tomichi Creek project.—This project would bring into production 3,100 acres of arable dry land and provide supplemental water for 8,300 acres of partially irrigated grass lands along Tomichi Creek, extending upstream from Parlin, Colo., which is 10 miles southeast of Gunnison. A 10,000 acre-foot reservoir at the Upper Tomichi Creek site and a 22-mile canal to reach part of the area would be required. In the event an export diversion project is constructed which would divert water from other tributaries of the Gunnison River into the Tomichi Creek Basin en route to the Arkansas Basin, a larger acreage in the Tomichi Creek Basin could be irrigated.

Cochetopa Creek project.—Twenty-five miles south of Gunnison along Cochetopa Creek, a principal tributary of Tomichi Creek, are 3,900 acres of irrigable land and 4,700 acres of irrigated land requiring supplemental water. A full irrigation supply could be obtained for these lands with a 5,500 acre-foot reservoir at the Banana Ranch site on Cochetopa Creek and a 2,500 acre-foot reservoir at the McDonough site on Los Pinos Creek, a tributary. A new canal would also be required to reach part of the area.

Ohio Creek project.—High lands along Ohio and Antelope Creeks north of Gunnison, Colo., suitable for growing native grasses would be irrigated by this project. About 3,470 acres of new land would be furnished a full supply of water, and 11,300 acres in need of more water, a supplemental supply. Two reservoirs would be required: Lake Brennan (capacity to be enlarged from 376 acre-feet to 3,000 acre-feet) on Anthracite Creek, a tributary of North Fork River, and Castle Creek (6,000 acre-feet capacity) on a tributary of Ohio Creek. A 2.5-mile canal to carry storage releases from Lake Brennan to Ohio Creek and canals to reach the new land would be needed.

Lake Fork project.—On Lake Fork of the Gunnison River 2 miles south of Lake City, Colo., is a potential power site. The development would include a dam near the outlet of Lake San Cristobal creating a reservoir of 29,800 acre-feet capacity and a conduit 2.85 miles long, connecting the reservoir with a power plant in Wade Gulch. Nearby on Henson Creek a low diversion dam at Hidden Treasure Mill would divert the flow into another conduit 2.45 miles long. The flow of both Lake Fork and Henson Creek would be available for power production under a static head of 308 feet. The power plant installed capacity would be 6,000 kilowatts and the annual firm production 12 million kilowatt-hours.

Sapinero project.—Potential transmountain diversions from the headwaters of the Gunnison River would require a reservoir for re-regulation of the flow before it enters the Black Canyon of the Gunnison. A dam at a site near the mouth of Sapinero Creek could also be utilized for power production. A power plant could be constructed at the dam with an installed capacity of 18,000 kilowatts capable of producing 100 million kilowatt-hours each year.

Fruitland Mesa project.—Crystal Creek, flowing southwest joins the Gunnison River about 4 miles upstream from the intake portal of the Gunnison Tunnel of the Uncompahgre Reclamation project. Its waters are diverted northward to lands on the Fruitland Mesa south and west of Crawford, Colo. An additional supply of about 35,000 acre-feet yearly could be brought to Crystal Creek from Curecanti and Sapinero Creeks to the east by means of 30 miles of canal and 3 miles of tunnel. Stream regulation would be provided either in the basins of origin, on Crystal Creek, or by the enlargement of the existing Gould or Fruitland Reservoirs, supplied by a canal from Crystal Creek. A full water supply would be furnished 7,650 acres of new land and 9,590 acres now irrigated would receive supplemental water.

Smith Fork project.—Construction of a 4-mile feeder canal from Smith Fork to supply a 15,000 acre-foot reservoir at the Grand View site south across the creek from Crawford, Colo., and the enlargement and extension of existing distribution canals would make possible the irrigation of 4,230 acres of new land and provide supplemental water to 9,220 acres now insufficiently irrigated, all in the vicinity of Crawford.

Paonia project.—Construction of a dam to store 14,000 acre-feet of water at the Spring Creek site on East Muddy Creek, a tributary of the North Fork of Gunnison River, and the enlargement of a 35-mile distribution canal would bring water to 2,000 acres of new land and supplement present inadequate supplies for 12,700 acres located north of North Fork near Hotchkiss, Colo. This plan is a modi-

fication of the Paonia project as previously authorized for construction.

Minnesota project.—This project would require only a 3,000 acre-foot reservoir at the Beaver site on Minnesota Creek to supply water to 2,600 acres of partially irrigated land and 200 acres of undeveloped land located south of North Fork River near Paonia.

Leroux Creek project.—A reservoir with a capacity of 10,000 acre-feet at the Castle site on Deaver Gulch supplied by a 1-mile canal from Leroux Creek would provide water for 3,900 acres of dry land located on Redlands Mesa north of North Fork River near its confluence with Gunnison River. A service canal 8 miles long would be required.

Grand Mesa project.—Currant, Surface, and Tongue Creeks join the Gunnison River a few miles downstream from its confluence with the North Fork. Surplus flows of these streams could provide supplemental water for 18,200 acres of fertile land now irrigated and a full supply for 5,200 acres of good arable land. Construction required would include a dam to store 12,000 acre-feet of water at the Gorsuch Reservoir site on Currant Creek, a 19-mile feeder canal, and a 20-mile distribution canal. In addition, Eggleston Lake on the headwaters of Forked Tongue Creek, which now stores 2,700 acre-feet, would be enlarged to store 3,700 acre-feet.

Ouray project.—The Uncompahgre River, a tributary of the Gunnison River, heads in the San Juan Mountains of southwestern Colorado and in the first 27 miles of its course falls 3,200 feet.

The best power sites are in a canyon near Ouray, Colo. A few miles south of the town an earth dam could be constructed on Red Mountain Creek at Ironton Park creating a reservoir of 21,900 acre-feet to regulate the flow of the creek and to receive the flow of the Uncompahgre River diverted around the mountain side in a conduit.

A power plant down the canyon would receive water from the reservoir under a head of 1,130 feet. Below this plant the Uncompahgre River would be diverted to a second power plant at Ouray where a power head of 750 feet could be utilized. The third and final stage of the power development would be a power plant below Ouray at Bachelor Switch with a head of 475 feet. The total installed capacity of the entire development would be 16,000 kilowatts and the annual firm production 64 million kilowatt-hours.

Regulated power water releases below the Bachelor Switch power plant could be diverted in summer for the irrigation of 9,330 acres of new land and 2,340 acres in need of supplemental water on Log Hill Mesa, northwest of Ridgeway, Colo. A diversion dam and a canal 37 miles long would be required. The Ironton Park Reservoir would also provide some flood control downstream in Uncompahgre Valley.

Redlands project.—Lands on the Redlands Mesa west of Grand Junction, Colo., are irrigated by pumping from the Gunnison River with lifts ranging from 100 to 300 feet. An extension of present facilities within reasonable pump lifts would make possible the irrigation of 1,600 acres of new land.

Potential export diversions.—The Arkansas River Basin and to a small extent the Rio Grande Basin could receive water conveyed across the Continental Divide from headwaters of the Gunnison River. With works to collect and divert the water, including pumps with lifts up to 1,000 feet, and reservoirs from which to replace water required for irrigation and power generation in the Colorado River Basin, the following exportations could be made:

TABLE XLVII.—*Potential Export Diversions from the Gunnison River*

Exporting stream	Importing basin	Estimated average quantity available for export annually (acre-feet)
Gunnison River and tributaries above Gunnison, Colo.	Arkansas	460, 000
Gunnison River and tributaries below Gunnison, Colo.	do	340, 000
Anthracite Creek	do	40, 000
Cebolla Creek	Rio Grande	13, 000
Total		853, 000

Colorado River between Gunnison and Green Rivers

Possibilities for irrigation development in this part of the basin include four projects along the Dolores River, principal tributary of the Colorado River in this area, and two along lesser tributaries. Two main stream power potentialities are also described. Power development possibilities are believed to exist on the Dolores River and its tributaries but have not been investigated. In addition, three diversion projects would benefit lands in the adjoining San Juan division of the Colorado River Basin.

Saucer Valley project.—Disappointment Creek is the first stream to join Dolores River after it flows into San Miguel County. Along the creek are 1,300 acres of irrigated land requiring supplemental water and 5,600 acres of undeveloped land in need of a full supply. This area could be served by a 14,000 acre-foot reservoir at the Custer site on Spring Creek with a feeder canal from Disappointment Creek. Two new service canals would also be required.

Nucla project.—Supplemental water is needed for 5,800 acres of irrigated land located north of San Miguel River near Nucla, Colo. A full supply of water could bring into production 5,700 acres of dry land situated

northwest of the town. Water necessary for all of these lands could be provided by construction of dams to store 20,000 acre-feet at the Finch site on Horsefly Creek and 5,000 acre-feet at the Cottonwood site on Cottonwood Creek, and by enlargement and extension of the Colorado Cooperative canal. Both reservoirs would be on tributaries of the San Miguel River. Future water supply studies may show that water from these reservoirs could replace water from other tributaries now used on lands within the project area, thus releasing water from those tributaries for use on lands south of the river in the San Miguel project.

San Miguel project.—A new aqueduct, heading on the south bank of the San Miguel River, 4 miles downstream from Vance Junction could continue west past Fall, Saltado, and Beaver Creeks to the Miramonte and Stone Cabin Reservoirs. The aqueduct could divert natural flows of intercepted streams, including some water now used near Nucla, providing replacement storage can be had at the future Finch and Cottonwood Reservoirs of the Nucla project. Miramonte Reservoir on Naturita Creek would have a capacity of 63,000 acre-feet. Water released from Miramonte Reservoir would supplement present supplies for 14,100 acres and irrigate 33,900 acres of new land in the Dry Creek and Gypsum Creek Valleys and near Norwood and Redvale. Stone Cabin Reservoir to provide 12,000 acre-feet of storage capacity on Dry Creek could store natural and return flows of Dry Creek in addition to that supplied from the feeder canal for use on 7,000 acres of new land along East Paradox Creek. The Gurley Reservoir on Anderson Creek would be enlarged by 7,800 acre-feet to a total capacity of 11,000 acre-feet and its existing feeder canal would be enlarged and extended to Fall Creek. The enlarged reservoir could serve the same area as Miramonte Reservoir.

West Paradox project.—West Paradox Creek originates in Utah and flows southeast to join the Dolores River in Colorado. In its valley are 3,900 acres of irrigated land in need of supplemental water and 5,500 acres of arable dry land. At the present time high ditches bring water from nearby streams to West Paradox Basin where storage is provided at the 2,000 acre-foot Buckeye Reservoir. Full development would require present collecting ditches to be enlarged and extended to bring Taylor Creek into the system. The capacity of Buckeye Reservoir would need to be increased from 2,000 to 9,500 acre-feet and a new service canal constructed.

Dewey project.—The Dewey Dam site is in Utah on the Colorado River 3 miles below the mouth of Dolores River and 16 miles southeast of Cisco, Utah. A dam to raise the present river water surface from an elevation of 4,085 feet up to a maximum surface of 4,405 feet would create a reservoir with a total capacity of 8,200,000 acre-feet and an active capacity of 6,300,000 acre-feet. The reservoir would extend 55 miles up the Colorado River and 20 miles up the Dolores River with 110 square miles of lake surface and a maximum width at the lower end of 12 miles. The Denver and Rio Grande Western Railroad and highways U S 50 and Utah 128 would be relocated out of the flooded area. The town of Cisco, population 53, lies entirely within the reservoir site but if relocated on the reservoir shore line and on both a railroad and a transcontinental highway, it should have ample opportunity to become a resort center. The development would be multiple purpose for silt retention, flood control, recreation, hold-over storage for river regulation, and power production. A power plant at the dam would have an installed capacity of 140,000 kilowatts and could produce 797 million kilowatt-hours of firm energy annually.

Moab project.—A dam on the Colorado River, just above the highway bridge on U S 160 at Moab, Utah, would back the river up to the Dewey Dam site. The present stream elevation at the site is 3,947 feet and the reservoir would have a surface elevation of 4,085 feet and a capacity of 183,000 acre-feet. The town of Moab would not be inundated. The power plant installed at the dam would have a capacity of 60,000 kilowatts and an annual firm production of 344 million kilowatt-hours. The development would be multiple purpose for silt retention, flood control, recreation, hold-over storage, and power development.

Pack Creek project.—Along the lower channel of Mill Creek and continuing up Pack Creek, its tributary, is a 10-mile strip of land which includes 3,150 acres of good soil. Only 1,950 acres, mostly in the downstream portion near Moab, Utah, are irrigated, and these require supplemental water some years. A reservoir of 3,000 acre-feet capacity at a site on Mill Creek located just upstream from the land could store water to supplement existing supplies for the lower portion of the strip and to replace Pack Creek flows which could then be used entirely on the upper part. Also by driving a tunnel 640 feet through a ridge, Mill Creek flows above the reservoir could be diverted to augment the water of Pack Creek in irrigating the upper lands.

Hatch Creek project.—Hatch Creek, known also as Cain Spring Creek and Lockhard Creek, flows northwest and enters the Colorado River 12 air-line miles southwest of Moab. On two of its tributaries, Coyote and East Canyon Creeks, are two promising reservoir sites which have been surveyed by the State engineer of Utah. Below each site are strips of undeveloped and unclassified land which are considered arable by local interests. Water supplies have not been determined but it is probable that 8,500 acre-feet of water could be stored on Coyote Creek and 2,500 acre-feet on East Canyon Creek to supplement natural flows for irrigating about 4,000 acres of land.

Potential diversions to San Juan division.—Present diversions of water from the Dolores River to lands in the

San Juan River Basin, averaging 108,000 acre-feet annually could be increased 38,000 acre-feet by expansion of the existing Montezuma Valley project, and 120,600 acre-feet by construction of the Dolores project, including a dam to impound 185,000 acre-feet at the McPhee site on the Dolores River. Reservoir losses would consume approximately 6,000 acre-feet, reducing actual delivery under the Dolores project to 114,600 acre-feet.

The potential Blanding project would divert water from the head of Indian Creek, the lowest tributary of the Colorado River in the Grand division, to lands in the San Juan division. A 1-year record of stream flow (1928) indicates that an annual diversion of 1,800 acre-feet might be made.

These three projects are more fully described as potential developments in the San Juan division.

Summary

The following tables summarize the plan for ultimate development of the Grand division, showing potential projects and their multiple purposes, estimated costs, potential reservoirs and their capacities, new lands to be irrigated, areas to be furnished a supplemental supply of irrigation water, potential diversions to the San Juan Basin in the Colorado River Basin, potential export diversions, and estimated amounts of water to be consumed and exported by States.

TABLE XLVIII.—*Potential projects in the Grand Division*

Subdivision and project	Location of project	Source of water supply	Purpose to be served[1]	Estimated construction cost[2]
Colorado River above Gunnison River				
Troublesome	Colorado	Troublesome Creek	I, F	$2, 210, 000
Muddy Creek	do	Muddy Creek	I, F	500, 000
Gore Canyon	do	Colorado River	P	3, 800, 000
Fourmile	do	Fourmile Creek	I, F	600, 000
Cattle Creek	do	Cattle Creek	I, F	430, 000
Capitol Creek	do	Snowmass Creek	I	130, 000
Woody Creek	do	Roaring Fork	I	170, 000
Silt	do	Rifle Creek	I, F	1, 320, 000
West Divide	do	Middle Willow Creek	I, F	1, 300, 000
Hunter Mesa	do	Buzzard Creek	I, F	1, 500, 000
Roan Creek	do	Carr Creek	I, F	610, 000
Collbran	do	Plateau Creek	I, F, M	1, 940, 000
Grand Valley Extension	do	Colorado River	I	415, 000
Cisco-Thompson	Utah and Colorado	do.[3]	P, I, F, H, S	34, 240, 000
Gunnison River				
Tomichi Creek	Colorado	Tomichi Creek	I, F	1, 860, 000
Cochetopa Creek	do	Cochetopa Creek	I, F	1, 150, 000
Ohio Creek	do	Anthracite, Castle Creek	I, F	1, 080, 000
Lake Fork	do	Lake Fork	P, F	1, 300, 000
Sapinero	do	Gunnison River	P, F	7, 800, 000
Fruitland Mesa	do	Curecante, Sapinero Creeks	I, F	3, 500, 000
Smith Fork	do	Smith Fork	I, F	2, 200, 000
Paonia	do	East Muddy Creek and North Fork	I, F	1, 400, 000
Minnesota	do	Minnesota Creek	I, F	820, 000
Leroux Creek	do	Leroux Creek	I, F	2, 800, 000
Grand Mesa	do	Currant, Surface, and Tongue Creeks	I, F	1, 920, 000
Ouray	do	Uncompahgre River	P, I, F	4, 100, 000
Redlands	do	Gunnison River	I, F	367, 000
Colorado River between Gunnison and Green Rivers				
Saucer Valley	do	Disappointment Creek	I, F	940, 000
Nucla	do	Horsefly and Cottonwood Creeks	I, F	1, 500, 000
San Miguel	do	Anderson, Naturita, Dry Creek and San Miguel River.	I, F	6, 590, 000
West Paradox	do	West Paradox, Deep, and Geyser Creeks.	I, F	640, 000
Dewey	Utah	Colorado River	P, F, H, S	38, 000, 000
Moab	do	do	P, F, H, S	9, 900, 000
Pack Creek	do	Mill Creek	I, F	775, 000
Hatch Creek	do	Hatch Creek	I, F	400, 000
Total				138, 207, 000

[1] Symbols used: I=irrigation, P=power, F=flood control, S=silt retention, H=hold-over storage for river regulation, M=municipal supply.
[2] Preliminary estimates based on construction costs of Jan. 1, 1940.
[3] Half the water required for this project would be diverted from the Gunnison River by exchange.

TABLE XLIX.—*Potential reservoirs in the Grand division* [1]

Subdivision and name of site	Source of water supply	Project served	Total capacity (acre-feet)
Colorado River above Gunnison River			
Rabbit Ear	Troublesome Creek	Troublesome	7,500
East Troublesome	East Troublesome	do	9,000
Barbers Basin	Muddy Creek	Muddy Creek	7,000
Fourmile No. 4	Fourmile Creek	Fourmile	2,000
Missouri Heights enlargement	Cattle Creek	Cattle Creek	9,000
Rifle Gap	Rifle Creek	Silt	10,000
Haystack	Middle Willow Creek	West Divide	7,000
Owens Creek	Buzzard Creek	Hunter Mesa	10,000
Carr Creek	Carr Creek	Roan Creek	3,000
Vega	Plateau Creek	Collbran	24,000
Gunnison River			
Tomichi	Tomichi Creek	Tomichi	10,000
Banana Ranch	Cochetopa Creek	Cochetopa	5,500
McDonough	Los Pinos Creek	do	2,500
Lake Brennan enlargement	Anthracite Creek	Ohio Creek	3,000
Castle Creek	Castle Creek	do	6,000
Lake San Cristobal	Lake Fork River	Lake Fork	29,800
Sapinero	Gunnison River	Sapinero	200,000
Grand View	Smith Fork Creek	Smith Fork	15,000
Spring Creek	East Muddy Creek	Paonia	14,000
Beaver	Minnesota Creek	Minnesota	3,000
Castle	Leroux Creek	Leroux	10,000
Gorsuch	Surface, Tongue and Currant Creeks	Grand Mesa	12,600
Eggleston enlargement	Surface Creek	do	3,700
Ironton Park	Uncompahgre River	Ouray	21,900
Whitewater	Gunnison River	Cisco-Thompson	1,500,000
Colorado River between Gunnison and Green River			
Custer	Disappointment Creek	Saucer Valley	14,000
Finch	Horsefly Creek	Nucla	20,000
Cottonwood	Cottonwood Creek	do	5,000
Gurley enlargement	Anderson Creek	San Miguel	11,000
Miramonte	Naturita Creek	do	63,000
Stone Cabin	Dry Creek	do	12,000
Buckeye enlargement	Deep and Geyser Creeks	West Paradox	9,500
Dewey	Colorado River	Dewey	8,200,000
Moab	Colorado	Moab	183,000
Mill Creek	Mill Creek	Pack Creek	3,000
Coyote	Coyote	Hatch Creek	8,500
East Canyon	East Canyon Creek	do	2,500
McPhee [2]	Dolores River	Dolores	185,000
Total			10,641,400

[1] Does not include reservoirs for potential export diversions.

[2] Water diverted to San Juan Basin within Colorado River Basin.

TABLE L.—*Potential irrigation development in the Grand division*

Subdivision and project	State	Area to be benefited (acres)		
		New land	Furnished supplemental water	Total
Colorado River above Gunnison River				
Troublesome	Colorado	6,800	3,600	10,400
Muddy Creek	do	3,620	2,520	6,140
Fourmile	do	500	1,400	1,900
Cattle Creek	do	900	5,500	6,400
Capitol Creek	do	0	2,000	2,000
Woody Creek	do	0	2,000	2,000
Silt	do	1,100	5,200	6,300
West Divide	do	400	7,700	8,100
Hunter Mesa	do	4,700	2,300	7,900
Roan Creek	do	0	3,100	3,100
Collbran	do	7,100	18,900	26,000
Grand Valley extension	do	5,000	0	5,000
Cisco-Thompson	Colorado and Utah	87,000	0	87,000
Subtotal		117,120	54,220	171,340
Gunnison River				
Tomichi Creek	Colorado	3,100	8,300	11,400
Cochetopa Creek	do	3,900	4,700	8,600
Ohio Creek	do	3,470	11,300	14,770
Fruitland Mesa	do	7,650	9,590	17,240
Smith Fork	do	4,230	9,220	13,450
Paonia	do	2,000	12,700	14,700
Minnesota	do	200	2,600	2,800
Leroux Creek	do	3,900	0	3,900
Grand Mesa	do	5,200	18,200	23,400
Ouray	do	9,330	2,340	11,670
Redlands	do	1,600	0	1,600
Subtotal		44,580	78,950	123,530
Colorado River between Gunnison and Green River				
Saucer Valley	Colorado	5,000	1,300	6,300
Nucla	do	5,700	5,800	11,500
San Miguel	do	40,900	14,100	55,000
West Paradox	do	5,500	3,900	9,400
Pack Creek	Utah	1,200	1,950	3,150
Hatch Creek	do	4,000	0	4,000
Subtotal		62,300	27,050	89,350
Total		224,000	160,220	384,220

TABLE LI.—*Potential irrigation development in the Grand division by States*

State and subdivision	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total
Colorado			
Colorado River above Gunnison River	33,620	54,220	87,840
Gunnison River	44,580	78,950	123,530
Colorado River between Gunnison and Green Rivers	57,100	25,100	82,200
Subtotal	135,300	158,270	293,570
Utah			
Colorado River above Gunnison River	83,500	0	83,500
Colorado River between Gunnison and Green Rivers	5,200	1,950	7,150
Subtotal	88,700	1,950	90,650
Total	224,000	160,220	384,220

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TABLE LII.—*Potential power development in the Grand division*

River basin and project	State	Stream	Power plant installed capacity (kilowatts)	Annual firm generation (kilowatt-hours)
Colorado River				
Gore Canyon	Colorado	Colorado River	30, 000	177, 000, 000
Dewey	Utah	do	140, 000	797, 000, 000
Moab	do	do	60, 000	344, 000, 000
Gunnison River				
Lake Fork	Colorado	Lake Fork	6, 000	12, 000, 000
Sapinero	do	Gunnison River	18, 000	100, 000, 000
Ouray (3 plants)	do	Uncompahgre	16, 000	64, 000, 000
Cisco-Thompson	do	Gunnison	18, 000	100, 000, 000
Total			288, 000	1, 594, 000, 000

TABLE LIII.—*Potential diversions to the San Juan division*

Project	State served	Estimated average annual amount available for export (acre-feet)
Montezuma Valley extension	Colorado	38, 000
Dolores	Colorado and Utah.	[1] 120, 600
Blanding	Utah	1, 800
Total		160, 400

[1] Includes 6,000 acre-feet evaporation from McPhee Reservoir.

TABLE LIV.—*Potential export diversions from the Grand division* [1]

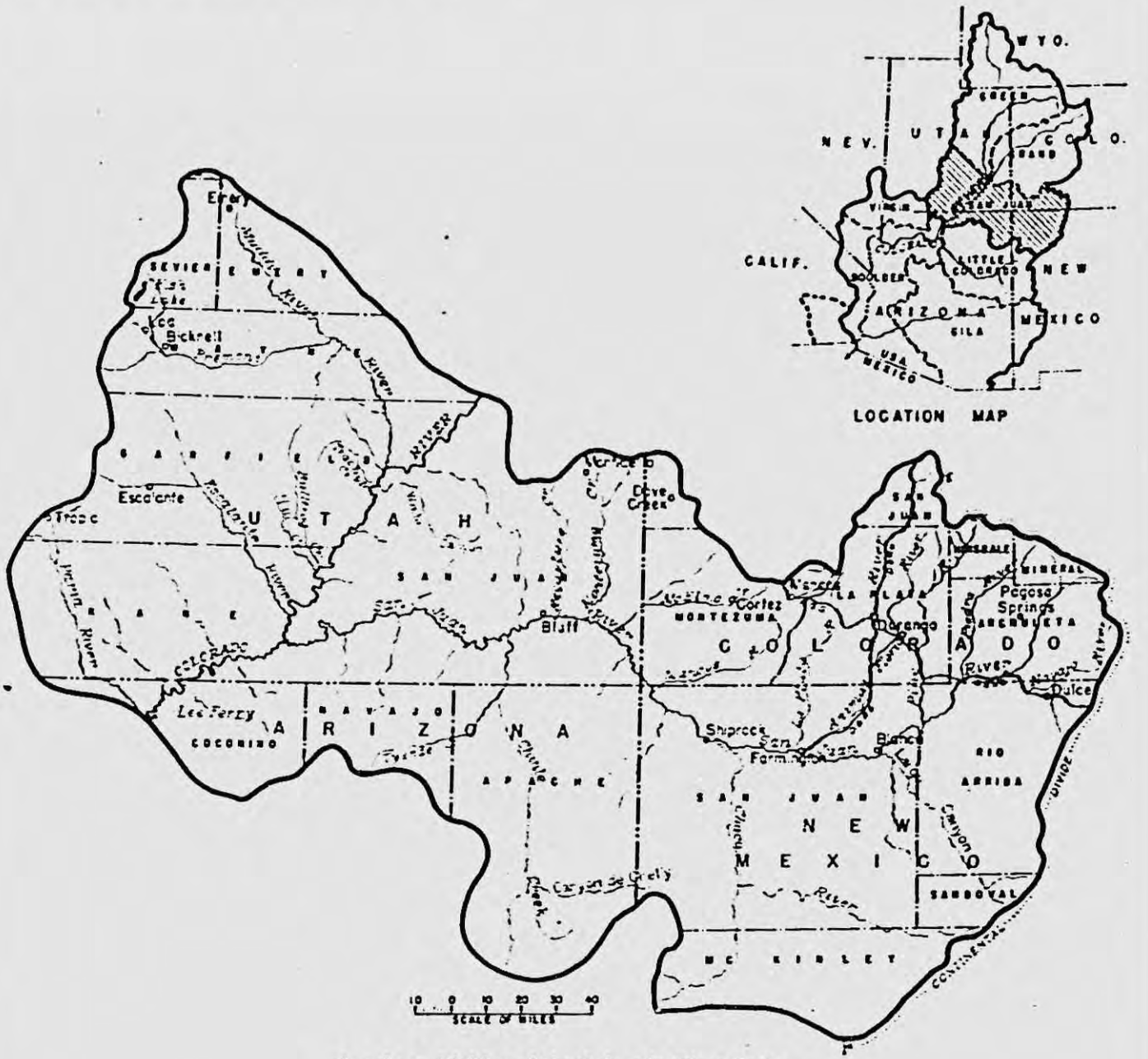
Exporting stream	Importing basin	Estimated average annual amount available for export (acre-feet)
Colorado River above Gunnison River	South Platte	500, 000
Do	Arkansas	139, 000
Gunnison River	do	840, 000
Do	Rio Grande	13, 000
Total		1, 492, 000

[1] For use in Colorado outside Colorado River Basin.

TABLE LV.—*Present and potential stream depletions in the Grand division*

State and subdivision	Estimated average annual depletion (acre-feet)				
	Present depletion		Potential increase		Total ultimate depletion
	Consumed in basin	Exported	Consumed in basin	Exported	
Colorado					
Colorado River above Gunnison River	[1] 409, 000	[2] 517, 000	72, 000	639, 000	1, 637, 000
Gunnison	[3] 367, 000	2, 300	104, 000	853, 000	1, 326, 300
Colorado River between Gunnison and Green Rivers	65, 000	[4] 108, 000	119, 000	[4] 136, 000	428, 000
Subtotal	841, 000	627, 300	295, 000	1, 628, 000	3, 391, 300
Utah					
Colorado River above Gunnison River	0	0	88, 000	0	88, 000
Gunnison River	0	0	88, 000	0	88, 000
Colorado River between Gunnison and Green Rivers	13, 000	0	10, 000	[4] 24, 400	47, 400
Subtotal	13, 000	0	186, 000	24, 400	223, 400
Total	854, 000	627, 300	481, 000	1, 652, 400	[5] 3, 614, 700

[1] Includes 33,000 acre-feet expected to be consumed through expansion of existing projects in Grand Valley.
[2] Includes 421,000 acre-feet expected to be exported through completion and expansion of existing projects.
[3] Includes 32,000 acre-feet expected to be consumed through expansion of the Uncompahgre project.
[4] Diverted to San Juan division within the Colorado River Basin.
[5] The Grand division will share also in the depletion of 500,000 acre-feet annually allowed for pasture irrigation in the Upper Basin.



San Juan Division of the Colorado River Basin

San Juan Division

Deeply entrenched in a plateau area the Colorado River meanders southwestward for 220 miles from the mouth of the Green River to Lee Ferry, an air-line distance of 130 miles. The main tributary to this section of the stream is the San Juan River, entering from the east about 80 miles upstream from Lee Ferry. Three small rivers, Fremont, Escalante, and Paria, designated as Western Tributaries, join the Colorado River from the west. The division is roughly rectangular in shape, averaging 300 miles long east and west, and 130 miles wide north and south. Its 39,000 square miles, an area almost as large as Ohio, are 43 percent in Utah, 25 percent in New Mexico, 17 percent in Arizona, and 15 percent in Colorado.

The division includes some mountainous areas where precipitation is heavy and vast stretches of desert plateau. Although it contains 35 percent of the land in the Upper Basin it contributes only 20 percent of the Colorado River flow at Lee Ferry.

Recorded flows of streams within the division for the long-time period of record and the critically dry decade (1931–40) appear in the following table:

TABLE LVI.—*Average annual stream flows in the San Juan division*

Station	Period of record	Average annual flow (acre-feet)	
		For period of record	For 1911–1940 period
San Juan River at Rosa, N. Mex.	1921–43	897,000	783,000
Pine River at Ignacio, Colo.	1911–43 [1]	271,000	184,000
San Juan River near Blanco, N. Mex.	1929–43	1,137,000	998,000
Animas River at Farmington, N. Mex.	1905–43 [1]	763,000	532,000
San Juan River at Farmington, N. Mex.	1905–43 [1]	2,000,000	1,623,000
San Juan River at Shiprock, N. Mex.	1917–43 [1]	2,100,000	1,745,000
San Juan River near Bluff, Utah	1916–43 [1]	2,140,000	1,659,000
Paria River at Lees Ferry, Ariz.	1924–43	26,000	25,000

[1] Records incomplete.

Streams originating in the mountains are almost the only source of water for present and potential developments within the division. They are fed mostly by melting snow and consequently the greater portion of the run-off is in the spring, usually during the months of May, June, and July. Stream flows decrease rapidly after the spring floods and usually are lowest during the latter part of July and in August. With few exceptions these low summer flows are now fully utilized and future irrigation expansion is largely dependent on storage of winter and flood season run-off.

Water in the mountain streams is of good quality and has been used for irrigation from 40 to 60 years. Little silt is carried by streams above the irrigated areas except after heavy rains. Below Blanco, N. Mex., the silt load of the San Juan River becomes heavy and is contributed mainly by intermittent tributaries draining the desert area to the south. Floods from summer cloudbursts discharge silt laden torrents into the San Juan River, which in turn delivers to the Colorado River a large portion of the silt that plagues downstream developments. In like manner, Fremont, Escalante, and Paria Rivers pick up silt from desert and badland areas during torrential rains.

PRESENT DEVELOPMENT OF WATER RESOURCES

The present development of water resources in the San Juan division has made possible the irrigation of 214,000 acres of land. Domestic, municipal, and stock-watering uses, although important, consume small quantities of water. Some water is used to generate power at five small hydroelectric plants, having combined installed capacities of 5,100 kilowatts, but is later reused downstream for irrigation.

San Juan River Basin.—Most sections of agricultural importance were once included in Indian reservations, and substantial areas are still under Indian control. United States, however, purchased 3 million acres from the Indians in 1873 and in 1899 opened to white settlers reservation lands unoccupied by Indians. Some Indian allotted lands have been purchased by individual whites.

Between 20,000 and 30,000 acres of Indian lands are now irrigated, the area varying with the seasonal water supply. These lands are widely scattered among numerous projects and are served by Government-built canals. Water storage capacity of 36,000 acre-feet is provided by seven of the larger Indian reservoirs built for use on Indian lands. Some Indian lands also receive water from the Vallecito Reservoir of the Pine River project, constructed by the Bureau of Reclamation.

Most white-owned irrigated lands in the San Juan Basin are reached by the hundreds of canals and ditches built by individual enterprise or group cooperation. The Montezuma Valley projects is the largest development. It brings natural flow from the Dolores River in the Grand division and storage from the 22,000 acre-foot Ground Hog Reservoir on that stream to 32,300 acres in the McElmo Creek drainage area of the San Juan Basin. The Narraguinnep Reservoir stores 9,300 acre-feet of water thus diverted near the irrigated land. Lost Canyon Creek, a tributary of the Dolores River, also provides water for 4,600 acres at the head of McElmo Creek, with storage provided in three small reservoirs.

In 1941 the Bureau of Reclamation substantially completed construction of Vallecito Dam to store 126,300 acre-feet of water on Pine River. The stored water is now being used in part to supplement natural flows on lands under existing canals. Full use will require the extension and rehabilitation of these canals to irrigate new lands. The Bureau is now building a dam on Jackson Gulch, supplied by a feeder-canal from West Mancos River, to provide reservoir capacity for storing 10,000 acre-feet of water to supplement the supply for 10,000 acres now irrigated from the Mancos River and tributaries, and for domestic use at Mesa Verde National Park.

Water resources have been developed to irrigate 184,000 acres in the San Juan River Basin as follows:

	Acres
San Juan River	18,250
Piedra River	4,000
Rio Blanco	1,150
Navajo River	2,000
Pine River	33,100
Florida River	13,800
Animas River	21,700
La Plata River	24,700
Mancos River	10,000
McElmo Creek	38,000
Montezuma, Recapture, and Cottonwood Creeks	7,300
Chinle Creek and Chaco River	10,000
Total	184,000

Except for the Pine River and McElmo Creek areas these lands usually suffer serious late-season water short-



VALLECITO DAM

Vallecito Dam on Pine River was completed by Bureau of Reclamation in 1941



VALLECITO RESERVOIR

Colorado's high San Juan Mountains provide a picturesque setting for Vallecito Reservoir

ages. The Mancos River area will be fully supplied upon completion of construction now under way.

Several small ditches divert annually an average of about 4,000 acre-feet of water from the San Juan River Basin to the Rio Grande Basin. Authorized for construction by the Bureau of Reclamation as a part of the San Luis Valley project is the Weminuche Pass diversion, whereby an open canal from the headwaters of Pine River will divert an average of 21,000 acre-feet annually into the Rio Grande Basin. Replacement storage will be required to protect future developments in the San Juan Basin.

The Western Colorado Power Co's. 4,500-kilowatt Tacoma plant located on the Animas River 20 miles above Durango generates most of the electric energy produced in the San Juan River Basin. Stream flow through the plant is regulated by the off-stream Electra Lake Reservoir of 21,000 acre-feet capacity, supplied from Cascade and Elbert Creeks. Three other hydroelectric plants in the basin have capacities totaling only 450 kilowatts.

Western Tributaries.—In this area about 30,000 acres are irrigated, of which 14,600 acres are served from Fremont River; 8,000 acres from Muddy River, a tributary of the Fremont; 4,400 acres from Escalante River; and 3,000 acres from Paria River. A minor diversion from the Sevier River in the Bonneville Basin to Paria River lands is the only importation of water into the Colorado River Basin. Nearly all canals, ditches, and reservoirs have been constructed by individual or community enterprise. The four largest reservoirs are on the Fremont River and have combined capacities of 14,400 acre-feet. Several smaller reservoirs are distributed throughout the area, but there is insufficient stored water to supply the late-season demands of most lands.

Hydroelectric power is generated at only one small plant in this area having an installed capacity of 150 kilowatts. This plant, supplemented by a small diesel installation, provides energy for the upper Fremont River area. Most other populated areas are served with electricity transmitted from adjoining regions.

Summary.—Present irrigation developments in the San Juan division are summarized in the following tables which show the larger reservoirs, irrigated areas, estimated consumption of water in the division, water imported into the division, and water exported from the division to adjacent basins.

Potential Development of Water Resources

Control and use of present surplus flows of the San Juan division and diversion of an average of 154,400 acre-feet annually from the Grand division could bring a full irrigation supply to 367,160 acres of arable dry land and supplemental water to 73,220 acres now inadequately irrigated. With an installed capacity of 965,000 kilowatts potential power plants in the division could produce 5,115,000,000 kilowatt-hours of firm energy annually. Most all developments would provide, in some degree, other benefits for flood and silt control, recreation, and propagation of fish and wildlife.

Potential transmountain diversions to the Sevier River and Rio Grande Basins would export annually an average

Table LVII.—*Reservoirs in the San Juan division* [1]

Subdivision and reservoir	Source of water supply	State	Capacity (acre-feet)
San Juan River Basin			
Vallecito	Pine River	Colorado	126,300
Electra Lake	Cascade and Elbert Creeks	do	21,000
Jackson Gulch [2]	West Fork Mancos River	do	10,000
Bauer Lake	Chicken Creek	do	1,070
Summit	Lost Canyon	do	4,800
Narraguinnep	Dolores River	do	9,300
Captain Tom [3]	Toadlena Wash	New Mexico	1,730
Choiska [3]	Choiska Wash	do	1,000
Juans Lake [3]	Kimenola Wash	do	5,000
Many Farms [3]	Chinle Wash	Arizona	25,000
Lower Rock Point [3]	do	do	1,000
Marsh Pass [3]	Laguna Creek	do	1,160
Wheatfields [3]	Wheatfields Creek	do	1,000
Western Tributaries			
Fish Lake	Fremont River	Utah	4,000
Johnson Valley	do	do	4,000
Forsythe	do	do	3,400
Spectacle Lake	Escalante River	do	1,250
Torgeson	Fremont River	do	3,000

[1] Includes only reservoirs with capacities of more than 1,000 acre-feet. All are irrigation reservoirs except Electra Lake which is used only for power.

[2] Under construction, Mancos project.

[3] Serves Indian lands.

TABLE LVIII.—*Present irrigated areas in the San Juan division by States*

Subdivision	Area irrigated (acres)				
	Arizona	Colorado	New Mexico	Utah	Total
San Juan Basin	6,000	132,300	38,000	7,700	184,000
Western Tributaries	0	0	0	30,000	30,000
Total	6,000	132,300	38,000	37,700	214,000

TABLE LIX.—*Estimated present average annual water consumption in the San Juan division*

Subdivision	Water consumption (acre-feet)				
	Arizona	Colorado	New Mexico	Utah	Total
San Juan Basin	10,200	238,000	68,400	13,400	330,000
Western Tributaries	0	0	0	54,000	54,000
Total	10,200	238,000	68,400	67,400	[1] 384,000

[1] Deduction of water imported from adjoining basins (See Table) reduces depletion of water originating in the San Juan division, exclusive of exports, to 272,000 acre-feet.

TABLE LX.—*Estimated present average annual water imports into the San Juan division*

State	Importing stream	Exporting stream	Acre-feet
Colorado	McElmo Creek	Dolores River	100,000
Do	do	Los Canyon Creek	8,000
Utah	Paria River	Sevier River	[1] 4,000
Total			112,000

[1] Only importation of water into Colorado River Basin.

TABLE LXI.—*Estimated present average annual water exports from the San Juan division*

State	Exporting stream	Importing stream	Acre-feet
Colorado	San Juan River, Piedra River, Pine River	Rio Grande	4,000
Colorado [1]	Pine River	do	21,000
Total			25,000

[1] Weminuche Pass diversion, authorized for construction as a part of the San Luis Valley project.

of 92,000 acre-feet for use in these adjoining areas. Additional exportations are alternatives to irrigation developments in the San Juan division.

San Juan River Basin

Twenty projects, 19 for basin development, and 1 for exportation of water to an adjacent basin are described in the San Juan River Basin. Three alternative export diversion developments are also outlined.

Dulce - Chama - Navajo Project. — A reservoir at the Navajo site on the Navajo River, two low diversion dams, two main canals, and a distribution system would be required to irrigate 15,900 acres of new land, including 3,700 acres along the Navajo and Little Navajo Rivers and in the Coyote Park area of Colorado and 12,200 acres in New Mexico extending from Dulce to and slightly across the low ridge which forms the Continental Divide west of Chama, N. Mex. Supplemental water also would be provided for 1,950 acres now irrigated with only a partial water supply. A reservoir with a capacity of 20,000 acre-feet at the Navajo site would be sufficient for this project but a greater capacity, probably 50,000 acre-feet, would be desirable for joint use with the South San Juan project or the alternative San Juan-Chama diversion project.

South San Juan Project.—South of San Juan River in New Mexico, extending southeast from Bloomfield to the Continental Divide near Cuba and westward from Largo Canyon to Chaco River, is a vast area of undeveloped and unclassified land, part of which is considered arable by local people. The land is high, ranging in elevation from 5,600 feet near the San Juan River to 8,000 feet at the Continental Divide. A reconnaissance indicates that irrigation water could best be supplied by a gravity diversion from headwaters of the San Juan River. The aqueduct would head on the West Fork of the San Juan River in Colorado, run southward to a point near the Continental Divide 15 miles west of Chama, N. Mex., continue southwest along the west slope of the Divide to a point near Cuba, and thence turn northwest onto project lands. The main aqueduct would be nearly 300 miles long. Storage reservoirs would be required on the West and East Forks of the San Juan River and on Rio Blanco and Navajo River. The development probably would be limited by the available water supply to 75,000 acres.

Carracas project.—This project would provide water for 840 acres of new land and 190 acres inadequately irrigated along the San Juan River between Gato (Pagoso Junction) and Arboles, Colo. Construction of a low diversion dam on the river and a canal to carry water to the land would be required.

O'Neal Park project.—The 5,820 acres of new land and 1,780 acres now partially irrigated, possible of development through construction of this project, are located in O'Neal Park and near the head of Stollsteimer Creek west of Pagosa Springs, Colo. A 32,200-acre-foot reservoir (13,600 acre-feet active capacity) at the offstream O'Neal Park site, supplied by a new canal from the Piedra River, and a distribution canal system would be required.

Hammond project.—Natural flow of the San Juan River could be diverted into a future canal at a low diversion dam to be constructed near Blanco, New Mexico, and used to irrigate a 3,700-acre strip of arable dry land on

the south side of the river near Bloomfield, New Mexico.

Shiprock project.—A compact area of arable land, comprising 70,000 acres, is located within the Navajo Indian Reservation south of Shiprock, N. Mex., and west of Chaco River. Irrigation of these lands would require a 125,000 acre-foot reservoir (100,000 acre-feet active capacity) at the Arboles site on the San Juan River near the Colorado-New Mexico State line, a diversion dam near Blanco, and a gravity conduit extending 75 miles to the land. A pump lift of 100 feet would be needed to irrigate part of the land above the conduit.

Emerald Lake project.—On the Pine River, a tributary of the San Juan River, is a power site in the San Juan mountains 25 miles northeast of Durango, Colo. Two natural lakes, Emerald and Divide, could be used as reservoirs by the construction of a dam at the outlet of each. With a combination of collection conduits, three short tunnels, a siphon, and penstock the flow would be available for power production under a static head of 1,973 feet. A power plant with an installed capacity of 15,000 kilowatts could produce 72 million kilowatt-hours of firm energy annually. The development would be multiple purpose for power production and flood control.

Pine River project extension.—Surplus flows of Pine River and its tributaries, supplemented by storage from the existing Vallecito Reservoir, could be used to irrigate 15,100 acres of new land owned by both Indians and whites and would provide supplemental water to 1,200 acres now irrigated. Ten thousand acres of this land are located west and southwest of Ignacio, Colo. To serve this area construction of a diversion dam at the head of the existing King Consolidated Canal, north of Bayfield, Colo., and enlargement and extension of that canal would be required. The remaining 5,100 acres are in small tracts scattered throughout irrigated lands in the vicinity of Bayfield, Ignacio, and Arboles, Colo. Rehabilitation and extension of 10 existing canals would be necessary to irrigate these lands.

Florida project.—Along the Florida River and on adjoining mesas in the vicinity of Durango, Colo., are 6,300 acres of new land and 13,800 acres of irrigated land with only a partial water supply. Additional water for full irrigation of these lands could be provided by construction of a dam to store 23,300 acre-feet at the Lemon site on the Florida River and enlargement and extension of existing distribution canals.

Animas-La Plata project.—Supplemental water for 24,700 acres of insufficiently irrigated land in the La Plata River Basin and a full supply for 86,300 acres of new land in that basin and adjacent areas, including 25,500 acres under the Monument Rock project on the Navajo Indian Reservation, could be furnished by this project. In addition power could be produced and flood damage would be mitigated. Nine reservoirs would be needed, three of which would be primarily for power production.

A collection aqueduct could bring the flows of Mineral Creek and Cement Creek to the Howardsville Reservoir (54,000 acre-feet capacity) on Animas River which would be connected by a pressure conduit to a 12,000-kilowatt power plant downstream at Silverton, Colo., operating under a static head of 542 feet. Farther downstream on the Animas River between Sultan Creek and Whitehead Gulch is the Silverton Reservoir site (28,000 acre-feet capacity). From this reservoir, water could be released through a tunnel to Lime Creek, where a reservoir (30,000 acre-feet capacity) could be provided to receive this regulated flow plus unregulated inflows from Cascade Creek through a collection conduit and tunnel. From Lime Creek a short tunnel through West Needle Mountain would lead to a power plant on the Animas River where the static head would be 1,155 feet and the installed capacity 40,000 kilowatts.

The two power plants in this development would have installed generating capacities aggregating 52,000 kilowatts and annual firm production of 192 million kilowatt hours. A reconnaissance survey of other tributaries of the San Juan River would probably reveal additional power sites.

The Teft Reservoir (140,000 acre-feet capacity) on the Animas River, 20 miles north of Durango, would collect water released in the winter from the three power reservoirs. Heading at the Teft Reservoir, the main project canal would continue on the west side of the Animas River intercepting flows of Hermosa, Junction, and Lightner Creeks and storage releases from the Hermosa Park Reservoir (25,000 acre-feet capacity) on Hermosa Creek. The canal would cross the Animas-La Plata Divide northeast of Fort Lewis College and extend across the La Plata River Valley to the Dry Side area, serving lands along its course. It would continue thence southwest along the Mancos-La Plata Divide to the head of Salt Creek, which creek in turn would supply the Monument Rocks Reservoir (19,800 acre-feet capacity) and project lands below it, located north of Shiprock. Long Hollow Reservoir (14,000 acre-feet capacity), 12 miles southwest of Durango, would be connected with the La Plata River by inlet and outlet canals. Another canal diverting from Long Hollow Creek would irrigate the McDermott-Farmington Glade area near the Colorado-New Mexico State line. State Line Reservoir (32,000 acre-feet capacity), astride the State line on La Plata River, would serve valley lands and regulate flows into an outlet canal extending southwest to the Meadows Reservoir (11,400 acre-feet capacity) and to lands in the Meadows area.

McElmo project.—A reservoir of 3,000 acre-feet capacity on Mud Creek would provide adequate water to supplement the supply and improve the quality of water for 1,000 acres of irrigated land in McElmo Canyon, Colo.

Montezuma Valley project extension.—Water from Dolores River in the Grand division now irrigates 30,000 acres of land in Montezuma Valley in the San Juan River Basin. Storage to supplement natural flow is provided at the Ground Hog Reservoir on the headwaters of Dolores River and at the offstream Narraguinnep Reservoir in the San Juan Basin. Expansion of the project to include another 10,000 acres would be possible by enlargement of the Narraguinnep Reservoir to store 5,700 acre-feet in addition to its present 9,300 acre-feet, creation of 8,000 acre-feet of storage at Totten Lake, also in the San Juan Basin, and extension of distribution canals.

Dolores project.—A storage reservoir of 185,000 acre-feet capacity (100,000 acre-feet active capacity) at the McPhee site on the Dolores River in the Grand division about 10 miles below Dolores, Colo., and a canal, leading from that reservoir and crossing the divide into the San Juan Basin by means of a 4,400-foot tunnel, could provide water for 40,000 acres of arable land located in the Dove Creek area. About 32,500 acres are in Colorado and 7,500 acres are in Utah.

Blanding project.—Thirty-eight hundred acres of land on the mesa between Recapture and Cottonwood Creeks in the vicinity of Blanding, Utah, are partially irrigated from direct flows of Recapture Creek. The diversion of water from Indian Creek, a tributary to the Colorado River in the Grand division, and a storage reservoir on Recapture Creek would provide supplemental water to these lands. A collection ditch on the headwaters of Indian Creek, a mile-long tunnel to Recapture Creek, and a 1,000-acre-foot reservoir on Recapture Creek about 6 miles north of Blanding would be required. Construction of the tunnel has been started by local interests.

Navajo Indian projects.—The Office of Indian Affairs has outlined 57 small potential projects in the San Juan Basin to benefit lands in the Navajo Indian Reservation. Five are located in the Red Wash drainage area, 21 in Chaco River Basin, 21 in the Chinle Creek area, 4 along the San Juan River, and 6 in miscellaneous drainage areas. The developments involve the construction of additional canals and offstream reservoirs to store flash flows. By means of these projects supplemental water would be provided for 14,600 acres now irrigated and a full irrigation supply would be furnished to 34,200 acres of new land.

Bluff project.—In the canyon of the lower San Juan River is the Bluff dam site near Comb Wash, 13 miles below Bluff, Utah, at a river elevation of 4,135 feet above sea level. A reservoir capacity of 3,000,000 acre-feet would require construction of a dam to raise the water surface to an elevation of 4,475 feet. A power plant with an installed capacity of 52,000 kilowatts could produce 289 million kilowatt-hours of firm energy annually. The reservoir also would have value for flood control and silt retention.

Goosenecks project.—At a point on the San Juan River 43 miles below Bluff, Utah, at a river elevation of 3,958 feet is the Goosenecks site. A dam to raise the water surface to an elevation of 4,135 feet would provide a reservoir with storage capacity of 500,000 acre-feet. The power plant installed capacity would be 30,000 kilowatts and the annual firm production 152 million kilowatt-hours.

Slick Horn Canyon project.—Named Slick Horn because of the seepage from oil sands that coats the water and canyon walls, this reservoir site is on the San Juan River 70 miles below Bluff, Utah, at river elevation of 3,750 feet. Here a dam could be constructed to raise the water to a maximum elevation of 3,958 feet and form a reservoir with storage capacity of 300,000 acre-feet. The capacity of the power plant would be 30,000 kilowatts and the annual firm production 176 million kilowatt-hours.

Great Bend project.—Thirty miles above the mouth of the San Juan River is the Great Bend reservoir site at elevation 3,498 feet. Backwater from the potential Glen Canyon Dam would flood the site to a maximum reservoir elevation of 3,528 feet. However, much of the time this site would not be flooded as the average Glen Canyon Reservoir elevation would be only 3,461 feet. The Great Bend Dam would raise the reservoir water surface to an elevation of 3,750 feet forming a reservoir with a capacity of 1,000,000 acre-feet. A power plant with an installed capacity of 36,000 kilowatts could produce 203 million kilowatt-hours of firm energy annually. Below this site the San Juan River empties into the colorado River 78 miles above Lee Ferry, Ariz.

Piedra-Rio Grande diversion project.—Two reservoirs in the Piedra River Basin and a tunnel through the Continental Divide would be required to export an average of 85,000 acre-feet of water annually from the Piedra River to the Rio Grande Basin. Replacement storage reservoirs would be necessary to provide water for future developments in the San Juan Basin.

Alternative plans.—Three projects for exportation of waters of the San Juan Basin are possible but allocation of water to them would restrict supplies for some of the other developments outlined for use of water within the basin. For this reason these projects are presented as alternative possibilities but are excluded from the tables summarizing potential basin developments. However, detailed investigations may show construction of some of these to be desirable.

The Animas-Rio Grande diversion project could export annually an average of 130,000 acre-feet of water from the Animas River watershed above Silverton, Colo., to the Rio Grande Basin. Fourteen miles of collecting canal leading to a reservoir of 54,000 acre-feet capacity on the Animas River at Howardsville, Colo., and a 13-mile tunnel through the Continental Divide would be re-

quired. There is insufficient water for both this project and the Animas-La Plata project as outlined.

San Juan-Chama diversion project could export 300,000 acre-feet of water annually from headwaters of the San Juan River to the Rio Grande Basin. Reservoirs would be provided on the east and west forks of the San Juan River, and on the Rio Blanco and Navajo River. An aqueduct would collect the water and convey it through the Continental Divide to the head of the Rio Chama, a tributary of the Rio Grande. Benefits from use of this water need not be limited to downstream water users in the Rio Grande Basin in New Mexico, but users in the San Luis Valley of Colorado could also benefit by exchange. As in other potential trans-mountain diversions, replacement storage would be required to compensate San Juan Basin interests. This project would utilize the same water supply as would the South San Juan project, consequently both could not be constructed.

San Juan-South Fork diversion project could export annually an average of 53,000 acre-feet of water from the headwaters of the San Juan River above Pagosa Springs, Colo., ot the south fork of the Rio Grande. The diversion system would consist of a feeder canal 2.6 miles long from the west fork of the San Juan River to Beaver Creek, and a tunnel 10 miles long from Beaver Creek to the south fork of the Rio Grande, with a 1-mile branch tunnel intercepting the flow of Wolf Creek. Water available to the South San Juan project or the San Juan-Chama diversion project would be depleted by the amount diverted to the south fork of the Rio Grande.

Western Tributaries

Three projects for further irrigation development in these stream basins and one for export of water to the adjoining Bonneville Basin are outlined.

Fremont project.—A supplemental water supply for 9,000 acres of irrigated land and a full supply for 1,000 acres of new land located in the vicinity of the towns of Fremont, Loa, Lyman, and Bicknell would be provided by a 4,000-acre-foot reservoir on Fremont River at the Mill Meadows site, 4 miles northeast of Fremont, and a 2,000-acre-foot reservoir on Road Creek, a tributary of Fremont River near Loa.

Torrey project.—A 2,000-acre-foot reservoir at the Torrey site on Fremont River would by exchange furnish supplemental water to 1,200 acres in the vicinity of Torrey, Utah. The reservoir water would be released to downstream lands in exchange for increased upstream diversions to the existing Torrey Canal.

Escalante project. An impounding dam on Escalante River near Escalante, Utah, could provide 25,000 acre-feet of storage capacity (18,000 acre-feet active capacity). With a feeder canal to the reservoir from Pine Creek and an outlet canal cut through a natural embankment on the south side of the reservoir, a full irrigation supply could be furnished 3,000 acres southeast of the town.

Muddy Creek Diversion project.—Lack of storage sites on Muddy Creek to regulate water for downstream use suggests the possibility of exporting surplus flows of that stream west to the Bonneville Basin. By construction of 11 miles of feeder canal and a 2.2-mile tunnel through the mountain divide, an average of 7,000 acre-feet annually could be exported to Twelvemile Creek, a tributary of the Sevier River.

Main stream of Colorado River

Two prospective sites for power developments are located on the main stream of the Colorado River below Green River and above Lee Ferry and therefore are in the San Juan division.

Dark Canyon project.—This dam site on the Colorado River in Utah is 186 miles by river above Lee Ferry, Ariz., and 74 miles by road and trail southeast of Hanksville, Utah. Much of this region is unexplored. The Dark Canyon site has been photographed from the air by the National Park Service and surveyed and photographed by the Geological Survey.

A dam raising the water surface 432 feet from the present river elevation of 3,528 feet up to 3,960 feet would provide a reservoir storage capacity of 1,400,000 acre-feet of which 1,100,000 acre-feet would be active. The reservoir, confined between canyon walls would extend up the Colorado River to the Moab Dam site and up the Green River almost to Green River, Utah. A power plant at the dam with an installed capacity of 350,000 kilowatts could generate 1.8 billion kilowatt-hours of firm energy annually. The project would also have value for silt retention, flood control, recreation and, hold-over storage to satisfy flow requirements of the Colorado River Compact at Lee Ferry.

Glen Canyon project.—A few miles south of the Utah-Arizona State line and 4 miles up the Colorado River from Lee Ferry, Ariz., is the Glen Canyon site at river elevation 3,127 feet. A dam to raise the water surface 401 feet would provide a reservoir of 8,600,000 acre-feet capacity with active storage of 6,300,000 acre-feet. The power plant installed capacity would be 400,000 kilowatts and the annual firm production 2.2 billion kilowatt-hours. The lake would extend 182 miles up the Colorado River to the Dark Canyon dam site and up the San Juan River 30 miles to the Great Bend site. Only 10 miles from highway U. S. 89, this lake would have unusual recreational possibilities. The reservoir would also be useful for silt retention, hold-over storage, and flood control.

An alternative plan would place a higher dam at the Glen Canyon site to raise the water 605 feet above the

present streambed. This would create a reservoir of 34,000,000 acre-feet capacity (larger than Lake Mead, 32,360,000 acre-feet capacity) of which 29,000,000 acre-feet would be active capacity. In addition to having value for flood control and silt retention, the reservoir would have tremendous hold-over capacity to assist the upper basin in delivering water at Lee Ferry as required by the Colorado River Compact. A 580,000-kilowatt power plant installed at the dam could generate an average of 3.3 billion kilowatt-hours annually. When full, the reservoir would inundate the Great Bend dam site on the San Juan River, precluding construction at that location, and extend to within 18 feet of the elevation of the Slick Horn Canyon site farther upstream. The Dark Canyon dam site on the Colorado River would be submerged under 204 feet of water. With the potential Dark Canyon development thus eliminated it would be necessary to find other means of developing the 215 feet of head between Moab, Utah, and the Glen Canyon Reservoir.

Summary

Potentialities for the development of water resources of the San Juan division are summarized in the following tables:

TABLE LXII.—*Potential projects in the San Juan division*

Subdivision and project	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [2]
San Juan Basin				
Dulce-Chama-Navajo	Colorado	Navajo River	I, F	$1, 627, 000
South San Juan	New Mexico	San Juan River	I, F	35, 000, 000
Carracas	Colorado	do	I	36, 000
O'Neal Park	do	Piedra River	I	880, 000
Hammond	New Mexico	San Juan River	I	725, 000
Shiprock	do	do	I, F	21, 141, 00
Emerald Lake	Colorado	Pine River	P, F	6, 200, 000
Pine River extension	Colorado, New Mexico.	do	I	1, 835, 000
Florida	Colorado	Florida River	I, F	2, 290, 000
Animas-La Plata	Colorado, New Mexico.	Animas and La Plata River	I, P, F, S	63, 534 000
McElmo	Colorado	McElmo Creek	I, F	390, 000
Montezuma Valley extension	do	Dolores River	I, F	1, 300, 000
Dolores	Colorado, Utah	do	I, F, S	12, 200, 000
Blanding	Utah	Recapture Creek	I, F	567, 000
Navajo Indian projects	Colorado	San Juan River	I, F, S	2, 910, 000
Bluff	Utah	do	P, F, S, H	19, 000, 000
Goosenecks	do	do	P, S, F, H	5, 200, 000
Slick Horn Canyon	do	do	P, S, F, H	6, 300, 000
Great Bend	do	do	P, S, F, H	10, 000, 000
Western tributaries				
Fremont	do	Fremont River	I, F	800, 000
Torrey	do	do	I, F	200, 000
Escalante	do	Escalante River	I, F	900, 000
Main stream Colorado River				
Dark Canyon	do	Colorado River	P, F, S, H	105, 000, 000
Glen Canyon	Arizona	do	P, F, S, H	64, 000, 000
Total				362, 035, 000

[1] Symbols used: I=irrigation; P=power; F=flood control; S=silt retention; H=hold-over storage for river regulation.
[2] Preliminary estimates based on construction costs of Jan. 1, 1940.

TABLE LXIII.—*Potential reservoirs in the San Juan division*

Subdivision and name of site	Source of water supply	Project served	Total capacity (acre-feet)
San Juan Basin			
Navajo	Navajo River	Dulce-Chama-Navajo and South San Juan.	50, 000
West Fork	West Fork San Juan River	South San Juan	70, 000
East Fork	East Fork San Juan River	do	35, 000
Blanco	Rio Blanco	do	15, 000
O'Neal Park [1]	Piedra River	O'Neal Park	32, 200
Arboles	San Juan River	Shiprock	125, 000
Emerald Lake	Pine River	Emerald Lake	6, 000
Divide Lake	do	do	21, 000
Lemon	Florida River	Florida	23, 300
Howardsville	Animas River	Animas-La Plata	54, 000
Silverton	do	do	28, 000
Lime Creek	do	do	30, 000
Teft	do	do	140, 000
Hermosa Park	Hermosa Creek	do	25, 000
Long Hollow [1]	La Plata River	do	14, 000
State Line	do	do	32, 000
Meadows [1]	La Plata and Animas Rivers	do	11, 400
Monument Rocks [1]	do	do	19, 800
Totten Lake [1]	Dolores River	Montezuma Valley extension	8, 000
Narraguinnep Enlargement [1]	do	do	15, 000
McElmo	McElmo Creek	McElmo	3, 000
McPhee	Dolores River	Dolores	185, 000
Recapture	Recapture Creek	Blanding	1, 000
Bluff	San Juan River	Bluff	3, 000, 000
Goosenecks	do	Goosenecks	500, 000
Slick Horn Canyon	do	Slick Horn Canyon	300, 000
Great Bend	do	Great Bend	1, 000, 000
Western tributaries			
Mill Meadows	Fremont River	Fremont	4, 000
Road Creek	Road Creek	do	2, 000
Torrey	Fremont River	Torrey	2, 000
Escalante	Escalante River	Escalante	25, 000
Main stream Colorado River			
Dark Canyon	Colorado River	Dark Canyon	1, 400, 000
Glen Canyon	do	Glen Canyon	8, 600, 000
Total			15, 776, 700

[1] Offstream.

TABLE LXIV.—*Potential irrigation development in the San Juan division*

Subdivision and project	State	Area to be benefited (acres)		
		New land	Furnished supplemental water	Total
San Juan Basin				
Dulce-Chama-Navajo	Colorado, New Mexico	15, 900	1, 950	17, 850
South San Juan	New Mexico	75, 000		75, 000
Carracas	Colorado	840	190	1, 030
O'Neal Park	do	5, 820	1, 780	7, 600
Hammond	New Mexico	3, 700		3, 700
Shiprock	do	70, 000		70, 000
Pine River extension	Colorado, New Mexico	15, 100	1, 200	16, 300
Florida	do	6, 300	13, 800	20, 100
Animas-La Plata	Colorado, New Mexico	86, 300	24, 700	111, 000
McElmo	Colorado		1, 000	1, 000
Montezuma Valley extension	do	10, 000		10, 000
Dolores	Colorado, Utah	40, 000		40, 000
Blanding	Utah		3, 800	3, 800
Navajo Indian projects	Colorado	34, 200	14, 600	48, 800
Subtotal		363, 160	63, 020	426, 180
Western tributaries				
Fremont	Utah	1, 000	9, 000	10, 000
Torrey	do		1, 200	1, 200
Escalante	do	3, 000		3, 000
Subtotal		4, 000	10, 200	14, 200
Total		367, 160	73, 220	440, 380

TABLE LXV.—*Potential irrigation development in the San Juan division by States*

State	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total
Arizona: San Juan River Basin	18,680	6,000	24,680
Colorado: San Juan River Basin	110,960	37,920	148,880
New Mexico: San Juan River Basin	224,960	15,100	240,060
Utah:			
San Juan River Basin	8,560	4,000	12,560
Western tributaries	4,000	10,200	14,200
Subtotal	12,560	14,200	26,760
Total	367,160	73,220	440,380

TABLE LXVI.—*Potential power development in the San Juan division*

Subdivision and project	State	River	Installed capacity (kilowatts)	Annual firm generation (kilowatt hours)
San Juan River				
Emerald Lake	Colorado	Pine	15,000	72,000,000
Animas-La Plata (2 plants)	do	Animas	52,000	192,000,000
Bluff	Utah	San Juan	52,000	289,000,000
Goosenecks	do	do	30,000	152,000,000
Slick Horn Canyon	do	do	30,000	176,000,000
Great Bend	do	do	36,000	203,000,000
Colorado River				
Dark Canyon	do	Colorado	350,000	1,843,000,000
Glen Canyon	Arizona	do	400,000	2,188,000,000
Total			965,000	5,115,000,000

TABLE LXVII.—*Potential import diversions to the San Juan division* [1]

Subdivision and project	State served	Estimated average annual diversion (acre-feet)	Estimated construction cost [2]
San Juan River Basin			
Montezuma Valley extension	Colorado	38,000	$1,300,000
Dolores	Colorado, Utah	[3] 114,600	12,200,000
Blanding	Utah	1,800	567,000
Total		[3] 154,400	14,067,000

[1] All potential diversions are from the Grand division in the Colorado River Basin.
[2] Includes cost of works in exporting basin. Preliminary estimates based on construction costs of Jan. 1, 1960.
[3] Exclusive of 6,000 acre-feet evaporation from McPhee Reservoir.

TABLE LXVIII.—*Potential export diversions from the San Juan division*

Subdivision and project	State served	Estimated average annual diversion (acre-feet)
San Juan Basin		
Piedra-Rio Grande	Colorado	85,000
San Juan-Chama	North Mexico, Colorado	[1] 300,000
San Juan-South Fork	Colorado	[1] 53,000
Animas-Rio Grande	do	[1] 130,000
Western tributaries		
Muddy Creek	Utah	7,000
Total		92,000

[1] Alternative projects excluded from estimates of potential stream depletions in San Juan division.

TABLE LXIX.—*Present and potential stream depletions in the San Juan division* [1]

State and subdivision	Estimated average annual depletion (acre-feet)				
	Present depletion		Potential increase		Total ultimate depletion
	Water consumed	Water exported [2]	Water consumed	Water exported	
Arizona					
San Juan Basin	10, 200	.....	39, 000	.....	49, 200
Colorado					
San Juan Basin	238, 000	[3] 25, 000	251, 000	85, 000	599, 000
New Mexico					
San Juan Basin	68, 400	.....	450, 000	.....	518, 400
Utah					
San Juan Basin	13, 400	.....	19, 000	.....	32, 400
Western tributaries	[4] 50, 000	.....	11, 000	7, 000	[4] 68, 000
Subtotal (Utah)	63, 400	.....	30, 000	7, 000	[4] 100, 400
Total	380, 000	25, 000	770, 000	92, 000	[4] 1, 267, 000

[1] Includes depletions of water originating in the San Juan division, also water imported from the Grand division in the following quantities: Colorado, 168,000 acre-feet, present, and 136,000 acre-feet, potential; Utah, 24,400 acre-feet, potential (San Juan). Excluding imported water San Juan division depletions are, present, 297,000 acre-feet, potential, 701,600 acre-feet; total ultimate, 998,000 acre-feet.

[2] Includes 21,000 acre-feet expected to be exported via Weminuche Pass as a part of the San Luis Valley project.

[3] Does not include depletion of 4,000 acre-feet of water imported from Bonneville Basin.

[4] The San Juan division will share also in the depleting of 500,000 acre-feet annually allowed for pasture irrigation in the upper basin.

Summary—Upper Basin

Present irrigation developments and stream depletions in the upper basin are summarized by States in the tables which follow. Summaries of potential developments with estimated costs based on 1940 prices and potential stream depletions also are shown.

Table LXXIII shows that with full development of existing and potential projects the ultimate average reduction from virgin stream flow at Lee Ferry would exceed 9 million acre-feet. In estimating this probable depletion alternative projects which would compete directly for a water supply with other projects were excluded. However, in a sense, all of the projects are competitive to the extent that the total demand for water exceeds the Colorado River Compact allocation to the upper basin.

Since water-supply studies are based on average flows during the period 1897–1943, wide annual fluctuations from the averages in both natural flows and depletions may be expected. In years of short water supply both basin use and exportations will be limited of necessity to available natural flows except as hold-over storage has been provided. In years when natural flows are abundant, greater quantities will be used and exported and hold-over reservoirs will be filled. The larger main-stem reservoirs provided chiefly for power will be operated on a long-time hold-over basis, being filled during a succession of wet years and emptied to provide firm power and to satisfy compact requirements for water at Lee Ferry during dry periods, such as the 1931–40 decade.

Upstream depletions either from basin use or exportation will affect the amount of water available for the generation of power. The total permissible depletion in the upper basin, however, is subject to limitations of the Colorado River Compact. Estimates of potential power output were made on the basis that enough water would be allowed to flow through the power plants and on to the lower basin to satisfy requirements of the Colorado River Compact and the pending treaty with Mexico. On any particular tributary, power potentialities may be greater or less than estimated, depending on the extent to which upstream water-consuming projects are developed.

TABLE LXX.—*Present irrigated areas in the upper basin*

Division	Acres irrigated					
	Arizona	Colorado	New Mexico	Utah	Wyoming	Total
Green	.....	105, 870	.....	229, 120	[1] 247, 540	[1] 582, 530
Grand	.....	[2] 564, 670	.....	8, 000	.....	[2] 572, 670
San Juan	6, 000	132, 300	38, 000	37, 700	.....	214, 000
Total	6, 000	[2] 802, 840	38, 000	274, 820	[1] 247, 540	1, 369, 200

[1] Includes 11,170 acres of new land in Eden project, authorized for construction.

[2] Includes 32,670 acres irrigable under existing projects.

TABLE LXXI.—*Present hydroelectric generating capacity in the upper basin*

Division	Present installed capacity (kilowatts)					
	Arizona	Colorado	New Mexico	Utah	Wyoming	Total
Green		200		2,050	150	2,400
Grand		49,667		50		49,717
San Juan		4,650	280	170		5,100
Total		54,517	280	2,270	150	57,217

TABLE LXXII.—*Potential development of water resources in the upper basin* [1]

State and division	Acres to be irrigated		Power plants		Estimated construction cost [2]
	New land	Furnished supplemental water	Installed capacity (kilowatts)	Annual firm generation (kilowatt-hours)	
Arizona: San Juan	18,680	6,000	400,000	2,188,000,000	$65,628,000
Colorado:					
Green	197,800	30,360	170,500	944,000,000	96,300,000
Grand	135,300	158,270	88,000	453,000,000	57,232,000
San Juan	110,960	37,920	67,000	264,000,000	69,227,000
Subtotal	444,060	226,550	325,500	1,661,000,000	222,759,000
New Mexico: San Juan	224,960	15,100	0	0	76,882,000
Utah:					
Green	150,520	145,010	288,000	1,579,000,000	116,500,000
Grand	88,700	1,950	200,000	1,141,000,000	80,975,000
San Juan	12,560	14,200	498,000	2,663,000,000	150,298,000
Subtotal	251,780	161,160	986,000	5,383,000,000	347,773,000
Wyoming: Green	291,330	95,360	1,500	9,000,000	47,100,000
Transmission grid					170,000,000
Total	1,230,810	504,170	1,713,000	9,241,000,000	930,142,000

[1] In addition to irrigation and power production, many potential reservoirs would have value for flood control, silt retention, recreation, fish and wildlife conservation, and provide hold-over storage for river regulation.

[2] Preliminary estimates based on construction costs of Jan. 1, 1940. For interstate projects irrigation costs are prorated to States on basis of area irrigated; power costs are allocated to States in which power plants will be located. Does not include costs for potential export diversions.

TABLE LXXIII.—*Present and potential stream depletion in upper basin*

State and division	Estimated average annual depletion (acre-feet)						
	Existing or authorized projects				Potential projects		Total ultimate depletion
	Present depletion		Future increase		Consumed in basin	Exported	
	Consumed in basin	Exported	Consumed in basin	Exported			
Arizona: San Juan	10,200	0	0	0	39,000	0	49,200
Colorado:							
Green	115,000	0	0	0	324,000	[1] 75,000	514,000
Grand	776,000	98,300	65,000	421,000	295,000	1,492,000	3,147,300
San Juan	238,000	4,000	0	21,000	251,000	85,000	599,000
Subtotal	1,129,000	102,300	65,000	442,000	870,000	1,652,000	4,260,300
New Mexico: San Juan	68,400	0	0	0	450,000	0	518,400
Utah:							
Green	358,000	81,500	0	32,000	264,000	975,700	1,711,200
Grand	13,000	0	0	0	186,000	0	199,000
San Juan	63,400	0	0	0	30,000	7,000	100,400
Subtotal	434,400	81,500	0	32,000	480,000	982,700	2,010,600
Wyoming: Green	374,000	0	17,000	0	489,000	87,000	967,000
Evaporation from power reservoirs					831,000		831,000
Reserved for pasture irrigation					500,000		500,000
Total	2,016,000	183,800	82,000	474,000	3,659,000	2,721,700 [1]	9,136,500

[1] Return flow usable in Wyoming.

LOWER BASIN

The Lower Colorado Basin, embracing an area of 121,500 square miles, is twice as large as the six New England States combined. It is slightly larger tha nthe upper basin, on which it is dependent for most of its water supply. With its vast areas of fertile lands and excellent growing climate, the lower basin's demands for water greatly exceed available water resources.

The term "lower basin" is here used to refer not only to areas downstream from Lee Ferry which drain into the Colorado, but also to the drainage basin of the Salton Sea, including Imperial and Coachella Valleys. Diversions to this area are treated as exportations, since from them no water can return to the parent stream.

Present export diversions from the lower basin are made only in California and amount to approximately 2,500,000 acre-feet or more than half of the present depletion of the entire river system below Lee Ferry. Full development under existing or authorized exportation projects, all in California, would more than double present exports. Aside from this possible expansion, only one potential project is described which would take water out of the Colorado River Basin. It involves a diversion of 112,000 acre-feet for municipal use by the city of San Diego.

Water of the Colorado River system is now irrigating 1,351,100 acres in the lower basin which is comparable to the present irrigated area in the upper basin. Full expansion under recently constructed works will increase the irrigated area by 509,000 acres. Potential projects are described in this chapter which, if constructed, would bring water to an additional 303,150 acres and supplement present supplies for 618,100 acres inadequately irrigated.

The construction of Boulder Dam and other appurtenant structures is largely responsible for the vast irrigation expansion still under way. Even more spectacular is the recent increase in hydroelectric power generation. Upon completion of present authorized construction in the lower basin hydroelectric generating capacities will exceed 1,800,000 kilowatts. This capacity would be more than doubled with construction of the potential projects outlined.

Little Colorado Division

Flowing northwest to join the Colorado River midway in its long course to the sea, the Little Colorado River drains 25,000 square miles in northeastern Arizona and west - central New Mexico. Crystal - clear tributary streams rising in the mountains are rapidly absorbed by the thirsty sands of the lower channels. Rain is infrequent but sometimes falls with great intensity. At such times the streams become raging, chocolate-colored torrents, carrying to the main Colorado in 1 year the equivalent of 9 inches of top soil from an entire township.

Vegetation over the basin as a whole is scant. Luxuriant growths, however, are found along river courses where water is available throughout the year, and they consume large quantities of water. It is estimated that over 98 percent of the rain falling in this division is consumed by plants, is lost by evaporation, or percolates underground and does not reappear within the basin.

Water Resources

Surface water.—The following table summarizes the average annual flows past those points where sufficient information is available to permit their computation.

TABLE LXXIV.—*Average annual stream flows in the Little Colorado division*

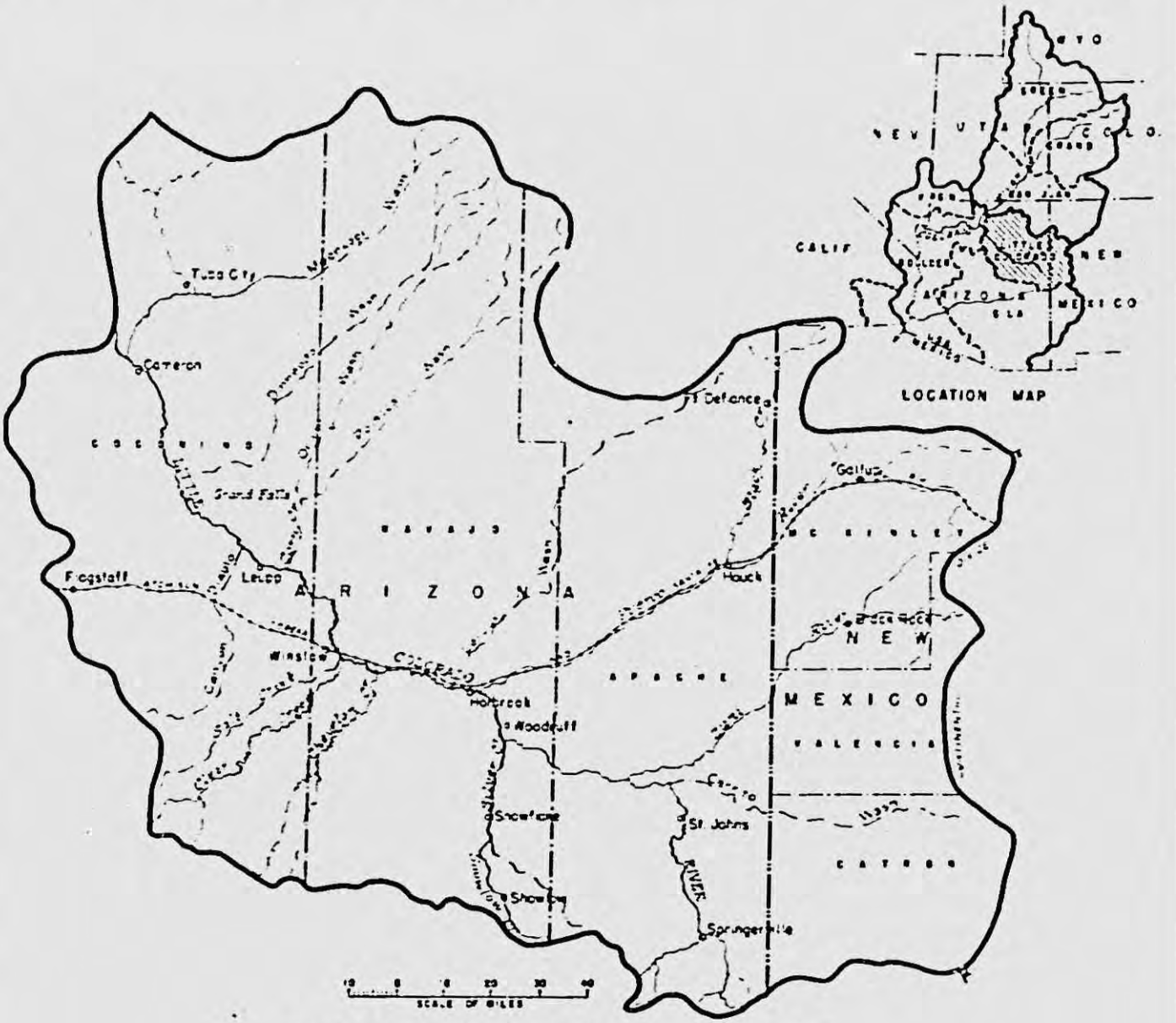
Station	Period of record	Average annual flows (acre-feet)	
		For period of record	For 1931-40 period
Little Colorado River at Grand Falls, Ariz.	1926-43	236,700	199,000
Chevelon Creek near Winslow, Ariz.	[1] 1930-43	38,800	37,300
Clear Creek near Winslow, Ariz.	[1] 1930-43	69,300	61,600
Moenkopi Wash near Tuba, Ariz.	1927-43	16,600	13,700

[1] Record incomplete.

The foregoing stations, except that on Chevelon Creek, are downstream from all diversions and represent the surplus flows of the streams in question. During the period of record the irrigated acreage within the basin has been virtually constant.

Stream-flow characteristics over the basin as a whole are similar. The channels contain water the year-round in the higher elevations but receive only intermittent flows in the lower altitudes. Flows over the entire area are erratic and subject to flash floods of great magnitude. The larger part of the annual run-off from the northern tributaries usually occurs during the summer months, while that from the south is somewhat retarded by the heavily vegetated highlands of the Mogollon Rim.

Approximately 55 percent of the average annual flow of Little Colorado River at Grand Falls, Ariz., downstream from all major tributaries except Moenkopi Wash, occurs during the months of February, March, and April, while only 35 percent comes during July, August, and September. Extremes in fluctuation occurred in 1938 when there was no flow in the stream for 213 days, while in March of that year a flood of 38,000 second-feet was recorded. Undependable stream flows make hold-over storage a prerequisite for maximum irrigation development.



Little Colorado Division of the Colorado River Basin

Ground water.—Little is known about the ground water resources of the basin. The scarcity of existing wells and the absence of accurate data on wells preclude definite conclusions as to the location and extent of ground waters. The very fact that no exploitation has been made of this resource in a country where water is such a valuable commodity would indicate the lack of possibilities.

Small artesian areas are known to exist in some portions of the basin. Two such areas are found south of the Little Colorado River, one southwest of Holbrook, Ariz., and the other northwest of Hunt, Ariz. In the absence of more complete geological and water level information, it is impossible to determine accurately the extent of these areas or the existence of other artesian belts, or to predict potential yields. It appears, however, that the artesian water resources are small and cannot be expected to furnish any large quantities of irrigation water.

Nonartesian water is often found in sandstones, in lava flows, and in sands and gravels along major streams. Frequently water is at great depths, particularly when found in the sandstones. All known pumped wells are used for domestic, public, stock watering, or railroad purposes. Irrigation with pumped water is not practiced to any appreciable extent in the division. There is no evidence which indicates that the ground-water resources of this basin are of sufficient importance to be considered as a potential source of water for irrigation development.

Quality of water.—Surface flows of water in this division are of good quality near their points of origin. As the water progresses downstream, however, it flows through formations that are high in soluble salts, thus becoming unsuited for irrigation use near the mouths of the streams. Mineral springs, in places, contribute large quantities of dissolved salts to the waters of the streams. Near Winslow, Ariz., several springs discharge an average of 20 tons of salts daily into the flows of both Chevelon and Clear Creeks. Salt concentrations in the waters range from virtually zero near the headwaters to as high as 3,000 and 4,000 parts per million in the lower Little Colorado River. Waters of the Little Colorado are of questionable quality between St. Johns and Holbrook, Ariz., and are entirely unsuited for irrigation use below the latter town.

The quality of the ground water in the basin varies widely with location. Chemical analyses show water from different wells varying from 100 to 6,000 parts per million total dissolved solids. The more saline water is not suitable for irrigation use. In general, wells containing the poorest quality water are located in shale-sandstone formation or in the sands and gravels of Cottonwood Wash, Leroux Wash, or the Little Colorado River bottoms.

Present Development of Water Resources

General.—Early settlers in the division learned through bitter experience that it was impossible for them to control the rivers except in a few selected localities. Settlers gradually migrated to the more readily irrigated areas, and development progressed without a coordinated plan and without knowledge of the wide variations in annual stream flow to which the rivers are subject. During wet periods far more land was brought under irrigation than could possibly be supplied during periods of drought. Subsequent years of deficient stream flow brought economic and even physical suffering. This was especially true in the upper Little Colorado River area, where overdevelopment progressed to the point where a court decree was necessary to establish relative priorities. As a result, virtually all of the waters of this area have been apportioned. Only during extreme floods does any water escape the region.

Development of the surface water resources on the Indian reservations has followed a somewhat different pattern. Irrigation projects have been planned, constructed, and operated under the supervision of the Office of Indian Affairs. Agricultural development has been adapted, insofar as possible, to the needs and temperament of the Indians. Individual holdings are small, and dry farming is practiced to some extent with little success. Flood-irrigated lands, or areas which receive water only during times of flood, are extensively cultivated. Despite the planning, supervision, and assistance of the Office of Indian Affairs, serious problems have arisen because the Indian population is continually increasing.

Irrigation.—The climate of the basin is such that irrigation is essential for successful agriculture.

The principal areas irrigated in the division are:

	Acres irrigated
Little Colorado River above St. Johns	15,180
Silver Creek Basin	4,360
Woodruff area	520
Holbrook-Joseph City area	1,520
Winslow area	610
Upper Zuni River	6,770
Scattered areas	19,040
Total	[1] 48,000

[1] Includes Indian lands: 5,560 acres in the upper Zuni River Basin, 2,540 acres in scattered areas, and 10,500 acres under flood irrigation.

Irrigation is accomplished chiefly by gravity diversions from the main stream. About three-fourths of the white irrigated land is served through the facilities of 13 irrigation companies. The remaining one-fourth is irrigated by individuals.

There is no import or export of water by transmountain diversions.

Power development.—The character of the stream flow in the area does not lend itself to the development of power. In addition, there is little market for power owing to the scattered population and the lack of industrial development. There are only two hydroelectric generating plants in the Little Colorado division capable of producing firm power. The combined installed capacity of these plants is 125 kilowatts. Steam and Diesel plants scattered through the area have a total installed capacity of approximately 3,000 kilowatts.

Drainage.—Some areas of the division have become waterlogged and have been taken out of production. As these areas should never have been in production, no effort has been made to drain them. On a whole the topography has reduced drainage problems to a minimum on most of the irrigated areas.

Flood control.—Most of the lands lying in the flood plains of this division are undeveloped and unimproved. Hence, the rampant floods to which the area is subject cause relatively little damage except for occasional removal of diversion dams. In only a few independent areas do floods endanger developments. The swollen streams, however, transport large quantities of silt into the Colorado River. Existing rservoirs in the Little Colorado division were neither constructed nor are operated for flood control; however, they afford a certain amount of protection.

Summary.—The following tables summarize present development of water resources in the Little Colorado division:

TABLE LXXV.—*Existing reservoirs in the Little Colorado division* [1]

Reservoir	Source of water	Location	Purpose served	Capacity (acre-feet)
Lyman	Little Colorado River	Arizona	Irrigation	21, 900
Lake Mary	Walnut Creek	do	Municipal	18, 900
Lone Pine	Showlow Creek	do	Irrigation	14, 000
Udall	Carrizo Wash	do	Irrigation, stock	9, 530
Daggs	Silver Creek	do	Irrigation	5, 170
Upper Lake Mary	Walnut Creek	do	Municipal	5, 080
Soldiers Annex Lake	Canyon Diablo	do	Irrigation, stock	5, 000
Chevelon	Chevelon Creek	do	Irrigation	4, 300
White Mountain No. 1	Hall Creek	do	do	2, 390
River No. 3	Little Colorado River	do	do	1, 670
New Scott	Porter Creek	do	do	1, 200
Lakeside	Showlow Creek	do	Irrigation, power	1, 200
Concho Lake	Concho Creek	do	Irrigation, stock	1, 200
Hog Wallow No. 4	South Fork	do	Irrigation	1, 000
Pine Lake	Showlow Creek	do	do	1, 000
Zuni	Zuni River	New Mexico	do	13, 000
Rescad	do	do	Domestic, irrigation	8, 720
Ramah	do	do	Domestic, stock	1, 170

[1] Includes only reservoirs with capacities of more than 1,000 acre-feet.

TABLE LXXVI.—*Present irrigated areas in the Little Colorado division*

Area	Acres irrigated		
	Arizona	New Mexico	Total
Silver Creek Basin	4, 360	0	4, 360
Holbrook-Joseph City area	1, 520	0	1, 520
Winslow area	610	0	610
Other	32, 740	8, 770	41, 510
Total	39, 230	8, 770	48, 000

TABLE LXXVII.—*Estimated percent average annual depletions in the Little Colorado division*

Area	Depletions (acre-feet)		
	Arizona	New Mexico	Total
Silver Creek Basin	6, 500	0	6, 500
Holbrook-Joseph City area	2, 300	0	2, 300
Winslow area	900	0	900
Other	49, 000	13, 000	62, 000
Total	58, 700	13, 000	71, 700

POTENTIAL DEVELOPMENT OF WATER RESOURCES

Opportunities for development in the Little Colorado division are largely confined to four areas. One potential project is outlined for each of these areas. The potential Bridge Canyon project on the Colorado River, discussed in this chapter under the Boulder division, would bring power into the Little Colorado division.

Although the Coconino dam site is located on the Little Colorado River downstream from the Little Colorado division, construction of a dam at this site would form a reservoir extending into the division. The Coconino Dam is discussed in this chapter under the Boulder division.

Snowflake project.—This development in Silver Creek Basin would include the diversion of water from Showlow Creek through a 2-mile tunnel into a storage reservoir of 25,000 acre-feet capacity at the Shumway site. At the reservoir the waters of Showlow Creek would be commingled with those of Silver Creek and distributed to about 6,700 acres of new lands lying on both sides of Silver Creek in the vicinity of Snowflake, Ariz. A portion of the 2,000 acres now irrigated would be supplied water through the facilities of the new system. The irrigation structures planned would have some incidental flood-control benefit.

Black Creek project.—Construction of a reservoir at the Black Creek site near Houck, Ariz., would provide 48,600 acre-feet of irrigation storage capacity. Releases to the natural channel of Black Creek would be diverted into a canal north of the Puerco River. A siphon crossing of the Puerco River would convey the water to a distribution system serving 4,000 acres along the south bank of that stream. This project is an alternative to an upstream irrigation development within the Navajo Indian Reservation in Arizona and New Mexico, for which the Office of Indian Affairs holds prior water rights. Either plan would have about the same depletory effect upon stream flows.

Holbrook project.—Along the Little Colorado River near Joseph City, Ariz., are 1,800 acres of new land and 600 acres now inadequately irrigated which would receive water from this project. Storage would be provided in a reservoir at the Fork site on Little Colorado River just below the mouth of Silver Creek. Of its total capacity of 117,000 acre-feet, 75,000 would be for silt retention. A canal diverting from this reservoir would parallel the river on the south side to a point 4 miles west of Holbrook,

where a siphon would carry the water across the river into a canal leading to the project lands. Incidental channel improvements resulting from construction of this project, together with the regulatory effect of silt and irrigation storage, would provide some flood protection for downstream property.

Winslow project.—This development would utilize the waters of Clear and Chevelon Creeks for the irrigation of 19,750 acres of new lands, including 5,000 acres of Indian lands and 14,750 acres of white-owned lands, all on the north side of the Little Colorado River in Arizona. Construction of the Willow Creek Dam on Clear Creek would provide for storage of 45,000 acre-feet of water, and construction of Wildcat Dam on Chevelon Creek would impound another 49,000 acre-feet for irrigation use. Because of the steep-walled canyons in which the streams are entrenched, tunnels heading at diversion weirs would be necessary to convey water to the canals leading to the project lands. In addition, a siphon crossing under the Little Colorado River would be required.

Summary

The following tables summarize potential development in the Little Colorado division, showing various purposes to be served by potential projects, estimated construction costs, potential reservoirs, and present and potential stream depletions.

TABLE LXXVIII.—*Potential projects in the Little Colorado division*

Project	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [2]
Snowflake	Arizona	Showlow and Silver Creek	I, F, S	$2, 600, 000
Black Creek	do	Black Creek	I, F, S	1, 800, 000
Holbrook	do	Little Colorado River	I, F, S, C	1, 300, 000
Winslow	do	Clear and Chevelon Creek	I, F, S	19, 000, 000
Total				24, 700, 000

[1] Symbols used: I = irrigation, P = power, F = flood control, S = silt retention, C = channel improvement.
[2] Preliminary estimates based on construction costs of Jan. 1, 1940.

TABLE LXXIX.—*Potential reservoirs in the Little Colorado division*

Name of site [1]	Source of water supply	Project served directly	Total capacity (acre-feet)
Shumway	Showlow and Silver Creeks	Snowflake	25, 000
Black Creek	Black Creek	Black Creek	48, 600
Forks	Little Colorado	Holbrook	117, 000
Willow Creek	Clear Creek	Winslow	45, 000
Wildcat	Chevelon Creek	Winslow	49, 000
Total			284, 600

[1] All in Arizona.

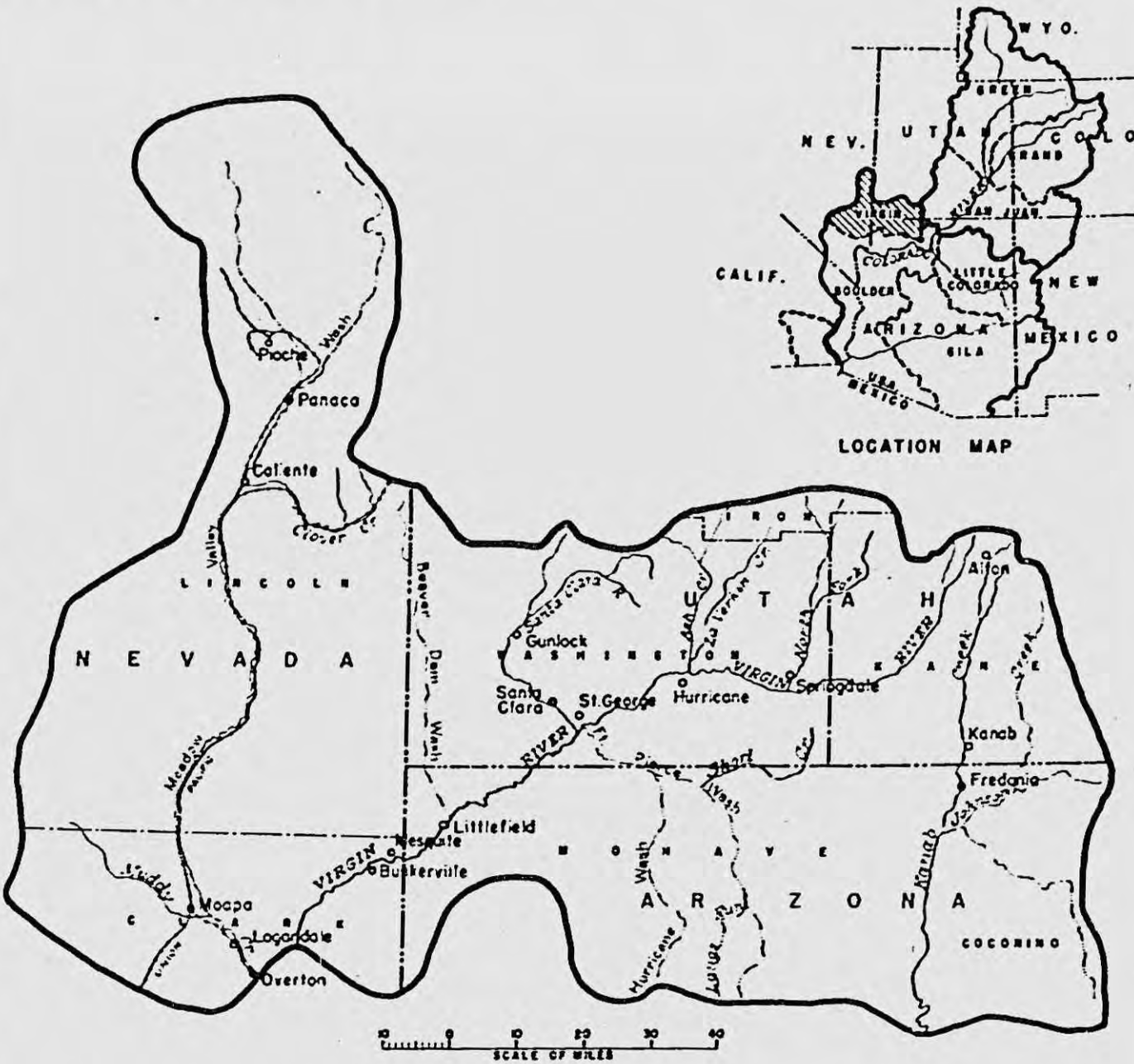
TABLE LXXX.—*Potential irrigation development in the Little Colorado division*

Project [1]	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total
Snowflake	6, 700	0	6, 700
Black Creek	4, 000	0	4, 000
Holbrook	1, 800	600	2, 400
Winslow	19, 750	0	19, 750
Total	32, 250	600	32, 850

[1] All projects in Arizona.

TABLE LXXXI.—*Present and potential stream depletions in the Little Colorado division*

State subdivision	Estimated average annual depletion (acre-feet)		
	Present depletion	Potential increase	Total ultimate depletion
Arizona:			
Silver Creek Basin	6, 500	10, 000	16, 500
Black Creek Project	0	6, 000	6, 000
Holbrook-Joseph City area	2, 300	2, 700	5, 000
Winslow area	900	30, 000	30, 900
Other areas	49, 000	0	49, 000
Subtotal	58, 700	48, 700	107, 400
New Mexico (all areas)	13, 000	0	13, 000
Total	71, 700	48, 700	120, 400



Virgin Division of the Colorado River Basin

Virgin Division

The Virgin River is flanked on the east by Kanab Creek and on the west by Muddy River. All three streams flow south or southwest to the Colorado River. The Virgin and Muddy Rivers once joined before reaching the Colorado, but both now discharge separately into Lake Mead, the reservoir formed by Boulder Dam. Kanab Creek enters the Colorado River in Grand Canyon National Park. The combined drainage areas of these tributaries in Arizona, Nevada, and Utah constitute the 12,700 square miles of the Virgin division.

Water Resources

Surface water.—The principal streams, fed chiefly from springs and melting snow, head in the high plateaus and mountains bounding the area on the north. Except for several springs and occasional freshets from summer rains, the proportionately large areas at lower and intermediate elevation contribute little run-off.

The discharge rate of several major springs in the division is nearly uniform throughout the year. All other stream flows are erratic and fluctuate widely from season to season and from year to year. Storage regulation,

therefore, is necessary for maximum utilization of water. High spring run-off from melting snow usually ends in May or June. Low flows then continue well into the fall. Occasional freshets or floods occur in all seasons of the year; in winter and spring from heavy rain or rapidly melting snow or both, and in summer and fall from localized torrential rains.

The average annual virgin flow of the Virgin River at Littlefield, Ariz., near its mouth is estimated at 310,000 acre-feet. Recorded flows of streams at various points are shown in the following table. Unfortunately there are no discharge records of Kanab Creek and Meadow Valley Wash, the principal tributary of Muddy River.

TABLE LXXXII.—*Average annual stream flows in the Virgin division*

Station	Period of record	Average annual flow (acre-feet)	
		For period of record	For 1931-1940 period
North Fork of Virgin River near Springdale, Utah	1926-1943	78, 000	78, 000
Virgin River at Virgin, Utah	1910-1943	162, 000	142, 000
Virgin River at Littlefield, Ariz.	1930-1943	204, 000	189, 000
Santa Clara River below Gunlock, Utah	1939-1943	22, 000	[1] 19, 000
Muddy River at head of Moapa Indian Reservation, Nevada	[2] 1917-1943		[1] 31, 000

[1] Estimated.
[2] Records incomplete.

Ground water.—Many small springs and seeps scattered through the area have been developed for stock watering and domestic purposes, and all the larger springs are utilized for irrigation. Other than the discharge of springs, ground water is of limited importance. A few small wells in alluvial-filled valleys are operated for irrigation and domestic purposes. There are no known ground-water basins having large contributing drainage areas, and the possibilities of further ground-water development for irrigation are believed to be insignificant.

Quality of water.—Waters of the upper portion of the Virgin River and of all its northern tributaries are of suitable chemical quality for irrigation use. These waters have been used for many years for irrigation, and no detrimental effects to crops have been apparent.

Below La Verkin, Utah, mineral springs contribute to the Virgin River large quantities of water which are highly charged with mineral salts, chiefly carbonates, sulphates, and chlorides of calcium, magnesium, and sodium. At Littlefield, Ariz., near the mouth of the river, mineral springs contribute an average of 60 second-feet of water, which constitutes most of the low flow of the stream. This water is unsatisfactory for domestic use. Only because a high percentage of the mineral content is gypsum is the water at all usable for irrigation, and then only for the more salt-tolerant crops.

Waters of Kanab Creek and Meadow Valley Wash are of good chemical quality and have long been used for irrigation. Muddy River waters, derived principally from springs, are of fairly good quality for irrigation.

Silt content of streams in the Virgin division is fairly low in the headwaters at nearly all times and also in the lower reaches during ordinary low flows. Freshet and flood flows, however, are high in silt content.

PRESENT DEVELOPMENT OF WATER RESOURCES

General.—Although the total run-off during the low-flow season is now fully utilized for irrigation and some shortages are experienced, the major part of the stream flow during the nonirrigation and high spring run-off seasons escapes from the area unused. Plans for development of portions of this surplus water for irrigation have been proposed from time to time and there has been some effort toward promotion of projects, but no successful developments therefrom have as yet materialized.

Domestic water for communities is obtained for the most part from springs, and nearly all communities have municipal distribution systems. Some community domestic supplies are pumped from wells. Outlying farmsteads obtain domestic supplies from privately owned springs, irrigation ditches, small wells, or by hauling from distant sources. Many seeps and springs have been developed for stock watering, and many watering ponds have been constructed on the ranges for capture of occasional surface run-off.

Irrigation.—Irrigation was early expanded to the limits of natural stream flow, and by 1905 some streams were overappropriated, with shortages resulting in low run-off seasons. The high cost of potential projects has precluded any material development of new systems by local interests for irrigation of additional lands in the area since about 1905. Present storage development is practically negligible.

Approximately 36,100 acres are irrigated in the Virgin division, of which 23,500 acres are in Utah, 2,800 acres are in Arizona, and 9,800 acres are in Nevada. These areas include 400 acres of Indian lands; the Office of Indian Affairs estimates that 700 additional acres of Indian lands in existing developments will be irrigated ultimately. Irrigated acreage varies somewhat from year to year depending upon fluctuations in stream flow as well as economic conditions. All irrigation development has been accomplished by individuals and mutual irrigation companies.

Nearly all irrigation developments are simple gravity diversions without storage regulation. Some small areas

are served by pumping. About 15,000 acres of the total irrigated area have a fairly adequate water supply. The remaining area suffers frequent water shortages of varying degree. No water is imported into the division and only one small diversion is made out of the area. This diversion is from the headwaters of Santa Clara River to Pinto Creek in the Bonneville Basin.

Power development.—Stream flow is used for power production at five hydroelectric plants in the area. One plant of 1,000-kilowatt capacity is located on the Virgin River at La Verkin, Utah, and three plants with combined capacities of 1,890 kilowatts are located on Santa Clara River near Veyo and Gunlock, Utah. These four plants are owned and operated by the Southern Utah Power Co., which supplies electric energy to most of the communities in the Utah portion of the division. The fifth plant is the recently installed St. George municipal plant located on the pipe line diverting municipal water from springs at the head of Cottonwood Creek, 15 miles northwest of St. George. This plant has a capacity of 550 kilowatts, and its output is augmented by two diesel installations at St. George, having a combined capacity of 800 kilowatts. Communities in the Nevada portion are served with power from the Boulder Dam power plant.

Summary.—Irrigated areas and estimated amounts of water consumed in the Virgin division are summarized in the following tables:

TABLE LXXXIII.—*Present irrigated areas in the Virgin division*

Stream	Acres irrigated			
	Arizona	Nevada	Utah	Total
Virgin River	1, 800	2, 800	19, 600	24, 200
Muddy River	0	7, 000	0	7, 000
Kanab Creek	1, 000	0	3, 900	4, 900
Total	2, 800	9, 800	23, 500	36, 100

TABLE LXXXIV.—*Estimated present average annual depletions in Virgin division*

Stream	Depletions (acre-feet)			
	Arizona	Nevada	Utah	Total
Virgin River	3, 600	9, 800	38, 000	51, 400
Muddy River	0	14, 000	0	14, 000
Kanab Creek	1, 500	0	7, 000	8, 500
Total	5, 100	23, 800	45, 000	73, 900

POTENTIAL DEVELOPMENT OF WATER RESOURCES

The major water-use problem in this division is that of providing storage regulation of the available stream flow to secure a full supply for lands now inadequately irrigated and for as large an additional irrigable area as is practicable. Such development would help to stabilize irrigated agriculture, relieve the local population pressure, and enlarge the livestock feed base so as to attain more nearly a balance in industry of the area.

Kanab Creek project.—Storage on the main streams of either Kanab Creek or its tributary, Johnson Creek, is impracticable because of the high silt discharge of these streams. New development is limited to offstream storage of the comparatively silt-free, nonirrigation season flows of Kanab Creek, which are derived essentially from springs emerging in the stream bed several miles above the town of Kanab. To provide such storage a reservoir of 1,400 acre-feet capacity at the offstream State Line site would be fed a water supply from Kanab Creek through a short extension of the existing Kanab canal. The stream flow thus diverted and stored would furnish a supplemental supply for 1,000 acres of land near Fredonia, Ariz.

Hurricane project.—A reservoir of 165,000 acre-feet total capacity (65,000 acre-feet active and 100,000 acre-feet reserved for silt) on Virgin River at the Virgin City site 3 miles northeast of Hurricane, Utah, together with a 27-mile canal extending southwest from the reservoir, would furnish a supplemental supply for 6,500 acres of land now insufficiently irrigated and a full supply for 14,000 acres of new land, all in the Hurricane-St. George Valley in Utah and Arizona. The existing 1,000-kilowatt power plant at La Verkin, Utah, dependent on erratic river flow, would be abandoned, and power would be developed at three new plants having a combined capacity of 4,600 kilowatts and a combined head of 800 feet. In addition to meeting power replacement and project pumping needs, these plants would produce about 15,000,000 kilowatt-hours of firm power annually. The reservoir would also have incidental value for flood control, silt retention, fishing, and recreation.

Santa Clara project.—Full regulation and utilization of the flow of Santa Clara River, the principal Virgin River tributary, could be obtained by means of an 18,000-acre-foot (14,000 acre-feet active capacity) reservoir at the Lower Gunlock site on that stream. A supplemental water supply for irrigating 1,700 acres of land in need of more water and a full supply for 2,000 acres of new land in Utah under existing canals would be provided. The reservoir would have incidental value for flood and silt control and for fishing and recreation.

Panaca Valley project.—Irrigation development in the Muddy River Basin is limited by available water. A 48,000-acre-foot reservoir at the Delmue site on Spring Creek near its mouth (the head of Meadow Valley Wash) 7 miles northeast of Panaca, Nev., would provide storage for irrigation water and flood control. A new 10-mile canal would carry this water to 2,000 acres of land in need of a supplemental supply and 2,000 acres

of new land. The reservoir would have incidental value for fishing and recreation.

Moapa Valley project.—A reservoir of 9,500 acre-feet capacity at the White Narrows site on Muddy River would provide water storage regulation to furnish a supplemental water supply for 2,500 acres and a full supply for 1,500 acres of new land in Moapa Valley, Ariz. This reservoir would also provide 2,500 acre-feet of storage for flood control and silt retention. Rehabilitation of the present distribution system and drainage of project lands would be included in the project development.

Moapa Valley Pumping project.—This development would provide an irrigation supply for 6,000 acres of new land in the Muddy River drainage area by pumping from Lake Mead. The first pump would lift the water 130 feet to a canal 22 miles long. A second pump would lift the water an additional 105 feet where half the flow would be diverted in a 5-mile canal. A third pump would lift the remaining flow another 80 feet to a canal 10 miles long.

Summary

The following tables summarize potential development of water resources in the Virgin divisions, including the various purposes to be served by potential projects, estimated construction costs, areas to be irrigated, and stream depletions.

TABLE LXXXV.—*Potential projects in the Virgin division*

Project	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [2]
Kanab Creek	Arizona	Kanab Creek	I	$200,000
Hurricane	Utah, Arizona	Virgin River	I, P, S, F	9,200,000
Santa Clara	Utah	Santa Clara River	I, F, S	1,700,000
Panaca Valley	Nevada	Meadow Valley Wash	I, F	1,300,000
Moapa Valley	do	Muddy River	I, F, S	700,000
Moapa Valley pumping	do	Lake Mead	I	2,800,000
Total				15,900,000

[1] Symbols used: I-irrigation, P-power, S-silt retention, and F-flood control.
[2] Preliminary estimates based on construction cost of Jan. 1, 1949.

TABLE LXXXVI.—*Potential reservoirs in the Virgin division*

Name of site	Source of water supply	Project served	Total capacity (acre-feet)
State Line	Kanab Creek	Kanab Creek	1,400
Virgin City	Virgin	Hurricane	165,000
Lower Gunlock	Santa Clara	Santa Clara	18,000
Delume	Meadow Valley Wash	Panaca Valley	48,000
White Narrows	Muddy Creek	Moapa Valley	9,500
Total			241,900

TABLE LXXXVII.—*Potential irrigation development in Virgin division*

Project	State	Area to be benefited (acres)		
		New land	Furnished supplemental water	Total
Kanab Creek	Arizona	0	1,000	1,000
Hurricane	Utah, Arizona	14,000	6,500	20,500
Santa Clara	Utah	2,000	1,700	3,700
Panaca Valley	Nevada	2,000	2,000	4,000
Moapa Valley	do	1,500	2,500	4,000
Moapa Valley pumping	do	6,000	0	6,000
Total		25,500	13,700	39,200

TABLE LXXXVIII.—*Potential irrigation development in the Virgin division by States*

State	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total
Arizona	3, 000	1, 000	4, 000
Nevada	9, 500	4, 500	14, 000
Utah	13, 000	8, 200	21, 200
Total	25, 500	13, 700	39, 200

TABLE LXXXIX.—*Potential power development in the Virgin division*

Project	Name of power plant	River	Installed capacity (kilowatts)	Annual generation (kilowatt-hours)
Hurricane	Virgin	Virgin	2, 000	12, 900, 000
Do	Bench Lake	do	800	5, 200, 000
Do	Warner Valley	do	1, 800	14, 700, 000
Total			4, 600	[1] 32, 800, 000

[1] Net firm generation would be 15,000,000 kilowatt-hours in addition to replacement of power from the 1,000-kilowatt La Verkin, Utah, plant, project pumping needs, and secondary energy.

TABLE XC.—*Present and potential stream depletions in the Virgin division*

State and subbasin	Estimated average annual depletion (acre-feet)		
	Present depletion	Potential increase	Total ultimate depletion
Arizona			
Virgin River	3, 600	12, 000	15, 600
Kanab Creek	1, 500	700	2, 200
Subtotal	5, 100	12, 700	17, 800
Nevada			
Virgin River	9, 800	0	9, 800
Muddy River	14, 000	15, 000	29, 000
Colorado River	0	21, 000	21, 000
Subtotal	23, 800	36, 000	59, 800
Utah			
Virgin River	38, 000	56, 300	94, 300
Kanab Creek	7, 000	0	7, 000
Subtotal	45, 000	56, 300	101, 300
Total	73, 900	105, 000	178, 900

Boulder Division

The Boulder division, roughly 450 miles long and 150 miles wide, embraces 48,600 square miles in Arizona, California, and Nevada. It includes not only the area which drains into the Colorado River below Lee Ferry, excluding areas tributary to the Little Colorado River above Moenkopi Wash, Kanab Creek, Virgin River, Muddy River, and the Gila River above Sentinel, but the valley containing the Salton Sea, whose drainage is not tributary to the Colorado River and whose diversions therefore constitute exports from the basin.

The Colorado River enters the division from the northeast at Lee Ferry, weaves its way west and south for 350 river miles, then flows south 358 miles emerging from the Boulder division at the Mexican border. The Williams River, formed by the confluence of Big Sandy and Santa Maria Rivers in west central Arizona and entering the Colorado just above Parker Dam, is the only major stream rising in the Boulder division.

WATER RESOURCES

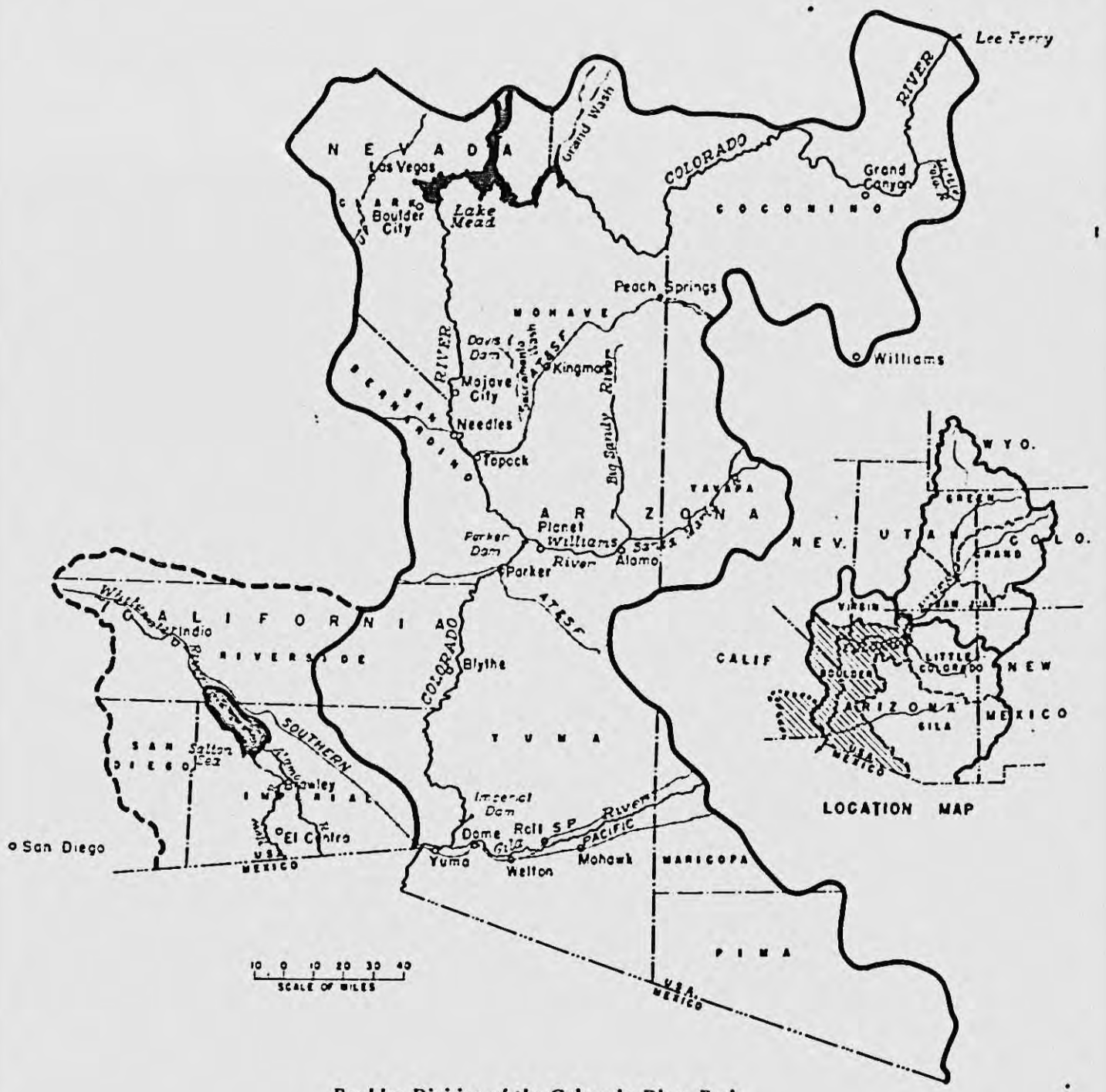
Surface water.—Gage height records of the Colorado River at Yuma, Ariz., have been maintained continuously since 1878, although discharge measurements date only from 1902. During later years other measuring stations have been established on the main stream and tributaries. The average annual virgin flow of the Colorado River at Lee Ferry, based on the period 1897–1943, is estimated at 16,270,000 acre-feet. The virgin flow for the Gila River near Dome, Ariz., is estimated to be 1,270,000 acre-feet. The average annual flows of the Colorado River and two of its tributaries as recorded at various points in the Boulder division are as follows:

TABLE XCI.—*Average annual stream flows in the Boulder division*

Station [1]	Period of record	Average annual flows (acre-feet)	
		For period of record	For 1931–40 period
Colorado River at Lees Ferry	1921–43	12, 727, 000	10, 142, 000
Colorado River at Bright Angel	1922–43	12, 977, 000	10, 520, 000
Colorado River near Topock	1917–43	13, 740, 000	[2] 7, 729, 000
Colorado River at Yuma	1903–43	13, 316, 000	[2] 5, 709, 000
Williams River at Planet	1928–43	116, 000	125, 400
Gila River near Dome	1930–43	84, 600	57, 900

[1] All in Arizona.
[2] Filling of Lake Mead was started in 1935, which accounts for the low average flow at these gaging stations.

About 67 percent of the annual run-off of the Colorado River occurs during the period April to July inclusive. Regulation by reservoirs is necessary to permit full utilization of the water. Large storage reservoirs also provide protection from floods, which normally occur during the spring period from melting snow, but occasionally come in late summer or early fall with torrential downpours.



Boulder Division of the Colorado River Basin

At present the flow of the Colorado River exceeds the requirements of the irrigated lands, but future developments should be limited to the available water supply.

Flows from the Williams River are erratic and subject to flash floods of great magnitude. During the 10-year period, 1931 to 1940, the annual flows varied from 11,800 to 307,000 acre-feet.

The Gila River channel is dry at Dome, Ariz., for long periods. No flow is recorded at this station some years. Occasionally torrential rains cause large floods.

Ground water.—Ground water occurs in this division in the valleys of the Colorado River and the lower Gila River. The Las Vegas Valley in southern Nevada and the Coachella Valley in the Salton Sea Basin in southern California have benefited from use of ground water.

Of the 250 producing wells in the Las Vegas area in

1938, about 75 percent were artesian. The depth of the wells drilled varied from 150 to over 1,150 feet. Lack of conservation of the artesian water has depleted the available supply, especially in the upper artesian sands.

The development of the Coachella Valley, also an artesian-well basin, has been almost continuous since the first well was drilled in 1898. However, the placing of new lands under irrigation recently has caused a serious drawdown of the ground-water level in the basin.

Other developments of irrigated lands by wells exist in the Colorado and lower Gila River Valleys, the most important of which is the Wellton-Mohawak area in southwestern Arizona. Supplies of ground water in this area are replenished by the flood waters of the Gila River. Developments on the upper Gila watershed have greatly reduced the amount of flood water reaching these downstream areas. In recent years the ground water supply has decreased and its salt content has increased. As a consequence, an unsatisfactory economic condition exists in this area.

Quality of water.—Water of the lower Colorado River is suitable for irrigation use. Before the completion of Boulder Dam and the subsequent storage of water in Lake Mead, the content of dissolved material in the water tended to fluctuate with the various flows. Generally, high flows were relatively low in total dissolved solids and low flows were high. Since the lake has filled, the outflow water is fairly constant in dissolved solid content, averaging annually about 680 parts per million. As it progresses downstream, however, the content of dissolved solids in the river water increases somewhat until at Yuma, the total dissolved solids average about 700 parts per million. Water of this quality is suitable for irrigation and domestic use. Although the calcium carbonate content makes the water hard, thus requiring more soap for cleansing purposes, it is of benefit to the sandy soils of the southwestern desert lands. When water of this quality is used for irrigation, the calcium ions present in the water replace to some extent the sodium ions in the soil. This tends to improve soil structure by making it more granular or flocculent, as well as more friable.

The silt content of the waters of the Colorado River has been greatly reduced by the construction of Boulder, Parker, and Imperial Dams. During the years 1911 through 1934, before the construction of these dams, the river carried an average annual silt load of 179,920,000 tons at the Yuma sampling station. For the years 1936 through 1942, the average annual silt load of the river at the same point was 13,100,000 tons.

Silt problem.—Water entering the Boulder division at Lee Ferry carries immense quantities of silt. The San Juan River, largest of the southern tributaries of the upper basin, contributes about one-quarter of the silt passing Grand Canyon, and the northernmost tributary of the lower basin, the Little Colorado, accounts for about one-sixth more. From Lee Ferry to the upstream end of Lake Mead, the Colorado River, falling approximately eight feet per mile, is continuously cutting its course, even through the hard rocks of the canyon. Silt originates not only from stream cutting in the channels of the river and its important tributaries, but also from general erosion. The rate of land reduction through erosion in the Colorado River Basin is the highest of any stream basin in the United States.

Lake Mead receives the silty load of both the Colorado and the Virgin Rivers. Storage capacity in Lake Mead is being reduced an estimated 137,000 acre-feet a year by the deposition of this silt.

The clear water discharged from Lake Mead picks up and transports downstream a considerable amount of river bed material, progressively lowering the bed for the first 88 miles. An estimated 100 million cubic yards had been removed by the end of 1943. From 1941 through 1943 about 35 million cubic yards were deposited in the next 32-mile stretch downstream. A large but unknown amount of material has been carried beyond this stretch and deposited in Havasu Lake, the reservoir formed by Parker Dam. For a long period prior to Boulder Dam the river deposited some of its silt load in these same sections, causing a rise in the water surface elevation averaging annually about 0.35 feet in the vicinity of Needles and about 0.55 feet at the Topock gaging station.

A similar condition of cutting out and redepositing has taken place below Parker Dam. Clear water leaving Parker Dam has scoured out bottom material and lowered the river bed elevation for 93 miles downstream, and beyond that point the river bed has been raised.

By early 1944 the water surface at the diversion of the Palo Verde irrigation district had been lowered by river retrogression to such an extent that a full diversion into the district's canal became impractical.

Between Imperial Dam and Laguna Dam little change in river conditions has taken place, but below Laguna Dam some 30 million cubic yards of material have been removed from the river banks and bed since January 1940. All material passing the Imperial Dam sluiceway, as well as that from the Gila River, has been transported downstream.

Controlling the silt load of the Colorado River and its tributaries to prevent damage is an important phase of water conservation for beneficial use. Silt control is especially desirable upstream from Lake Mead, where the Colorado River alone carries each year about 180 million tons of silt, which, when deposited, occupies a volume estimated at 110,000 acre-feet. Obviously, therefore, any plan of development must provide adequately for sediment storage. The possibility of removing sediment deposits by sluicing holds little prospect for success.

PRESENT DEVELOPMENT OF WATER RESOURCES

General.—Boulder Dam and Lake Mead, with over 32 million acre-feet of storage capacity, provide the key to present and future development of water resources in the division. Water stored here is released as required for irrigation, for power development, and for domestic uses. The lake acts as a desilting basin, clarifying the muddy Colorado and making it fit for human consumption; it catches and, to a great extent, subdues the floods which pour down the river channel; and in addition it furnishes an unexcelled water playground in the desert. For complete development and regulation of the river, however, other dams should be built above Boulder.

Davis Dam, on the Colorado River 67 miles below Boulder with its reservoir of 1,600,000 acre-feet capacity, will serve many purposes by reregulating the releases from Boulder Dam. Construction of this dam, temporarily halted by an order of the War Production Board, is scheduled to be resumed in 1946.

Below Davis Dam are four diversion dams: Parker, for the Metropolitan Water District of Southern California; Headgate Rock, for the Colorado River Indian Reservation; Imperial, for the All-American Canal System and the Gila project; and Laguna, for the Yuma project. Although the latter three are primarily for diversion purposes, small amounts of power are generated at plants either at the dams or in the canals below. The Parker power plant is an important unit in the power network of the area.

Prior to the construction of Boulder Dam, all irrigation from the river was dependent on natural stream flow; now, however, storage water is used to supplement natural flow for most of the irrigated areas.

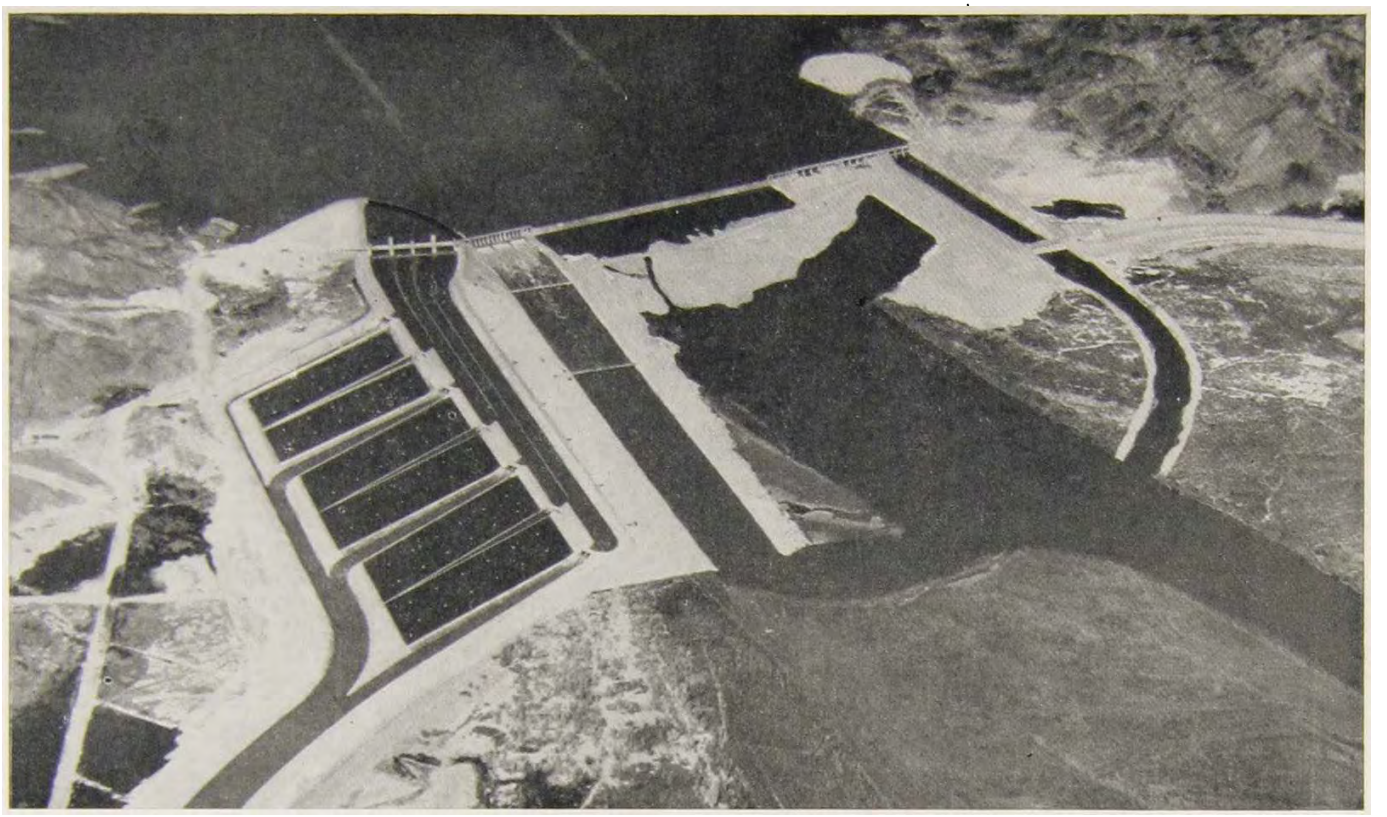
Irrigation.—The Colorado River Indian irrigation project is the first major irrigation development downstream from Boulder Dam. Irrigation has been practiced on this reservation since the seventies, first by gravity ditch diversions which later failed, then by pumping, and since June 1942 by diversion at the newly completed Headgate Rock Diversion Dam and Main Canal. Works are now completed to irrigate 9,400 acres. The system is designed ultimately to irrigate 100,000 acres.

Palo Verde irrigation district lands are located along the Colorado River in California mainly in southeastern Riverside County but with a small area extending into Imperial County. Distribution works have now been constructed by the district to deliver water to 75,000 acres. This district in recent years has experienced difficulty in diverting its required water because of silt deposits in the intake canal and the lowering of the river channel at the headgate by scouring. By 1943 the channel had lowered to such an extent that it was evident the district would not be able to maintain its gravity diversion, and an appeal was made to the Bureau of Reclamation for assistance. The Bureau subsequently constructed a temporary rock weir to raise the water surface to a sufficient height for diversion into the district's canal, pending a permanent solution of the problem.

Prior to 1940, lands in the Imperial irrigation district were served by the Imperial Canal, which diverted water from the Colorado River below Yuma. A part of this canal looped into Mexico, which led to complications and made it highly desirable to have a canal located entirely within the United States. The All-American Canal system of the Bureau of Reclamation's Boulder Canyon project answers this purpose. In 1943, there were 400,400 acres irrigated in the Imperial irrigation district from the All-American Canal. The project is still under construction and will irrigate ultimately lands in Imperial Valley, Coachella Valley, East and West Mesas, and Pilot Knob Mesa. The area now irrigated in Coachella Valley by ground water will be served supplemental water from the Colorado River.

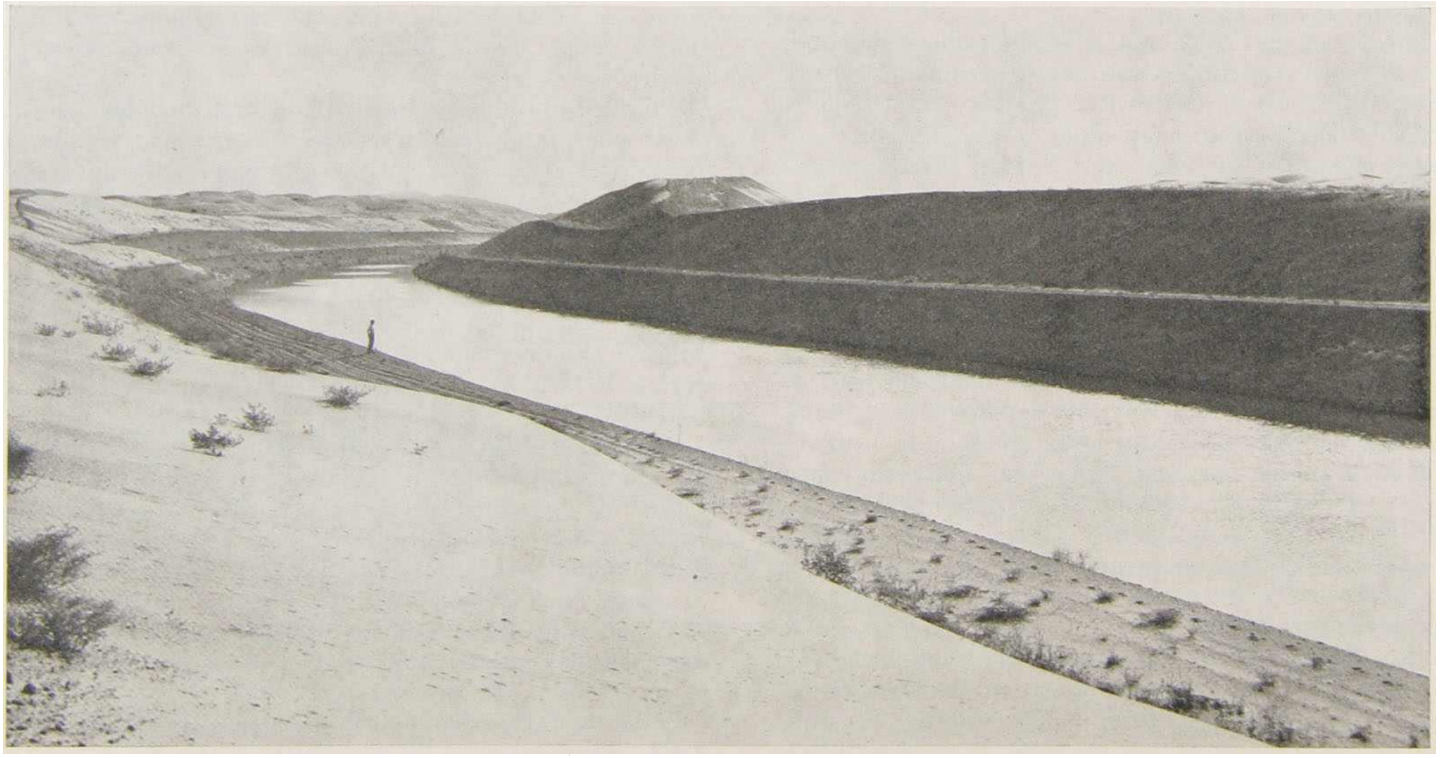
The Yuma project, located in Yuma County, Ariz., and Imperial County, Calif., was one of the first irrigation developments of the Bureau of Reclamation and its earliest on the Colorado River. Construction was authorized in 1904, and the first water was delivered during the 1907 season. Water is diverted at Laguna Dam for a portion of the California lands and from the All-American Canal at the Siphon Drop power plant for the remainder of the project. In 1943, 58,800 acres were irrigated including 7,800 acres of Indian land, reported by the Office of Indian Affairs as the maximum development possible.

The Gila project is located in the southwest corner of Arizona and borders on the east side of the Yuma project. As originally conceived, this project contemplated irrigation of 585,000 acres of land. Although considered as one development, the location of the lands suggests certain groupings within the project itself. These are designated as the Yuma Mesa, South Gila Valley, North Gila Valley, and Wellton-Mohawk divisions. Construction of facilities for the irrigation of 150,000 acres in the Yuma Mesa, South Gila Valley, and North Gila Valley divisions has been started. Imperial Dam, already completed, is the diversion dam for both the All-American Canal and the Gila Gravity Main Canal. Water is now being delivered to North Gila Valley and to a small acreage of the Yuma Mesa. Originally it was planned to develop 139,000 acres in the Yuma Mesa. It now appears more desirable to limit the irrigated area to 70,000 acres thus permitting greater development in the other three divisions where it is believed the water could be used to better advantage. A new authorization will be required, however, for any development in the Wellton-Mohawk division. The extent of ultimate development in the Gila project will depend upon the final allocation of water between this project and the potential central Arizona project,



IMPERIAL DAM AND DESILTING BASINS ON COLORADO RIVER

Diversion structure for both All-American and Gila Main Canals



ALL-AMERICAN CANAL

Carries Colorado River water 90 miles to irrigate California's Imperial Valley

discussed under the Gila division, or other possible developments within the State of Arizona.

About 1,200 and 500 acres are irrigated by gravity diversion from Big Sandy River and Kirkland Creek, respectively. Both streams are tributaries of the Williams River.

Some 1,200 acres near Las Vegas, Nev., are now irrigated from ground water sources. About 16,000 acres in Coachella Valley, 6,600 acres in the South Gila Valley, and 7,800 acres in the Mohawk Municipal Water Conservation District near Roll, Ariz., are also irrigated from ground water. The two areas last named may be furnished a water supply under the Gila project.

Municipal and industrial use.—The Colorado River aqueduct in southern California is the only large municipal diversion out of the Boulder division. The aqueduct was constructed by the Metropolitan Water District of Southern California, composed at present of the cities of Anaheim, Beverly Hills, Burbank, Compton, Fullerton, Glendale, Long Beach, Los Angeles, Pasadena, San Marino, Santa Ana, Santa Monica, and Torrance and of the Coastal Municipal Water District. The Metropolitan District's first objective in constructing the Colorado River aqueduct was to supply Colorado River water for domestic, industrial, and other beneficial uses to the area within its boundaries, and to such additional surrounding areas as may later desire to join the district. Water is pumped from Havasu Lake and conveyed by the aqueduct to the southern California area.

Because of the critical nature of the water situation at San Diego, President Roosevelt on November 29, 1944, directed that the Bureau of Reclamation complete plans and specifications for an aqueduct to take 50 million gallons of water per day from the Colorado River aqueduct of the Metropolitan Water District of Southern California and deliver it to San Vicente Reservoir of the San Diego water system. The President directed that the Bureau of Yards and Docks perform the necessary construction. Contracts for construction of some parts of the aqueduct were awarded during the summer of 1945.

Water is pumped from Lake Mead and conveyed by pipe line to Henderson, Nev., for municipal and industrial use, mainly by Basic Magnesium, Inc.,

Drainage and overflow protection.—The cultivated areas included in the Colorado River Indian Reservation, Palo Verde Irrigation District, Yuma project, and Imperial Irrigation District are protected by levees from river overflow. In these districts the lands next to the river are higher than those farther removed and bordered by table lands. Seepage from canals and storm run-off from these higher lands cause drainage problems on the lower lands. As yet the canal seepage from higher lands has not been serious, but some protective measures have been taken. All four areas are dependent on artificial drains to remove excess water.

In recent years it has been difficult to maintain a satisfactory discharge from the drain-ditch system in the lower part of the Palo Verde Valley.

Drainage conditions on the upper Colorado River Indian Reservation and the Yuma project have been benefited by retrogression of the river channel opposite the lands.

Water drained from California lands of the Yuma project is pumped over the levee to the river when the river is high; water drained from Arizona lands of the project is pumped over the levee into Mexico.

Some of the levees and drains protecting lands in the division are:

TABLE XCII.—*Levees and drains in the Boulder division*

	Open drains (miles)	Underground tile drains (miles)	Levees (miles)
Colorado River Indian Reservation	35	.....	2
Imperial irrigation district	[1] 1,238	546	[2]
Palo Verde irrigation district	80	.....	35
Yuma project	87	.....	45

[1] Maintained by the district. Length of open drains in private ownership not available.
[2] Levees are in Mexico.

Power.—Power production in the Boulder division is of utmost importance to the lower basin and to southern California. It is here that the waters of the Colorado River are utilized to generate the tremendous electric energy output of the Boulder and Parker Dam power plants.

Thirteen transmission lines extend from Boulder Dam power plant to power market areas in Arizona, Nevada, and southern California. The two largest electric utilities in southern California, the Southern California Edison Co., Ltd., and the City of Los Angeles Department of Water and Power, obtained 25 and 78 percent, respectively, of their total energy from this one source in 1943. Average firm power production at the Boulder power plant is about 4.5 billion kilowatt-hours annually, but during 1944 about 6 billion kilowatt-hours were generated.

The Parker Dam power plant is connected to the Boulder Dam power plant by transmission facilities which permit an interchange of electric energy, thereby conserving water. During the fiscal year 1944 the Parker Dam plant generated 781,642,000 kilowatt-hours. Transmission lines run from the Parker Dam plant to load centers in Arizona, to the Metropolitan Water District pumping plants, and to the All-American Canal power plants in California.

Other hydroelectric plants in the area include those on the All-American Canal, which, although comparatively small, are very important because of their location near the power market. Some plants on the canal are not yet

installed but are authorized and considered as present developments.

Power facilities in the area have been taxed to capacity, and the demand shows a definite need for additional generating and transmission facilities. The Davis Dam power plant, when constructed, will help to alleviate power shortages in the area.

Summary.—Important dams, irrigated acreages, and net effective stream depletion are summarized in the following tables:

TABLE XCIII.—*Important dams in the Boulder division*

Name of dam	River	Purpose	Capacity of reservoir (acre-feet)
Boulder	Colorado	River regulation, irrigation, power	32,359,000
Davis [1]	do	do	1,940,000
Parker	do	River regulation, irrigation, municipal diversion, power	716,600
Headgate Rock	do	Irrigation diversion	
Imperial	do	Irrigation diversion, desilting	85,000
Laguna	do	Irrigation diversion	

[1] Authorized

TABLE XCIV.—*Irrigated and irrigable area under present developments (1943)*

Area	Irrigated (acres)	Additional irrizable (acres)	Total (acres
Colorado River Indian Reservation	5,000	95,000	100,000
Palo Verde irrigation district	38,600	37,000	75,000
All-American Canal:			
Imperial Irrigation district	400,400	122,600	523,000
East Mesa		[1] 40,000	40,000
West Mesa		[1] 50,000	50,000
Pilot Knob Mesa		[1] 15,000	15,000
Coachella Valley	[2] 16,000	69,000	85,000
Yuma project	58,800	8,500	67,300
Gila project:			
Yuma Mesa	100	69,900	70,000
North Gila Valley	4,400	1,000	5,400
South Gila Valley	[2] 6,600	1,000	7,600
Wellton-Mohawk	[2] 7,800		7,800
Las Vegas area	[2] 1,200		1,200
Williams River	1,700		1,700
Total	[2] 540,000	[2] 509,000	[2] 1,049,000

[1] Based on incomplete land classification.
[2] Now irrigated from ground water.
[3] The 416,400 acres of irrigated and 296,600 acres of irrigable land under the All-American Canal are outside the natural Colorado River Basin. Excluding these lands Boulder division totals would be irrigated 123,600 acres; irrigable 212,400 acres; total 336,000 acres.

TABLE XCV.—*Areas irrigated in the Boulder division by States (1943)*

Area	Arizona (acres)	California (acres)	Nevada (acres)	Total (acres)
Colorado River Indian Reservation	5,000	0	0	5,000
Palo Verde irrigation district	0	38,000	0	38,000
All-American Canal	0	[1] 400,400	0	[1] 400,400
Coachella Valley (ground water)	0	16,000	0	[1] 16,000
Yuma project	52,300	6,500	0	58,800
Gila project	4,500	0	0	4,500
South Gila Valley (ground water)	6,600	0	0	6,600
Wellton-Mohawk (ground water)	7,800	0	0	7,800
Williams River	1,700	0	0	1,700
Las Vegas (ground water)	0	0	1,200	1,200
Total	77,900	460,900	1,200	540,000

[1] Outside the natural Colorado River Basin.

TABLE XCVI.—*Estimated present average annual stream depletions in the Boulder Division*

Stream	Irrigation, industrial, municipal uses			Reservoir losses acre-feet	Total depletions acre-feet
	Arizona acre-feet	California acre-feet	Nevada acre-feet		
Colorado River	205,000	[1] 2,680,000	[2] 20,000	713,000	3,618,000
Williams River	3,100	0	0	0	3,100
Total	208,100	[1] 2,680,000	[2] 20,000	713,000	3,621,100

[1] Includes exportation of 2,240,000 acre-feet to the Salton Sea drainage area by the All-American Canal and 145,000 acre-feet to Metropolitan Water District of southern California by the Colorado River aqueduct for municipal purposes, exports thus totaling 2,535,000 acre-feet.

[2] Diversion for industrial use by Basic Magnesium, Inc.

POTENTIAL DEVELOPMENT OF WATER RESOURCES

The Boulder division is naturally divided by physical characteristics into two general regions. Above Boulder Dam the deep canyons and rapid fall of the Colorado River are ideal for power developments, while below Boulder the region is more susceptible of irrigation and it is there where most of the additional irrigation projects probably will be located.

Marble Canyon-Kanab Creek project.—The Colorado River drops approximately 1,260 feet in the 150 miles between Glen Canyon Dam site in the upper basin and the estimated normal water surface of the potential Bridge Canyon Reservoir. Approximately 100 miles of the river and 950 feet of the drop are within the boundary of the Grand Canyon National Park. To develop fully the power possibilities of the Colorado River and yet avoid the construction of dams or other works in the Grand Canyon National Park, Colorado River waters not needed to maintain a steady stream for scenic purposes in the park could be diverted through a tunnel 44.8 miles long to a power plant near the mouth of Kanab Creek. With an installed capacity of 1,250,000 kilowatts this Kanab Creek power plant operating under an average head of about 1,100 feet could produce 6.5 billion kilowatt-hours of firm energy annually. A 300-foot dam constructed at the Marble Canyon site would divert water to the tunnel and form a reservoir of 500,000 acre-feet capacity extending upstream to the potential Glen Canyon Dam. Water released from the dam in Marble Canyon for scenic purposes in the park would pass through a 22,000-kilowatt power plant at the dam under an average head of 275 feet. This plant would be capable of producing 164,000,000 kilowatt-hours of firm energy annually.

Coconino project.—Construction of a dam at the Coconino site on the Little Colorado River would provide silt and flood control. This construction would reduce the amount of silt entering the potential Bridge Canyon Reservoir by an estimated 18,000 acre-feet annually. Reduction of flood peaks on the Colorado River main stem would also result. The height of the dam would be 260 feet above bedrock and the reservoir capacity would be 1,600,000 acre-feet.

Bridge Canyon project.—A dam at the Bridge Canyon site on the Colorado River at the head of Lake Mead would serve both power and irrigation purposes. This dam would have a height above bedrock of 740 feet and would form a reservoir with a capacity of 3,720,000 acre-feet. The Colorado River falls about 670 feet between the western portion of the Grand Canyon National Park and this dam site. Practically all of this fall could be utilized to produce power in a power plant at the dam with a total installed capacity of 650,000 kilowatts. The power plant would be operated in coordination with all other Government-owned plants on the Colorado River to make possible greater production of firm energy. The Bridge Canyon Dam could also serve as an irrigation diversion structure for the Central Arizona project, discussed in this report under potential development in the Gila division.

With construction of this dam it would be possible to reduce storage space reserved in Lake Mead for flood control, thus increasing the average available power head for the Boulder Dam power plant.

Other benefits accruing as a result of the construction of this project would include improved regulation of stream flow and development of a scenic region between Grand Canyon National Park and the Boulder Dam National Recreation area.

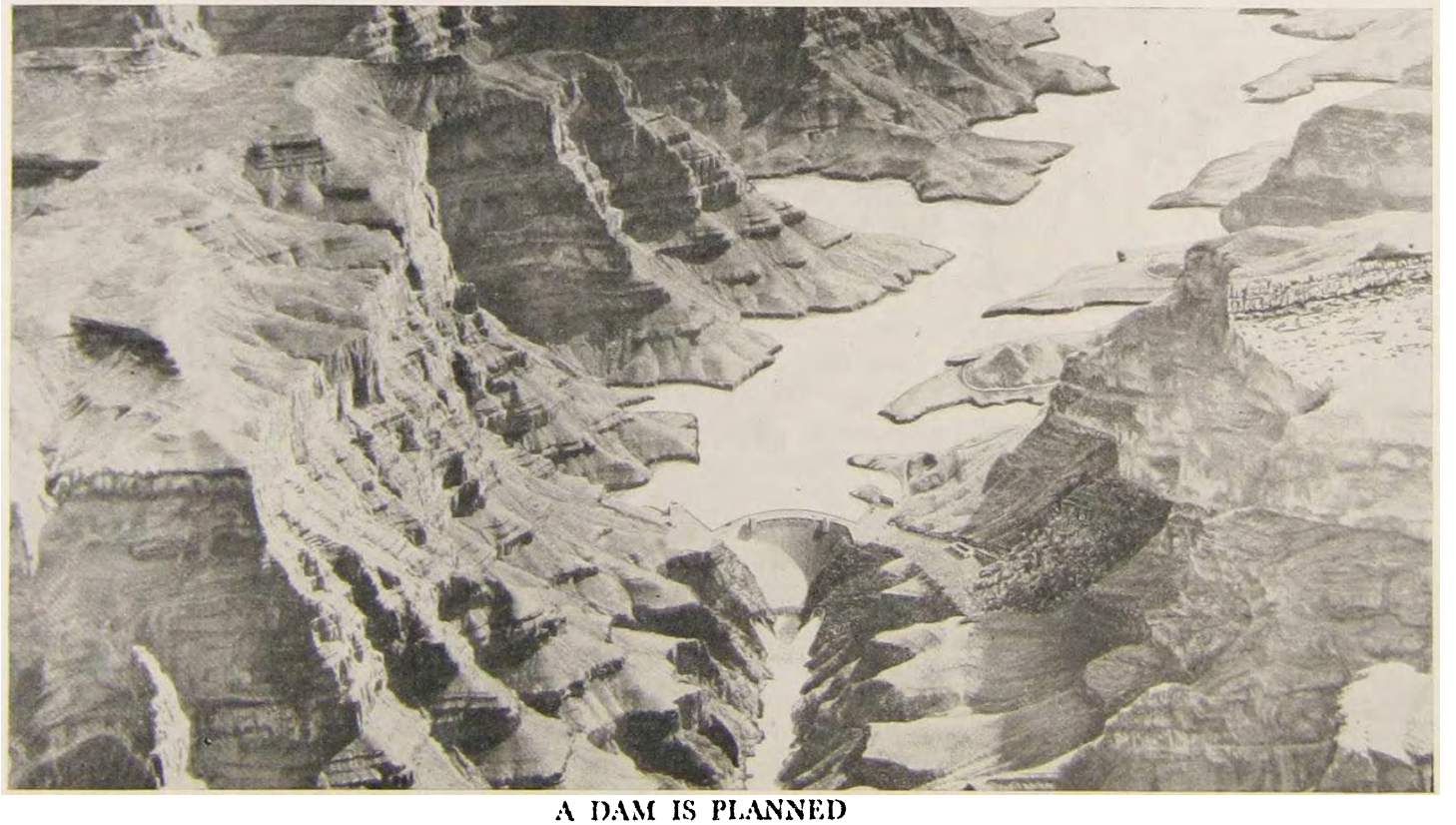
Virgin Bay pumping project.—This project would make possible the irrigation of 2,800 acres of new land along a 6-mile stretch at the eastern edge of the Virgin River arm of Lake Mead by pumping from the lake. An average lift of 200 feet would irrigate 1,600 acres of the area, and an average lift of 360 feet would serve the remaining 1,200 acres. Two main lateral canals totaling some 20 miles in length, including 1.5 miles of tunnel, and 1.5 miles of pump penstock would be required.

Las Vegas pumping project.—Water for this project, which embraces an area of 20,000 acres of new land surrounding the city of Las Vegas, would be pumped from Lake Mead with a maximum total lift of some 900 feet to irrigate 15,000 acres, and through another lift of about 275 feet to serve an additional 5,000 acres. Some 24 miles of lined, open main canal, 6.5 miles of tunnel, 1



A SITE IS FOUND

Reclamation engineers and geologists locate suitable dam sites



A DAM IS PLANNED

Potential Bridge Canyon Dam as envisaged by Reclamation project planners

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mile of siphon, and 3 pumping plants would be required. Practically all project lands would require drainage.

The present draft on the ground water supply in the Las Vegas Valley is believed to about equal the natural recharge of the underground reservoir. Population expansion and increased needs for future industries will require supplemental water from Lake Mead. This Las Vegas pumping project could be enlarged to serve additional needs, or an independent development for an industrial and domestic water supply may prove desirable. Domestic and industrial needs together with steadily growing recreational uses ultimately may require 100,000 acre-feet of water annually.

Davis Reservoir pumping project.—An area of 2,000 acres of new land 20 miles above Davis Dam site on the Nevada side of Davis Reservoir would be irrigated by pumping from the reservoir. One pump would lift the water an average of 180 feet to irrigate 400 acres, and a second pump lift of 200 feet would serve the other 1,600 acres in the project. A total of some 8,000 feet of pressure pipe and several miles of main laterals would be required.

Big Bend pumping project.—An area of 3,700 acres of new land extending from one mile below Davis Dam 6 miles downstream on the Nevada side of the Colorado River would be irrigated by pumping from the river into two main laterals, each about 6 miles long. Two pumping lifts would be required, one of 250 feet to serve 2,000 acres and another of 500 feet to reach the remaining 1,700 acres.

Fort Mojave project.—About 5,100 acres of new land located in the southern tip of Nevada would be served under this project by pumping from the Colorado River. An area of 2,600 acres of bottom lands, including 1,630 acres of Indian lands in the Fort Mojave Reservation, could be reached with a 30-foot lift, and a total of 2,500 acres of slope lands could be served by five successive 100-foot lifts serving 500 acres each.

Mojave Valley project.—Lands situated on the Arizona side of the Colorado River about 8 miles upstream from Needles, Calif., would be included in this project. By pumping from the river, 10,000 acres of mesa and bench lands could be irrigated. A pumping plant located near near Fort Mojave, Ariz., would lift the water 215 feet to a main canal extending east and south for a distance of 7 miles.

Alamo project.—Floods on Williams River menace principally lands along the Colorado River below Parker Dam. Havasu Lake, formed by Parker Dam, can control floods originating in the watershed area of the Colorado River between Davis Dam site and Parker Dam, but only at the expense of serious loss of potential energy production.

To remedy this situation would require construction of a flood-control dam at the Alamo site on Williams River. The dam would have a height above bed rock of 270 feet, and the nominal reservoir capacity at the spillway crest would be 946,000 acre-feet. The dam would be so constructed that it could be modified eventually for use in conserving water and generating power. Erratic stream flows, however, would make considerable hold-over storage imperative, and resultant high evaporation losses preclude the irrigation of any considerable areas of land.

Palo Verde Mesa project.—Near Blythe, Calif., 16,000 acres of mesa lands would be served by enlarging 13 miles of the Blythe Canal and pumping with a lift of 165 feet to a new 20-mile main canal on the mesa.

Chuckawalla project.—The Chuckawalla project in California is in a large inland basin with no surface drainage outlet. To provide surface drainage would require a channel about 16 miles long with a maximum cut of 115 feet. Water to irrigate lands in this basin could be pumped about 210 feet from the Palo Verde irrigation district canal to a main canal about 40 miles long. Soils of the valley are largely coarse, granitic alluvial outwash from the surrounding mountains, and large sections of the land are covered with surface rock or cut by drainage courses. Some land near the lower elevations of the valley is suitable for agriculture if drained properly. Under priorities to Colorado River water presently assigned by the State of California, a water supply for the Chuckawalla Valley appears to be remote. The potentialities of the valley must be recognized in future planning; but because of the uncertainty of water supply, these potentialities are not shown in the summary tables.

Wellton-Mohawk division of Gila project.—As previously stated, it now appears desirable to limit development of the Yuma Mesa division of the Gila project and utilize the same water for more advantageous developments elsewhere. One such possibility is the Wellton-Mohawk division of the Gila project. Seventy thousand acres of new land could be served. In addition 7,800 acres now irrigated by pumping ground water could be furnished a supplemental supply. Water would be diverted from the existing Gila gravity main canal on the south side of Gila River and conveyed by canal to a pump where it would be raised to project lands, all of which are below the 342-foot contour. A siphon would be constructed to convey the pumped water to project lands on the north side of the Gila River.

San Diego project.—The exportation of 112,000 acre-feet of water annually from the Colorado River to the San Diego area is contemplated for this project. Under one plan water would be diverted at Imperial Dam and carried in the All-American Canal to the west side of the Imperial Valley, thence by pumping, canals, siphons, and tunnels through and across the Peninsula Range of California into the San Diego River where it would be captured in San Diego City's El Capitan Reservoir. Existing

main and lateral pipe lines would transport the water to points of municipal use.

Choice of the aqueduct route which was surveyed by the Bureau of Reclamation from the Colorado River aqueduct of the Metropolitan Water District of Southern California to the San Vicente Reservoir of the San Diego water system was based on its adaptability to emergency construction. An aqueduct could be built here to relieve the critical water situation at San Diego in much shorter time than could one from the All-American Canal. This emergency construction, however, does not eliminate the possibility of a future connection with the All-American Canal. Whether such a connection ultimately will be made will depend on economic and other considerations which take into account the delivery of water over a long period of time.

Sentinel or Painted Rock project.—A dam constructed at or near the Sentinel site on the Gila River below the Gillespie Diversion Dam to form a reservoir with a capacity of about 3,000,000 acre-feet would provide control of devastating floods in the lower Gila River and protect downstream developments on that river and on the Colorado River below the entry of the Gila. Because the dependable water supply at this potential reservoir is uncertain, its use for irrigation is, for the present, discounted. Irrigation possibilities should be appraised later, following future upstream developments and after the regimen of the stream has become stabilized.

The United States Engineer Office of the War Department has made a field survey and examination for a dam at Painted Rock, about 15 miles above the Sentinel Dam site, and is of the opinion that the site at Painted Rock is more suitable than the one at Sentinel. Full consideration should be given, therefore, to the Painted Rock site in connection with a project in this general locality.

River rectification and control.—In the preceding text under the heading "Silt Problem," reference was made to changing conditions in the Colorado River channel both before and after the building of Boulder Dam. Three existing examples of river control construction intended to cope with the vagaries of the river can be cited: First, levee construction near Yuma, undertaken several years ago for general flood protection; second, present dyking and other construction at Needles where aggradation of the river channel has caused flooding and bank cutting; and third, construction of a temporary diversion weir at the headworks of the Palo Verde irrigation district canal where degradation of the river channel, although improving land drainage, has impaired the functioning of the existing headworks.

These three examples are typical of construction to meet the conditions of the present. Conditions along the river are continually undergoing change at this instant but there are no problems in a critical state other than those mentioned. Notwithstanding, steps for river regulation and prevention of damage are immediately necessary. The Bureau of Reclamation is now preparing plans for river control involving strengthening of the Yuma levees, continuing construction of emergency measures at Needles and at the Palo Verde canal intake, and maintaining all constructed works. Dredging of the channel near Needles should be started. The Bureau should plan to forestall future damage where that is possible, and be prepared to take remedial measures where the need arises.

Summary

Potential development in the Boulder division is summarized in the following tables:

TABLE XCVII.—*Potential projects in the Boulder division*

Project	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [2]
Marble Canyon-Kanab Creek	Arizona	Colorado River	P, F, S, H	$382,000,000
Coconino	do	Little Colorado River	F, S, H	4,000,000
Bridge Canyon	do	Colorado River	P, I, F, S, H	146,500,000
Virgin Bay pumping	Nevada	Lake Mead	I	1,300,000
Las Vegas pumping	do	do	I, M	8,400,000
Davis Reservoir pumping	do	Davis Reservoir	I	500,000
Big Bend pumping	do	Colorado River	I	700,000
Fort Mojave	do	do	I	800,000
Mojave Valley	Arizona	do	I	1,900,000
Alamo	do	Williams River	F, P, H	3,200,000
Palo Verde Mesa	California	Colorado River	I	3,100,000
Wellton-Mohawk	Arizona	do	I	10,600,000
Sentinel	do	Gila River	F, H	15,000,000
River rectification and control	California, Arizona	Colorado River	F	5,000,000
Total				583,000,000

[1] Symbols used: I=irrigation, P=power; F=flood control; S=silt retention; H=hold-over storage for river regulation.

[2] Preliminary estimates based on construction costs of Jan. 1, 1940.

TABLE XCVIII.—*Potential reservoirs in the Boulder division*

Name of site	Source of water supply	Project served directly	Total capacity (acre-feet)
Marble Canyon	Colorado River	Marble Canyon-Kanab Creek	500,000
Coconino	Little Colorado River	Bridge Canyon	1,600,000
Bridge Canyon	Colorado River	do	3,720,000
Alamo	Williams River	Alamo	916,000
Sentinel	Gila River	Sentinel	3,000,000
Total			9,766,000

[1] All in Arizona.

TABLE XCIX.—*Potential irrigation development in the Boulder division*

Project	State	Area to be benefited (acres)		
		New land	Furnished supplemental water	Total
Virgin Bay pumping	Nevada	2,800	0	2,800
Las Vegas pumping	do	20,000	0	20,000
Davis Reservoir pumping	do	2,000	0	2,000
Big Bend pumping	do	3,700	0	3,700
Fort Mojave	do	5,100	0	5,100
Mojave Valley	Arizona	10,000	0	10,000
Palo Verde Mesa	California	16,000	0	16,000
Wellton-Mohawk division of Gila project	Arizona	70,000	7,800	77,800
Total		129,600	7,800	137,400

[1] All projects are in natural drainage basin of the Colorado River.

TABLE C.—*Potential irrigation developments in the Boulder division by States*

State	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total area
Arizona	80,000	7,800	87,800
California	16,000	0	16,000
Nevada	33,600	0	33,600
Total	129,600	7,800	137,400

TABLE CI.—*Potential power development in the Boulder division*

Project[1]	Name of power plant	River	Installed capacity (kilowatts)	Annual firm generation (kilowatt-hours)
Marble Canyon-Kanab Creek	Marble Canyon	Colorado	22,000	164,000,000
	Kanab Creek	do	1,250,000	6,570,000,000
Bridge Canyon	Bridge Canyon	do	650,000	3,440,000,000
Total			1,922,000	10,174,000,000

[1] All in Arizona.

TABLE CII.—*Present and potential stream depletions, Boulder division*

State River	Estimated average annual depletion (acre-feet)			
	Existing or authorized projects		Potential projects	Total ultimate depletion
	Present depletion	Future increase		
Arizona:				
Colorado River	205,000	571,000	346,000	1,122,000
Williams River	3,400	0	0	3,400
Subtotal	208,400	571,000	346,000	1,125,400
California:				
Colorado River	2,680,000	2,946,000	176,000	5,802,000
Nevada:				
Colorado River	20,000	0	177,000	197,000
Reservoir losses	713,000	66,000	91,000	870,000
Total	3,621,400	3,583,000	790,000	7,994,400

[1] Includes export of 5,415,000 acre-feet from the natural drainage basin of the Colorado River, made up of 2,535,000 acre-feet present, 2,798,000 acre-feet future increase from existing or authorized projects, and 112,000 acre-feet from potential projects.

Gila Division

The Gila division, consisting of the area drained by the Gila River above Sentinel and adjacent small independent drainage areas, embraces 53,000 square miles, 47,380 of which are in south and central Arizona, and 5,620 in western New Mexico.

WATER RESOURCES

Surface water.—The flow of the Gila River under virgin conditions is estimated at 1,752,000 acre-feet annually at Gillespie Dam and 1,270,000 acre-feet at Dome, Ariz., near its mouth. Recorded stream flows in the Gila division are shown in table CIII.

Streams within the Gila Basin attain their maximum flows during late winter and early spring when mountain snows are melting. Precipitation on the watershed falls mainly in late winter and late summer, the intervening

TABLE CIII.—*Average annual stream flows in the Gila division*

Station	Period of record	Average annual flow (a.f.)	
		For period of record	For 1931–40 period
San Francisco River near Glenwood, N. Mex.	1929–43	51, 800	50, 000
San Francisco River at Clifton, Ariz.	1914–43	172, 000	123, 000
Gila River near Gila, N. Mex.	1929–43	103, 000	93, 400
Gila River near Red Rock, N. Mex.	1910–43	140, 000	127, 000
Gila River below Blue Creek near Virden, N. Mex.	1928–43	137, 000	126, 000
Gila River near Clifton, Ariz.	1913–43	192, 000	112, 000
Gila River near Solomonsville, Ariz.[1]	1915–43	302, 000	271, 000
Gila River at Calva, Ariz.	1929–43	246, 000	209, 000
Gila River below Coolidge Dam, Ariz.[2]	1914–43	328, 000	214, 000
Gila River at Kelvin, Ariz.[3]	1911–43	444, 000	299, 000
Gila River below Gillespie Dam, Ariz.	1922–43	302, 000	149, 000
Gila River near Dome, Ariz.	1930–43	84, 000	57, 900
San Carlos River near Peridot, Ariz.	1929–43	45, 800	38, 300
San Pedro River at Charleston, Ariz.	1913–43	50, 700	45, 900
Santa Cruz River near Nogales, Ariz.	1930–43	15, 400	16, 900
Santa Cruz River at Tucson, Ariz.	1912–43	15, 800	15, 000
Salt River near Chrysotile, Ariz.	1924–43	493, 000	479, 000
Salt River near Roosevelt, Ariz.	1914–43	721, 000	584, 000
Salt River at Granite Reef Dam, Ariz.			1, 060, 000
Tonto Creek near Roosevelt, Ariz.	1902–40	97, 800	85, 000
Verde River near Pine, Ariz.	1935–39	425, 000	381, 000
Verde River above Camp Creek, Ariz.	1925–43	433, 000	417, 000
Agua Fria River above Lake Pleasant, Ariz.	1933–43	55, 300	53, 500
Hassayampa River at Box Canyon dam site, Ariz.			41, 400

[1] Includes Brown Canal diversions.
[2] Flow regulated by Coolidge Dam beginning 1929.
[3] Regulated after 1928.

seasons being almost devoid of rainfall. During these dry months flows of the rivers are usually small, but they increase enormously after a big storm or when sudden warm temperatures rapidly melt the mountain snow. About 45 percent of the annual run-off of the Gila River occurs during February, March, and April. Storage is imperative for efficient utilization of the available water. Numerous reservoirs already store the waters of the Gila River and its tributaries, which are almost completely utilized by existing irrigation projects. In fact, during protracted dry years the water available within the basin is inadequate to meet the demand. The Gila Basin, therefore, must look to other basins for an additional supply of surface water.

Ground water.—There is no law in Arizona regulating the development of percolating ground waters. In the absence of legal protection, development of ground water resources for any purpose would be hazardous, and this factor should be recognized in planning future developments.

Considerable portions of the broad basins of southwestern Arizona are underlain with uncemented valley-fill material, generally several hundred feet deep. This porous material absorbs much of the flow of streams as they enter the valley areas, thus creating great underground reservoirs. Irrigation seepage contributes substantial recharge to the reservoirs, but the scanty precipitation on valley lands adds little to the ground water supply.

Large quantities of water for irrigation and domestic use are obtained from ground water. Artesian wells of importance have been drilled in the upper Gila Valley, and small artesian flows have been encountered in the upper San Pedro and Santa Cruz Valleys. Yields of individual wells within the division range in discharge from .5 to 2,250 gallons a minute.

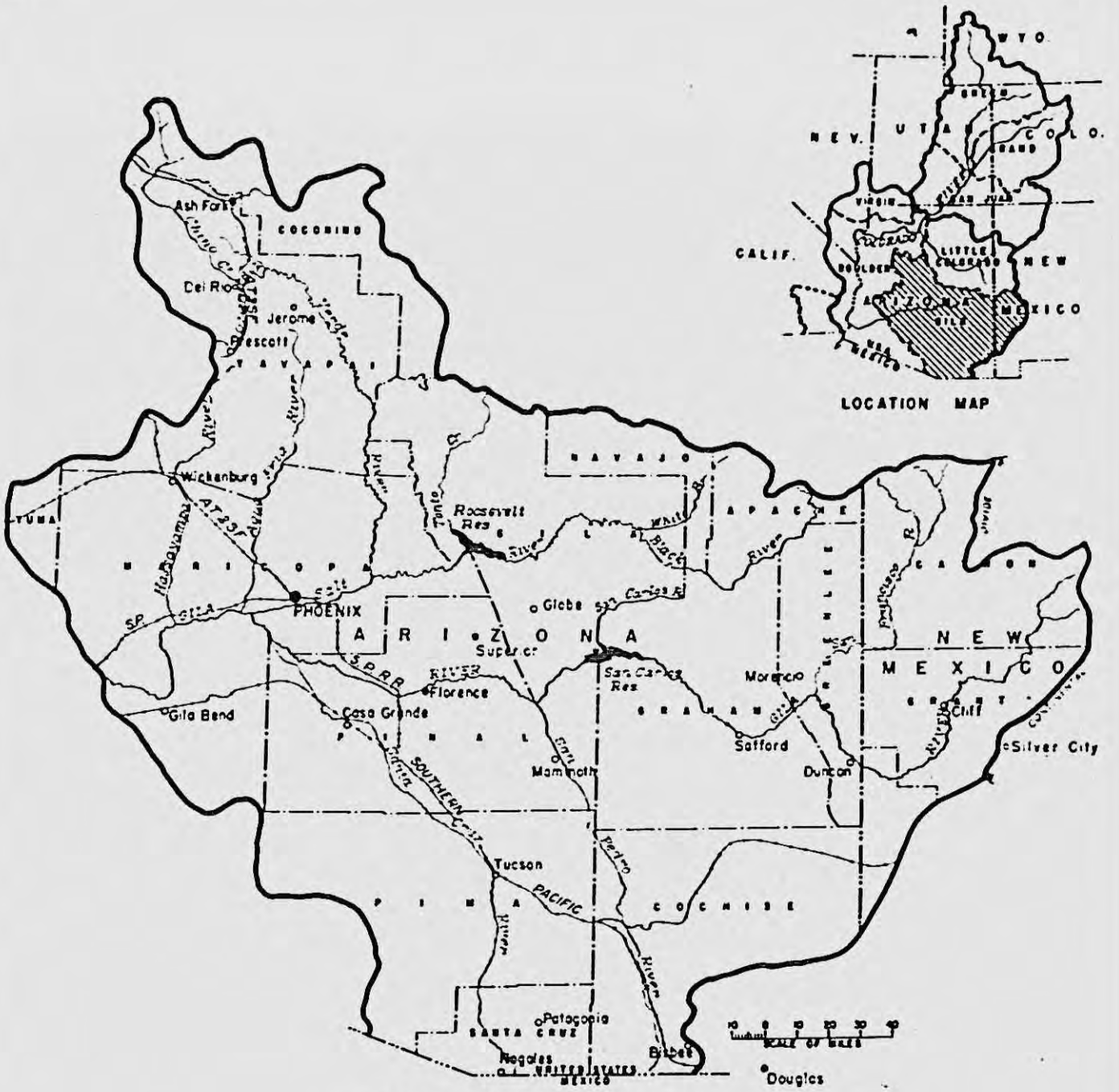
Small to moderate-sized springs are scattered through the watershed area. Only a small amount of land is irrigated directly from springs, but springs contribute a substantial amount of water to the perennial flows of the larger rivers. Spring water is particularly valuable in the semiarid outlying ranges, where creeks used for watering livestock are dry during large parts of the year.

With few exceptions, ground water within the basin has been developed beyond its economic limit, and in all but a few areas, ground-water withdrawals exceed replenishments.

Arizona lacks comprehensive legislation regulating the use of ground water, but the State Water Code provides that "water flowing in definite underground channels" is subject to appropriation. Since it is difficult to prove that such water does flow in a definite channel, little regulation of ground water exists in the State. In New Mexico the State Engineer can declare any area with underground water, the boundaries of which can be reasonably determined, to be an underground water basin. Underground water within the area must then be appropriated in much the same manner as that of surface streams. Present water users are thus protected, and expansion is permitted only where supplies are more than adequate for existing developments.

Quality of water.—Surface waters of Gila River and its tributaries carry considerable quantities of dissolved solids, chiefly sodium chloride and the sulphates and bicarbonates of sodium, calcium, and magnesium; however, the percentage of sodium is reasonably low. Low flows of the Gila River at Gillespie Dam in the lower part of the division carry over 6,000 parts per million total dissolved solids, while flood flows carry as little as 300 parts per million.

The quality of the ground water obtained from artesian wells and springs varies with location. Some waters have less than 100 parts per million dissolved salts, while others range as high as 5,000 parts per million. The total hardness of these waters, expressed as calcium carbonate, ranges from less than 5 to over 700 parts per million.



Gila Division of the Colorado River Basin

Ground waters of unsuitable quality for either irrigation or domestic use are found in wells in the upper Gila Valley, lower Salt River Valley, and in the Casa Grande and Coolidge districts. Ground waters of the division are generally unsuitable for industrial use.

Some of the surface water in the smaller tributaries and much of the ground water in the basin contain fluorides in such high quantities that it is quite often difficult to obtain a satisfactory domestic water supply.

Present Development of Water Resources

General

The surface and ground-water supplies of the Gila division are the basis for practically all its agricultural development, and stream flow, through the generation of hydroelectric energy, makes possible many of the area's industries. Surface waters, with the exception of



PUMPING GROUND WATER

Overdraft of underground supplies in Arizona is serious threat to agriculture. Thousands of acres may be abandoned unless more irrigation water is supplied

a few small tributary flows, are almost completely utilized by lands now under irrigation; and an estimated 1,600,000 acre-feet of ground water is pumped annually for irrigation and domestic use. Ground-water pumping greatly increases during dry years when reservoirs are low, throwing a tremendous strain on generating facilities already curtailed by low water conditions. The output of power plants in the division has been augmented recently by energy from Parker Dam on the Colorado River.

Rivers of the area transport large quantities of silt each year. Although river flows in dry weather are fairly clear, a load of sand constantly is being moved along the river bed even during the lowest river stages. High discharges, resulting from torrential rains and rapid run-off, carry in suspension heavy loads of fine silt and clay in addition to enormously increased bed loads.

The fine material carried in suspension presents no problem in canal maintenance, except when flows are exceptionally low. Coarser bed-load material, however, settles in canals and ditches and must be removed to maintain the capacity of the conduits. Both bed loads and suspended loads settle in storage reservoirs. This accumulation is important in determining the length of life of a reservoir. Records of the Salt River Valley Water Users' Association show a total silt accumulation of 108,000 acre-feet in Roosevelt Reservoir on Salt River during the period 1905 to 1934, inclusive. Other streams in the basin notably the Gila, are known to carry greater proportions of silt than Salt River, so this figure is lower than the average to be expected.

The suspended material found in the waters of the Gila River and its tributaries contains considerable organic matter and but little coloidal clay. When applied to sandy land, this material gives body to the soil and is beneficial. When spread on tight land, however, it clogs the pores of the soil, reducing its permeability and making its cultivation more difficult. In municipal water works, it clogs intakes and makes water clarification costly.

The only practicable solution of the silt problem lies in providing adequate silt storage capacity in reservoirs on major streams contributing silt and in limiting erosion by better watershed control.

Irrigation

Gila River.—Irrigated areas along the Gila River and its tributaries, San Francisco River, San Simon Creek, Queen Creek, and Centennial Wash, total 213,400 acres.

Irrigation projects located above Coolidge Dam have no water-storage facilities and must depend on diversions from the unregulated flow of the Gila River supplemented by pumping from ground water for their irrigation supplies. These upstream projects cover an area of approximately 51,000 acres and require additional water to irrigate adequately all project lands.

The San Carlos Reservoir, with a capacity of 1,200,000 acre-feet formed by Coolidge Dam (Office of Indian Affairs), stores water used for irrigation on several downstreams projects. The San Carlos project, largest of these irrigation developments, serves 100,500 acres, about half of which is farmed by Indians. Project lands require more water than is supplied to them by existing irrigation developments on the Gila River.

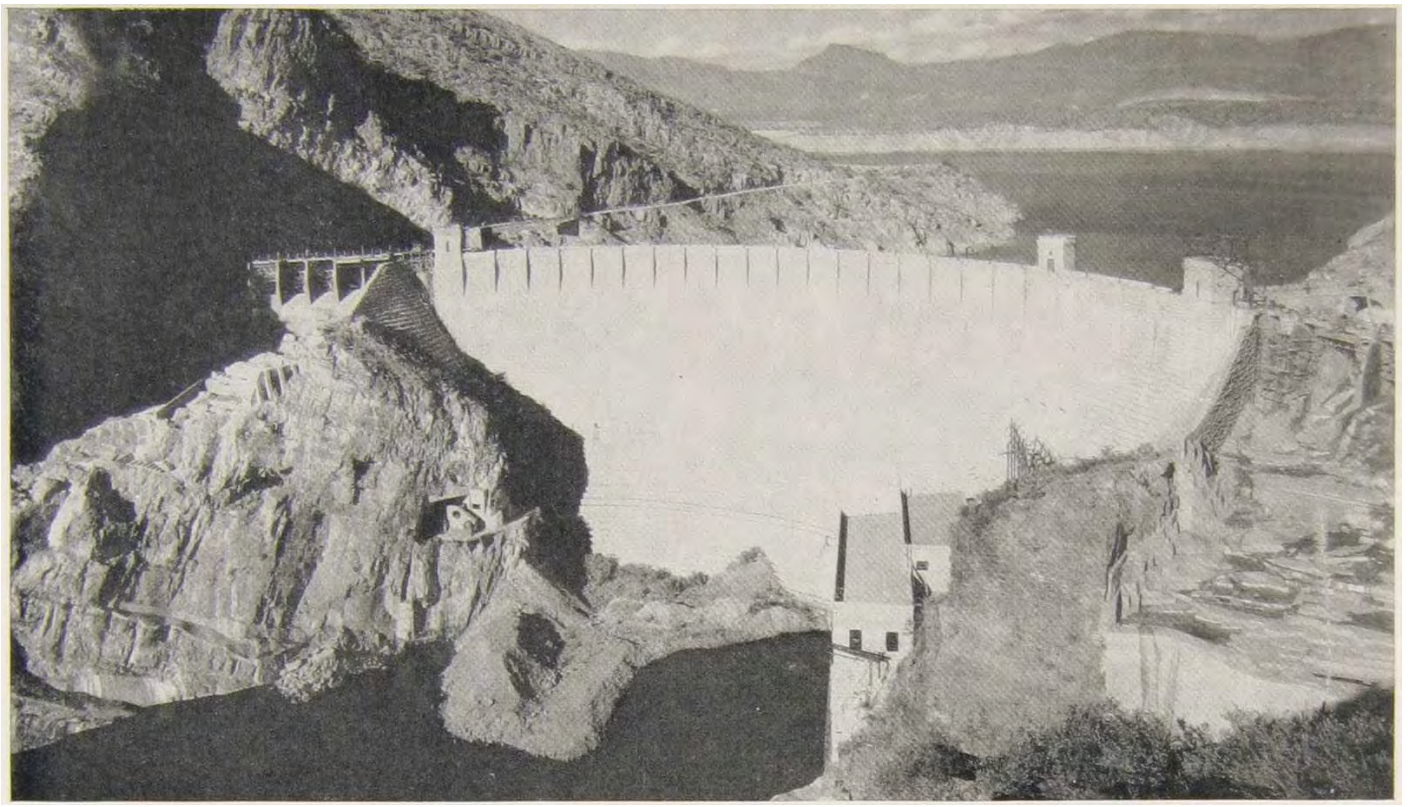
Other downstream developments include those made by the Buckeye Water Conservation and Drainage District, Arlington Canal Co., Gillespie Land & Irrigation Co., and others. These lands obtain much of their water supply by pumping from underground sources. At the present time ground-water depletions exceed recharges to a considerable degree, and unless replacement water is supplied, some land must be taken out of cultivation within a few years.

San Pedro River.—About 2,600 acres of land are irrigated in the Benson-St. David area of the upper San Pedro River watershed and a few hundred acres are dry-farmed. No surface water storage is available and irrigation supplies depend on the extremely variable flow of the river, the output of several small flowing wells, and a limited amount of pumping from ground water.

All of the dependable surface water supply of the San Pedro is now divided among irrigators in the San Pedro Valley and in the Gila River Valley downstream from the confluence of the two streams. The only possibility of irrigating additional lands in the San Pedro Valley is through the importation of water to the Gila Basin, so that San Pedro River water now used there may be released for use in the San Pedro Valley. Ground-water resources along the San Pedro River are not fully developed, and increased pumping would yield valuable but limited supplemental water supplies.

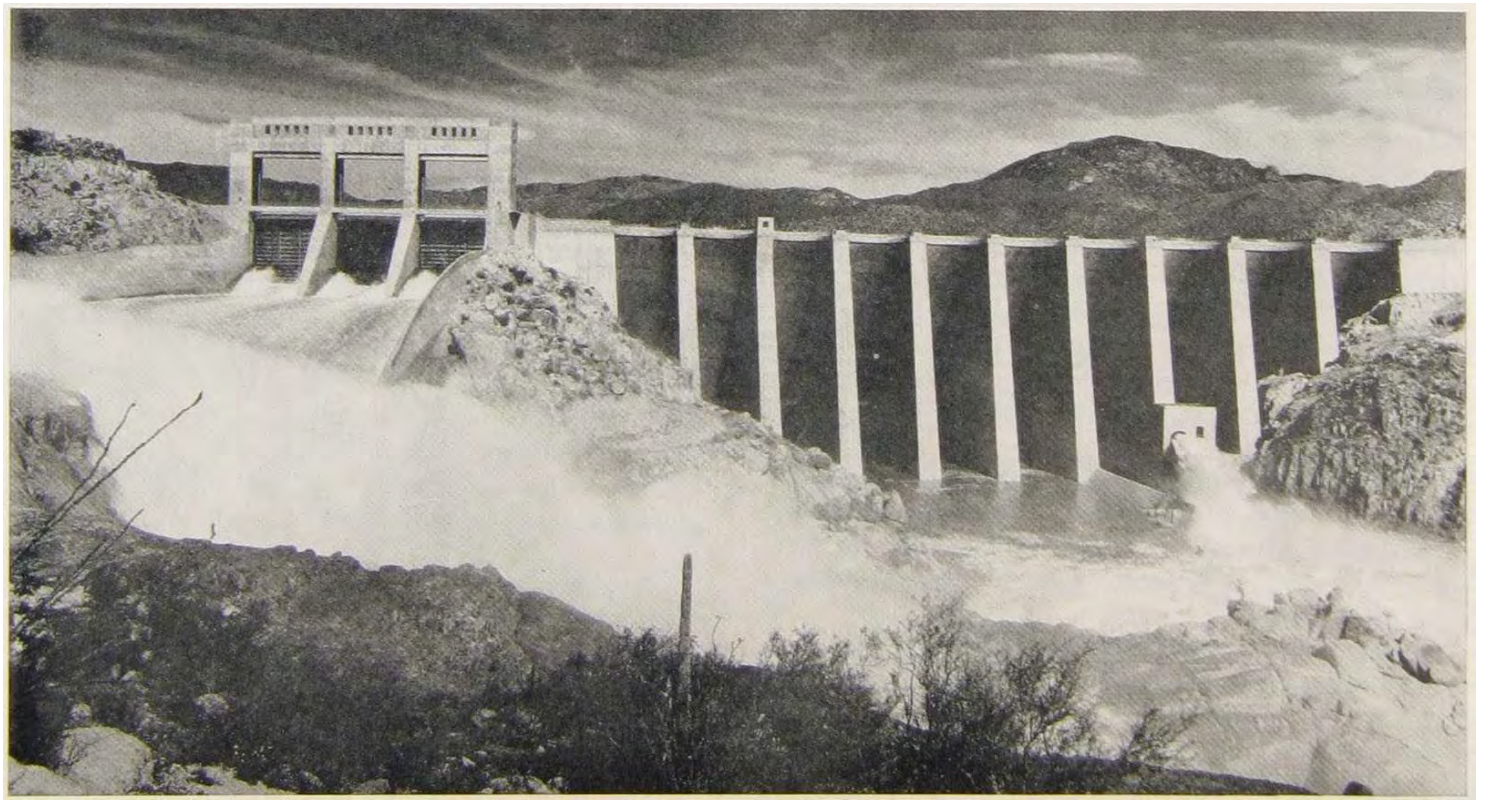
Salt and Verde Rivers.—Diversions of irrigation water from Salt River were first made by white settlers in 1867. Because of erratic river flows and lack of storage facilities, water supplies during dry years were inadequate to supply the demands of the lands in cultivation. The Bureau of Reclamation constructed Roosevelt Dam and power plant to provide storage and regulation of Salt River. Diversion works, canals, laterals, and other power plants were also built by the Bureau before turning the project over to the Salt River Valley Water Users' Association in 1917, subject to payment of the unpaid balance of construction charges. During the years between 1922 and 1930, the association constructed the Horse Mesa, Mormon Flat, and Stewart Mountain Dams for irrigation and power, and the Cave Creek Dam for flood control. The Bureau of Reclamation, during the 1936-39 period, built Bartlett Dam on the Verde River, principal tributary of Salt River.

Large areas of fertile land surrounding the Salt River



ROOSEVELT DAM ON SALT RIVER

First Bureau of Reclamation storage in Colorado River Basin



BARTLETT DAM ON VERDE RIVER

Another Reclamation dam to irrigate Arizona's thirsty lands

project are irrigated with water wholly or partly supplied by pumping from wells. The Salt River project also supplements its surface-water supplies with ground water.

Approximately 336,000 acres of land were irrigated in the Salt River and Verde River Valley region in 1939. This included 14,000 acres of Indian land, not all of which is irrigated at the present time. The Office of Indian Affairs contemplates ultimate development of the full acreage. Of the total area 240,000 acres were irrigated principally with surface water and the remainder with water from wells.

Pumping from underground storage exceeds recharges and unless ground-water supplies are supplemented, the amount of land under cultivation will have to be reduced.

An earth and rock-fill dam is at present being constructed at the Horseshoe site on the Verde River by the Phelps Dodge Corporation in cooperation with Defense Plant Corporation. Under the terms of an agreement between these corporations and the Salt River Valley Water Users' Association, water conserved by this dam will be exchanged for water diverted from Black River, another tributary of Salt River, for use at the Morenci Mine and Reduction Works, owned by the Phelps Dodge Corporation. The Horseshoe Dam will conserve a part of the Verde River flood water for use on the lands of the association, and in return the association will permit Phelps Dodge and Defense Plant Corporation to divert from Black River an amount of water equal to that conserved by Horseshoe Dam, but not in excess of 14,000 acre-feet a year, nor in excess of 250,000 acre-feet total.

The reservoir formed by Horseshoe Dam will have a storage capacity of 60,000 acre-feet, but the dam will be so constructed that it may be enlarged ultimately to increase the reservoir capacity to 300,000 acre-feet.

Santa Cruz River.—Wells furnish practically all of the water used by the 115,400 acres of irrigated land in the Santa Cruz River Valley. Electric energy for pumping purposes is imported from the Salt River Valley and Parker Dam power plants.

Because of the high fertility of the lands in this region the acreage under cultivation has increased greatly with a consequent increase in the amount of ground water pumped for irrigation use. Ground-water withdrawals exceed replenishments and unless additional water becomes available, much land must go out of cultivation within a few years.

Agua Fria and Hassayampa Rivers.—Approximately 18,700 acres of land are irrigated in and adjacent to the Agua Fria River Valley through the utilization of both surface and ground-water supplies. Surface waters are stored in a 178,000-acre-foot reservoir formed by Lake Pleasant Dam, and ground water is made available by means of numerous deep-well, electrically-driven pumps. As no electrical energy is generated in the area, all energy used is purchased from power plants located in other regions. Ground-water pumping should be reduced and, if possible, replaced by surface water.

Some 500 acres of land lying near the Hassayampa River is presently irrigated. Much fertile land in the valley would be very productive if adequately supplied with irrigation water.

Independent drainage basins.—Approximately 10,400 acres of irrigated farm land in the Gila division are in small independent drainage basins or in basins draining into Mexico. These lands derive their water supplies principally from artesian or pumped wells, although surface flows are used when available.

TABLE CIV.—*Irrigated areas in independent basins*

Basin	County and State	Drainage	Area irrigated (acres)
Sulphur Springs Valley	Cochise, Ariz	Independent	3,000
Whitewater Draw	do	Yaqui River	2,000
Yamori	Pima, Ariz	Independent	[1]5,200
Animas Valley	Hidalgo, N. M.	do	200
Total			10,400

[1] Indian lands.

Power

Power plants supplying electrical energy to the Gila division fall into two classes: (1) those which generate energy for sale, and (2) those which were constructed for the sole purpose of furnishing energy to some nearby industrial development. Both publicly and privately owned plants are located in the area. Those owned privately have by far the greater installed capacity and have been constructed mainly to supply the energy demands of mines, mills, and smelters. The total installed capacity of power plants in the division is about 327,000 kilowatts.

The Bureau of Reclamation's power plant at Parker Dam supplies large amounts of energy to power-marketing agencies located at Phoenix, Coolidge, and Tucson, Ariz. These agencies in turn distribute this energy over a wide area.

Power plants of the Gila division are hydroelectric, steam, or internal combustion. Steam plants predominate.

Drainage

Soils and topography within the Gila division are such that drainage under irrigation is generally adequate and in some cases excessive. Subsurface drainage is

usually good because of the open, permeable subsoils found through most of the region. Some areas of the Salt River Valley are drained by pumping from wells. Not only does this result beneficially in lowering the ground-water level but also makes available a dependable supply of irrigation water.

Several farming districts surrounding the Salt River project are wholly dependent upon this drainage water for their irrigation supply. The drainage system comprises about 190 wells. Electrically operated pumps lift the water about 86 feet to distributing canals, where it flows by gravity to the irrigated lands. Some 240,000 acres are thus drained and about 95,000 acres of this area are irrigated by pumped water.

Flood control

Cave Creek Dam, situated just north of Phoenix, Ariz., is the only dam constructed for flood control in the region. Its reservoir capacity is 14,000 acre-feet. Although other storage dams were constructed primarily for irrigation and power development, they offer some degree of protection. Considerable damage, however, still results from flash floods.

Summary

Important dams, irrigated acres, and the net effective stream depletion due to present irrigation development are summarized in the following tables:

TABLE CV.—*Important dams in the Gila division*

Name of dam	River	Purpose	Capacity (acre-feet)
San Jose	Gila	Irrigation diversion	
Coolidge	do	Irrigation, flood control, power	1,200,000
Ashurst-Hayden	do	Irrigation diversion	
Sacaton	do	do	
Gillespie	do	do	
Roosevelt	Salt	Irrigation, power	1,400,000
Horse Mesa	do	Power	245,000
Mormon Flat	do	do	57,800
Stewart Mountain	do	do	70,000
Granite Reef	do	Irrigation diversion	
Bartlett	Verde	Irrigation, flood control	182,600
Cave Creek	Cave Creek	Flood control	14,000
Lake Pleasant	Agua Fria	Irrigation	178,000
Horseshoe	Verde	do	60,000
Total			3,407,000

TABLE CVI.—*Present irrigated areas in the Gila division*

Stream basin	Acres irrigated		
	Arizona	New Mexico	Total
Gila River	202,600	10,800	213,400
San Pedro River	2,600	0	2,600
Salt and Verde Rivers	336,000	0	336,000
Santa Cruz River	115,400	0	115,400
Agua Fria River	48,700	0	48,700
Hassayampa River	500	0	500
Independent Basins	10,200	200	10,400
Total	716,000	11,000	727,000

TABLE CVII.—*Estimated present average annual stream depletion in the Gila division*

Division	Depletion (acre-feet)		
	Arizona	New Mexico	Total
Gila division	1,135,000	16,000	1,151,000

POTENTIAL DEVELOPMENT OF WATER RESOURCES

The water supply of Gila division is inadequate to meet the requirements of lands now irrigated. Groundwater supplies are being exhausted, and surface supplies are inadequate. In general, the area is suffering from a continual water shortage. The only source of water for supplemental, replacement, or additional use is the Colorado River.

Central Arizona project.—Several plans have been advanced for diverting Colorado River water to central Arizona. Preliminary investigations by the State of Arizona and by the Bureau of Reclamation have reduced the number of alternatives considered to three; these three are receiving study at the time this report is being prepared to determine which plan shall receive the detailed investigation necessary for project report.

All plans would serve the purpose of delivering Colorado River water to Granite Reef Dam, on the Salt River at the nominal head of irrigation. Brief descriptions of these routes follow: (1) *Marble Canyon route (grav-*

ity)—Colorado River water would be diverted from the potential Marble Canyon Reservoir, the dam site for which is about 320 miles upstream from Boulder Dam, through 143 miles of continuous tunnel, to discharge into the Verde River 95 miles upstream from its confluence with the Salt River. A series of reservoirs and power plants on the Verde River would regulate the diverted water, as well as Verde River water, for irrigation use, and develop power through the head available. In common with the other alternative routes, water imported from the Colorado River would be delivered finally at Granite Reef Dam on the Salt River. (2) *Bridge Canyon route (gravity)*—Colorado River water would be diverted from the potential Bridge Canyon Reservoir, the dam site for which is located 118 miles upstream from Boulder Dam. The diverted water would flow by gravity through a 78.5-mile continuous tunnel south to the Big Sandy River, thence by 235 miles of aqueduct and through 11 shorter tunnels totaling 13.7 miles, into the potential McDowell Reservoir, which would be located on the Salt River immediately upstream from Granite Reef Dam. (3) *Parker route (pumping)*—Under this plan Colorado River water would be pumped from Havasu Lake through a series of four pumping lifts totaling 985 feet, and thence would flow by gravity through 235 miles of aqueduct to Granite Reef Dam.

For simplicity in presenting the potentialities of the Central Arizona project, it has been necessary to limit discussion to one alternative plan. That employing the Bridge Canyon route has been selected arbitrarily for that discussion; likewise, an annual diversion by the project of 2,000,000 acre-feet has been assumed arbitrarily. Estimates of cost and of power potentialities are consistent with these assumptions. The plan finally selected may differ materially from that assumed herein, both as to route and as to quantity of water diverted, and it should not be assumed that the plan selected arbitrarily for discussion herein has been shown to have the greatest merit.

The Salt River unit would utilize Colorado River water delivered to Granite Reef Dam by diversion at points along the Salt and Gila Rivers through existing facilities. Supplemental water could be supplied to approximately 384,900 acres now inadequately irrigated in this area and to 20,000 acres of new land lying within the boundaries of existing irrigation districts.

The Paradise Valley unit would utilize Verde River water now required by the Phoenix area, that area receiving Colorado River water instead. Enlargement of Horseshoe Dam on the Verde River to increase the reservoir capacity to 300,000 acre-feet would provide additional regulation of this stream. Installation of a 10,000-kilowatt power plant at this site would provide replacement power for the Stewart Mountain power plant on Salt River. Diversion at the Bartlett Dam on the Verde River into a 64-mile canal would permit utilization of Verde River water on 85,000 acres of land in this unit north of Phoenix.

The San Carlos unit could divert water through a short tunnel from the Saguaro Reservoir (formed by Stewart Mountain Dam) on Salt River and through a canal extending over 100 miles to 157,400 acres of irrigated lands in the San Carlos Irrigation District and pumping developments in the Gila River Valley. Ground-water pumping could thereby be decreased to the safe yield of the ground-water basin. Reduction in energy generation at Stewart Mountain Dam, as a result of such a diversion, would be offset by energy generated at the proposed new plant at Horseshoe Dam.

A dam at the Buttes site on the Gila River below San Carlos Reservoir could be constructed to form a reservoir with a capacity of 400,000 acre-feet. This storage would regulate floods from tributaries entering the main stream below San Carlos Reservoir and thus provide protection for irrigated lands downstream. The stored water could be released as required by downstream users. An annual average of 17,000,000 kilowatt-hours of power could be generated at a plant at the Buttes site with an installed capacity of 5,800 kilowatts. This plant would operate only when water is required for irrigation purposes. The energy thus generated, while not firm, would be available for irrigation pumping and could be used for that purpose.

With demands of the San Carlos unit satisfied, irrigators on the upper Gila and tributaries could increase their diversions beyond any present legal limitation. In many cases, however, regulation of stream flow would be necessary to make such diversions physically possible.

The Charleston unit would involve construction of a dam at the Charleston site on San Pedro River and a 70-mile pipe line to deliver 12,000 acre-feet of water annually to the city of Tucson. With a safe source of supply thus provided, the city could discontinue or decrease its present pumping from a diminishing underground supply. A reservoir with a capacity of 240,000 acre-feet formed by Charleston Dam would provide sufficient storage to protect downstream irrigators from flood damage. Supplemental irrigation water could be furnished to 2,600 acres of land lying below the dam site.

The Safford Valley unit, through construction of a dam at the Elliott site on the Gila River, one-fourth of a mile below the mouth of San Francisco River to provide a reservoir of 70,000 acre-feet capacity would supply supplemental water to 32,460 acres of land in Safford Valley. Although the reservoir would be operated primarily for irrigation, it would serve also to control floods.

The San Francisco unit would furnish additional supplemental water to the Safford Valley unit by regulation of the San Francisco River. Storage could be obtained by the construction of a system of small reservoirs, the

number, location, and capacity of which have not been determined. By distributing these reservoirs in the upper reaches of the basin, regulated flows could also be utilized to supplement supplies to approximately 2,500 acres of land now irrigated in the San Francisco unit. In addition, approximately 2,000 acres of new land could be brought under irrigation. Although considered as a part of the Central Arizona project, it is possible that this unit could be developed independently on a modified scale.

The Duncan-Virden Valley and New Mexico units would provide storage at the Hooker site on Gila River near Cliff, N. Mex., to provide supplemental water and some flood-control protection for 13,600 acres of land now irrigated near Duncan, Ariz. A 3,000-kilowatt capacity power plant at Hooker Dam could supplement available electric energy in the area. A permanent lake in this vicinity would furnish valuable reactional opportunities. As presented, this dam would be an integral part of the Central Arizona project. Should Colorado River water not be diverted to central Arizona, a project in this area may warrant independent consideration.

Chino Valley project.—Approximately 2,540 acres of inadequately irrigated land in the upper Verde River Basin about 15 miles north of Prescott, Ariz., could be furnished an additional supply by concrete lining an existing canal leading from the diversion points on Granite and Willow Creeks to the project lands and by making certain other improvements to reduce water conveyance losses. No new lands could be brought under cultivation, and a full supply could not be furnished to the entire project area. However, distress occasioned by recurrent water shortages could be alleviated.

Hassayampa project.—By construction of a dam at the Box Canyon site on Hassayampa River a storage reservoir of 210,000 acre-feet capacity could provide sufficient water to irrigate 8,800 acres of desert land west of Wittman, Ariz. This reservoir also would help to control floods in the area.

Sentinel project.—Although the reservoir which would be formed by a flood-control dam near Sentinel, Ariz., would extend into the Gila division, the dam site and project lands are in the Boulder division. The project, therefore, is discussed under that division.

Summary

Potential developments in the Gila division are summarized in the following tables:

TABLE CVIII.—*Potential projects in the Gila division*

Project and unit	Location of project	Source of water supply	Purpose to be served [1]	Estimated construction cost [2]
Central Arizona	Arizona	Colorado River	I, F, P, M, U	$432, 800, 000
Salt River				
Paradise Valley				
San Carlos				
Charleston				
Safford Valley				
San Francisco				
Duncan-Virden Valley				
New Mexico				
Chino Valley	do	Granite and Willow Creeks	I	150, 000
Hassayampa		Hassayampa River	I, F	6, 650, 000
Total				439, 600, 000

[1] Symbols used: I=irrigation, F=flood control, P=power, M=municipal, U=underground water discharge. [2] Preliminary estimates based on construction costs of Jan. 1, 1940.

TABLE CIX.—*Potential reservoirs in the Gila division*

Name of site	Source of water supply	Project served	Total capacity (acre-feet)
		Central Arizona:	
McDowell	Salt River	Salt River unit	250, 000
Horseshoe Enlargement	Verde River	Paradise Valley unit	300, 000
Buttes	Gila River	San Carlos unit	400, 000
Charleston	San Pedro River	Charleston unit	240, 000
Elliott	Gila River	Safford Valley unit	70, 000
Hooker	do	New Mexico unit	150, 000
Miscellaneous	San Francisco River and tributaries	San Francisco unit	(1)
Box Canyon	Hassayampa River	Hassayampa	210, 000
Total			[2] 1, 620, 000

[1] Not determined. [2] Exclusive of potential reservoirs in San Francisco unit.

TABLE CX.—*Potential irrigation development in the Gila division*

Project and unit	State	Area to be benefited (acres)		
		New land	Furnished supplemental water	Total
Central Arizona:				
Salt River	Arizona	20,000	384,900	404,900
Paradise Valley	do	85,000	0	805,000
San Carlos	do	0	157,400	157,400
Charleston	do	0	2,600	2,600
Safford Valley	do	0	32,460	32,460
San Francisco	New Mexico	2,000	2,500	4,500
Duncan-Virden Valley	Arizona-New Mexico	0	8,100	8,100
New Mexico	New Mexico	0	5,500	5,500
Subtotal		107,000	593,460	700,460
Chino Valley	Arizona	0	2,540	2,540
Hassayampa	do	8,800	0	8,800
Total		115,800	596,000	711,800

TABLE CXI.—*Potential irrigation development in the Gila division by States*

State	Area to be benefited (acres)		
	New land	Furnished supplemental water	Total
Arizona	113,800	585,200	699,000
New Mexico	2,000	10,800	12,800
Total	115,800	596,000	711,800

TABLE CXII.—*Potential power development in the Gila division*

Project and unit	Name of power plant	Stream	Power plant installed capacity (kilowatts)	Annual firm generation (kw.-hrs.)
Central Arizona:				
Paradise Valley	Horseshoe	Verde River	[1] 10,000	[1] 37,000,000
San Carlos	Buttes	Gila River	5,800	8,000,000
New Mexico	Hooker	do	3,000	8,000,000
Total			18,800	[2] 43,000,000

[1] Replacement power for Stewart Mountain power plant.
[2] Net annual firm generation would be 16,000,000 kilowatt-hours.

TABLE CXIII.—*Present and potential stream depletions in the Gila division*

State and river	Estimated average annual depletion (acre-feet)		
	Present depletion	Potential increase	Total ultimate depletion
Arizona:			
Gila River	1,135,000	20,000	1,155,000
Colorado River	----------	1,588,000	1,588,000
Subtotal	1,135,000	1,608,000	2,743,000

TABLE CXIII.—*Present and potential stream depletions in the Gila division*—Continued

State and river	Estimated average annual depletion (acre-feet)		
	Present depletion	Potential increase	Total ultimate depletion
New Mexico:			
Gila River	16,000	----------	16,000
Colorado River	----------	8,000	8,000
Subtotal	16,000	8,000	24,000
Total	1,151,000	1,616,000	2,767,000

Summary of Present and Potential Development in the Lower Basin

The following tables summarize in the lower basin present irrigated areas, potential development of water resources with estimated construction costs, and present and potential stream depletions.

TABLE CXIV.—*Present irrigation development in the lower basin* [1]

Division	Acres irrigated					
	Arizona	California	Nevada	New Mexico	Utah	Total
Little Colorado	39, 230			8, 770		48, 000
Virgin	2, 800		9, 800		23, 500	36, 100
Boulder	[1] 244, 800	[2] 803, 000	1, 200			1, 049, 000
Gila	716, 000			11, 000		727, 000
Total	1, 002, 830	[3] 803, 000	11, 000	19, 770	23, 500	[3] 1, 860, 100

[1] Includes 166,900 acres not yet irrigated under existing projects.
[2] Includes 342,100 acres yet to be irrigated under existing projects.
[3] Includes 416,400 acres irrigated and 246,600 acres not yet irrigated under the All-American Canal system outside the Colorado River natural drainage basin

TABLE CXV.—*Present hydroelectric generating capacity in the lower basin*

State and division	Present installed capacity (kilowatts)	Authorized or planned capacity (kilowatts)	Total capacity (kilowatts)
Arizona:			
Little Colorado	40		40
Gila	87, 950		87, 950
Subtotal	87, 990		87, 990
Arizona-California:			
Boulder	120, 000		120, 000
Arizona-Nevada:			
Boulder	1, 030, 000	512, 500	1, 542, 500
California:			
Boulder	16, 600	68, 000	84, 600
Utah:			
Virgin	3, 440		3, 440
Total	1, 258, 030	580, 500	1, 838, 530

TABLE CXVI.—*Potential development of water resources in the lower basin* [1]

State and division	Acres to be irrigated [2]		Power plants		Estimated construction cost [4]
	New land	Furnished supplemental water	Installed capacity (kilowatts)	Annual firm generation (kilowatt-hours) [3]	
Arizona:					
Little Colorado	32, 250	600			$24, 700, 000
Virgin	3, 000	1, 000			2, 000, 000
Boulder	80, 000	7, 800	1, 922, 000	10, 174, 000, 000	563, 200, 000
Gila	113, 800	585, 200	15, 800	8, 000, 000	425, 500, 000
Subtotal	229, 050	594, 600	1, 937, 800	10, 182, 000, 000	1, 015, 400, 000
California:					
Boulder	16, 000				3, 100, 000
Nevada:					
Virgin	9, 500	4, 500			4, 800, 000
Boulder	33, 600				11, 700, 000
Subtotal	43, 100	4, 500			16, 500, 000
New Mexico:					
Gila	2, 000	10, 800	3, 000	8, 000, 000	14, 100, 000
Utah:					
Virgin	13, 000	8, 200	4, 600	15, 000, 000	9, 100, 000
River rectification and control					5, 000, 000
Transmission grid					192, 100, 000
Total	303, 150	618, 100	1, 945, 400	10, 205, 000, 000	1, 255, 300, 000

[1] In addition to irrigation and power production, many potential projects would have value for flood control, silt retention, recreation, and fish and wildlife conservation and recharge for underground water supplies.
[2] Does not include irrigable lands under constructed or authorized projects.
[3] Net firm generation, exclusive of replacement power.
[4] Preliminary estimates based on construction costs of Jan. 1, 1940.

TABLE CXVII.—*Present and potential stream depletion in the lower basin*

State and division	Estimated average annual depletion (acre-feet)						
	Existing or authorized projects				Potential projects		Total ultimate depletion
	Present depletions		Future increase		Consumed in basin	Exported	
	Consumed in basin	Exported	Consumed in basin	Exported			
Arizona:							
Little Colorado	58,700				48,700		107,400
Virginia	5,100				12,700		17,800
Boulder	208,400		571,000		346,000		1,125,400
Gila	1,135,000				1,608,000		2,743,000
Subtotal	1,407,200		571,000		2,015,400		3,993,600
California:							
Boulder	115,000	2,535,000	148,000	2,798,000	64,000	112,000	5,802,000
Nevada:							
Virgin	23,800				36,000		59,800
Boulder	20,000				177,000		197,000
Subtotal	43,800				213,000		256,800
New Mexico:							
Little Colorado	13,000						13,000
Gila	16,000				8,000		24,000
Subtotal	29,000				8,000		37,000
Utah:							
Virgin	45,000				56,300		101,300
Reservoir losses	713,000		66,000		91,000		870,000
Total	2,383,000	2,535,000	785,000	2,798,000	2,447,700	112,000	11,060,700

SUMMARY OF PRESENT AND POTENTIAL DEVELOPMENT IN COLORADO RIVER BASIN

The following tables summarize present and potential development of water resources in the entire Colorado River Basin.

Table CXXI shows that the "total ultimate depletions" are over 20,000,000 acre-feet annually. The long time average annual undepleted flow of the Colorado River at the International Boundary is estimated at 17,720,000 acre-feet. (See appendix I, Water Supply, Colorado

TABLE CXVIII.—*Present irrigation development in the Colorado River Basin*

State	Upper basin		Lower basin		Total (acres)
	Irrigated (acres)	Irrigable [1] (acres)	Irrigated (acres)	Irrigable [1] (acres)	
Arizona	6,000		835,930	166,900	1,006,830
California			460,900	342,100	[2] 803,000
Colorado	770,170	32,670			802,840
Nevada			11,000		11,000
New Mexico	38,000		19,770		57,770
Utah	274,820		23,500		298,320
Wyoming	236,070	11,470			247,540
Total	1,325,060	44,140	1,351,100	509,000	3,229,300

[1] Land that will be irrigated under present development.
[2] Includes 713,000 acres outside the natural Colorado River drainage area.

TABLE CXIX.—*Present hydroelectric generating capacity in the Colorado River Basin*

State and division	Present installed capacity (kilowatts)	Authorized or planned (kilowatts)	Total (kilowatts)
Colorado:			
Green	200		200
Grand	49,667		49,667
San Juan	4,650		4,650
Subtotal	54,517		54,517
New Mexico: San Juan	280		280
Utah:			
Green	2,050		2,050
Grand	50		50
San Juan	170		170
Subtotal	2,270		2,270
Wyoming: Green	150		150
Total, upper basin	57,217		57,217
Arizona:			
Little Colorado	40		40
Gila	87,950		87,950
Subtotal	87,990		87,990
Arizona-California:			
Boulder	120,000		120,000
Arizona-Nevada:			
Boulder	1,030,000	512,500	1,542,500
California:			
Boulder	16,600	68,000	84,600
Utah:			
Virgin	3,440		3,440
Total, lower basin	1,258,030	580,500	1,838,530
Total, Colorado River Basin	1,315,247	580,500	1,895,747

River.) The required delivery to Mexico, assuming ratification by Mexico of the pending treaty, with ultimate development in the United States is estimated to average 1,500,000 acre-feet annually, which would leave an average annual flow to be used in the United States of about 16,220,000 acre-feet, or about 80 percent of the sum of the present and potential development possibilities listed in the report.

It is evident that the list of potential projects selected for actual development will need to be modified to conform to the available water upply. A plan of modification is not suggested in this report. Final selection of projects will depend upon their relative merits, the final allocations of water among the States, the desires of each State as to alternative possibilities, and the findings of future investigations.

TABLE CXX.—*Potential development of water resources in the Colorado River Basin*

State and division	Acres to be irrigated [1]		Power plants		Estimated construction cost [2]
	New land	Furnished supplemental water	Installed capacity (kilowatts)	Annual firm generation (kilowatt-hours)	
Arizona:					
San Juan	18,680	6,000	400,000	2,188,000,000	$65,628,000
Little Colorado	32,250	600			24,700,000
Virgin	3,000	1,000			2,000,000
Boulder	80,000	7,800	1,922,000	10,174,000,000	563,200,000
Gila	113,800	585,200	15,800	8,000,000	425,500,000
Subtotal	247,730	600,600	2,337,800	12,370,000,000	1,081,028,000
California:					
Boulder	16,000				3,100,000
Colorado:					
Green	197,800	30,360	170,500	944,000,000	96,300,000
Grand	135,300	158,270	88,000	453,000,000	57,232,000
San Juan	110,960	37,920	67,000	264,000,000	69,227,000
Subtotal	444,060	226,550	325,500	1,661,000,000	222,759,000
Nevada:					
Virgin	9,500	4,500			4,800,000
Boulder	33,600				11,700,000
Subtotal	43,100	4,500			16,500,000
New Mexico:					
San Juan	224,960	15,100			76,882,000
Gila	2,000	10,800	3,000	8,000,000	14,100,000
Subtotal	226,960	25,900	3,000	8,000,000	90,982,000
Utah:					
Green	150,520	145,010	288,000	1,579,000,000	116,500,000
Grand	88,700	1,950	200,000	1,141,000,000	80,975,000
San Juan	12,560	14,200	498,000	2,663,000,000	150,298,000
Virgin	13,000	8,200	4,600	15,000,000	9,100,000
Subtotal	264,780	169,360	990,600	5,398,000,000	356,873,000
Wyoming:					
Green	291,330	95,360	1,500	9,000,000	47,100,000
River rectification and control					5,000,000
Transmission grid					362,100,000
Total	1,533,960	1,122,270	3,658,400	19,446,000,000	2,185,442,000

[1] Does not include irrigable lands under existing or authorized projects.
[2] Preliminary estimates based on construction costs of Jan. 1, 1940.

TABLE CXXI.—*Present and potential stream depletion in the Colorado River Basin*

State and division	Estimated average annual depletion (acre-feet)						
	Existing or authorized projects				Potential projects		Total ultimate depletion
	Present depletion		Future increase		Consumed in basin	Exported	
	Consumed in basin	Exported	Consumed in basin	Exported			
Arizona:							
San Juan	10,200				39,000		49,200
Little Colorado	58,700				48,700		107,400
Virgin	5,100				12,700		17,800
Boulder	208,400		571,000		346,000		1,125,400
Gila	1,135,000				1,608,000		2,743,000
Subtotal	1,417,400		571,000		2,054,400		4,042,800
California:							
Boulder	145,000	2,535,000	148,000	2,798,000	64,000	112,000	5,802,000
Colorado:							
Green	115,000				324,000	75,000	514,000
Grand	776,000	98,300	65,000	421,000	295,000	1,492,000	3,147,300
San Juan	238,000	4,000		21,000	251,000	85,000	599,000
Subtotal	1,129,000	102,300	65,000	442,000	870,000	1,652,000	4,260,300
Nevada:							
Virgin	23,800				36,000		59,800
Boulder	20,000				177,000		197,000
Subtotal	43,800				213,000		256,800
New Mexico:							
San Juan	68,400				450,000		518,400
Little Colorado	13,000						13,000
Gila	16,000				8,000		24,000
Subtotal	97,400				458,000		555,400
Utah:							
Green	358,000	81,500		32,000	264,000	975,700	1,711,200
Grand	13,000				186,000		199,000
San Juan	63,400				30,000	7,000	100,400
Virgin	45,000				56,300		101,300
Subtotal	479,400	81,500		32,000	536,300	982,700	2,111,900
Wyoming:							
Green	374,000		17,000		489,000	87,000	967,000
Pasture irrigation in upper basin					500,000		500,000
Reservoir losses	713,000		66,000		922,000		1,701,000
Total	4,399,000	2,718,800	867,000	3,272,000	6,106,700	2,833,700	20,197,200

Power From Water

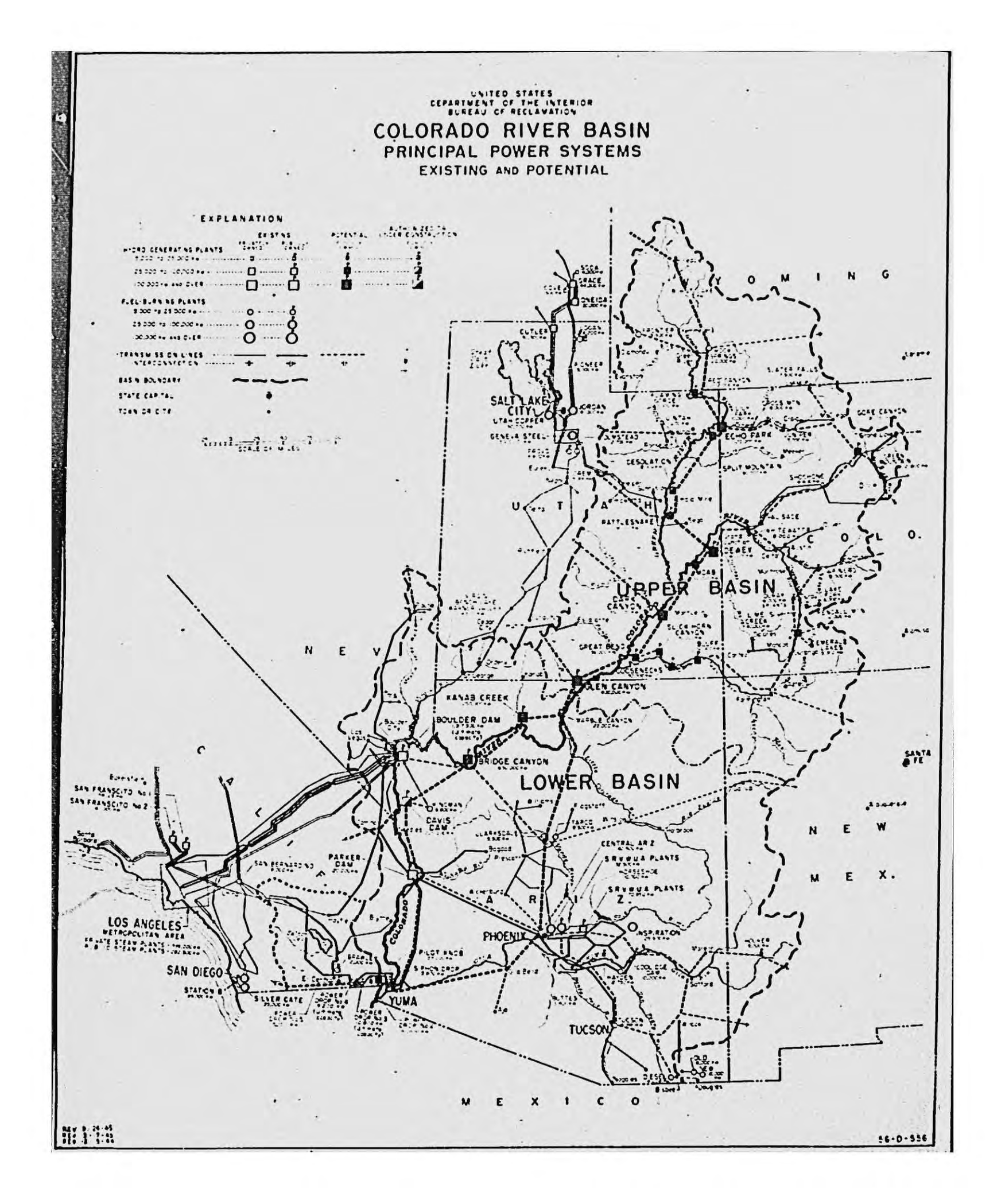
"A prerequisite for industrial growth in any area is the availability of a sufficient amount of low-cost electric power. . . .

"Opportunities exist for the installation of 1,713,000 kilowatts of hydroelectric generating capacity on the Colorado River and its tributaries above Lee Ferry. This is nearly 17 times the capacity of all plants now in the area. The potential power output of these plants would be 28 times the total upper basin power production of 1943. . . .

"Development of the potential multiple purpose projects in the lower basin would make available an additional 1,900,000 kilowatts of installed capacity. It is estimated that by 1960 the demands for power will exceed the output from all existing, authorized, and potential plants."

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER BASIN
PRINCIPAL POWER SYSTEMS
EXISTING AND POTENTIAL



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CHAPTER VI

Power From Water

Full development of the resources of the Colorado River Basin requires that the waters of the Colorado River system be brought under control by the construction of suitable regulatory structures. Additional storage projects on upper basin streams are necessary for full utilization of its land and water resources. In addition, the production of hydroelectric power and energy will be possible by using the heads made available by the construction of dams and appurtenant works. These dams will also reduce flood damage by providing storage space to hold flood waters. Many thousands of tons of silt are now carried down the Colorado River each year, damaging irrigated areas and curtailing storage capacity in present reservoirs in the lower basin. Proper watershed management is proposed as an aid in the solution of this problem, but storage reservoirs located in the upper basin will aid also by retaining silt which reaches the streams. The reservoirs will have value also for recreational purposes and for the propagation of fish and wildlife.

The Bureau of Reclamation has constructed many multiple-purpose projects throughout the Western States for irrigation, power production, flood control, silt retention, recreation, and fish and wildlife conservation. One of the earliest projects involving power was built in Arizona in 1906 with construction of the Roosevelt power plant on the Salt River. The early plants were used primarily as a source of power for the pumping of irrigation water or for project construction purposes. Later, power was made available to project settlers and to other people in rural areas, towns, and cities where economical service could be rendered.

To date only a small part of the potential hydroelectric power available in the Colorado River Basin has been harnessed by man. (See map, Colorado River Basin, Principal Power Systems, Existing and Potential.) The development and utilization of electric power have progressed at widely different rates in the upper and lower basins. This has been the result of great differences between the two basins with respect to location, climate, population growth, agricultural development, commercial and industrial activities, and transportation facilities. Power development and utilization are far less advanced in the upper basin than in the lower basin and the area served from it. The discussion on power in this chapter is divided into two sections, the upper basin and the lower basin.

UPPER BASIN

Although the upper basin has great potentialities for the production of electrical energy, it now produces a comparatively small amount and consumes less than it produces. In 1943 the installed capacity of all plants was only 101,082 kilowatts, of which 57,217 kilowatts were in hydroelectric plants.

Some of the energy produced in the upper basin in Colorado is carried by transmission lines eastward over the Continental Divide to the Denver and Leadville load areas, while requirements in the Utah part of the upper basin are largely supplied with energy imported from adjoining areas to the west and north. To date it has not proved practicable to connect the two areas for power supply purposes.

Opportunities exist for the installation of 1,713,000 kilowatts of hydroelectric generating capacity on the Colorado River and its tributaries above Lee Ferry. This is nearly 17 times the capacity of all plants now in the area. The potential power output of these plants would be 28 times the total upper basin power production in 1943. Growing power markets within the basin and in adjoining areas are expected to require eventually the maximum power output of these plants. A system of interconnected transmission lines will be needed to carry power to markets.

Potential power developments described herein indicate the hydroelectric possibilities of the upper basin. Cost allocations have not been included but will be considered in later specific project reports.

The multiple-purpose projects involving power production would create artificial lakes with an aggregate surface area of 555 square miles. In addition to the production of power, many of these reservoirs would have value for irrigation, long-term stream flow regulation, flood control, silt retention, recreation, and propagation of fish and wildlife.

Present Power Development

The extent of present power development in the upper basin has been determined principally by the needs of the mining industry. Coal mines use most of the energy available in the Utah and Wyoming areas, while in the Colorado area coal and metal mines are the largest industrial users. These mining areas are served by the largest utility systems and industrial plants in the upper basin. A number of communities receive service from isolated generating plants, both hydroelectric and fuel-burning. In general, loads are comparatively small and the development of power generating and transmission facilities has been limited in the upper basin.

In Colorado the availability of desirable hydroelectric power sites has resulted in the installation of generating plants and high voltage transmission lines which are mainly to supply loads to the east of and outside the basin area. In Utah the coal mining industry in Carbon and Emery Counties is supplied with power and energy imported over high voltage lines from utility systems located outside the basin. Wyoming coal mining interests have built their own generating plants to supply their requirements and the needs of people located nearby. Metal mining, which has developed in southwestern Colorado, uses most of the power and energy generated in that locality.

With a total of 101,082 kilowatts of capacity installed in plants in the upper basin, generation in 1943 amounted to 330,149,000 kilowatt-hours. Load requirements (sales plus losses and utility use) for that year totaled 238,870,000 kilowatt-hours, leaving a net export surplus of 91,279,000 kilowatt-hours. The total maximum demand of all loads in the upper basin area was approximately 52,404 kilowatts in 1943.

POWER FACILITIES

Colorado area.—By far the greatest part of the installed electric generating capacity in this area of the upper basin is hydroelectric. Although large coal deposits are available in western Colorado, it has been more economical generally to install hydroelectric rather than coal-burning plants. In some isolated areas where loads are small internal combustion engine plants have been provided.

The principal power systems are those of the Public Service Co. of Colorado, the Bureau of Reclamation, the Western Colorado Power Co., and the Colorado Utilities Corp. The interconnected systems of the Public Service Co., of Colorado, the Bureau of Reclamation, and the Redlands Water & Power Co. together form the largest electric generating and transmission system in the Colorado area and also in the upper basin. These interconnected facilities include some 250 miles of transmission lines, extending eastward from a point a few miles west of Grand Junction to the Continental Divide and on into the Denver metropolitan area. The total generating capacity connected to this system in the upper basin amounts to 45,675 kilowatts, of which 90 percent is hydroelectric and 10 percent is steam-electric capacity. Included in this total area are the 21,600-kilowatt Green Mountain hydroelectric plant (Colorado-Big Thompson project) of the Bureau of Reclamation and the 3,000-kilowatt Palisades hydroelectric plant (Grand Valley project) owned by the Bureau but operated by the Public Service Co. of Colorado. The latter plant is considered a part of the company's system in this report. No internal combustion engine-driven generating plants are connected to any of these major systems.

Southwestern Colorado is served by the system of the Western Colorado Power Co., which has 11,700 kilowatts of connected generating capacity, including 9,700 kilowatts of hydroelectric and 2,000 kilowatts of steam-electric capacity.

At McGregor in the northern part of Colorado the Colorado Utilities Corp. operates a 4,250-kilowatt steam-electric plant, with transmission lines extending to nearby communities.

Principal municipal plants are located at Gunnison (550 kilowatts, steam-electric), Delta (1,100 kilowatts, internal combustion), and Meeker (200 kilowatts hydroelectric, and 375 kilowatts steam-electric), all of which are isolated plants. Other generating plants are operated by smaller utilities.

The installed generating capacity of all plants in the Colorado area was 68,429 kilowatts in 1943. Energy generating in that year amounted to 245,083,000 kilowatt-hours, while total load requirements (sales plus losses and utility use) were 88,228,000 kilowatt-hours. The difference of 156,855,000 kilowatt-hours was transferred into the Denver and Leadville load areas over the 100,000-volt transmission line of the Public Service Co. of Colorado.

Utah area.—Although the Utah area of the upper basin contains a large amount of potential water power and large coal reserves, very few generating plants have been installed, the principal electric loads being supplied with power imported from outside the basin. The largest installation is the 1,200-kilowatt hydroelectric plant of the Uintah Power & Light Co. The Utah Power & Light Co. also operates two isolated plants, one at Vernal (840 kilowatts) and one at Moab (210 kilowatts). The towns of Monticello and Blanding operate small plants to serve their citizens. Two rural electric cooperatives financed by the Rural Electrification Administration have 1,090 kilowatts of installed generating capacity.

Power for the important coal mining area is supplied by two lines of the Utah Power & Light Co., one a 44,000-volt line extending from the Olmstead plant near Provo to

Sego and Hiawatha, and the other a 132-000-volt line extending from the Olmstead plant to Helper. These lines are extensions of the company's main Utah-Idaho system.

Only 3,400 kilowatts of generating capacity were installed in the Utah area of the Upper Basin in 1943. Energy generated in that year amounted to 6,677,000 kilowatt-hours. Load requirements totaled 72,253,000 kilowatt-hours, thus requiring 65,576,000 kilowatt-hours to be imported.

Wyoming area.—Nearly all power generated in the Wyoming area of the upper basin is from steam-electric plants. Coal mining companies operate the greatest amount of generating capacity. A 20,000-kilowatt plant at Rock Springs operated by the Union Pacific Coal Co. is the largest steam-electric plant in the upper basin. Most of the energy produced by this plant is used for coal mining, but about one-fourth is being distributed by the Southern Wyoming Utilities Co. to other consumers in the Rock Springs area. At Kemmerer the Lincoln Service Corp. operates a 5,500-kilowatt steam-electric plant, and at Diamondville the Diamond Coal & Coke Co. operates a 1,000-kilowatt steam-electric plant, both being used mainly to supply power to coal mines.

The Southern Wyoming Utilities Co. has recently acquired the 1,240-kilowatt capacity steam-electric plant at Green River, Wyo., from the Utah Power & Light Co., and has constructed a transmission line from the plant to Rock Springs.

No municipally owned plants have been installed in the Wyoming area. One system financed by the Rural Electrification Administration operates a 180-kilowatt internal combustion engine plant.

The combined capacity of all plants in the Wyoming area amounted to 28,423 kilowatts in 1943. Transmission facilities are limited, being designed to serve load areas in close proximity to the power plants. Energy generation in 1943 totaled 77,049,000 kilowatt-hours, which met the load requirements of the area.

New Mexico area.—This area of the upper basin is served by the Aztec-Farmington division of the New Mexico Public Service Co. Installed generating capacity in 1943 totaled 830 kilowatts of which 280 kilowatts were hydroelectric and 550 kilowatts were internal combustion. The energy generated in that year was estimated at 1,340,000 kilowatt-hours, all of which was consumed in the area.

Summary.—The amount of installed generating capacity in the upper basin in 1943 is given in table CXXII and the amount of energy generated and load requirements are shown in table CXXIII.

TABLE CXXII.—*Installed generating capacity in the upper basin (1943)*

State area and class of utility ownership	Installed capacity (kilowatts)			
	Hydro	Steam	Internal combustion	Total
Colorado:				
Privately owned	30,942	10,721	766	42,429
Publicly owned	23,575	1,000	1,425	26,000
Total	54,517	11,721	2,191	68,429
Utah:				
Privately owned	1,500	0	750	2,250
Publicly owned	770	0	380	1,150
Total	2,270	0	1,130	3,400
Wyoming:				
Privately owned	150	6,740	353	7,243
Publicly owned	0	0	180	180
Subtotal—Utilities	150	6,740	533	7,423
Industrial plants	0	21,000	0	21,000
Total	150	27,740	533	28,423
New Mexico:				
Privately owned	280	0	550	830
Upper Basin:				
Privately owned	32,872	17,461	2,419	52,752
Publicly owned	24,345	1,000	1,985	27,330
Subtotal—Utilities	57,217	18,461	4,404	80,082
Industrial plants	0	21,000	0	21,000
Total	57,217	39,461	4,404	101,082

PLANT FACTOR

Although the amount of installed generating capacity is of importance when considering the power facilities in an area, the real standard of power plant utilization is the amount of energy that can be generated for sale to the ultimate consumer. The degree of plant or system utilization is determined by comparing the amount of energy actually generated with the maximum it is possible to generate with the plant or system continually operated at full capacity. The percentage thus obtained is called the "plant factor."

Plant factors for interconnected systems are higher than for isolated plants because isolated plants need a greater part of their installed capacities as "reserve" to insure continuity of service. Also the operation of plants on an interconnected system may be coordinated to take advantage of the operating characteristics of the individual plants. Recently an annual plant factor of 61 percent was attained by the group of generating plants connected to the system of the Public Service Co. of Colorado in the upper basin, while plant factors on individual isolated plants ranged from 14 percent to 31 percent.

ENERGY PRODUCTION COSTS

Hydroelectric plants.—Hydroelectric plants in the upper basin in 1943 produced electric energy at average costs ranging from 0.65 to approximately 2.7 mills per

TABLE CXXIII.—*Energy generated and load requirements in the upper basin (1943)*

State area and class of utility ownership	Energy generated (thousand kilowatt-hours)				Load requirements (thousand kilowatt-hours)
	Hydro	Steam	Internal combustion	Total	
Colorado:					
Privately owned	168, 642	12, 738	358	181, 738	73, 430
Publicly owned	59, 142	1, 810	2, 393	63, 345	14, 798
Total	227, 784	14, 548	2, 751	245, 083	88, 228
Utah:					
Privately owned	4, 512	0	579	5, 091	65, 091
Publicly owned	1, 111	0	475	1, 586	7, 162
Total	5, 623	0	1, 054	6, 677	72, 253
Wyoming:					
Privately owned	100	13, 941	175	14, 216	29, 561
Publicly owned	0	0	500	500	614
Subtotal—Utilities	100	13, 941	675	14, 716	30, 175
Industrial plants	0	62, 333	0	62, 333	46, 874
Total	100	76, 274	675	77, 049	77, 049
New Mexico:					
Privately owned	450	0	890	1, 340	1, 340
Upper basin:					
Privately owned	173, 704	26, 679	2, 002	202, 385	169, 422
Publicly owned	60, 253	1, 810	3, 368	65, 431	22, 574
Subtotal—Utilities	233, 957	28, 489	5, 370	267, 816	191, 996
Industrial plants	0	62, 333	0	62, 333	46, 874
Total	233, 957	90, 822	5, 370	330, 149	238, 870

kilowatt-hour. In general, plants operating at the higher plant factors had the lowest average annual production costs. The costs include operation and maintenance items, but excluded fixed charges on the investment and taxes.

Steam-electric plants.—An analysis of production cost figures for steam-electric plants in the basin for which data are published by the Federal Power Commission shows that the total production cost is approximately 7 mills per kilowatt-hours. This includes operation, maintenance, and fuel costs, but does not include interest, depreciation, or taxes. Fuel cost is a major item of expense incurred in the operation of a steam-electric plant and for the plants selected this cost ranged from 2.1 mills to 3.18 mills per kilowatt-hour.

Internal combustion engine plants.—Cost data recently available on two internal combustion engine plants, with installed capacity totaling 750 kilowatts, show that the total production cost was 3.46 cents per kilowatt-hour, with fuel costing 0.86 cent per kilowatt-hour. The largest item of expense, amounting to 1.35 cents per kilowatt-hour, was for supervision, engineering, and labor.

POWER UTILIZATION

For the upper basin as a whole it is estimated that approximately 50 percent of the total amount of electricity used is consumed by industrial concerns connected with mining. Most of that industrial load is in the coal mining areas of Utah, Wyoming, and Colorado and in the metal mining area of Colorado. Other customers are residential, rural, and commercial users, and municipalities.

Area in the Rocky Mountain region where large-scale mining developments have taken place have the highest average annual load requirement per capita. The general lack of such development in the upper basin area compared with the Rocky Mountain region as a whole largely accounts for the much lower average annual load requirement per capita within the upper basin.

Selling price of electric energy.—The amount of energy used by residential consumers depends mainly on the selling price of electric energy. In the upper basin the average selling price to residential consumers, as taken

TABLE CXXIV.—*Electric energy load requirement in the upper basin (1943)*

State area	Total annual load (kw.-hrs.)	Population [1]	Average annual load requirement per capita (kw.-hrs.)
Colorado	88, 228, 000	119, 929	736
Utah	72, 253, 000	46, 957	1, 539
Wyoming	77, 049, 000	28, 331	2, 720
New Mexico	1, 340, 000	8,-262	162
Upper basin	238, 870, 000	203, 479	1, 174

[1] Bureau of the Census, estimated civilian population Mar. 1, 1943.

TABLE CXXV.—*Electric energy load requirements in the Rocky Mountain Region (1943)*

State [1]	Average annual load requirement per capita [2] (kw.-hrs.)
Colorado	1,244
Utah	2,859
Wyoming	1,073
New Mexico	912
Arizona	2,876
Montana	4,869
Idaho	2,266
Nevada	2,146
Rocky Mountain Region	2,241

[1] Entire State.
[2] Based on the electric utility and industrial energy requirements in 1943 and Bureau of the Census, estimated civilian population Mar. 1, 1943.

from reports made by the principal utilities operating therein, is 3.5 cents per kilowatt-hour and the average annual amount used per customer is approximately 1,000 kilowatt-hours.

With resepect to the sale of energy for commercial and industrial uses, those utilities operating in the basin whose industrial load is a substantial part of the total load, have average selling prices ranging from 0.98 to 1.89 cents per kilowatt-hour. Other utilities having small industrial loads compared with commercial loads reported considerably higher averages.

Power Market Survey and Load Trend

In making a power market survey and future load estimate for a given area, a knowledge of the area's physical characteristics, natural resources, principal economic activities, population distribution and growth, and other related factors is fundamental. Detailed discussions of those factors are included elsewhere in this report. They will be discussed in this chapter only to the extent necessary to develop the power market survey and to show how they affect the future load estimate.

The most important industries in the upper basin are livestock raising, farming, and mining. There is practically no manufacturing. Principal power loads are in the mining areas.

The development of the basin's resources, including the potential low-cost hydroelectric power, land, water, minerals, and timber would provide for considerable expansion of present industries and the establishment of many new industries. Such industries would include mining and refining of minerals, production of petroleum from oil shale and oil-bearing sandstone and by hydrogenation of coal, production of chemicals, development of lumber and related industries, manufacture of plastics, and the processing of foods.

FUTURE POWER CONSUMPTION

The following factors have been considered in estimating the total power load growth in the upper basin to the year 1980: the past load growth trends, the present status as compared with other areas, and economic trends and their probable effect on the future power market.

Estimates of future loads for each class of consumer have been made on the assumptions that low-cost power will become available, that the population will continue to grow at the rate of the past 40 years, that the number of farms will increase proportionately, and that the future labor force will more nearly resemble the present National labor force with respect to the distribution of workers in industrial classes.

Residential use.—In 1943 the average amount of energy used per residential consumer served by principal utilities in the upper basin was approximately 1,000 kilowatt-hours per year. Past records indicate that the average use has been increasing at the rate of about 5 percent per year. The average of the Nation for 1943 was 1,060 kilowatt-hours a year per consumer, and has been increasing at a rate of approximately 6 percent per year over the past 20 years.

The amount of electricity used in the home depends upon many factors, among them being the cost of electrical energy and equipment and the cost of completing fuel and equipment for cooking and heating. Development of the potential hydroelectric power projects in the upper basin would make it possible to supply the customer with low-cost energy. The present average residential rate is over 3 cents per kilowatt-hour. With respect to the United States as a whole those States having the highest residential use have the lowest rates. Furthermore, those same States are among the leading States in the amount of hydroelectric power developed.

Although rates are higher in the upper basin than in some other sections of the country, they have been decreasing in recent years. The production of low-cost hydroelectric power will lower rates.

Electrical manufacturing concerns are carrying on research and experimental work to produce a greater variety of better and cheaper electrical appliances and equipment for use in the home, such as refrigerators, ranges, water-heaters, ironers, washers, air-conditioning and house-heating equipment and a host of other conveniences.

Heating devices, whether used for cooking, water heating, or house heating, are the largest consumers of electrical energy in the home. In areas where natural fuels, such as coal, oil, gas, or wood, are plentiful and low in price, they are used for heating. In the greater part of the upper basin extensive deposits of coal have been and will continue to compete with electric energy for home heating purposes.

Various estimates of the future average annual use per

residential customer in the United States range from 2,000 kilowatt-hours by 1960 to 14,000 kilowatt-hours by 1980, provided that the heating of homes with electricity is then common. Considering the present average consumption, cost of energy to the consumer, the availability of competing forms of energy, and the length of time expected to elapse before large-scale hydroelectric developments are completed, it appears that an average of 3,000 kilowatt-hours per year for the residential customer in the upper basin is a reasonable estimate for 1980. With an estimated 91,250 homes, urban and rural nonfarm, in the upper basin in 1980, and on the assumption that 95 percent will be electrified, the total annual residential use would be 260,000,000 kilowatt-hours.

Farm use.—Farmers have less electricity available for use than any other class of people, although they need electricity not only as a matter of convenience but as a necessity on farms and in farm homes. In 1943 the Rural Electrification Administration reported that 44 percent of the farms in Colorado were electrified, 76 percent in Utah, 34 percent in Wyoming, and 19 percent in New Mexico. These percentages apply to the entire State. In the more sparsely settled areas in the upper basin the percentages were lower.

The census data for 1940, compiled by county areas of the upper basin, showed that 33 percent of farm dwelling units in the Colorado area, 42 percent in the Utah area, 25 percent in the Wyoming area, 11 percent in the New Mexico area, and 32 percent in the entire upper basin had electric lighting. Of the 27,402 rural farm dwelling units in the four State basin areas, only 8,741 had electric lighting equipment.

Expansion in rural electrical service in postwar years is to be expected. The Rural Electrification Administration has plans for an extensive program. Utilities also are preparing to build more rural extensions as soon as materials become available.

Data on present power use by farms are generally lacking as most utilities do not maintain a separate classification for sale of power to farms. An indication of average farm use, however, may be obtained from rural sales data where available. In west central Colorado the average rural sales including home, commercial, and rural power uses amounted to 875 kilowatt-hours per customer in 1939 and 1,083 kilowatt-hours in 1943, an average rate of increase to 5.9 percent per year. The 11 systems financed by the Rural Electrification Administration supplied an average of 728 kilowatt-hours per customer annually in the basin area.

Electricity is used on the farm and in the farm home for lighting, refrigeration, cooking, water supply, water heating, sterilizing, and to operate hotbeds, brooders, milking machines, and other equipment, depending on the type of farm. As the cost of energy and equipment becomes lower the farmer will use more electricity.

It is estimated that by 1980 the average annual use per farm in the upper basin will amount to 5,000 kilowatt-hours, and that the number of farms will be increased to 42,500. On the assumption that 85 percent of the total number of farms will be electrified, the total farm use will amount to 180,000,000 kilowatt-hours annually.

Commercial use.—Since commercial and industrial sales data have been combined in utility reports, separate data on commercial use are not available. Types of commercial enterprises using electricity include wholesale and retail trade; finance, insurance, and real estate businesses; business and repair services; personal services (hotels, lodging houses, etc.); amusement, recreation, and related types of businesses; professional and related services; Government (local, State, Federal); and transportation, communication, and other public utilities.

One method of estimating the commercial load is to determine the average use of energy per employee engaged in the above enterprises. A survey made by the Federal Power Commission in 1941 of a number of establishments in Washington, D. C., showed that the average use per worker was 2,700 kilowatt-hours per year, excluding air conditioning. Future requirements for lighting and air conditioning of offices, hotels, stores, restaurants and other establishments will undoubtedly be much higher than at present. Low-cost electricity will make electric cooking devices attractive for hotels, restaurants, and other places. For the upper basin area, it is estimated that by 1980 the average annual commercial energy use per worker will be 3,000 kilowatt-hours and the total energy use will amount to 271,000,000 kilowatt-hours annually.

Mining use.—Little has been done to develop the vast mineral resources in the upper basin. Geologists, mineralogists, and others interested the subject claim that presently worked mineral deposits in some areas are rapidly becoming depleted and new sources of supply will be required within a few years. As an example, known petroleum reserves are estimated to be sufficient for only 15 years at the 1940 rate of consumption. The exhaustion of the high-grade iron ores at Mesabi, Minnesota, now threatening, may have important effects on the western iron and steel industry.

Among the more important possibilities for developing reserves of minerals are the production of petroleum from coal, oil shale, and oil sandstone; production of fertilizer from phosphate rock and potash bearing minerals; and production of chemicals from coal.

Large amounts of power are used by the mining industry, particularly since the mechanization of mining has been increasing. In 1940 the average amount of energy used in the United States in all mining operations was approximately 10,000 kilowatt-hours per worker. New mining enterprises that will be developed in the upper basin will be more highly mechanized, thus requiring much more energy per worker than is presently used. It

is estimated that by 1980 the use per worker will average at least 20,000 kilowatt-hours annually, and with a total of 21,400 workers the mining industry in the upper basin will use 428,000,000 kilowatt-hours per year.

Manufacturing use.—As resources are developed new manufacturing plants to process and refine the raw materials from the farms and mines will arise in the basin. They will include food-processing plants, smelters, refineries, and chemical works, most of which require large quantities of electric power in their operation. An average use of 15,000 kilowatt-hours per worker a year by 1980 is a conservative estimate. With a total of 21,400 workers, manufacturing will use 321,000,000 kilowatt-hours annually.

Transportation use.—No railways in the upper basin are electrified at present. The electrification of sections of the following main-line railroads has been considered: the Denver and Salt Lake Railway over the Rocky Mountains from Denver to Bond, Colo. The Denver and Rio Grande Western Railroad from Ogden to Helper, Utah; the Union Palific Railroad from Cheyenne to Granger, Wyo., and on into Ogden, Utah; and the Oregon Short Line from Granger to Pocatello, Idaho. The estimated annual energy use or electrification of these railroad sections located in the upper basin will amount to 180,000,000 kilowatt-hours.

Progress in railway electrification will depend upon many factors, including the financial condition of the operating companies, new developments in the design of locomotives, and cost of power, as well as future volume of travel. The Diesel locomotive may not be used extensively in the future if petroleum supplies are conserved for other purposes. The gas-turbine locomotive is still in the experimental stage. Because of the higher speed and smoke-free operation of electric locomotives, it is possible that at least some of the existing lines will be electrified and possibly new ones constructed. It is estimated that by 1980 transportation facilities will consume 180,000,000 kilowatt-hours annually.

Estimated Future Load Summary

Future loads for each class of consumer in the upper basin are estimated as follows:

Class of consumer:	*Estimated total load, 1980 (kilowatt-hours)*
Residential	260, 000, 000
Farm	180, 000, 000
Commercial	271, 000, 000
Mining	428, 000, 000
Manufacturing	321, 000, 000
Transportation	180, 000, 000
Total consumption	1, 640, 000, 000
Losses and utility use	245, 000, 000
Total load requirements	1, 885, 000, 000
Maximum demand at 65 percent annual load factor	330, 000 kilowatts

The trend of estimated future load growth is shown on figure 14. The following tables summarizing future load growth indicates an average annual compound rate of increase of 5.9 percent per year as compared with the past 20-year National average annual rate of increase of 7.2 percent. The per capita requirements in the Upper Basin for 1980 thus would be approximately 3,500 kilowatt-hours per year, as compared with the present average of 1,174 kilowatt-hours per year.

TABLE CXXVI.—*Estimated load growth in the upper basin*

Year	Estimated annual energy requirements (kilowatt-hours)		
	Total	Load increase	
		Increment for 10 years	Accumulative (total)
1943	239, 000, 000		
1950	360, 000, 000	[1] 121, 000, 000	[1] 121, 000, 000
1960	695, 000, 000	335, 000, 000	456, 000, 000
1970	1, 215, 000, 000	520, 000, 000	976, 000, 000
1980	1, 885, 000, 000	670, 000, 000	1, 646, 000, 000

[1] For 7 years.

Potential Power Development

Power Plants

Included in the potential multiple-purpose projects for the upper basin are a number of developments that will produce hydroelectric power and enegry. These developments include 29 power plants which would have a

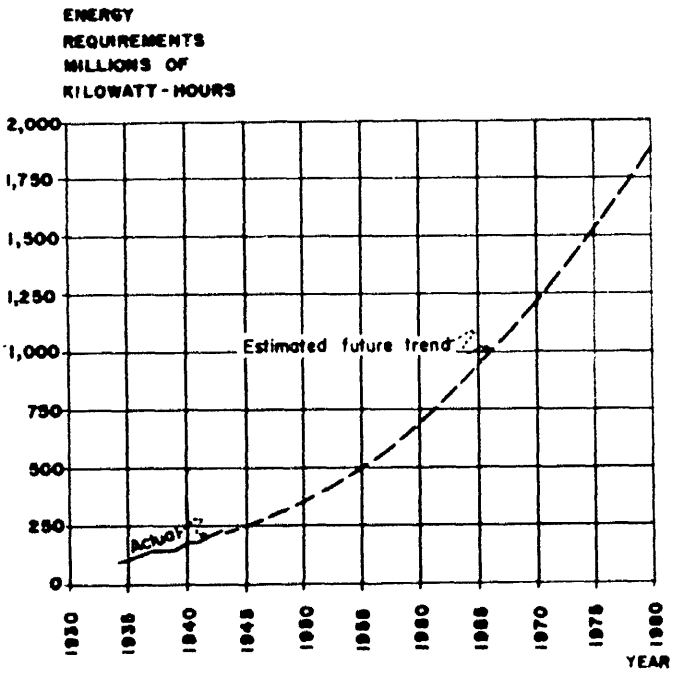


FIGURE 14.—*Upper Colorado River Basin, estimated trend, electric power load of basin*

total installed capacity of 1,713,000 kilowatts and an annual firm production of over 9 billion kilowatt-hours of electric energy. Plant capacities would range from 1,500 kilowatts to 400,000 kilowatts.

Potential power plants in the Upper Colorado River Basin are listed in table CXXVII which gives the stream location, project, installed capacity, and the annual firm generation of each plant.

Transmission System

The sites of the potential power plants in the upper basin are located away from principal load centers. In order to make power available to load areas, the plants would be connected with transmission lines to form an interconnected power system. This system would be connected to systems in other basins. Such a system would permit maximum flexibility of operation and maximum utilization of available water. Tentative locations of principal transmission lines are shown on the map entitled, "Colorado River Basin, Principal Power Systems, Existing and Potential," included in an appendix of this report.

The total cost of the upper basin potential transmission lines, terminal substations, and intermediate switching and transformation facilities is estimated, on the basis of 1940 prices, at $171,000,000.

Steam-electric generating equipment may be desirable as a supplementary source of power and for stand-by, firming up, or peaking purposes on the hydroelectric system; in some cases steam-electric capacity may be needed to supply power for construction purposes.

Cost Allocations

Cost allocations have not been included in this report because further investigations will be necessary in order to obtain sufficient data to evaluate properly the multiple benefits. Although the cost of producing power has not as yet been definitely determined, it is believed the production cost will permit the sale of hydroelectric power at such low rates as to enable industrial establishments, communities, rural users, and others to make liberal use of electric energy.

Summary

Hydroelectric power is one of the most important resources of the upper basin. Only a small part of the

Table CXXVII.—*Potential hydroelectric power plants in upper basin* [1]

River basin and power plant	Project	Stream	Installed capacity (kilowatts)	Annual firm generation (kilowatt-hours)
Green River:				
Burnt Lake	Sublette	Fall Creek	1, 500	9, 000, 000
Flaming Gorge	Flaming Gorge	Green River	30, 000	158, 000, 000
Red Canyon	Red Canyon	do	12, 000	68, 000, 000
Echo Park	Echo Park	do	120, 000	668, 000, 000
Split Mountain	Split Mountain	do	90, 000	486, 000, 000
Desolation	Desolation	do	78, 000	433, 000, 000
Rattlesnake	Rattlesnake	do	78, 000	434, 000, 000
Yampa River:				
Juniper	Deadman Bench	Yampa River	15, 000	87, 000, 000
Cross Mountain	Cross Mountain	do	18, 000	99, 000, 000
Slater Falls	Little Snake River	Slater Creek	7, 500	43, 000, 000
Lily Park	Lily Park	Yampa River	10, 000	47, 000, 000
Colorado River:				
Gore Canyon	Gore Canyon	Colorado River	30, 000	177, 000, 000
Dewey	Dewey	do	140, 000	797, 000, 000
Moab	Moab	do	60, 000	344, 000, 000
Dark Canyon	Dark Canyon	do	350, 000	1, 843, 000, 000
Glen Canyon	Glen Canyon	do	400, 000	2, 188, 000, 000
Gunnison River:				
Sapinero	Sapinero	Gunnison River	18, 000	100, 000, 000
Whitewater	Cisco-Thompson	do	18, 000	100, 000, 000
Lake Fork	Lake Fork	Lake Fork	6, 000	12, 000, 000
3 plants	Ouray	Uncompahgre	16, 000	64, 000, 000
San Juan River:				
2 plants	Animas-LaPlata	Animas River	52, 000	192, 000, 000
Emerald Lake	Emerald Lake	Pine River	15, 000	72, 000, 000
Bluff	Bluff	San Juan River	52, 000	289, 000, 000
Gooseneck	Gooseneeks	do	30, 000	152, 000, 000
Slick Horn Canyon	Slick Horn Canyon	do	30, 000	176, 000, 000
Great Bend	Great Bend	do	36, 000	203, 000, 000
Total			1, 713, 000	9, 241, 000, 000

[1] In addition to the plants listed, there are other sites in the upper basin where power could be developed, but the lack of information on those sites precludes the inclusion of their power possibilities. Further investigations may result in additions or deletions of power plants listed or changes in capacity and output of particular plants.

power resources has been developed. Full development of these power resources would result in an energy production equivalent to 6 percent of the Nation's power needs in 1940. Large-scale hydroelectric power developments would have far-reaching effects on the economic future of the upper basin and in adjoining areas. From an economic standpoint, the upper basin is one of the least developed regions in the United States. Future growth will depend upon development of the basin's agricultural and mineral resources, which will result in the expansion of existing industries and the creation of new ones.

A prerequisite for industrial growth in any area is the availability of a sufficient amount of low-cost electric power. Many attractive power sites exist on the streams in the upper basin and can be developed by construction of the multiple-purpose projects outlined in the previous chapter. With the construction of power plants and transmission lines, electric service can be provided to practically all parts of the basin and to many places outside of the basin. The availability of large quantities of low-cost hydroelectric energy will be an important factor in the establishment of new mining, manufacturing, and agricultural industries, all of which need electric power for the efficient operation required in modern industrial competition.

Power developments in the upper basin, including present and potential generating capacity (name-plate rating) and output, and load forecasts are summarized as follows:

	Kilowatts	Kilowatt-hours
Present installed generating capacity:		
Hydroelectric	57, 217	
Fuel-burning	43, 865	
Total	101, 082	
Present load requirements (1943)	52, 404	238, 870, 000
Potential installed generating capacity, hydroelectric	1, 713, 000	
Potential firm output		9, 241, 000, 000
Estimated load requirements (1980)	330, 000	1, 885, 000, 000
Estimated increase in load requirements (1943–80)	277, 596	1, 646, 130, 000
Estimated energy available for export (1980)		7, 594, 870, 000

The capacity of potential hydroelectric plants in the upper basin is greatly in excess of the upper basin's estimated power load by 1980. Studies of power needs in neighboring basins, however, indicate that their loads by 1980 will far exceed their possible hydroelectric developments. Power developments in the upper basin can be used in part to supply loads in areas outside the basin, including the Bonneville Basin (Salt Lake area), and the lower basin power area. Some power could also be supplied to western areas of the Missouri River and the Rio Grande Basins, and the extreme southeastern portion of the Columbia River Basin, if needed. In the power area of the lower basin annual deficiencies are estimated at 5 billion kilowatt-hours by 1970 and 9 billion by 1980, over and above the possible output of all present facilities, including those authorized and planned, and potential hydroelectric developments in the lower basin.

LOWER BASIN

A vast reservoir of potential hydroelectric power in the Lower Colorado River Basin awaits development. Only minor steps had been taken toward full development of this natural power resource until the construction of Boulder Canyon and Parker Dam projects, which completed two links in a chain of dams and power plants to harness the waters of the Colorado River and provide large quantities of low-cost power to meet urgent and growing demands in Arizona, southern California, and southern Nevada. Now low-cost electrical energy from these two sources is pouring into industrial plants, pumping plants, and municipalities of the region. In 1943 installed generating capacity, including additional units planned and authorized projects, in the lower basin power area was 3 million kilowatts, of which about 2 million kilowatts were in hydroelectric plants, yet a power shortage existed.

Development of the potential multiple-purpose projects in the lower basin would make available an additional 1,900,000 kilowatts of installed capacity. It is estimated that by 1960 the demands for power will exceed the output from all existing, authorized, and potential plants.

Potential power developments described herein indicate hydroelectric possibilities of the Lower Basin. Early construction of some of these plants is urgently needed to avoid power shortages and consequent curtailment of economic development. Cost allocations have not been included, but will be considered in later special project reports.

Power Area

For the purpose of this report the lower basin power area includes the drainage basin of the Colorado River below Lee Ferry, the Salton Sea Basin, and the Pacific coastal area south of the Tehachapi Mountain Range. Some sections of this power area are now being supplied wholly and other sections in part by the power plants located in the Lower Basin.

This power area is divided for discussion into five divisions; (1) Arizona—entire State; (2) southern California—San Diego, Imperial, Riverside, Orange, San Bernardino, Los Angeles, and Ventura Counties, and part

of Santa Barbara County; (3) southern Nevada—Clark and Lincoln Counties; (4) Utah—that part included in the lower basin in Washington, Kane, and Iron Counties; and (5) the part of New Mexico included in the lower basin in McKinley, Valencia, Catron, Grant, and Hidalgo Counties.

Present Power Development

Present power development and utilization vary considerably throughout the area. Much electricity is used in the thickly populated metropolitan areas. Extensive power developments in or feeding into these areas include both hydroelectric and fuel-burning plants. In the remaining expansive but sparsely populated parts of the area most power loads are small and widely scattered. Many communities are served by small isolated power systems or local power plants, chiefly of the fuel-burning type. Some of the present generating and transmission facilities in the power area rapidly are becoming obsolete and are neither adequate nor properly designed for full coordination of operation. In addition energy is now being generated at three different frequencies, and transmitted at various voltages.

Construction of Boulder and Parker power plants and high-voltage transmission lines from these plants to major load centers in central Arizona and southern California has made it possible to deliver large blocks of low-cost power and energy to distant load centers. These developments together with a comparatively small amount of modern equipment in several local systems constitute the present electrical development within the basin which is suitable for supplying economically substantial quantities of power.

In 1943 the total installed capacity of the generating units in the principal power plants, both hydro and fuel-burning types, within the power area, exclusive of authorized projects, was about 2.5 million kilowatts. (This included one 82,500-kilowatt unit being installed in Boulder Dam power plant in 1943). Interconnections with plants outside the area made available to the area approximately 0.4 million kilowatts of additional capacity, thus bringing the total installed capacity available to the area in 1943 to 2.9 million kilowatts. It is estimated that of this total capacity only about 2.5 million kilowatts were classed as dependable capacity available at all times to supply system loads and reserve requirements in the area. Additional units which have been authorized and planned but which have not as yet been installed in the area will increase the capacity by about 0.6 million kilowatts.

Total electric energy consumed in the power area in 1943 was in excess of 11 billion kilowatt-hours. This large amount of energy had been generated by operating many of the plants at or near maximum capacity for extended periods because of war demands. Normal operation will permit shut down of the less efficient fuel plants and operation of the more efficient ones for peaking and stand-by service. This is important because of the growing necessity to conserve the diminishing oil supply and to reserve the natural gas fields for long-time domestic and industrial requirements.

Although power deficiency in the power area was rather critical during the year 1943 owing to the tremendous war load, it has eased considerably since that time. With war demands lessened and the production of magnesium, aluminum, and certain other war products curtailed, the rapid rate of load growth is slackening. With further reduction in war industries and with the installation of new generating capacity now under construction or authorized, available power supply will be sufficient to meet estimated normal load requirements in the immediate future.

Power Facilities

Present power facilities in the power area are discussed by States, except for the major power developments on the lower Colorado River, which are considered separately as they involve distribution of large quantities of power and energy to two or more States.

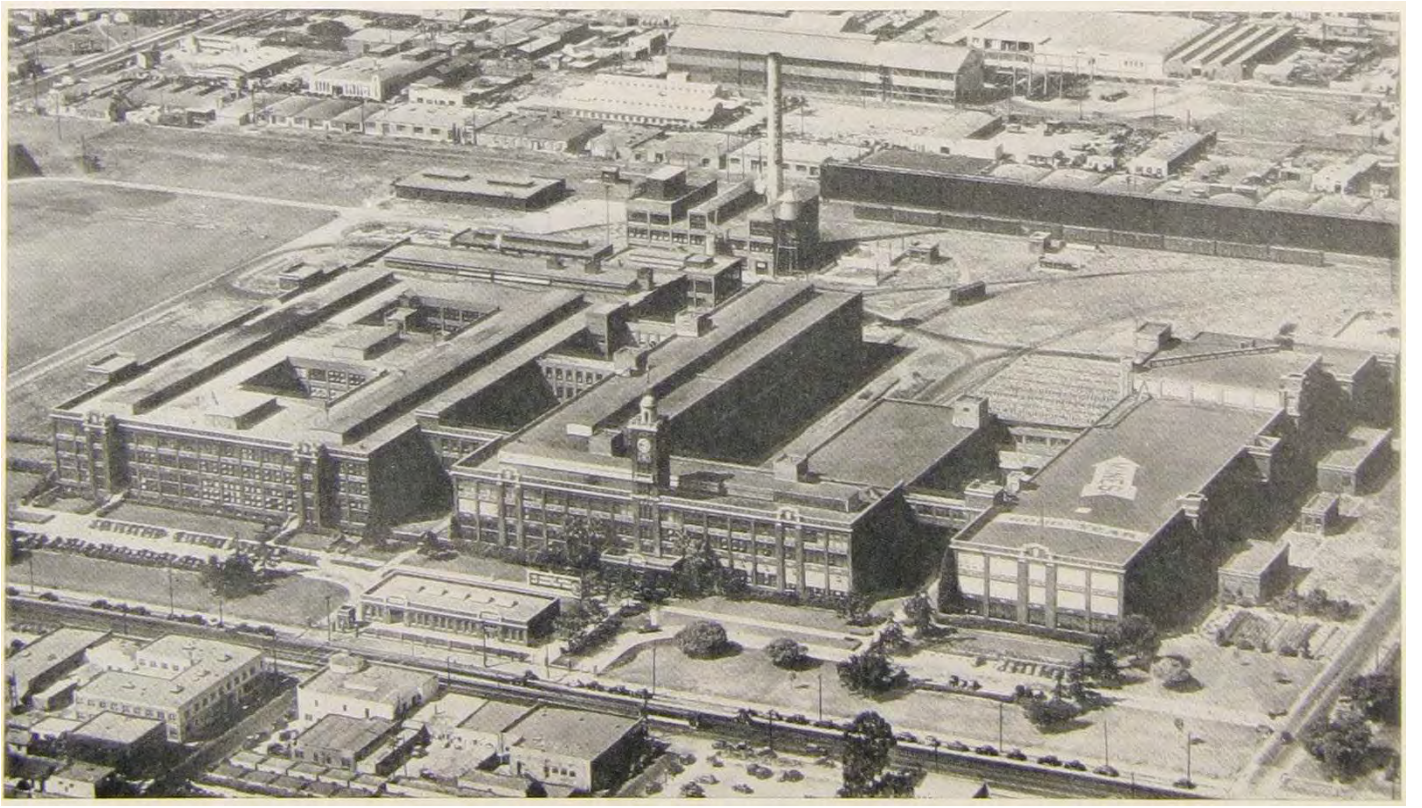
Lower Colorado River plants.—Construction of Boulder Dam power plant by the Bureau of Reclamation was begun in 1931 and the first of the main generating units was placed in service in 1936. The power plant is designed for an ultimate installed capacity of 1,317,500 kilowatts provided by fifteen 82,500-kilowatt and two 40,000-kilowatt generating units. The installation of one 82,500-kilowatt unit completed in 1944, brings the present installed capacity to 1,030,000 kilowatts. Lake Mead has a maximum storage capacity in excess of 32 million acre-feet of water. The great amount of generating capacity installed in the power plant, together with the tremendous storage of water, provides the flexibility of operation needed to meet daily, monthly, and seasonal fluctuations in electrical load. Moreover, this vast storage will be useful in coordinating the operation of many present and potential plants in the power area. The firm energy output of the Boulder Dam power plant was established at 4,330,000,000 kilowatt-hours for the year of operation ending May 31, 1938, and thereafter reduced by 8,760,000 kilowatt-hours annually as an average adjustment for upstream depletions. Total generation, firm and secondary, for the calendar year 1943 was 5,727,906,714 kilowatt-hours, and was near that same amount in 1944.

Parker Dam power plant is located on the Colorado River 155 miles by river downstream from Boulder Dam, just below the confluence of the Williams and Colorado Rivers. Parker Dam was originally constructed as head-



DOWNTOWN LOS ANGELES

Boulder Dam power lights cities and homes



GOODYEAR TIRE AND RUBBER COMPANY, LOS ANGELES

This plant uses Colorado River power and water

works for the Colorado River aqueduct of the Metropolitan Water District of Southern California, but later provision for construction of a power plant was made. The Bureau of Reclamation rushed the construction of the Parker Dam power plant in order to relieve a severe shortage of power in Phoenix, Ariz., and to furnish power for pumping on the Gila irrigation project in southwestern Arizona. By June 1943 the 120,000-kilowatt power plant was completed with four units in operation. This was years ahead of schedule. Power produced at this plant is delivered by means of high-tension transmission lines to load centers at Phoenix, Tucson, and Yuma, Ariz. These lines also connect with the Imperial irrigation district lines in Imperial Valley, Calif. Havasu Lake, the reservoir formed by Parker Dam, has a storage capacity of 716,000 acre-feet and makes available a maximum head of 75 feet. During the period June 1, 1943, to May 31, 1944, the Parker Dam power plant generated a total of firm and secondary energy of 781,642,000 kilowatt-hours. It is estimated that the plant can produce an average of about 500,000,000 kilowatt-hours of energy a year on a firm power basis.

Approximately 67 miles downstream from Boulder Dam and about 88 miles upstream from Parker Dam is the site of Davis Dam power plant. The Davis Dam project was authorized by the Congress and a contract for construction was awarded by the Bureau of Reclamation in June 1942; however, the War Production Board later issued a revocation and the contract was terminated in February 1943, with very little work having been accomplished. This action was considered necessary because of shortages of critical materials and manpower. Although the additional energy that Davis power plant would have generated was urgently needed, the length of time necessary to complete construction did not warrant continuance of the project during the war emergency. Construction will be resumed as soon as practicable. The reservoir will have an active storage capacity of 1,600,000 acre-feet and will back water up to the tailrace of the Boulder Dam power plant. The Davis Dam power plant will utilize the 140-foot head made available and will have an ultimate installed capacity of 225,000 kilowatts. Transmission lines will connect with Parker Dam power plant and with the power area transmission grid. The initial firm energy that the Davis Dam power plant can generate is estimated at 800 million kilowatt-hours annually. It is expected that future upstream developments and other factors affecting stream flow will reduce the amount of water available to the extent that the firm energy will be reduced ultimately to approximately 600 million kilowatt-hours annually.

Existing hydroelectric plants not located on the river but utilizing Colorado River water diverted at Imperial Dam and delivered by the All-American Canal include the 1,600-kilowatt Siphon Drop power plant of the Yuma irrigation project, Arizona, and Drop No. 3 and No. 4 plants of the Imperial irrigation district, California. Additional plants planned for in the building of the All-American Canal but not yet constructed include plants at Canal Drops No. 2 and No. 5, and at Pilot Knob.

Arizona.—The Bureau of Reclamation by virtue of its Boulder Dam and Parker Dam power plants is the largest producer of electrical energy in the State. Other principal agencies, exclusive of mining companies, contributing to the power supply are the Salt River Valley Water Users' Association; Central Arizona Light & Power Co.; the Tucson Gas, Electric Light & Power Co.; Arizona Power Corp.; Arizona Edison Co.; and Office of Indian Affairs (San Carlos project).

A number of mining companies produce electricity for their own use and a few of them generate some energy for public consumption. Only about one-fourth of the total generating capacity in the State exclusive of Colorado River plants of the Bureau of Reclamation is hydroelectric.

Transmission systems of the State are entirely inadequate to meet the requirements of the rapidly growing electric power load. Two generating frequencies, 25 and 60 cycles, and many transmission voltages are now used. Interconnections between systems are inadequate and some smaller systems are completely isolated. Initial steps have been taken toward rectification of these conditions. Since 1940 the Bureau of Reclamation has constructed transmission lines that connect Parker Dam power plant with Phoenix, Tucson, and Yuma, and an interconnection has been made through lines of the Metropolitan Water District of Southern California with Boulder Dam power plant.

Southern California.—The power area in southern California is supplied principally by the following agencies: Southern California Edison Co., Ltd.; California Electric Power Co.; city of Los Angeles Department of Water and Power; city of Burbank; city of Glendale; city of Pasadena; Metropolitan Water District of Southern California; San Diego Gas & Electric Co.; California-Pacific Utilities Co.; and Imperial irrigation district.

Most of the power systems of these organizations are interconnected, although some of the ties are not of adequate capacity for the desired integration of operation. A substantial connection with a capacity of 157,000 kilowatts is maintained between the Southern California Edison Co., Ltd., and the Pacific Gas & Electric Co., the principal generating agency in the central part of the State. The largest amount of power available to the area comes over eight transmission lines from Boulder Dam power plant. Three lines are operated by the city of Los Angeles, two lines are operated by the Southern California Edison Co., and one line by each of the following agencies: the California Electric Power Co., the Metropolitan Water District of Southern California, and the

California-Pacific Utilities Co. Power is also available from plants owned by Southern California Edison Co., Ltd., city of Los Angeles Department of Water and Power, and California Electric Power Co. located outside of the power area.

Southern Nevada.—Clark and Lincoln Counties are almost entirely dependent for their power supply upon Boulder Dam and Parker Dam power plants. The operating agencies for this region are: Southern Nevada Power Co., Lincoln County Power District, California-Pacific Utilities Corp., and United States (Boulder City).

The power demand for operation of the reduction plant of Basic Magnesium, Inc., reached about 200,000 kilowatts during periods of peak production, but by the end of 1944 the demand decreased owing to curtailed operations in this war plant.

Present power requirements in this area, exclusive of the magnesium plant and town site, are about 41,000 kilowatts. Transmission lines of sufficient capacity for the present load extend from Boulder Dam power plant to load centers.

Utah.—Electric service is supplied in the Utah area by the Southern Utah Power Co. and the St. George municipal plant. A total of 4,569 kilowatts of generating capacity is installed in the area, 3,440 kilowatts hydro and 1,129 kilowatts internal combustion.

New Mexico.—Gallup, N. Mex., operates a municipal distribution system and purchases its electric energy requirements from a nearby coal mining company which operates a 4,000 kilowatt steam-electric plant.

Summary.—A summary of the present power generating facilities in the power area of the Lower Colorado River Basin is given in table CXXVIII. Total capacity includes units installed, under construction, authorized, or for which installation has been definitely planned in the construction of existing projects. It is estimated that these facilities can produce approximately 11 billion kilowatt-hours of energy annually.

Energy Production Costs

The average expense of power production in 1940 reported by the Federal Power Commission for five leading private utilities in Arizona, exclusive of taxes, depreciation, and allowance for return on investments, was 4.13 mills per kilowatt-hour. The addition of taxes and depreciation on production plants brings this average up to a little more than 6 mills per kilowatt-hour. The average cost of power purchased by these agencies during the same period was over 8 mills per kilowatt-hour. Energy is produced by fuel-burning plants at relatively high costs throughout most of the power area. Small plants and isolated plants, in general, produce power at very high costs. Boulder Dam and Parker Dam power plants are

Table CXXVIII.—*Installed generating capacity in the lower basin power area (1943)*

Division area ownership	Generating capacity (kilowatts)					
	Present installed				Authorized or planned (hydro)	Total installed, authorized or planned
	Hydro	Steam	Internal combustion	Total		
Lower Colorado River: Publicly owned	[1] 1,151,600	0	0	1,151,600	516,500	1,668,100
Arizona:						
Privately owned	7,040	224,567	40,180	271,787	0	271,787
Publicly owned	80,950	22,500	15,492	118,942	0	118,942
Subtotal	87,990	247,067	55,672	390,729	0	390,729
Southern California:						
Privately owned	11,870	509,000	31,084	551,954	0	551,954
Publicly owned	124,225	282,500	12,000	418,725	64,000	482,725
Subtotal	136,095	791,500	43,084	970,679	64,000	1,034,679
Utah:						
Privately owned	2,890	0	329	3,219	0	3,219
Publicly owned	550	0	800	1,350	0	1,350
Subtotal	3,440	0	1,129	4,569	0	4,569
New Mexico: Privately owned	0	4,000	0	4,000	0	4,000
Lower Basin:						
Privately owned	21,800	737,567	71,593	830,960	0	830,960
Publicly owned	1,357,325	305,000	28,292	1,690,617	580,500	2,271,117
Total	1,379,125	1,042,567	99,885	2,521,577	580,500	3,102,077

[1] Includes one 82,500-kilowatt unit of the Boulder Dam plant placed in operation in 1944.

generating large quantities of energy at much lower cost. A market is now available for still larger quantities of such low-cost energy.

Fuel Supply for Generation of Electricity

Oil and natural gas are the principal fuels utilized in fuel-burning electric generating plants in the area. The war has caused a heavy drain on these natural resources. Above ground reserve supplies of oil in California have been greatly depleted even with an increased production of crude oil. Many steam-electric plants normally using oil for fuel have been converted to utilize natural gas. It is evident, however, that the known sources of both oil and natural gas in the region will not continue indefinitely to supply these fuels at the present rate of consumption. Unless extensive new reserves of these fuels are discovered, it is certain that their use for generation of electricity will be sharply curtailed in a very few years. An increase in the cost of producing electricity in fuel-burning plants in the near future is anticipated. If coal were to replace present fuels, it would have to be transported for long distances, probably from mines in Utah, as there are no known extensive coal deposits in the area.

A number of fuel-burning plants may be retired in the future because of their obsolescence and the high cost of fuel. It is anticipated that the larger and more efficient plants will continue to be used for peaking and stand-by purposes. Minimum generating capacity which should be held in reserve to meet probable emergency requirements of the present power systems in the power area is considered to be about 300,000 kilowatts. A substantial amount of capacity in fuel-burning plants is required for such stand-by when hydroelectric energy must be transmitted long distances over transmission lines, as is the case in this power area. Energy generation by fuel-burning plants, however, will be reduced appreciably as the supply of low-cost hydroelectric energy increases.

Power Utilization

Electrical energy requirements (sales plus losses and utility use) in the power area of the lower basin during the year 1943 were a little more than 11 billion kilowatt-hours with a corresponding peak-load demand of about 2,100,000 kilowatts. Approximately 95 percent of the area's 1943 energy requirements was generated within the area, while about 5 percent was imported. Annual energy requirements had increased over 4.5 billion kilowatt-hours from 1940 to 1943. Much of this increase resulted from the great expansion of war industries. Increasing amounts of power and energy were also required in agriculture for farm use and irrigation pumping, in mining, and in many other service and trade industries.

The following tabulation shows the total energy requirements and the requirements per capita in the lower basin power area.

Table CXXIX.—*Electric energy load requirements in the lower basin power area (1943)*

Division area	Total annual load [1] (kilowatt-hours)	Population [2]	Average annual load requirement per capita (kilowatt-hours)
Arizona	1, 206, 324, 000	578, 756	2, 084
Southern California	8, 506, 391, 000	3, 986, 847	2, 134
Southern Nevada	[3] 1, 445, 009, 000	45, 823	31, 534
Utah	9, 300, 000	11, 000	846
New Mexico	7, 000, 000	31, 870	220
Lower Basin area	[3] 11, 174, 024, 000	4, 654, 296	2, 400

[1] Exclusive of energy generated by industrial concerns for their use.
[2] Estimated civilian population by Bureau of Census, Mar. 1, 1943.
[3] Includes 1,315,261,000 kilowatt-hours load requirements of Basic Magnesium, Inc.

The average annual energy requirement per capita for the United States, comparable to the figures shown in the above table, is 1,677 kilowatt-hours.

Selling Price of Electrical Energy

Domestic requirements comprise a large portion of the electrical load and were rapidly increasing even prior to the war period. About 27 percent of the total energy sold in 1939 was delivered to residential customers, both urban and rural, at an average cost to the consumer of 2.8 cents per kilowatt-hour. Corresponding combined sales to commercial and industrial establishments amounts to 44.7 percent of the total energy sold at an average cost of 1.6 cents per kilowatt-hour.

Rates for sale of power and energy vary considerably in this power area. Throughout most of the area with exception of the cities on the west coast, rates have been high. In general, communities receive power from Boulder Dam and Parker Dam plants at a comparatively low cost and isolated communities still pay very high prices for power from smaller local plants.

Power Market Survey and Load Trend

Demand for electric power in the area has increased at a rapid rate during the past decade. Even prior to the stimulating influence of war conditions a remarkable growth was being experienced. Indications are that the potential power market in the area will continue to grow for many years in the future. With the cessation of hostilities, however, it is to be expected that there will be some temporary dropping off or leveling of power loads.

Opportunities exist for greatly expanding agriculture, mining, manufacturing, recreational areas, and health

centers. The expansion of these industries will increase the demand for more low-cost power.

Since 1900 population has grown much more rapidly in the metropolitan areas on the west coast than in other parts of the power area. Some sections are very sparsely settled. Only 4,650,000 persons were living in the lower basin power area in 1943. It has ample room and resources to support a population considerably in excess of this number and by 1980 it is estimated the population will have increased to at least 8,500,000.

Future Power Consumption

Residential use.—Domestic utilization of electricity in the past has been limited somewhat because of the high cost to the consumer and because of the lack of widespread knowledge and acceptance of the many services and conveniences which electricity can provide in the home. An increasing demand for more power for domestic use is expected in future. The climate throughout most of the power area is especially suited to electric heating and air conditioning because excessive consumption of electricity for these purposes is not required. Also, there is a lack of natural fuels, such as coal, oil, gas, and wood in the greater part of this area. Refrigeration for food preservation has become a necessity in the modern home. Introduction of new type equipment, such as "deep freeze" units, and the expansion of the use of present domestic-type refrigerators, stoves, heaters, and washing machines would increase greatly the use of electricity in homes. Total energy requirements for heating, air conditioning, and for other conveniences for an "all-electric" home would be about 14,000 kilowatt-hours annually. If favorable rates for sale of power and energy are made available to practically all communities in the power area it is estimated that an average yearly domestic consumption of 4,000 kilowatt-hours per home would be reached by 1980.

Farm use.—The agricultural industry in the area is largely dependent on irrigation. Dry farming is of little consequence. Any plan for development of the potential irrigation projects would necessitate the use of a substantial amount of power and energy for irrigation and drainage pumping. It is also anticipated that farms will use additional amounts of electricity under extensive programs of rural electrification, possibly reaching an average annual consumption of 4,000 kilowatt-hours per farm, or 8,000 kilowatt-hours including the farm residence.

Commercial use.—The use of electricity by commercial establishments is comparatively high. The long, hot summers make the use of air conditioning equipment highly desirable in many parts of the area, especially in hotels, office buildings, restaurants, and in places of public gatherings. Electricity is used for cooking in many places and is becoming more and more popular every year as better appliances and lower rates are made available. With the possibility that lower cost energy and better appliances and lighting equipment will continue to be made available throughout the area a steady and substantial increase in the commercial load is foreseen.

Mining use.—The mining industry has been greatly stimulated by the war emergency. Large, important underground supplies of minerals, however, remain undeveloped in the area. The availability of large amounts of low-cost power would help to reduce mining costs and would encourage greater use of electricity in the industry. Substantial quantities of such cheap power would also be used to replace present generation of many fuel-burning plants which are owned and operated by mining companies. It is anticipated that the future consumption of electric energy in the mining industry within the power area will average about 1 billion kilowatt-hours annually.

Manufacturing use.—More manufacturing industries in the area are needed. Some industries have sprung up and expanded greatly under the war impetus but in some instances industrial expansion has been limited by the lack of available low-cost electric power. The construction of the potential hydroelectric developments would provide for broad industrial expansion. Low-cost electric power and energy would encourage the processing of agricultural products and special metals as well as the production of many finished goods that previously have been produced in other parts of the country and transported long distances to markets in the area.

Transportation use.—Some consideration has been given to the possibility of electrification of that section of the Atchison, Topeka & Santa Fe Railroad between San Bernardino, Calif., and Winslow, Ariz. The increasing scarcity of fuel supply in the region and the availability of low-cost power in the future would increase the desirability of converting this section of main line railroad from steam to electric operation. Electrification of this section would probably consume 300 million kilowatt-hours of electric energy annually.

Estimated Future Load Summary

Future loads for each class of consumer in the lower basin power area are estimated as follows:

Class of consumer:	Estimated total load, 1980 (kilowatt-hours)
Residential	8,000,000,000
Farm	2,200,000,000
Commercial	5,500,000,000
Mining	1,000,000,000
Manufacturing	10,000,000,000
Transportation	300,000,000
Total consumption	27,000,000,000
Losses and utility use	3,000,000,000
Total load requirements	30,000,000,000

Maximum demand, 5,300,000 kilowatts.

Total energy requirements for all purposes in the lower basin power area rose from an average of about 350 kilowatt-hours per capita in 1910 to approximately 2,400 kilowatt-hours in 1943. It is anticipated total annual requirements will reach at least 3,500 kilowatt-hours per person by 1980.

An estimate of future load growth for the lower basin power area is shown in table CXXX and figure 15. Studies previously made through extensive research by the Federal Power Commission, by individual power-generating agencies, and by State and local planning boards and commissions have been used as guides in preparing this forecast.

TABLE CXXX.—*Estimated load growth in the lower basin power area*

Year	Estimated annual energy requirements (kilowatt-hours)		
	Total	Load increase	
		Increment for 10 years	Accumulative total
1940	6, 512, 000, 000		
1950	14, 164, 000, 000	7, 652, 000, 000	7, 652, 000, 000
1960	20, 687, 000, 000	6, 523, 000, 000	14, 175, 000, 000
1970	25, 971, 000, 000	5, 284, 000, 000	19, 459, 000, 000
1980	30, 000, 000, 000	4, 029, 000, 000	23, 488, 000, 000

Potential Power Development

POWER PLANTS

Potential generating capacity in the lower basin would be concentrated fairly well, as 1,922,000 kilowatts, or 99 percent of the total capacity of 1,945,400 kilowatts, would be installed in three plants located on the main stem of the Colorado River between Lee Ferry and Boulder Dam. The remaining capacity, 23,400 kilowatts, would be installed in six small widely separated plants in Arizona, Utah, and New Mexico. The locations of the potential power plants are shown on the map "Colorado River Basin, Principal Power Systems, Existing and Potential" included in the appendix.

The potential power plants in the Lower Basin would have a total firm energy generation of 10,242,000,000 kilowatt-hours per year. Of this amount 37,000,000 kilowatt-hours would replace loss of generation at the Stewart Mountain hydroelectric plant because of a potential upstream diversion from Salt River. The net increase in firm generation therefore would be 10,205,000,000 kilowatt-hours. It is estimated that the present power developments, including units operating, under construction, authorized or planned, can produce about 11 billion kilowatt-hours annually. The present and potential plants described herein would be capable of a total output

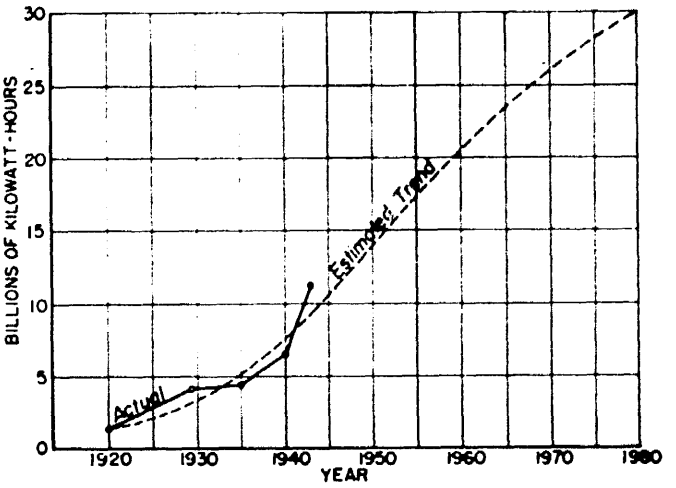


FIGURE 15.—*Lower Colorado River Basin, estimated trend, electric power load of market area*

of more than 21 billion kilowatt-hours of firm energy annually.

Potential plants in the Lower Colorado River Basin are listed in table CXXXI which gives the location by stream, project, the installed capacity, and annual firm generation of each plant.

TRANSMISSION SYSTEM

A tentative plan for construction of a high voltage power transmission grid for the delivery of power and energy to principal load centers in the lower basin power area is indicated on the map in the appendix. This map shows the general location of potential transmission lines which would complement the existing lines and connect the present and potential major generating plants with the principal load centers and with each other. Such a transmission system would permit a high degree of coordination in the operation of the power plants. This is desirable from the standpoint of economy of power system operation and of conservation of water and fuel resources. Some of the generating plants would be located at great distances from the load centers. Operating characteristics of hydroelectric plants vary greatly because of the fluctuation in water supply and in reservoir releases for irrigation, flood control, and other purposes. Under these conditions an extensive transmission system is required to produce a maximum amount of firm power and energy and to provide for supplying economically large quantities of power and energy to widely scattered load centers.

The total cost of the potential transmission system for the lower basin area including transmission lines, terminal substations, and intermediate switching and transformation facilities is estimated, on the basis of 1940 prices, at $195,000,000.

TABLE CXXXI.—*Potential hydroelectric power plants in the lower basin*

River basin power plant	Project	River	Installed capacity (kilowatts)	Annual firm generation (kilowatt-hours)
Colorado River:				
Marble Canyon	Marble Canyon—Knab Creek	Colorado	22,000	164,000,000
Kanab Creek	do	do	1,250,000	6,570,000,000
Bridge Canyon	Bridge Canyon	do	650,000	3,440,000,000
Gila River:				
Buttes	Central Arizona	Gila	5,800	8,000,000
Horseshoe	do	Verde	[1] 10,000	[1] 37,000,000
Hooker	do	Gila	3,000	8,000,000
Virgin River: [2]				
Virgin	Hurricane	Virgin	2,000	3,000,000
Bench Lake	do	do	800	2,000,000
Warner Valley	do	do	1,800	10,000,000
Total			[3] 1,945,400	[3] 10,242,000,000

[1] Would be used to replace loss of generation at Stewart Mountain plant.
[2] In addition to the firm energy shown there will be 17,800,000 kilowatt-hours generated annually to be used as replacement for energy now being generated at the LaVerkin plant, project pumping, and secondary energy.
[3] Net increase in installed capacity 1,935,400 kilowatts and net increase in annual firm generation 10,235,000,000 kilowatt-hours.

COST ALLOCATIONS

Construction of some of the potential power plants in the lower basin probably will be needed in the near future. Any plan for full development of the water resources will require the construction of many multiple-purpose projects. The costs of construction and operation of such multiple-purpose projects should, therefore, be distributed among the purposes served in accordance with benefits received. From available information it is estimated that the total cost for production and delivery of power and energy will permit the sale of large quantities of electricity at rates sufficiently low to be very attractive to the future growing power market.

Summary

Requirements for electric energy by the metropolitan areas of southern California, and by people in Arizona and southern Nevada, have resulted in the construction of large hydroelectric power developments in the lower basin power area. The total hydroelectric generating capacity now installed, authorized, and planned to be installed in the power area is 1,959,625 kilowatts. Another 1,142,452 kilowatts of capacity are installed in fuel-burning electric generating equipment. Although the present power developments in the area are on a very large scale and supply a vast area, the potential hydroelectric developments would double the amount of hydroelectric capacity available to the lower basin power area. The greater degree of coordinated generation of the area's power plants, present and potential, which will be made possible by more extensive interconnecting transmission lines and better stream flow regulation, will result in a higher energy output per kilowatt of installed capacity than is now being obtained.

Load growth in the past has been at a high rate of increase from year to year, and the average consumption for the area is now well above the national average. In view of the expected increases in population throughout the area, and the resultant increases anticipated in the demand for electricity for use in the home, on the farm, and by mining, industrial, commercial, and other users, it is estimated that by 1980 the total load requirements of the area will be nearly three times the present load requirements.

Power developments in the lower basin power area, including present and potential generating capacity (name plate rating) and output, and load requirements are summarized as follows:

	Kilowatts	Kilowatt-hours
Present installed generating capacity: [1]		
Hydroelectric	1,959,625	
Fuel-burning	1,142,452	
Total	3,102,077	
Present load requirement (1943)	2,100,000	11,174,024,000
Potential installed generating capacity: Hydroelectric	[2] 1,935,400	
Potential firm output		[2] 10,205,000,000
Estimated load requirements (1980)	5,300,000	30,000,000,000
Estimated increase in load requirements (1943–80)	3,200,000	18,825,976,000
Estimated energy deficiency (1980)		8,620,976,000

[1] Existing, authorized, and planned installed capacity.
[2] Excludes Horseshoe plant, 10,000 kilowatts installed capacity, and 37,000,000 kilowatt-hours output for replacement.

At the estimated rate of future load growth shown on the load trend curve (fig. 15) the load requirements by about 1960 will require the entire output of the potential plants in the lower basin. The deficiency after 1960 could be supplied from some of the upper basin potential

plants. Although such energy would have to be transmitted long distances, it is believed technical advances in electrical engineering will make this transmission practicable.

SUMMARY—COLORADO RIVER BASIN

Power in the Colorado River Basin has been developed in the upper basin on a much smaller scale than in the lower basin mainly for the reason that a much smaller market for power is available to the upper basin as compared with the large metropolitan markets in southern California available to the lower basin. The use of power in those metropolitan areas has made possible the great developments on the lower Colorado River. The only city of over 10,000 inhabitants in the upper basin is Grand Junction, Colo. Development of the vast land, water, and mineral resources in the upper basin area has been on a very small scale. Present power developments in the two basin areas are summarized for comparison in table CXXXII.

Future load requirements in the Colorado River Basin and its electric service areas will grow as the demand increases for products from the basin and the service areas. As more people move westward to live, the demand for western products will increase; wants of the millions of people living on the west coast will also create an increased market for the products of Western States. These new marketing possibilities will stimulate industrial development throughout the Western United States; and the Colorado River Basin area will benefit greatly by increased population, and industrial and economic growth. Development of water resources on a basin-wide basis, as now being planned by the Bureau of Reclamation, will do much to stimulate future activities in the basin.

The future economic growth of the Colorado River Basin will depend upon more extensive utilization of the basin's land and water resources. Electricity, a product of water development, is used by people in all walks of life—in homes, on farms, in offices, in mines, in factories, and wherever else they may be. The benefits of large amounts of low-cost electric energy accrue to everyone. Industry uses great amounts of electric energy in modern practice. The greatest benefit to industry within the basin is likely to come from the development of low-cost hydroelectric power by the basin's potential power plants. The combination of large quantities of low-cost electricity with the abundant mineral resources in the basin offers untold possibilities. The people of the basin, the Mountain and Western States, the Pacific coast, the Nation, and the world would all benefit.

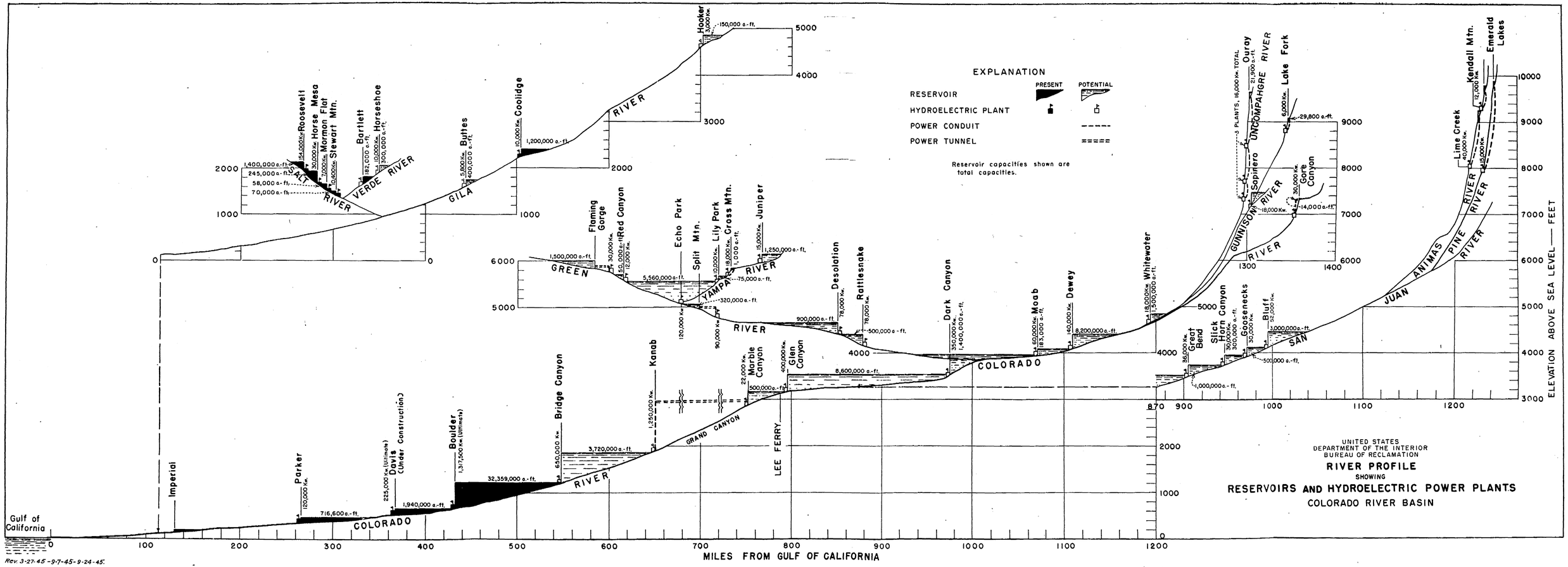
Mining and processing of minerals within the basin would be greatly stimulated if abundant low-cost power were made available. The high cost of electricity and undependable service from the present isolated plants are important handicaps to the expansion of mining and processing activities. In the upper basin are vast deposits of minerals including phosphates, magnesium, potash, coal, and oil shales; while in the lower basin are reserves of copper, gold, silver and zinc, along with other metals and nonmetallic minerals.

Transmission lines could be constructed to carry electricity from the basin's potential power plants to adjoining areas outside the basin, and thus stimulate growth in those areas. Lines into central Utah, interconnecting potential upper basin plants and Bonneville Basin plants, would result in industrial development in combination with materials from within and outside the basin. A basic steel industry has been started in the West by construction of the new Geneva steel plant near Provo, Utah. This industry with its associated and allied industries will require electricity in quantity and at low cost if it is to be developed on a large scale. Copper and zinc refining by the electrolytic process offers important possibilities in Arizona, Utah, Colorado, and New Mexico. As an example of what can be accomplished by the generation and transmission of large amounts of low-cost electricity, the lower Colorado River power system can be cited. Electric power from those plants is used in quantity in the lower basin areas in Nevada, Arizona, and California, while transmission lines carry large amounts of power to the metropolitan areas in southern California located many miles from the basin. These large developments have made profound changes in the economic structure of the lower basin power area. The construction of similar

TABLE CXXXII.—*Present power development in the Colorado River Basin (1943)*

Power area	Installed generating capacity [1]			Total annual load requirements (kilowatt-hours)	Average annual load requirements per capita (kilowatt-hours)
	Hydro (kilowatts)	Fuel-burning (kilowatts)	Total (kilowatts)		
Upper basin	57, 217	43, 865	101, 082	238, 870, 000	1, 174
Lower basin	1, 959, 625	1, 142, 452	3, 102, 077	11, 174, 024, 000	2, 400
Total	2, 016, 842	1, 186, 317	3, 203, 159	11, 412, 894, 000	2, 348

[1] Includes total installed, authorized, and planned.



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projects will be of the utmost importance to the Colorado River Basin States and the Nation.

Estimates of future electric power load growths have been based on past trends and future possibilities resulting from potential developments. Low-cost electric power will be used in large amounts not only by industrial consumers to stimulate industrial developments, but by the residential, farm, commercial, railway, and municipal classes of consumers. The estimates of future load growth, taking all classes of users into consideration, indicate total annual load requirements by 1980 of 31,885,000,000 kilowatt-hours for the entire Colorado River Basin area, or 1,885,000,000 kilowatt-hours for the upper basin and 30,000,000,000 kilowatt-hours for the lower basin.

Potential hydroelectric power developments would total 3.6 million kilowatts of installed capacity for the Colorado River Basin, with 1.7 million kilowatts in the upper basin in 29 plants and 1.9 million kilowatts in the lower basin in 9 plants. The firm energy output of the basin's potential plants would total slightly over 19 billion kilowatt-hours annually with 9 billion kilowatt-hours from the upper basin plants and 10 billion kilowatt-hours from the lower basin plants. The locations of potential plants and reservoirs are shown on figure 16, "River profile showing reservoirs and hydroelectric power plants, Colorado River Basin."

Estimated load requirements of the lower basin power area for 1980 are far in excess of the output of the lower basin plants, while the upper basin load is expected to be much less than the output of the potential plants located there. Energy from upper basin potential plants could therefore be used to supply at least a part of the load increase anticipated in the lower basin power market area, as well as in other basin areas where energy deficiencies may materialize in future years.

Power development in the Colorado River Basin including present and potential generating capacity (name plate rating) and output, and load forecasts is summarized as follows:

	Kilowatts	Kilowatt-hours
Present installed generating capacity [1]	3, 203, 159	
Present load requirements (1943)	2, 152, 404	11, 412, 894, 000
Potential installed generating capacity hydroelectric	[2] 3, 648, 400	
Potential firm output		[2] 19, 446, 000, 000
Estimated load requirements (1980)	5, 630, 000	31, 885, 000, 000
Estimated increase in load requirements (1943–80)	3, 477, 596	20, 472, 106, 000
Estimated energy deficiency (1980)		1, 026, 106, 000

[1] Existing, authorized, and planned installed capacity.
[2] Excludes Horseshoe plant, 10,000 kilowatt installed capacity, and 37,000,000 kilowatt-hour output for replacement.

Cost and Benefits from Power Production

Further investigation and study will be necessary before cost allocations of all the multiple-purpose potential projects can be determined. However, results of preliminary studies indicate that the sale of firm commercial energy at an average rate of approximately four mills per kilowatt-hour would provide for repayment of the power features and would provide additional funds which could be applied toward repayment of other project features.

Wealth From Water

"The whole Nation has a stake in the Colorado River . . .

"Water can be brought to this land to produce crops; . . . trade can be established; and in general, the wealth produced can be converted into more and better opportunities for the American people. . . . A great potential market for electric energy is provided by the mineral resources of the Colorado River Basin, among the richest and most varied in the world. . . ."

CHAPTER VII

Wealth From Water

Thousands of acres of desert land in the Colorado River Basin produce nothing more than sagebrush or cacti. Millions of acre-feet of water waste annually into the Pacific Ocean. Billions of tons of copper, coal, and other minerals lie buried in mountains. In their present state this land, this water, and these minerals are not wealth because they are not being utilized economically. They can, however, become wealth or produce wealth. Man's ingenious nature has assured him of this. Water can be brought to this land to produce crops; these minerals can be mined and processed with an abundance of low-cost hydroelectric energy made available; trade can be established; and in general, the wealth produced can be converted into more and better opportunities for the American people.

In the 169 years since the United States become a Nation its people have increased from a handful of 3 million dwelling along the eastern seaboard to 135 million distributed to all corners of the land. The average annual increase has been 780,000 persons. The current rate of growth is nearly 1 million annually. One million people must be absorbed each year into the National economy. Each must be provided with food, clothing, and shelter and given an opportunity to share in the advantages of the American way of life, contributing his bit toward the National welfare.

There are nations where the population has reached the saturation point, the maximum that the natural resources will support. In some of these, poverty and starvation stalk the land. Each new birth in effect brings death to the most feeble of the living.

America as a whole has not felt the pinch of overpopulation. Throughout its rapid growth its standard of living has continued to improve until it now surpasses anything the world has ever known. America's vast resources have been more than sufficient. Its frontiers have been rolled back as necessary. Virgin natural resources have awaited exploitation, and fertile land has stood ready to produce as soon as turned by the plow. American ingenuity and spirit have reached new heights in adapting the offerings of nature to the advantage of the people.

Today, however, the Nation faces a changing situation. The people pushing across the country have reached boundary lines or oceans on all sides. No longer do exterior frontiers invite exploitation. Yet the population continues to increase by almost a million a year. Since the area cannot be expanded to provide for these newcomers, the resources within its borders must be developed more intensely if the American standard of living is to be maintained and improved. Fortunately nature has provided opportunities for such development. Upward trends in both population and living standards can be maintained for many years to come. To achieve this goal, however, Americans must continue with the agressiveness and resourcefulness of their pioneer fathers, but henceforth the pioneering will have to be done on interior frontiers.

The undeveloped resources of the Colorado River Basin present one of the most inviting of the interior frontiers. Full control and utilization of these waters of the Colorado River system will create new wealth and new opportunities in America. The benefits will not be confined by basin boundaries but will extend throughout the land.

Water is perhaps the world's most important single resource. Without water no living thing, either plant or animal, can exist. Man requires it in abundance, not only to quench his thirst and cleanse his linens but in vastly greater quantities to produce and process the food that he eats and the other materials necessary to his welfare. The Colorado River Basin is in the heart of the arid west where water, because of scarcity, is especially precious. The basin has vast resources in land, fuels, oils, fertilizers, timber, metals, and recreational attractions, all dependent on water in one way or another for their development. Only by irrigation can this parched land become productive. Water is required to preserve and enhance the excellent fishing and recreational allurements. Water and the electric energy that can be generated by falling water are necessary to bring forth and process the basin's great mineral wealth. Water, so important, and yet so limited in this area, is the resource that above all others will determine the extent to which the bounties of the Colorado River Basin can be pressed into the service of the Nation.

Some resources, such as minerals, can be preserved in their natural depositories and hoarded until taken up for man's use. If little is used in this generation more will be available for the next. The flowing water of the



CITRUS GROVES

[illegible]



ONIONS ON UNCOMPAHGRE PROJECT

A former cat-tail swamp becomes productive with drainage and irrigation

Boundary Waters, Wilderness Areas

Irrigation. In October there were 10 million acres of arable land in the United States. Acres of each

the Middle Western States. Furthermore, western population is increasing at a rate much faster than the National average. Even with the most efficient use of water for irrigation, increasing quantities of food must be shipped into the Western States.

In the Colorado River Basin agriculture and irrigation are almost synonymous. Successful crop production with reliance only upon rainfall is of negligible importance. Irrigation has provided farm homes for hundreds of thousands of people, created cities, and established markets for many millions of dollars worth of eastern and middle western farm and industrial products. Continued expansion of such developments will depend on how wisely the meager supply of water is utilized.

Potential irrigation projects described in chapter V, exclusive of export diversions, could bring water to 1,533,960 acres of land now dry and largely unproductive, and supplement present inadequate supplies on 1,122,270 acres. All of these projects may not be constructed, but any reduction in these acreages from this cause could be offset by the expansion of irrigation in adjoining basins with water diverted from the Colorado River. Ten thousand new farms could be created on land now uncultivated. Present farms could be made more productive. Some large holdings could be subdivided into family-sized units. Other small farms could be enlarged to economically sized units. The new farms would provide agricultural opportunities for some of the 100,000 servicemen who are returning to the Colorado River Basin.

Increased agricultural production resulting from such a program would have an annual value of $65,000,000. Compared with the growing needs of the Nation this increase is small but important. It represents beef, hides, wool, citrus and other fruits, vegetables, seeds, dairy products, honey, sorghums, and other foods and fibers—goods not produced domestically in sufficient quantities to meet domestic needs.

These crops are complementary to, rather than competitive with, crops produced on agricultural lands of other sections. Most of the forage and grain crops, considered National surplus crops, are consumed in the livestock regions of the irrigated West in greater quantities than produced. New irrigation developments thus create uses for surplus crops. A study of the 11 Western States shows that over and above what is produced locally for home consumption, there are purchased from other sections of the country annually: $120,000,000 of corn and hog products; $97,000,000 of cotton, cottonseed, and textiles; $90,000,000 of tobacco and tobacco products; $15,000,000 of hard wheat flour and processed cereals; and large amounts of other commodities.

Power.—The deep canyons cut by the Colorado River as it falls over 10,000 feet in its wild dash to the ocean provide some of the best power sites in the world. With full development the river channel could become a great stairway of reservoirs—quiet mill ponds—extending upstream from Parker Dam on the boundary between Arizona and California, through Arizona, Nevada, and Utah, into Wyoming and Colorado. In most cases each dam would back reservoir water to the toe of the dam next upstream. Branches of the stairway would reach up the San Juan, Green, and Yampa Rivers, a total continuous length of 1,600 miles. Other power dams would be distributed on tributary streams. Many dams would be multiple-purpose structures serving also for irrigation, flood control, and silt retention; providing opportunities for fishing and recreation; and making accessible many scenic wonderlands.

These power developments could generate 19 billion kilowatt-hours of electrical energy each year to add to that now being produced at Boulder Dam and other existing plants on the river system. The annual value of this energy delivered at power markets would be $72,000,000.

The market for this power was discussed in chapter VI. The experience of recent years shows that power markets move to areas where abundant low-cost energy is available. A great potential market for electric energy is provided by the mineral resources of the Colorado River Basin, among the richest and most varied in the world. A good start has been made in the extraction of a few of these minerals but processing within the basin, especially stages requiring large amounts of electrical energy, is almost nonexistent. Arizona and Utah together are mining 70 percent of the copper produced in the United States but most of this is shipped all the way across the continent for electrolytic refining.

The Upper Basin's vast deposits of bituminous coal are the nearest substantial coal deposits to the Pacific Coast. They will become increasingly more important as petroleum reserves approach exhaustion. Likewise the great beds of oil shale in the Upper Basin are a potential source of oil.

Without recounting the value to the Nation of greater development of the vast and numerous mineral resources of the Colorado River Basin, and without reiteration of the many requirements for electricity in the process, it can be plainly stated that nothing else would give such impetus to that development as would the availability of low-cost power accompanied by agricultural expansion through greater control of water resources.

In the last 3 years intensive exploration in California has located only as much new oil as is being taken from wells every year. As a conservation measure production is expected soon to drop below normal peacetime demands, making imports necessary. Oil cannot be shipped in at the low price of $1.15 a barrel to which California is accustomed. Dr. Joe S. Bain, for the Haynes Foundation, has estimated that the price of both domestic and imported crude oil might rise to $2 a barrel. If this happens many oil-burning power plants may be retired to standby



YUMA CANTALOUPES

Sacks of cantaloupes grown on the Yuma project of the Bureau of Reclamation are dumped into a truck to be carried to the picking sheds



PRIZE PRODUCE

Prize vegetables and fruits are grown in irrigated areas of the west. This picture shows an assortment of Grand Valley produce

service, and hydroelectric power will be required to fill the gap. Industrial plants also might be forced to convert from oil to electricity for heat and power. Western railroads, powered almost exclusively by fuel oil and coal, might turn to electrification, probably starting with lines in the more mountainous sections where electric locomotives would have distinct advantages.

Abundant low-cost electric power would stimulate activity in other directions. Already Boulder Dam has enabled the Los Angeles area to climb to first place in the manufacturing of aircraft and oil-well machinery, to assemble more cars than any other city except Detroit, to make more furniture than Grand Rapids, to manufacture almost as many tires as Akron, and to jump to third place in the Nation in food processing and oil refining, and to fourth in clothing manufacture. The Colorado River could supply sufficient energy for a $2-billion industrial expansion that would give employment to 350,000 workers. Such an industrial development, including accompanying business and trade establishments, would support an additional population of 2 million people.

The tremendous defense value of abundant electric energy has been demonstrated by the war. By 1940 recent hydroelectric power developments had made electricity in quantity available to Pacific Coast States. Upon this foundation great war industries hurriedly sprang up on a scale almost unequaled elsewhere in the Nation. Ships, airplanes, and light metals were turned out in great quantities. The dollar volume of aircraft produced in Los Angeles County exceeded that of the whole Detroit industry in peacetime. In the Los Angeles and San Diego areas the population increased by 600,000, or 18 percent, from 1940 to 1944. The labor force grew at an even faster rate. Between 1940 and 1943 the working force covered by unemployment compensation in California, Oregon, and Washington increased from 1,900,000 to 3,100,000—some 63 percent.

How much the war was shortened and how many American lives were saved because this electric power was ready to produce weapons cannot be estimated, but the contribution was enormous. Great dams and hydroelectric power plants, built when labor and materials were abundant in time of peace, stood ready under the stress of war to pour out energy with only minimum expenditure of manpower for operation and maintenance.

Flood and silt control.—Boulder Dam now provides full control of the Colorado River at Black Canyon. It now impounds the great destructive floods that before continually harassed the people living along the river's lower plains. This area is still subject to floods of lesser degree originating in the watershed areas of the Colorado and Williams River below Boulder Dam. Above Boulder Dam there are no flood control structures of significance to the river system as a whole. Local damage occurs frequently along tributary streams. For hundreds of miles above Boulder Dam the river and the lower stretches of its tributaries are confined to deep and barren canyons where floods can do no damage, but from these regions great quantities of silt are carried away to be deposited in Lake Mead. The silt problem on the Colorado River is discussed in chapter V under the Boulder division.

Boulder Dam has provided the basis for the great industrial and agricultural expansion of the Pacific Southwest in recent years. It is presently doing much to control floods and silt but this great dam and its many appurtenant structures will some day succumb to the silt it now controls unless aid is received from other basin developments. Not in this generation or even in this century will the threat to Boulder Dam become acute, but prudence dictates that the problem be recognized and attacked now. The capacity of Lake Mead will constantly diminish until a remedy is provided. The potential Bridge Canyon and Marble Canyon-Kanab Creek projects upstream from Lake Mead will provide comparatively little reservoir capacity. Reservoirs to retain silt should be provided on tributaries concurrently with construction of these projects.

Plainly, full control of floods and silt cannot result from a few large dams at strategic locations along the river. Flood waters would deposit silt and debris in the first reservoir reached and eventually fill and destroy it. This process of nature can be combated only by proper watershed management and by construction of a sufficient number of dams to control destructive flows of the Colorado River and its chief tributaries in the canyon areas of Utah and Arizona. Each reservoir built to conserve and control water anywhere in the drainage area would contribute its bit.

The San Juan and Little Colorado Rivers are the principal contributors of silt to the Colorado River. On each of these, large reservoirs are urgently needed to prevent floods and retain silt. The Bluff project on the San Juan River and Coconino project on the Little Colorado River are proposed to be constructed for these purposes. The Alamo project would control floods and silt from the Williams River and the Sentinel project would serve the same purpose on the lower Gila River.

These additional projects to control floods and silt are necessary to protect the vast stake the Nation now has in the Colorado River Basin. The developments outlined will have the dual benefit of providing this protection and also of forming the basis for greater use of the waters of the Colorado River system. There can be little doubt as to the economic justification of such a program.

Municipal and industrial water supplies.—No modern community can thrive without a good supply of pure water for domestic and municipal purposes. These uses are usually recognized as more important than other demands for water. When necessary it is possible to obtain water for domestic use by condemnation of prior rights for

power production, irrigation, or other purposes. A water supply is indispensable to any community. If the community is justified economically, its water system is also justified. Some cities are required to make enormous expenditures to bring water from great distances while others find it at their door. In most parts of the Colorado River Basin municipal water can be provided at nominal cost.

Industrial uses are closely related to municipal uses and are commonly supplied through the municipal pipe lines, although it is not unusual for large or isolated industrial plants to have their own water systems. Few industrial operations actually consume large quantities of water. Where the water is used only for cooling or similar purposes it can be returned to the stream channel almost undiminished in quantity. Other processes polute the water to a degree that it is harmful to fish and wildlife or downstream water users. In such cases the water must be either purified after use or disposed of in evaporating ponds or otherwise.

Projects are outlined which would provide municipal water to Grand Junction, Colo.; Tuscon, Ariz.; and San Diego, Calif.; in addition to the expanded municipal and industrial uses to be supplied from the Colorado River aqueduct, the Duchesne tunnel of the Provo River project, and the Moffat tunnel of the Denver municipal system.

Other requirements for municipal and industrial water will arise from time to time but cannot be anticipated sufficiently to justify present planning of specific projects. As these needs arise they can be satisfied by relatively minor adaptations in the basin plan of development. Expansion of cities and towns will be largely on irrigated or irrigable land. Experience has shown that about the same quantity water will be required for municipal use as would have been required to irrigate the land occupied by the community.

Recreation and fishing.—With the peacetime trend toward a shorter work week, more leisure time, widespread vacation privileges, improved transportation, and greater prosperity, recreational facilities are becoming more important. The great variety of natural attractions in the Colorado River Basin together with the highest dam and the world's largest man-made reservoir make it one of the most outstanding recreational regions in the United States. The value of these attractions will be enhanced through development of the basin's water resources. Improved roads constructed to remote reservoirs, power plants, or tunnel portals will make accessible great scenic wonders, fishing spots, and hunting areas not now reached by modern travel. The reservoirs will add scenic beauty and have recreational value for boating, swimming, and fishing. Lake Mead, formed by Boulder Dam, is called the "Eden of all bass fishermen" and is famous throughout the country for its scenic beauty. Many of the numerous reservoirs that will be required for full river control will be provided with sufficient capacity below the outlet structures to provide permanent habitats for fish. The reservoirs can be operated to control unnecessary turbidity at high flows and to maintain sufficient water in the streams to support fish during dry seasons. The desilting of the main Colorado River and the formation of large reservoirs along its course will multiply the fishing and recreational benefits already provided by Boulder Dam. Cooperation in this phase of the basin development will be required of the National Park Service, Fish and Wildlife Service, Forest Service, and various State and local agencies.

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Widespread Benefits From Colorado River Development

Trade created.—The whole Nation has a stake in the Colorado River. Its full development would bring to American tables foods required for balanced and healthful diets, and to American factories, minerals and other raw materials for which there is an ever growing demand. These things, important in peacetime are doubly important in war when self-sufficiency is a bulwark of national strength and safety. But potential benefits to the Nation are not confined to the basin's exportable products. New homes erected in the Colorado River Basin will require lumber, steel, plumbing fixtures, heating equipment, wire, roofing materials, glass, paint, floor covering, hardware, and numerous other items from industries throughout the land. To make them inhabitable will require furniture, appliances, carpets, fabrics, clocks, pottery, and utensils produced elsewhere. The inhabitants of these homes will purchase from other parts of the Nation a continual flow of such items as tools, implements, machinery, automobiles, magazines, books, rayon and cotton goods, clothing, shoes, furs, processed cereals, fish, rice, peanuts, paper, tobacco, sweet potatoes, and many other items of everyday use. These people will be customers for various forms of insurance centralized in other parts of the country. Railroads, bus, and truck lines and airplanes will benefit from the commerce created by both imports to and exports from the basin.

Long-time records show that only about one-fourth of the irrigation farmer's income is used for operation, taxes, labor, and local supplies, while three-fourths of it goes into the general industrial and trade stream. For every dollar spent for irrigation development, a business increase amounting to about $30 is created. In making a home on irrigated land, each settler creates the need for at least another family in the trading circles and still another in the industrial centers.

New taxable wealth.—In the Colorado River Basin

arable land without water is covered mostly with sagebrush and valued at $1 to $5 an acre. Improved and irrigated it will be worth from $75 to $300 an acre. Thus irrigation creates new taxable wealth and has proved a good investment for the Government. Federal Reclamation projects have created taxable values exceeding $400 for every person living on the projects either on farms or in cities and towns which the farms have created. State and county governments benefit from this enlarged base for property taxes. In addition, a large amount of revenue from taxes, direct and indirect, constantly flows from Reclamation projects to the Federal treasury.

In irrigated sections local institutions receive adequate income to maintain good schools, roads, medical services, churches, civic improvements and public utilities, the many comforts and conveniences that are essential to the American standard of living, which cannot be satisfactorily maintained by scattered populations of uncertain income.

Employment opportunities provided.—Construction of many of the projects could be scheduled for timely widespread employment of returning servicemen and released workers from war industries. Later phases of the development could be intensified during periods of economic recession and widespread unemployment. Less than half of the amount spent for labor would go to workers at project sites and the remainder to workers at producing centers principally in the 31 States east of the western irrigation states. Construction of all projects outlined in the report would employ a quarter million men for nearly 4 years.

Summary of Costs, Benefits, and Repayment

A definite economic analysis of basin-wide development of water resources cannot be presented until a final selection of projects has been made. The following estimates and approximations are based on development of all potential within-basin projects summarized in the report. Although there would be enough water in the river system to serve all of these projects if no further exportation of water is made, it may be found more economical and the States may elect to forego construction of some irrigation projects within the natural drainage basin in order to make water available for exportation to adjacent watersheds within the basin States. When final allocations of water are made, moreover, some states may be unable to use their full amount unless part is exported. Power projects do not consume water except by evaporation from power reservoirs, but most of these reservoirs serve multiple purposes and are required for full river regulation and control. Virtually all power projects outlined in the report could be constructed, therefore, without regard to the depletory effect upon stream flows.

Estimates of cost

Construction costs.—The total construction cost of basin-wide development, likewise cannot be estimated until the plan is definite but preliminary cost estimates of the potential projects described in the report within the natural drainage basin and excluding alternative projects, amount to $2,185,442,000, based on January 1940 prices. Increases in the total cost may result if projects for exportation of water to adjacent basins are selected, but such increases will be partly offset by the elimination of projects within the natural drainage basin for which water then would not be available.

Annual costs.—After projects are constructed, there are annual costs for operation, maintenance, replacements and repairs necessary to keep the projects in good operating conditions, transmit the electrical energy to load centers and distribute the irrigation water to the farms. Roughly the annual operation and maintenance costs of all within-basin developments described and summarized in the report may amount to $23,000,000.

To amortize the total construction cost as described above in 50 years with interest at 3 percent would require annual payments of $85,000,000, which added to the cost of operation and maintenance results in a total annual cost of $108,000,000.

Annual benefits

Benefits from the irrigation of new land are represented by the increase in gross crop returns. With the irrigation of 1,533,960 acres of new land and the furnishing of 1,122,270 acres of inadequately irrigated land with supplemental water that would be possible if all within-basin projects were constructed, a gross increased crop return of $65,000,000 annually, based on January 1940 prices, may be expected. If exportations are made, the return may be greater.

Revenues from the sale of power from the potential multiple-purpose projects will approximate $72,000,000 a year at a rate of 4 mills per kilowatt-hour for power delivered at market area. Revenues from the sale of municipal water may amount to $500,000 annually. A flood control benefit of $1,000,000 annually may be expected if all projects summarized are constructed. The total measurable annual benefits thus would total $138,500,000, which is substantially in excess of the estimated annual cost.

In addition to these benefits which are susceptible of evaluation there are the numerous other intangible benefits, none the less real, that have been described previously in this chapter. Studies of a general nature show that a program for complete river development would be fully justified. Direct evaluated benefits would exceed the costs even though many public benefits are not considered.

Repayment and flood control allocation

Repayment laws now in effect provide for water and power users directly benefited to be charged with the cost of construction works that serve them and for costs to be allocated to irrigation, power, municipal use, flood control and other miscellaneous uses. Repayment of construction costs are made on four different bases: (1) Costs allocated to irrigation are repaid in 40 annual installments without interest. The national benefits are recognized in that construction money is advanced by the Government interest free. (2) Costs allocated to power with interest at 3 percent may be returned over a period designated by the Secretary of the Interior. (3) Costs allocated to municipal water supply are repaid over a period not to exceed 40 years with interest not exceeding 3½ percent annually. (4) Costs allocated to flood control are largely nonreimbursable. Flood control is considered a national benefit and for that reason costs allocated to flood control are financed in large measure by the Federal Government.

Under existing reclamation laws nonreimbursable funds are not available for allocating costs to the many other direct benefits resulting from river development. For example, the value of fishing and recreational resources of the Colorado River Basin would be greatly enhanced by construction of the many potential multiple-purpose projects, but there is no means at present for allocating costs to these benefits.

Although increased gross crop returns amounting to $65,000,000 are estimated from potential irrigation projects in the Colorado River Basin, a large share of the increase will be used to meet costs of production, taxes, return on farm investment, and living costs. From experience on other projects operated by the Bureau of Reclamation it is estimated that the farmers could pay $8,000,000 annually to meet operation and maintenance costs and repay the portion of the construction costs allocated to irrigation. The gross revenue from power, estimated at $72,000,000 annually, would be sufficient to pay operation and maintenance costs and cost allocations to power. Municipal revenues estimated at $500,000 could be used to repay cost allocations and interest. Of the total construction cost it is estimated that an allocation of $25,000,000 may reasonably be made to flood control reducing the total estimated reimbursable cost of basin development to $2,160,442,000.

Gross annual revenues of $80,500,000 from irrigation power and municipal use would cover all charges for operation and maintenance and leave $57,500,000 annually to pay interest and construction costs. Interest charges cannot be determined until cost allocations are made to the various benefits. It is quite likely, however, that when interest charges are considered the cost of the entire development will not be fully reimbursable. Authorization is necessary for the use of nonreimbursable funds to cover costs allocable to certain other benefits of a public nature which cannot appropriately be considered repayable by water users under Reclamation law.

The above approximations and estimates are presented merely to indicate the justification of basin-wide development. The benefits to the people of the West and to the Nation would exceed the costs of constructing all projects that would develop and utilize fully the available water resources of the Colorado River Basin.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	**I-3_pgs 220-App II**	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

Cooperating Interests in the Basin

"The various agencies of the Department of the Interior having an interest in development of resources in the basin have teamed together in the preparation of this comprehensive report . . . Their cooperation is . . . practical, and essential, as evidenced in this chapter, which presents their specific comments and programs.

"Other Federal agencies that are involved in the development of the resources of the basin have likewise cooperated with the Bureau of Reclamation and their reports appear as parts of this chapter."

CHAPTER VIII

Cooperating Interests in the Basin

Integrated development of the resources of the Colorado River Basin can best be achieved by the cooperation of all Federal, State, and local interests in the region. This cooperation is necessary not only in the formulating of a comprehensive, coordinated plan, but in the execution of a unified program that will be keyed to the welfare of the people in the basin.

The various agencies of the Department of the Interior having an interest in development of resources in the basin have teamed together in the preparation of this comprehensive report in the development of the water resources of the basin. These agencies have cooperated to the extent of funds and personnel available. Their cooperation is vital, practical, and essential, as evidenced in this chapter, which presents their specific comments and programs. The Geological Survey has outlined a program for stream gaging and has furnished basic data on stream flow, quantity and quality of surface and underground water supplies, and water utilization. The National Park Service has surveyed the recreational possibilities of the potential projects and appraised the benefits with a view to preserving the parks and areas of historic and scenic interest. The Fish and Wildlife Service has made recommendations that will assure the restoration and conservation of game and fish resources. The Grazing Service has outlined the objectives of its range improvement program and the benefits that will result from the potential projects in the stabilization of livestock industry and the conservation of land and its resources. The Bureau of Mines has probed the minerals of the basin to discover how they might best be mined, processed, and utilized to support the metallurgical and industrial economy that is envisioned. The Office of Indian Affairs has outlined projects that will benefit the Indians of the basin. The General Land Office has presented a program to obtain optimum use of these public lands and to coordinate their utilization with the development of water resources.

Other Federal agencies that are involved in the development of the resources of the basin have likewise cooperated with the Bureau of Reclamation and their reports appear as parts of this chapter. The Forest Service, United States Department of Agriculture, has emphasized the need for careful management of watersheds on the national forest lands to insure adequate safeguarding of their water yields. The Federal Power Commission has furnished data upon which power utilization and market trends are based and has commented generally on the power resources of the basin.

The interests and cooperation of State and local groups as well as other Federal agencies in the basin are reflected throughout the report.

GEOLOGICAL SURVEY

Quantity and Quality of Water

Factual information, systematically collected and arranged, relative to both quantity and quality of water, is a prerequisite of the successful utilization of water. This information is necessary because of the fluctuations in quantity caused by the vagaries in climate, especially in precipitation and temperature, and by the changes resulting from the activities of man; and because of the differences in quality caused by sediment and the varieties of soluble matter with which the water comes into contact in its flow over and through the crust of the earth, by the variations in the length of time that the water remains in contact with the various soluble substances, and by the changes in pollution caused by the activities of man, especially in the use of water for agriculture, industrial processes, and municipal supplies, the return flow from which reaches and mixes with other surface and ground waters. Such information is needed as a basis not only for planning and constructing but also for operating plants and systems that utilize water.

Although the conspicuous uses of water in the basin relate to irrigation and the generation of hydroelectric power, there are many other important uses such as those for industrial, municipal, domestic supplies, and water for stock on the range. These uses, which are not spectacular, affect the life, prosperity, and security of many people and therefore are for serious consideration. For example, the stock business in the basin is of major proportions. It depends largely on the capacity of range lands to carry stock,

and that capacity is affected largely by the ability to get water for stock at many places so distributed as to permit a maximum use of the range. The finding and developing of stock water is therefore of major importance.

There are many conflicting interests in the use of water because there is either not enough water to serve all needs or its use for one purpose may impair or prevent its use for another purpose. The general basic information must be collected and published without reference to the use that may be made of the water or to the public or private agency that may utilize it. It must, therefore, be collected, assembled, and presented without bias as to kind or place of use or to particular projects. Because of the fluctuations in the quantity and quality of water, the information concerning it must be collected over a period of years and at some places indefinitely. In order to satisfy everyone that the records are free from bias, they must be collected by an organization that has no administrative or construction responsibilities. The United States Geological Survey is primarily an investigational agency whose reports are recognized as reliable, to which Congress appropriates funds for the study of the general basic aspects of water without reference to uses or projects. In accordance with that Congressional mandate, the Geological Survey measures the daily flow of surface streams and records fluctuations of reservoirs to ascertain the availability of water for conservation and use; investigates ground-water resources to ascertain availability, depth, recharge, discharge, and storage; makes chemical analyses of both surface and ground water with reference to fitness for use in agriculture and industry, and to treatment for public and domestic water supplies; and prepares statistical and interpretative reports—all with a view to furnishing reliable information that is essential as a basis for the full and best use of the water resources. This investigational work is supported in part by funds appropriated by Congress "for gaging streams and determining the water supply of the United States, investigating underground currents and artesian wells and methods of utilizing the water resources," in part by funds furnished by other Federal agencies for use in specific investigations related to the activities of those agencies, and in part by cooperating States and municipalities.

The cooperation with States is based on the understanding that both Federal and State governments are interested and that responsibility for the work is divided properly between them. The work is conducted through field offices of the Geological Survey placed generally in State capitols in order that State officials may be easily consulted as to State problems and needs. Permanent Federal employees assigned in these field offices, through long residence and service, become local citizens familiar with local problems and requirements. The agencies of the States participating in the cooperation also contribute valuable experience and knowledge to the conduct of the investigations. In these ways local needs are served and reliable Government records are assured that are uniform in accuracy and form of publication for all sections of the country.

Accordingly, the Survey is now maintaining four offices in the basin as follows:

Las Vegas, Nev., for ground water.
Tucson, Ariz., for surface water and ground water.
Phoenix, Ariz., for ground water.
Safford, Ariz., for surface water and ground water.

It maintains seven other offices outside the basin from which work in the basin is done, as follows:

Salt Lake City, Utah, for surface water, ground water, and water utilization.
Logan, Utah, for surface water.
Cheyenne, Wyo., for ground water.
Denver, Colo., for surface water.
Santa Fe, N. Mex., for surface water.
Albuquerque, N. Mex., for ground water and quality of water.
Los Angeles, Calif., for water utilization.

The investigational work of the Geological Survey on the quantity, quality, and utility of water in the Colorado River Basin is essential to the stable development of the basin because water in great or small quantities enters into all activities. Interstate and international character of the river serve to complicate the situation as to water supplies because of the necessity for equitable division of the water among the States of the basin, and because of the interest of Mexico in the water that flows across the international boundary. The interstate and international problems which are of far reaching importance emphasize the requirement that basic water information shall not be related to particular use or projects but shall serve the needs of all purposes equitably.

As the canyons of the Colorado River divide the basin into two parts with respect to both utilization of water and routes of transportation, and as the interstate compact for the division of water between the upper basin and lower basin divides the basin in the same way, the description of the water work of the Geological Survey in the basin is similarly divided. Because of the differences in qualifications of personnel and methods used for investigating the different aspects of water and its utility, the work of the Geological Survey in investigating water is organized and will be presented in its relation to the Colorado River Basin, under the following four headings: surface water, ground water, quality of water, and water utilization.

Upper Basin

The Colorado River Basin above Lee Ferry, defined by the Colorado River Compact as the "upper basin," has

an area of mountains, plateaus, and valleys of approximately 110,500 square miles. It contains literally hundreds of streams, lakes, and underground reservoirs. Thus far the principal use of water in this vast area is for irrigation. A few small hydroelectric power plants use the flow of small streams, and a negligible amount of water is used for municipal and industrial purposes. Since the white man first diverted water into ditches in this region for irrigation and community use (1854) more than 1,300,000 acres (U. S. Census 1940) have been put under irrigation in the upper basin and many millions of dollars have been invested in irrigation works. As the water problems are becoming increasingly complex, more information covering more streams and underground water resources is necessary for proper and orderly future development. Records of measurements of water resources have their principal value in their continuity. Therefore, the necessity for continuance of key gaging stations and observation wells in no wise diminishes with the increasing necessity of additional stations and wells. This necessity, for more than a decade past, has become more or less critical in the upper basin, and many temporary gaging stations have been established in order to expedite the program of current investigations.

Summary of Estimated Costs

For acquiring necessary equipment, conducting investigations, and preparing reports on the water resources of the upper basin a continuing program is essential. For the first 3 years of that program, participation by the Geological Survey as here outlined will require funds as shown in the following table of estimated costs.

TABLE CXXXIII.—*Estimated cost of program—Upper Colorado River Basin*

Program	First year	Second year	Third year	Total
For installation of 85 new gaging stations, at an average cost of $1,000 per station	$50,000	$35,000		$85,000
For operation of new stations at an average annual cost of $600 per station	30,000	51,000	$51,000	132,000
For rehabilitation of existing gaging stations	20,000	15,000	15,000	50,000
For operating 237 existing stations at an average annual cost of $600 per station	142,200	142,200	142,200	426,600
For investigations of ground-water storage and withdrawal, for drilling test holes and permanent observation wells, and for progressive appraisal of ground-water resources	50,000	50,000	50,000	150,000
For studies of the sediment loads in streams with relation to reservoir and channel capacities, and of the chemical quality of stream waters and of ground water with respect to uses in agriculture and industry	81,000	62,000	62,000	205,000
For miscellaneous studies of water facts, advisory service, and preparation of water utilization reports	15,000	12,000	12,000	39,000
Total	388,200	367,200	332,200	1,087,600

Surface Water

Colorado.—The Colorado portion of the upper basin is mountainous, and the chief industry is livestock raising, with agriculture subordinated to it. With the exception of the Uncompahgre and Grand Valleys, where large irrigation projects were built by the Bureau of Reclamation, the valleys are narrow and irrigation has been effected by means of cooperative and individual ditches. Although the total water supply is abundant, it is necessary to store the high-water flow for use in the late irrigation season. Many small reservoirs, most of them with capacities of 1,000 acre-feet or less, have been constructed. Also, there are half a dozen larger ones, among which the largest are Green Mountain, Vallecito, and Taylor Park, each with a capacity greater than 100,000 acre-feet.

The chief value of stream-flow records is in connection with irrigation, particularly transmountain diversions. The bulk of irrigable land in Colorado is east of the Rockies and the surplus water is in the Colorado River Basin, where physiographical conditions limit the opportunities for additional irrigation.

At the present time, several transmountain diversions take from the Colorado River Basin an average of 170,000 acre-feet annually. This will be increased by several hundred thousand acre-feet by the Colorado-Big Thompson project, under construction, and the Blue River-South Platte diversion, under investigation. A study in the Gunnison River Basin indicates a possible diversion to the Arkansas River Basin, and similar studies in the San Juan River Basin indicate several possible diversions to the Rio Grande Basin for use chiefly in the San Luis Valley where the operation of the Tri-State Compact limits the water supply available for use in that valley. All of these projects have important bearing on the final allotment of waters of the Colorado River Basin to the individual upper basin States as contemplated by the Colorado River Compact. Accordingly, records of flow of the streams involved are fundamental to that allotment.

Stream-flow records are not particularly needed for flood studies in the Colorado portion of the upper basin because the basin is not subject to disastrous floods. Likewise, such records at this time are not an important factor

in water administration except in certain areas where water shortages occur. In the case of water-power developments it is quite probable that, with the exception of small plants in the national forests, they will be developed chiefly at storage reservoirs constructed primarily for irrigation and designed as "multiple-use" projects.

At present (1945) 149 gaging stations are being maintained in cooperation with the State Engineer and also with the Colorado Water Conservation Board. Cooperation with the former started in 1933 and with the latter in 1941. The cooperation with the State Engineer comprises a general study of the State's water resources, and with the Colorado Water Conservation Board it enables the Survey to maintain additional gaging stations urgently needed by the Bureau of Reclamation in its basin-wide studies. Of the stations being maintained, the Bureau of Reclamation equipped 60 and transferred them to the Survey for operation.

Forty-four of these stations are situated in the Colorado River Basin above and including the Roaring Fork Basin where all the existing and prospective transmountain diversions from the Colorado River and tributaries are located except those from the Gunnison and San Juan Basins. Records at these stations are of particular value to the Grand Lake-Big Thompson diversion, now under construction, and to the Blue River-South Platte diversion, being studied, and to the Fraser River diversion for the city of Denver. At six stations records are made of the inflow and outflow of Green Mountain Reservoir on Blue River. This reservoir, the largest in Colorado, provides active storage of more than 100,000 acre-feet, primarily for late irrigation in the Colorado River Basin to replace waters taken out of the basin by transmountain diversions, and secondarily for the development of power. The base station in this area is on the Colorado River at Glenwood Springs. It has been operated continuously since 1900.

Seven stations are situated between Roaring Fork and Gunnison River. The possibilities of additional irrigation are limited in this section.

In the Gunnison River Basin 38 stations are being maintained, of which 18 are for studying the possibility of diverting water from the Gunnison to the Arkansas River Basin, 9 are for small irrigation projects, 3 are base stations at various points in the basin, and the remainder are chiefly for administrative purposes. The third largest storage reservoir in the State, Taylor Park Reservoir, is in this basin and 3 gaging stations are maintained in connection with its operation.

Sixteen gaging stations are being maintained in the Dolores River Basin, one a long-term base station, and the others for possible irrigation projects.

In the San Juan Basin 34 stations are in service, of which 3 are for administration of the La Plata River Compact between Colorado and New Mexico, 2 are base stations, 6 are for administrative purposes, and the remainder are for determining the amount of water that can be diverted from the San Juan to the Rio Grande Basin.

The northwestern part of Colorado is drained by the Yampa and White Rivers, both tributaries of Green River. Ten stations are maintained in these basins, two base stations, one on each stream, and eight for irrigation investigations.

Wyoming.—As in Colorado, the chief use of stream-flow records is for irrigation, present and future. About 200,000 acres are now irrigated in the Green River Basin in Wyoming by community and individual ditches, and although the total water supply is abundant, there is need for additional storage for irrigation during the late summer months. There are opportunities for developing additional areas in the basin, and also in adjacent basins, the latter by means of transmountain diversions. Three of such diversions are under study—one to the North Platte River Basin, and two to the Bear River Basin.

Water administration at present is a very minor use of the records. Water power, except in relatively small amounts in the national forests will probably be developed at storage reservoirs constructed primarily for irrigation. Disastrous floods are not characteristic of the basin, and stream-flow records are not particularly needed for flood studies.

Through cooperation with the State Engineer, which began in 1915, 35 gaging stations are being maintained. Since 1939 additional cooperation has been carried on with the State Planning and Water Conservation Board covering 35 stations, some of which were installed and maintained by the Bureau of Reclamation. That agency still contributes directly to the maintenance of 4 of the 35 stations. The stations are located as follows:

In the Green River Basin, exclusive of the Henrys Fork, Blacks Fork, and Little Snake River Basins, 19 stations are being maintained. One of these, the Green River near Linwood, Utah, is the base station, supported wholly by Federal funds. It has been operated since 1928, and replaces the former base station at Green River, Wyo., operated since 1915.

Six stations are located in the Blacks Fork area where irrigation has long been practiced and where supplemental supplies are needed.

Five stations are located in the Henrys Fork Basin, and four in the Little Snake River Basin.

Utah.—The Utah portion of the upper basin consists largely of high plateaus, rugged mountains, and limited valleys. The Uinta Basin and the valleys of the Price and San Rafael Rivers are the principal agricultural areas where extensive irrigation is practiced. Stock raising is an important part of the agricultural industry. Rapid agricultural development began in the Uinta Basin in 1905 following the opening of lands that were set aside by Ex-

ecutive order of October 3, 1862, as an Indian reservation for some of the Ute tribes.

This development created serious need for reservoirs, and many of the lakes and basins on the headwater areas of the Duchesne River and its tributaries have been developed for storage; others are under study. The Moon Lake Reservoir is one notable development recently made by the Bureau of Reclamation.

Along the Price and San Rafael Rivers, irrigation development has outrun the natural regimen of the streams, and storage problems are of fundamental importance to future irrigation expansion. Several important reservoirs have been built by private enterprise and other important projects are planned.

Water power in the upper basin in Utah is an important resource on the Green and Colorado Rivers but of relatively small importance on the smaller streams. When large reservoirs are built on these main streams, considerable hydroelectric power will be available at the dams.

Settlement and growth of agriculture in the Utah area have created a growing need for additional stream-flow information. Accordingly, the cooperative stream-gaging program conducted by the Geological Survey with the State engineer was expanded in 1941.

At the present time 45 gaging stations are maintained in the upper basin in Utah. New stations are of temporary construction and some are not provided with equipment for high-water discharge measurements. Several need rehabilitation or rebuilding. For more complete coverage of the streams of the basin at least 31 additional stations are needed and 14 stations should be rehabilitated. A number of these are necessary to supply factual water data for the State's small reservoir program and for small transmountain diversions of considerable importance.

Some of these stations would be situated in high remote areas and their accessibility would be relatively difficult—a condition which requires relatively high maintenance costs.

Water studies have not as yet shown the origin of much of the silt now reaching Lake Mead. There are no gaging stations at suitable locations on the San Rafael, Fremont, and Escalante Rivers, three important tributaries of the Colorado River between Green River, Utah, and Lees Ferry. Stations are proposed on these streams near their mouths. Stream-flow measurements, silt samples, and quality of water data, would be collected by a resident engineer assigned to each area because of the isolated and remote desert character of the region.

New Mexico.—In the San Juan River Basin in New Mexico, eight stream-gaging stations are being maintained. Four of these are situated at the following places on the main stream: one at Rosa which records the flow into the State from Colorado; one near Blanco which records the stream flow at Pump Canyon Dam Site; one at Farmington, installed in 1912 for general surface-water study and continued for long-time record, shows the stream flow below the mouth of the Animas River and inflow from arroyos below Blanco; and one at Shiprock which records the stream flow below irrigation diversions and into Utah. The other stations are situated on tributaries as follows: one on Animas River near Cedar Hill which records the flow into the State from Colorado; one on Animas River at Farmington which records the discharge of the Animas River into the San Juan River; one on the La Plata River near Farmington which records the flow from La Plata Valley into the San Juan; and one on Los Pinos River at Ignacio, Colo., near the Colorado-New Mexico State line, that records the flow into the State from Colorado.

Summary.—The total number of stream-gaging stations now being maintained in the upper basin is 237. Stream-flow records obtained at all of these stations are published annually in the water-supply papers of the Geological Survey. Many stations are on small streams and are relatively close together, whereas others are isolated and not easily accessible. Under these conditions, costs of operation vary from approximately $275 to $1,000 annually per station. Many of the stations have temporary installations as some of them will not be needed after a few years. Others will be continued indefinitely and these must be rehabilitated.

Present analysis of the needs for additional stations in the upper basin indicates a total of 85. It is estimated that within the next few years 10 of these will be required to furnish data for water administration of the large transmountain diversions now under construction or investigation and for determining natural inflow into large reservoirs.

No fewer than 61 additional stations are required at this time to furnish more information to the Bureau of Reclamation during its current investigations and to furnish the States with water data for small reservoirs, etc., and at least 14 new stations are suggested for supplying stream-flow data to the Forest Service for its studies of water-power resources within the national forests.

Ground Water

The development and utilization of ground water in the upper basin to date has been negligible. Geologic and hydrologic records are quite inadequate and ground-water areas are little known. There is need for thorough systematic study of the occurrence of ground water throughout the basin and the inauguration of the systematic collection of water-supply records in order that the available supply may be determined and put to optimum use in its relation to surface-water supplies. Return flow from irrigated areas and the operation of extensive canal systems create a great demand for factual information

on which to base estimates of the effects of ground-water conditions on the development of water projects.

The principal objective of the comprehensive ground-water study in the upper basin is the quantitative evaluation of ground-water recharge, discharge, and storage. Such study will furnish data for solving the many problems that are controlled or affected in some degree by the occurrence of water below the surface. The study can be made either by countries or by drainage basins; in either case giving first attention to those areas in which critical ground-water problems now exist or in which water project developments are in prospect. Items in this program include the collection of records of the quality of water, fluctuations of water levels in wells, measurements of water taken from wells, measurements of the gain in flow of streams that yield large quantities of water during fair weather, determination of direction and quantity of movement of the ground water, depth of the ground water below land surface, water-yielding properties of the formations and their thickness and areal extent, areas in which large quantities of ground water are used by vegetation, amount of rainfall penetration to the subterranean reservoirs, seepage from canals and reservoirs, and the mapping of areas in which artificial recharge may be practiced successfully.

The evaluation of these factors will provide basic information for determining the effect of diversions from streams on the flow of these streams in their lower reaches, the trend of the ground-water levels in areas of heavy development, and the perennial yield of the water-bearing formations, the effect of pumping from wells on the flow of streams, and the effect of the construction of dams, irrigation canals, reservoirs, and drainage ditches on the level of the water table and on the flow of streams.

The following procedure for conducting ground-water studies in the upper basin is proposed:

(1) Devote first attention to those areas in which critical ground-water problems now exist or in which water project developments will soon take place.

(2) Ascertain by drilling test holes, the character, thickness, and areal extent of the water-bearing formations; the character, thickness, and areal extent of the alluvium in the valleys of the streams; and the location of permeable deposits beneath the uplands. This method of exploration will be particularly valuable where geologic conditions cannot be ascertained by inspection and where the development of new water supplies is vital.

(3) Make pumping tests wherever possible. Recent advancement in pumping-test methods facilitates the determination of the water-yielding properties of formations and provides practical means for determining well spacing, quantities of water to be expected from wells of different size, draw-down of ground-water level, interference of one well with another, amount of water derived from flow of nearby streams, local geologic conditions affecting the occurrence of ground-water, and the design of wells.

Geologists with ground-water experience will study and correlate the samples obtained from the test holes and outcrop of the formations. Such study will aid in planning further test drilling in locating new supplies, and improving existing supplies.

(4) Records will be obtained of the quantities of water withdrawn from wells throughout the basin in order that these data may be available for use in conjunction with studies of fluctuations of water level in determining the perennial yield of the formations. Records will be obtained from each town, irrigated area, and railroad and industrial plant, and measures will be developed for obtaining continuing records of this kind for keeping a current inventory of ground water.

In order to determine the trends of ground-water levels and the changes in ground-water storage, the inventory records will include measurements of water levels in wells. The number and location of these observation wells will depend upon the importance and complexity of the ground-water conditions. Some of the wells will be equipped with automatic water-stage recorders, others will be measured once a week, once a month, or only a few times a year. New observation wells will be placed in areas of heavy ground-water pumpage and in areas in which water development projects are to be made. They will also be established near dams, reservoirs, irrigation canals, and drainage ditches, in order to determine the effects of the operation of these structures on ground-water conditions. Maps will be prepared, where feasible, showing lines of equal depths to water level.

(5) The study will include mapping of areas where there may be a building up of ground-water storage through artificial recharge from reservoirs and irrigation canals and where the flood flows of some of the streams can be diverted in such a manner that there will be seepage into the subterranean reservoirs where geologic conditions are favorable. Lowering of the water table along streams produces conditions favorable for artificial recharge in the sense that seepage in them is induced from the streams into the subterranean reservoirs. The location of wells near streams to take advantage of this source of water, including the filtering action of the sands and gravels and more uniform temperature of the ground water, will undoubtedly prove valuable in the solution of many water-supply problems. The ground-water study of the basin will include the mapping of stretches of the stream valleys that are favorable for this kind of ground-water development.

(6) The data gathered in the field study will be interpreted by competent engineers and geologists and both the data and the interpretation will be presented in comprehensive reports, which will constitute an inventory of

the ground-water resources of the basin. The interpretation of the data will be directed toward specifying new sources of water supply for cities, railroads, farms, industries, and irrigation, and methods of improving the present supplies.

The experience of the Geological Survey indicates that studies made in the detail outlined above require an average total expenditure of $10,000 or $15,000 per project area, consideration being given to the fact that some areas will require a much larger expenditure than others.

Quality of Water

The available information on the quality of water in the upper basin serves as an indication of the chemical character and concentration of the water at certain points in the basin, but information is needed on the quality of the water in the headwaters of the main stream and its principal tributaries, and also on changes that are taking place and may take place through changes in the regimen of the stream. Because of diversion from the headwaters to other drainage basins there will be changes in the quality of the water in the streams below the diversions, through utilization of water for irrigation and other purposes there will be changes in the quality of water, and during storage in reservoirs there will be changes caused by evaporation of large volumes of water and the accompanying concentration of dissolved solids. Water utilization in the headwaters, which will cause changes in chemical character of the water, will have an effect on the quality of water available below the headwaters and the effect may be noticeable at the lower end of the lower basin.

Sediment records for the upper basin will be of value in planning for utilization of the water in both the upper and lower basins.

Brief descriptions of quality of water and sediment studies for the upper basin are given in the following paragraphs:

Quality of water for industrial and agricultural purposes.—It is desirable to have information on the changes in concentration and character of waters that are potential sources for industries and public supplies. The requirements for industries are rigid and complete information on the quality of the available supplies is needed in making plans for industrial processes. The value of a water supply for industrial purposes may be seriously impaired because of previous uses to which the water has been put, especially when the source may be contaminated because of such uses. The comprehensive records proposed for this study will give the data necessary to determine the usefulness for most industrial purposes.

The quality of a water for irrigation purposes is dependent on the nature and the amount of dissolved constituents in the applied water, and on the amount of dissolved solids that can be removed from the irrigated area, so that studies must include the determination of the concentration and chemical character of the waters used as irrigation waters and also of the drainage waters. For the computation of quantities of dissolved solids carried onto and removed from an irrigated area, it is necessary to have adequate stream-gaging records, and all samples must be collected at points for which stream-flow records are available.

In the upper basin information is needed on the quality of the available ground-water supplies. In irrigated areas it will be necessary to collect samples of the normal ground waters and also of drainage waters. Such a sampling program is needed for the Grand Valley project area near Grand Junction, Colo., because of the high concentrations of dissolved solids in the drainage waters and because of the increase in concentration of the river water between the head and lower end of the project area. For most ground-water sources, one complete analysis and the partial analysis of from 3 to 12 samples each year will be needed to give the desired information. For surface-water sources, it will be necessary to have daily samples on which one or more determinations will be made to determine changes in concentration. As a rule, the samples for ten consecutive days will be made into one composite sample for a complete analysis.

Sediment transportation.—Sediment samples have been collected regularly for a number of years at the following gaging stations: Colorado River near Cisco, Utah; Green River near Green River, Utah; and San Juan River near Bluff, Utah. The records for these three stations show the loads of sediment carried at the chosen sampling points, but no other information is available to show the sources of the sediment. Moreover, the sum of the loads carried past these three stations has amounted to about 90 percent of the flow at Grand Canyon. Studies should be made to determine the source of this unmeasured sediment. It is likely that considerable quantities of sediment come in from the San Rafael, Fremont, and Escalante Rivers. It will be expensive to obtain records of discharge and sediment in these streams because of the isolation of the lower reaches of these rivers, but to obtain a complete picture of the sediment transportation in the Upper Colorado, it will be necessary to obtain these records for a period of years.

The concentration of sediment will be determined for all samples and an average concentration will be computed, which with the discharge records, will furnish data for computation of the daily loads of suspended sediment. Extra samples will be collected for the determination of the sizes of the particles of sediment and with similar information for deposited sediment, it will be possible to estimate the nature and rate of deposition of sediments in reservoirs below the sampling points.

Water Utilization

The international and interstate aspects of the Colorado River and the unique basic importance it has in the settlement and development of the Southwest make numerous the problems incident to the utilization of the waters of its drainage basin. Among these problems are those involved in the determination and delivery of quantities of water to Mexico in the administration of treaty provisions and to the several States as provided in the Colorado River Compact, those of administration by the respective basin States of their water resources, and those of operation by Government and private agencies. In ways that will contribute most effectively to the solution of these problems the water program of the Geological Survey is designed. This program embraces not only the collection of basic information relating to quantity and quality of stream flows and ground waters—comprising an inventory of the water resources—but it also includes special physical and economic information for analytical and interpretative reports that will be useful in the consideration of the best method of utilizing the water supplies and to rendering advisory service on the subject.

Field investigations and surveys constitute an integral part of the work incident to these special studies and reports. In the program for the Colorado River the reports would present authoritative historical data concerning floods and droughts, the development and status of utilization of the surface and ground-water resources, and other data that would clarify questions regarding natural flow and the possible influence of climatic oscillations and changes wrought by man. Such information is fundamental in the determination of the respective interests of the States in the waters of the basin and in the consideration of the availability and suitability of the water supply for various industries and activities which may be considered for establishment in the basin.

The reports also may include studies of specific plans of water development with such surveys of sites and projects including physical and economic aspects as are necessary for evaluating the merits of different schemes of development.

One type of survey is the "river survey" which comprises a plan and profile of the stream with elevations of water surface, and contours showing the detailed topography of the land adjacent to the stream bed. These surveys are primarily for determining possibilities of developing storage and water power. Some of the earlier maps show only the plan and profile of the stream with very little topography. The more recent surveys show topography, usually to a height of 200 feet or more above the water surface. The scale generally used by the Geological Survey for river surveys is 1:31,680 or half a mile to the inch. The contour interval ordinarily is 20, 25, or 50 feet on land and 5 feet on the water surface. Dam sites and reservoir sites are often shown in greater detail on larger scale.

Where the more detailed river surveys have not been made, studies of river development are greatly aided by the information contained on the standard topographic maps of the Geological Survey in areas where such maps are available.

Water Supply Paper 558, Preliminary Index to River Surveys made by the United States Geological Survey and other Agencies, and supplements thereto now list and briefly describe all of the river surveys available. They are also delineated on the indexes to topographic maps that are published from time to time to show areas covered by standard topographic maps, geologic folios, etc.

In the matter of advisory service, the program embraces close cooperation with State engineers and other officials charged with duties involving water resources, also with the Committee of Sixteen which is the agency of the seven Colorado River Basin States created for the purpose of coordinating the respective interests of the States in the waters of the basin and determining the comprehensive and orderly development of them.

Advisory service is unbiased. It is based on analysis and treatment of statistical facts, the significance of which is not always readily apparent. It has been found that some kinds of analysis enter into nearly every water-supply problem, and indeed, the availability of such basin analysis may encourage, or hold to wise limits, as the case may be, the application of the records to the solution of water problems.

The upper basin is one of the numerous basins of the West where deficiencies in hydrologic research are common and many basic studies and investigations are needed. These should include studies in precipitation, temperature, and run-off and all phases of climatological history that will aid in extending knowledge of climatic behavior. Furthermore, a quantitative hydrologic inventory will provide a great many facts regarding the water resources for use in statistical analyses, and studies of the intimate relationships of streams with such factors as precipitation, interception by vegetation, infiltration, soil moisture, run-off, surface and ground storage, evaporation and transpiration.

The administration of land and water uses and conservation programs involve many kinds of water problems that are common to the arid region and in many areas where no gaging station records are available the information developed in these studies serves as a basis for estimating available water supplies. Hydrologic conditions are, of course, different in most basins and for that reason the technique applied in hydrologic research is modified by the adequacy of the data on hand and the conditions peculiar to the basin under study.

Thus far, four water-utilization reports on the Colorado River are available as published water supply papers.

The first one of these, Water-Supply Paper 395, Colorado River and its Utilization (1916), covers the pioneer work of assembling the principal facts relating to the subject, and especially of studying the possibility of controlling the flow of the whole river and rendering it available for profitable use.

The second, Water Supply Paper 556, Water Power and Flood Control of the Colorado River below Green River, Utah (1925), was at that date latest compilation of data relating to the water supply of the Colorado River Basin and the results of all surveys of sites for reservoirs and power dams. Only a small part of the upper basin is covered in this report.

The third, Water Supply Paper 617, Upper Colorado River and its Utilization (1929), presents important facts relating to the water resources of the Upper Colorado River and its tributaries to afford a basis for comprehensive consideration of their development and utilization.

The fourth, Water-Supply Paper 618, The Green River and its Utilization (1930), sets forth the available physical facts with respect to the present and probable utilization of the Green River and its tributaries to serve as a guide in the agricultural and industrial growth within that basin.

In addition to these published reports, the following manuscript report has been prepared and is open to public inspection in the offices of the Geological Survey in Washington, D. C., and Denver, Colo.: Water utilization in the San Juan River Basin, by E. C. La Rue.

Water development for stock use.—Stock raising is one of the major industries in the upper basin, which contains many thousands of acres of grazing lands under the administration of the Grazing Service and Office of Indian Affairs. The quantity and availability of the forage crop on these lands are dependent on the availability of stock water at suitable locations. Only a portion of the range lands has ample water so distributed as to make full and efficient use of the forage crop year after year. Forage on lands situated far from water is unused while lands near water are overgrazed, often to the point where serious deterioration of the vegetative cover and destructive erosion of the soil mantle is taking place. There is pressing need for numerous and properly spaced range-water supplies in order that overgrazed areas may be relieved and given opportunity for recovery. This can be accomplished with little or no interference with the livestock industry if presently unused areas are made available for grazing by providing additional range water.

The Department of the Interior, Office of Land Utilization, looks to the Geological Survey for information and advice concerning water supplies on the public range. Immediate and pressing needs for such service on the part of the land-management agencies of the Department have taxed beyond limit the inadequate facilities of the Survey, and in some instances developments have been undertaken without benefit of adequate geologic investigation. Demands for ground-water prospecting too often crowd the driller onto the heels of the geologist, and advice given under such conditions is without the background of geologic mapping, exploratory drilling, or geophysical surveys that are essential to intelligent application of geologic and hydrologic principles.

With the anticipated future development in the upper basin, requests for advice and information on well locations and other water-development projects will increase materially during the postwar period.

Stock tanks for impounding surface water are an important item in the water development program for stock use. Construction of these tanks, too often, is considered a simple task of excavation without regard for geologic formations which are so vitally important in connection with seepage losses, run-off characteristics of the contributing drainage area, silt movement, spillway capacities, and evaporation losses that contribute to the safety, life, and efficiency of the tank. Ineffective stock tanks emphasize the necessity of factual data on which to base design and select locations. Tanks, of necessity are usually constructed on washes and stream courses where the flow is erratic and infrequent. Virtually no hydrologic data are extant on drainages of this character. For this reason, specially designed stream gages are needed on representative "dry washes" to obtain water supply data. Such installations are proposed by the Survey as funds and equipment become available. For determining evaporation and seepage losses, staff gages have been installed in a few tanks. This study should be expanded to other areas having different hydrologic and climatic characteristics. Rainfall and direct evaporation losses are obtained from gages installed at strategic locations and from nearby Weather Bureau stations. Analysis and correlation of the information above mentioned provides the necessary factual data for design of stock-water tanks and gives reasonable assurance of successful performance and long-life service of the tanks. Such a program also reduces the tremendously high aggregate cost of haphazard development so commonly associated with inadequate base data. It is equally applicable and important in the lower basin.

The upper basin is scarred by myriads of erosion channels, and many valleys are being trenched by deep gullies that drain the ground-water level beyond the reach of plant roots, thus drying up and making valueless large tracts of land that formerly produced quantities of excellent forage. Silt from these areas becomes a potential menace to farm lands, irrigation canals, reservoirs, and sometimes to towns. The cause of what is often called "accelerated erosion" has been the subject of repeated cross-arguments for some years. The Survey program with respect to this problem involves the collection of factual

information on the subject, and the recommendation of remedial measures.

In the San Juan Basin, the Geological Survey in 1934–36, made detailed surveys of three washes that had eroded through deep valley fill to bedrock and had indications of active and aggressive head cuts. These surveys were made with a view to remapping at intervals in the future to note the changes taking place. The areas were resurveyed in 1944. Continuous observations of this kind will furnish factual information to be used in determining causes of the ensuing changes and for making plans to arrest or control the erosion. Similar studies are needed in many parts of the entire Colorado River Basin. These studies should include buried horizons or other evidence of previous cycles of cutting and fill, and with geologic and climatic facts a detailed historical chronology of gully erosion will add valuable information to assist in solving the problems of so many western valleys.

Lower Basin

The Lower Colorado River Basin embraces approximately 131,500 square miles in the United States. Since it is international and interstate, contains mountain plateaus and desert valleys, is arid to semiarid in climate, extends through 8° in both latitude and longitude with elevations varying from 100 feet to 12,000 feet above sea level and has vegetation ranging from heavily forested areas and rich irrigated farm lands to desert growths, its water problems are many and varied, and exceptionally important because of the limited supply in spite of seasonal flood menaces. As precipitation is heaviest in the mountains, water is most abundant in the eastern and northern regions, with perennial stream flow utilized largely for irrigation in the southwestern regions. Problems of water availability and use, including those which result from Colorado River water originating in the Upper Colorado River Basin but available to the lower basin and Mexico, arise in all parts of the basin and are very acute in many sections.

The Survey's current program of water investigations in the Lower Colorado River Basin is conducted in cooperation with the States which are wholly or partly within the basin, and with other Federal bureaus, notably the Corps of Engineers, United States Army, and the Bureau of Reclamation. Its plans, which contemplate expansions of the program along all lines of the Survey's activities related to water in an attempt to meet the diverse and growing Federal, State, and local needs, are included in the statements set forth below.

Summary of Estimated Costs

Recommendations for water resources investigations in the Lower Colorado River Basin during 3 years in the postwar period for expansion of activities beyond current programs are given in the following table:

Table CXXXIV.—*Estimated cost of program—Lower Colorado River Basin*

Program	First year	Second year	Third year	Total
Surface water.—For installation of 29 new gaging stations at an average cost of $2,050; for operation of 29 new gaging stations at an average of $910 per annum; for rehabilitation work on the existing program of 101 gaging stations, $3,330 per annum	$31,000	$41,000	$50,800	$122,800
Ground water.—For inventories of ground-water storage and withdrawal, drilling test wells and permanent observation wells, geophysical and geological surveys, experiments of clearing river-bottom growth, and estimates of perennial ground-water yield	125,000	175,000	125,000	425,000
Quality of water.—For quality of water studies, including both chemical quality with special reference to uses in agriculture and industry and to silt content in its relation to reservoir and channel capacities	104,000	85,000	85,000	274,000
Water utilization.—For utilization studies related to problems in water power, navigation, irrigation, and range development and operation	7,000	6,000	6,000	19,000
Total	267,000	307,000	266,800	840,800

Surface Water

Surface water is used largely in the Lower Colorado River Basin for irrigation, hydraulic power, industry, mining, and domestic supply. The supply necessary to meet these needs or uses is limited, and therefore, records resulting from an investigation of the quantity and distribution of surface water are of prime importance. The investigation of the availability of surface water is a continuing one, each record increasing in value with each passing year, records of 10, 20, and 50 years increasing proportionately in value and importance because of seasonal changes and hydrologic cycles in precipitation and stream flow. Emphasis of the necessity for continuation and extension of such a program cannot be stressed too often. Data resulting from these investigations are published annually in the water-supply papers of the Geological Survey.

As mentioned in the introductory statement, these investigations are financed by Federal funds, by cooperative funds provided by States and municipalities, and by funds

furnished by other Federal agencies. The various non-Federal agencies in the respective States providing funds for support of this work are as follows:

Arizona: Office of State Land Commissioner, O. C. Williams; Salt River Valley Water Users' Association; San Carlos Irrigation and Drainage District; Maricopa County Municipal Water Conservation District No. 1.

California: Metropolitan Water District of Southern California (for certain stations on Colorado River in Arizona and California and on Williams River).

New Mexico: Office of State Engineer, T. M. McClure; New Mexico Interstate Stream Commission, T. M. McClure, Secretary.

Utah: Office of State Engineer, E. H. Watson.

Federal agencies providing financial assistance are the Corps of Engineers, United States Army; the Bureau of Reclamation, United States Department of the Interior; and the Defense Plant Corporation.

The program in the Lower Colorado River Basin necessarily relates to problems of an intrabasin, interbasin, interstate, and international nature. It relates to development plans that include the possibilities or irrigating large areas of fertile lands, coordinated with the development of hydraulic power. It must be related not only to present and future developments for industrial, mining, municipal, domestic, irrigation, or power uses, but also to administrative requirements with reference to political boundaries, to the Colorado River Compact and possible international agreements, to court decrees, to hydrologic studies such as reservoir and channel losses, flood control and recharge to ground-water reservoirs, and to transmountain diversions. Thus gaging station sites must be selected carefully to meet present requirements and the program should be expanded to new sites where records are needed for new needs or projects.

At the end of August 1944 the Geological Survey in cooperation with other Federal and State agencies was operating 101 gaging stations in the Lower Colorado River Basin, including 21 stations pertinent to the main stem of the Colorado River itself, 5 of which are in subbasins near the mouth of tributary streams. For a more complete coverage of the streams in the basin and for meeting fully current and postwar needs for the development, utilization, adjudication, and administration of the waters in the Lower Colorado River Basin and to aid, enlarge, and develop inadequate records now being obtained for present requirements, the establishment and operation of 29 additional stations is recommended. The existing stations and those proposed are not limited to any one use but relate to many; in addition they establish a general surface-water pattern over the entire area.

The distribution of the existing stations, and of the additional stations, among the principal areas of the basin and among the States is as follows:

	Existing stations	*Additional stations*
Areas:		
Kanab Creek Basin	1	0
Virgin River Basin	6	4
Little Colorado River Basin	13	5
Colorado River main stem	16	5
Williams River Basin	4	0
Gila River Basin	61	15
Total	101	29
States:		
Arizona	74	22
California	7	3
Nevada	0	2
New Mexico	14	0
Utah	6	2
Total	101	29

The existing program of 101 gaging stations requires approximately $112,000 per annum for operation. Because of the inevitable deterioration of structures and equipment during the war period when maintenance was reduced or stopped because of scarcity of material, $10,000 is now needed for the rehabilitation of existing gaging stations. For the expansion to 29 additional gaging stations, $59,500 is required for installation, and amounts cumulative to $26,400 per annum for the third of 3 years for the operation of the 29 additional stations.

Ground Water

Current need.—The importance of ground water in the Lower Colorado River Basin is apparent from the fact that in 1943 a total of more than 2,000,000 acre-feet of ground water was pumped in the basin for public works, industrial supplies, domestic supplies, and farms and ranches. In several parts of the basin the ground-water supply is already being depleted and in others it is rapidly approaching that stage; in other parts, however, the supply is ample for increased development and there are probably areas where the resources have not been discovered.

A large amount of the water supplies of the basin are wasted through transpiration by worthless valley-bottom vegetation. The amount lost by this process in the basin is roughly estimated as 1,000,000 acre-feet annually. The problems related to the destruction of this vegetation, the prevention of its future growth, and the erosional and other changes that would ensue, are so complicated that much more investigational work must be done to insure their economic and safe solution.

The increasing mineralization of the ground water and possible means of abatement should be investigated in several of the greatly developed parts of the basin.

The water-bearing formations tapped by wells, and from which springs issue, vary greatly in character, thickness, and areal extent over the basin, as do the hydrologic factors that control the development and utilization of the ground water. The development to date has been

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chiefly unplanned owing to inadequate geologic and hydrologic records and imperfectly understood ground-water principles. Thorough systematic study of the occurrence of ground water throughout the entire basin is needed, as well as the systematic collection of water records, in order that the available supply may be put to the most advantageous use. The necessity for such a study has been made apparent by the declining water levels accompanied by the diminution of the supplies obtained from wells in some places; by the difficulties encountered by cities and railroads, farmers, stock raisers, and others in obtaining adequate supplies of good quality; by prolonged legal controversies over water rights; and by the great demand for factual information on which to base estimates of the effects of ground-water conditions on the development of water projects.

The principal objective of a ground-water study of the Lower Colorado River Basin is the quantitative evaluation of ground-water recharge, discharge, and storage, and the obtaining of data for solving the multitude of problems arising from the occurrence and use of ground water. The study should be made systematically by valleys and should include the collection of records of quality of the water, pumpage from wells, fluctuations of water levels in wells, measurements of the gain or loss in flow of streams, determination of direction and quantity of movement of the ground water, depth of the ground water below the land surface, water-yielding properties of the formations and their thickness, and areal extent, areas in which large quantities of ground water are used by vegetation, amount of rainfall penetration to the subterranean reservoirs, seepage from canals and reservoirs, and the mapping of areas in which artificial recharge may be practiced successfully. The evaluation of these factors will provide basic information for determining the effect of diversions from streams, the trend of ground-water levels in areas of concentrated developments, and the perennial yield of the water bearing formations, the effect of pumping from wells on the flow of streams, and the effect of the construction of dams, irrigation canals, reservoirs, and drainage ditches on the level of the water table and on the flow of streams. To a large extent the future development of the basin will depend on obtaining permanent and adequate supplies of good water and obtaining the maximum use from the supply perennially available. The results of the study will, therefore, be of great practical and economic importance to the residents in the basin who must always depend largely upon wells and springs.

General ground-water conditions in the basin.—For this discussion the basin is described in two parts, the plateau region, and the basin and range region.

The plateau region is in northeastern Arizona, southeastern Utah, southwestern Colorado, and northwestern New Mexico. It constitutes most of the physiographic division known as the Colorado plateaus. It is arid to semiarid and includes all of the Little Colorado River Basin, the eastern part of the Virgin River Basin and the headwater basins of the Gila and Salt Rivers. The region is underlain by sedimentary formations and laval flows of Carboniferous to Recent Age. The formations are sufficiently warped and broken to cause a close relation between rock structure and the occurrence of ground water and a marked variation in ground-water conditions from place to place. The Coconino sandstone is the principal aquifer of the area with other standstones and conglomerates supplying water in local areas. Large flowing wells are obtained from the Coconino sandstone in some localities but usually the supply is only sufficient for domestic and stock use. Northeast of the Little Colorado River this standstone usually produces salt water only. The limestone beds and lava flows are also fair aquifers in local areas and at the edges of the high mountains large amounts of water are recharged into them. One of the major problems of the area is to find what becomes of this water. Another major source of water is from the valley fill of Tertiary to Recent Age in the valleys of the Little Colorado River and its larger tributaries. This source is supplying water for some irrigation and can probably supply more, especially if the waste by transpiration from large areas of valley-bottom vegetation along the Little Colorado River can be eliminated. In some parts of this region, water even for stock or domestic use is extremely hard to obtain. One large ranch expended more than $100,000 for test drilling with very little success.

The basin and range region is part of the physiographic division known as the basin and range province. It forms the southern part of the lower Colorado River Basin. It is an arid region of mountain ranges elongated in a northwesterly direction with wide intervening valleys filled with debris from the erosion of the mountains. Much of this fill is relatively unsorted sand, silt, and gravel, but some of the material, deposited in old lake basins, is well sorted. The lake bed clays give rise to artesian conditions in some of the valleys. In the area near Las Vegas, Nev., large amounts of water are used from artesian wells for irrigation and city use, and for a large army camp. A large part of the artesian supply in this area is wasted through uncontrolled flowing wells and faulty casing.

Drafts on ground water.—In the Gila and Santa Cruz River Basins of Arizona, a pumpage inventory made in 1943 indicated the approximate pumpage from the alluvial fill by counties to be as follows: Pinal County 515,000 acre-feet, Pima and Santa Cruz Counties 115,000 acre-feet, Graham County 36,000 acre-feet, and Greenlee County, Ariz., and Hidalgo County, N. Mex. 7,000 acre-feet. It is estimated that the pumpage in Maricopa County was 1,000,000 acre-feet. During the past several years, water-level measurements showed that in several areas water levels were continuously declining, indicating that the pumpage was in excess of the safe perennial yield.

This was true in the Eloy area of Pinal County, the areas concentrated pumping in Pima and Santa Cruz Counties, and the parts of Maricopa County that depend solely on ground water for irrigation. Accelerating the decline in water levels was the waste of water by transpiration from valley-bottom vegetation. In the Gila and Salt River Basins, in Maricopa and Pinal Counties, it is estimated that this waste probably amounts to between 400,000 and 500,000 acre-feet a year, and in Safford Valley in Graham County the annual waste amounts to 70,000 acre-feet. The value of the water for irrigation is also deteriorating as its mineral content increases through concentration resulting from irrigation use.

Methods of study.—The following procedure is proposed: To study each valley separately and to give each one special attention according to the nature of its ground-water problems. The valley unit is a logical subdivision in the basin and range region because each valley is a separate ground-water basin. The county unit is the logical division in the plateau region. First attention should be given to those valleys or counties in which critical ground-water problems now exist or in which water-project developments will soon take place.

Test drilling.—The character, thickness, and areal extent of the water-bearing formations can best be ascertained by drilling small test wells. These wells can often be used as permanent observation wells. For this purpose it would be desirable to purchase drilling rigs and to operate them continuously throughout the period of investigation. This method would also aid in determining the location of permeable deposits beneath the uplands as well as in the valley lowlands.

Geophysical prospecting.—The value of the test wells drilled in the above program could be greatly extended by the use of geophysical prospecting. This has already been proved in connection with the drilling of water wells for army camps in the area.

Geologic correlation.—Geologists with ground-water experience should study and correlate the samples obtained from the test wells and outcrops of the formations with the results of the geophysical probes. Such study will aid in planning further test drilling, in locating new supplies, and improving existing supplies.

Pumping tests.—Pumping tests should be made wherever possible, usually on existing wells. The recent advance in pumping-test methods makes possible the determination of the water-yielding properties of formations and provides practical means for determining well spacing, quantities of water to be expected from wells of different size, draw-down of the ground-water level, interference of one well with another, amount of water derived from flow of nearby streams, local geologic conditions affecting the occurrence of ground water, and the design of well fields.

Pumpage inventory.—Records should be obtained of the quantities of water withdrawn from wells throughout the basin in order that this information may be available for use in conjunction with studies of fluctuations of water level in determining the perennial yield of the formations. Records should be obtained from each town, irrigated area, railroad, and industrial plant, and measures should be developed for obtaining continuing records of this kind for the future.

Water-level measurements.—In order to determine the trends of ground-water levels and the changes in ground-water storage, an enlarged program of measurements of water levels in wells should be started and periodic observations should be made. The number and location of the observation wells in each valley or county would depend upon the importance and complexity of the ground-water conditions. Some of the wells should be equipped with automatic water-stage recorders in order to obtain daily records. Other wells should be measured once a week, once a month, or only a few times a year. New observation wells should be placed in areas of heavy ground-water pumpage and in areas in which water development projects are to be made. They should be established also near dams, reservoirs, irrigation canals, and drainage ditches, in order to ascertain the effects of the operation of those structures on ground-water conditions. Observations of this kind are now being made in the Santa Cruz River Basin in Santa Cruz, Pima, and Pinal Counties, and in parts of Maricopa, Graham, and Greenlee Counties.

Depth to water level.—The study should include an inventory of existing wells and the collection of information on the size, depth, and diameter of the wells, the kind and size of pump, and the use to which the water is put. Maps should be prepared where feasible, showing depths to water level.

Delimiting areas in which vegetation draws heavily on ground water.—Where ground water occurs at shallow depths, the roots of plants and trees extend to the capillary fringe or to the zone of saturation and they extract water in a manner similar to pumping from a well. It is roughly estimated that 1,000,000 acre-feet of ground water is consumed in this manner in the Lower Colorado River Basin, most of it by useless vegetation. Probably the greatest potential source of salvage of ground water lies in the reduction of use by vegetation that has little or no value; areas having such vegetation should be mapped with view to the effecting of measures for reducing the wastage of water. Some work has been done on this problem in Arizona and the results indicate a tremendous use of ground water by this type of vegetation. Salt cedar is one of the heaviest users and also one of the worst types in choking the flood channels. Along the Gila River from the Ashurst-Hayden Dam to the junction with the Salt River, more than 100,000 acre-feet of water are wasted annually by this type of growth. Similar conditions pre-

vail at many other places in the basin including localities where irrigation has raised the ground-water levels and has created new areas of vigorous plant growth.

Determining water used by valley-bottom vegetation and experimental clearing.—An area would be carefully chosen where full cooperation of all interested parties could be obtained. Tests would be run on this area which would then be cleared and the salvage of water determined.

Mapping areas favorable for artificial recharge.—The building up of ground-water storage through artificial recharge from reservoirs and irrigation canals is accomplished in many places and the extension of this practice to new projects in the basin will undoubtedly augment ground-water storage. In addition, the flood flows of some of the streams could be diverted in such a manner that there would be seepage into the subterranean reservoirs where geologic conditions are favorable. Such possibilities should be mapped, especially where it may be expected to become over-developed in the future. Artificial recharge may be effected in some of the cities through recharge wells in which water is fed into the water-bearing formation during certain seasons of the year in order that it will be available for use in other seasons. The lowering of the water table along streams produces conditions favorable for artificial recharge in the sense that seepage is then induced from the streams into the subterranean reservoirs. The location of well fields near streams to take advantage of this source of water, including the filtering action of the sands and gravels and the more uniform temperature of the ground water, will undoubtedly prove to be the most logical solution for many water-supply problems of the basin. The ground-water study of the basin would include the mapping of stretches of the stream valleys that are favorable for this kind of ground-water development.

Interpretation of data and preparation of reports.—The data gathered in the field studies should be interpreted by competent engineers and geologists, and both the data and the interpretation should be presented in comprehensive reports. These reports should constitute an inventory of the ground-water resources of the Lower Colorado River Basin. They should form a reference library of information on the subject that would be invaluable in future planning for all kinds of water development. The interpretation of the data would be directed toward specifying new sources of supply for cities, railroads, farms, industries, and irrigation, determining the safe yield of developed areas, and methods of improving the present supplies.

Estimates of cost.—The collection of the data, the interpretation of these data, and the preparation of the reports should be carried on simultaneously, in large part by the same group of geologists and engineers. It does not appear practical, therefore, to estimate the total cost of the comprehensive study on the basis of individual items. Moreover, the annual cost of the study would depend upon the number of valleys or counties in which investigations were made each year. The experience of the Geological Survey indicates that studies made in the detail outlined above would require an average annual expenditure of about $125,000 with the addition of $50,000 the second year to cover the cost of a clearing project.

Quality of Water

There are two aspects of the quality-of-water problems in the Lower Colorado River Basin, namely: (1) The quality of the waters now available in surface- and ground-water sources, and (2) the quality of the water in surface sources that will be available after further development of irrigation in the upper basin and after diversions have been made from the headwaters into other drainage basins. By the withdrawal of water of good quality, these diversions will deteriorate the quality of the water in the streams below the diversions. Utilization of water for irrigation and other purposes will also cause changes in the quality of the water. The evaporation of large volumes of water stored in reservoirs and the resulting concentration of dissolved solids will obviously deteriorate the quality of the water that remains. Water utilization in the headwaters that causes changes in the chemical character of a river water will have an effect on the quality of water available below the headwaters, and the effect may be noticeable at the lower end of the lower basin.

Sediment records are needed for several streams in the lower basin, and the sediment records obtained for streams in the upper basin will be of value in planning for utilization of existing and new reservoirs in the lower basin.

Brief descriptions of quality-of-water and sediment studies that should be made are given in the following paragraphs:

Quality of water for industrial and agricultural purposes.—It is desirable to have information on the changes in concentration and character of waters that are potential sources of industrial and municipal supplies. The requirements for industries are rigid, and complete information on the quality of the available supplies is needed in making plans for industrial uses. The value of a water supply for industrial purposes may be seriously impaired because of previous uses to which the water has been put, especially when the source may be contaminated because of such uses. The comprehensive records proposed for this study will give the data necessary to determine the usefulness for most industrial purposes.

The quality of a water for irrigation uses is dependent on the nature and the amount of the dissolved constituents

in the applied water, and on the amount of dissolved solids that are carried by the drainage from the irrigated area. Studies must, therefore, include the determination of the concentration and chemical character of both the waters used in irrigation and those in the drainage ditches. For the computation of quantities of dissolved solids carried to and removed from an irrigated area, it is necessary to have adequate stream-gaging records and all samples must be collected at points where stream-flow records are available.

In the Lower Colorado River Basin, information is needed on the quality of available ground-water supplies. In irrigated areas, it will be necessary to collect samples of the normal ground waters and also of the drainage waters. For most of these sources, one complete analysis and partial analysis of three to twelve samples a year will be needed to give the desired information. For surface water sources, it will be necessary to have daily samples on which one or more determinations will be made for showing change in concentration. As a rule, the samples for ten consecutive days will be made into a composite sample for a complete analysis.

The proposed quality-of-water studies will include the analysis of samples from reservoirs for the purpose of studying changes that may take place during storage. Because of the high rates of evaporation in the lower basin, there are appreciable changes in concentration and chemical character during storage, but records of these changes are meager.

The estimated cost of the quality-of-water studies in the Lower Colorado River Basin, including the quality studies in irrigated areas, quality studies in reservoirs, equipping of the laboratory, field work, and analyses of the samples, will amount to $44,000 for the first year and $35,000 for each subsequent year. It is likely that the existing gaging stations will be satisfactory for the sampling program and no new stations will be needed.

Sediment transportation.—Sediment studies have been carried on for a number of years at the Lees Ferry, Grand Canyon, and Yuma gaging stations on the main river. Prior to the closing of Boulder Dam, samples were collected at the Topock and Willow Beach gaging stations. The records for Lees Ferry and Grand Canyon should be continued, and sampling points should be established in the Little Colorado, Paria, Virgin, and Williams Basins. In addition, studies should be made to determine the nature and rate of sedimentation along the course of the river and in reservoirs. Such studies would be in the nature of a reconnaissance and would not duplicate the work done in a comprehensive sedimentation survey of the existing reservoirs. The estimated cost of the sediment studies, including the collection of samples, equipment, field and laboratory work, is $60,000 for the first year, and $50,000 for each subsequent year.

Water Utilization

In addition to the collection of basic information concerning stream flow, ground waters, and the quality of both, the water program of the Geological Survey embraces special compilations or arrangements of these data for purposes of general utility and the interpretation of the data, as well as other related physical and economic information.

Compilation of water facts.—An essential item of the program for the Lower Colorado River Basin is the collection of comprehensive water information pertaining to the quantity and quality of surface and ground waters, the status of their utilization, and the publication of such information in reports of convenient form for use and reference. The reports would present data regarding storage, diversion, and types of water use. The inclusion of a series of monthly charts of the Lower Colorado River Basin and adjoining areas showing in detail the relation between monthly and normal stream flow, would be useful in evaluating or expanding short or broken stream-flow records. The reports would give authoritative historical and other data concerning floods and droughts that would be helpful in the consideration of problems of natural flow and possible influences of climatic oscillations and changes wrought by man. Such information is a primary need in the adjudication of the conflicting interests of the political subdivisions and various industries now or propectively involved in the utilization of the limited water resources of the Lower Colorado River Basin. It is also needed for determining the availability and suitability of the water supply for various industries and activities that may be considered for establishment in the basin.

Interpretation of water facts.—Statistical records pertaining to water often require supplemental analysis or treatment in order to reveal their significance. The form of the analysis depends largely on the nature of the problem at hand, but it has been found that certain kinds of analyses enter into nearly every water-supply problem, and indeed, the availability of such basic analysis may encourage, or hold to wise limits, as the case may be, the application of the records to the solution of water problems.

"Deficiencies in Hydrologic Research," published by the National Resources Planning Board in 1940, describes the great number of needed investigations, some of which have singular bearing on the surface-water hydrology of the Lower Colorado River. Much fundamental work needs to be done in the Southwest and only the most preliminary or basic treatments are planned. The most general types of study that can be undertaken are statistical and inventorial.

A study of trends in precipitation, temperature, and run-off is included among the statistical investigations planned. Trend graphs shown in Water Supply Paper 772, reveal an irregular though marked downward trend

in precipitation and an upward trend in temperature over most of the country. This combination produced a substantial reduction in run-off during the period of record then available. These analyses should be brought up to date, expanded, and examined more in detail with particular emphasis on the Lower Colorado River and with such reference to tree-ring chronology or other possible ways of extending knowledge of climatic behavior as may seem applicable or prudent.

In addition to statistical analyses, a great many facts regarding the water resources can be gained from the preparation of a quantitative hydrologic inventory. Such studies consider water in streams not by itself, but as one phase in a cycle containing other intimately related phases and factors including precipitation, interception by vegetation, infiltration, soil moisture, run-off from surface and ground sources, surface and ground storage, evaporation, and tranpiration. The information developed is useful in many kinds of water problems, particularly in administration of land use and conservation programs, and in flood control. Moreover, it can serve as a basis for estimating stream flow in areas where no gaging-station records are available, and as a supplemental method in combination with rainfall records for the synthesis and extension of stream-flow records, especially through critical period of drought or flood.

The technique for the preparation of an inventory as outlined above is available but must be modified by the adequacy of the data on hand as well as by the hydrologic conditions peculiar to the basis under examination.

Water for stock use.—As in the upper basin, stock raising is one of the major industries in the Lower Colorado River Basin. Vast areas of grazing lands are administered by the Grazing Service and the Office of Indian Affairs. The usable forage crop is dependent upon available stock watering places; forage on lands remote from water is unused whereas that on lands near water is overgrazed, often to the extent of accelerating destructive erosion of the soil mantle. Numerous and properly spaced range water supplies are necessary in areas now unused in order that overgrazed areas may be relieved and given opportunity for recovery.

Information and advice about water supplies on the public range is supplied by the Geological Survey for use by the Grazing Service, Office of Indian Affairs, and other land management agencies of the Department of the Interior. However, the extremely limited facilities of the Survey have prevented it from keeping abreast of current requests for advice on water supplies, and in some instances developments have been undertaken without benefit of competent geologic investigation. It is anticipated by the agencies administering the public range that the urgent need for water-development projects for stock use will greatly increase after the war.

In order to supplement well-water supplies and to open up new areas where it appears impractical or impossible to obtain water from wells, stock-watering tanks are constructed on washes and intermittent stream courses to catch some of the "flash" run-off. Virtually no hydrologic data are available for water courses of this type, and specially designed stream gages for obtaining such data are an item in the water program of the Survey. Evaporation and seepage losses are studied by means of staff gages installed in tanks at strategic sites. Weather data from nearby Weather Bureau stations are analyzed and correlated with all water information obtainable for the region under study and basic data are thus obtained for design of stock-watering tanks with reasonable assurance of successful performance and long life.

Accelerated erosion is an important problem in the lower basin. Deep gullies are trenching many valleys and draining the ground-water level below the reach of plant roots, making valueless large tracts that formerly produced excellent forage crops, and producing vast amounts of silt that became a troublesome problem to reservoirs, irrigation canals, and farms. The collection of factual information on this subject and recommendation of remedial measures is contemplated in the Survey program.

NATIONAL PARK SERVICE

The forthcoming report of the National Park Service, Recreational Resources of the Colorado River Basin, will cover this subject in more detail and will supplement the material contained herein.

The National Park Service is primarily a conservation and recreation agency performing functions which are an integral part of a program of land use of the Department of the Interior. The prime function of the Service is the administration of the National Park and Monument System. The Service seeks to preserve and render available to the public outstanding scenic, scientific, historic and prehistoric areas of national importance. The act of June 23, 1936, "authorized and directed the Secretary of the Interior—to cause the National Park Service to make a comprehensive study, other than on lands under the jurisdiction of the Department of Agriculture, of the public park, parkway and recreational area programs of the United States, and of the several states and political subdivisions thereof, and of the lands throughout the United States which are or may be chiefly valuable as such areas . . . The said study shall be such as, in the judgment of the Secretary will provide data helpful in developing a plan for coordinated and adequate public

park, parkway and recreational area facilities for the people of the United States."

With this responsibility and the fact that several areas in the National Park and Monument System would be directly affected by certain water-control possibilities being considered by the Bureau of Reclamation, it was determined that the National Park Service should investigate and furnish the Bureau with essential facts basic to the establishment of Departmental policy regarding the classification, development and administration of possible water-control projects and related areas in the basin, in which recreation is or will become an important dominant or collateral resource. On January 27, 1941, Secretary Ickes approved the proposal of the National Park Service and the Bureau for including a basin-wide recreational survey as a part of the studies and investigations for the formulation of a comprehensive plan of utilization of the waters of the entire Colorado River system.

Colorado River Basin Water Utilization Program and its Effect on Recreation

From Gannett Peak in the Wind River Mountains, highest point in Wyoming, elevation 13,785, Milner Pass in Rocky Mountain National Park, and the 14,000-foot mountain peaks in southwestern Colorado to the Salton Sea, 241 feet below sea level, stretches a vast region of forests, deserts, plains, mountains, canyons, and plateaus. The Colorado River Basin is one of the most outstanding recreational regions in the United States, because of great variety of natural scenery, climatic conditions, and areas and objects of scientific interest, its early romantic history, archeological background, and present Indian, Spanish, and Anglo cultures.

Here is the world's greatest canyon, the largest natural bridge, the largest man-made lake, and the highest dam. Here, too, one may enjoy the largest percentage of possible sunshine of any place in the United States and find perfect climates for outdoor recreation the year around. Hunting, fishing, photography, snow sports, boating, swimming, horseback riding, camping, mountain climbing, exploration, the entire realm of outdoor recreational activities may be enjoyed. Five national parks and 28 national monuments have been established within the basin to preserve some of the most outstanding natural, scientific, and cultural features. Large sections have been included in national forests, wildlife refuges, and grazing districts, and vast areas set aside as Indian reservations. Much of the basin is in public ownership, but this is not surprising when one sees the country and knows that about half the basin has a population of less than 2 people per square mile, and that the most densely populated county, Maricopa County, in which Phoenix, the largest city is located, has a population of only 20.2 people per square mile.

It is only natural in a region so endowed that recreation should become one of the major industries. Agriculture is restricted almost entirely to irrigated sections. Mining, lumbering, and the raising of cattle and sheep first attracted settlers to the basin, but the recreational features are now attracting many more; and as the various sections of the basin become better known and more accessible to the densely populated regions of the United States through improved highways and air transportation, catering to the recreational business should become a major industry. To foster this industry it must be recognized that recreational use of land may in certain places be the highest or best use of the land for the general welfare of the people in the basin, and in vast sections of the basin should be on an equal basis with other uses, such as grazing or production of timber. One of the most important recreational features of the basin is the great stretches of open range, unobstructed by buildings, fences, transmission lines, and other signs of modern civilization. As other sections of the United States become more and more highly developed, this one feature of the Colorado River country, if preserved, will have unusual appeal.

The major portion of the basin is desert or semidesert. Here water is the most precious single item. The life of the region is dependent upon the wise use of the streams and ground water. In the development of the water, recreational use should be considered along with other uses, such as irrigation, power, municipal water supply. In the mountains and high plateau sections of the Colorado Basin the clear, cold streams and lakes offer excellent fishing, amid delightful surroundings, and in some instances the recreational value of these streams and lakes may be such as to make this their most important use. In other sections the construction of dams for irrigation or power create new water areas of recreational importance, for example: Lake Mead, which has been called the "Eden of all bass fishermen," is famous throughout the country for its scenic beauty. There are also instances where the raising of water behind dams would submerge areas of scenic and scientific value or archeological importance. In such cases it must be decided whether a reservoir in that location is more or less desirable than the preservation of these existing features. If in the case of existing archeological features the decision is in favor of the reservoirs, there should be a thorough survey and excavation where found desirable, so that knowledge of the archeological material will not be lost forever. In the larger proposed reservoir areas surveys should also be made of the flora and fauna and records kept of the original biota.

The importance of recreational resources in the basin is recognized by the Bureau of Reclamation in planning for water conservation projects. Through a cooperative agreement with the National Park Service, the latter is carrying on a general survey of the recreational resources

of the Colorado River Basin for the Bureau. Although it has not yet been possible to cover the entire basin, a number of proposed reservoir sites have been investigated and considerable information gathered concerning the recreational features of large sections of the basin. In many instances the project plans have not advanced sufficiently to determine definitely what effect the proposed reservoir would have on existing recreational values or to determine the potential recreational values of the proposed reservoir area. The location and accessibility of the reservoir, the physical characteristics of the reservoir area; size and elevation of minimum, normal and maximum pool; the season and frequency of maximum draw-down; all have an important bearing on the potential recreational value of the reservoir, and the determination of the effect the reservoir would have on existing conditions.

Potential Projects on Main Stems of Colorado and Green Rivers

On the main stems of the Colorado and Green Rivers the plan lists 13 potential power dam sites, in addition to the Davis Dam project on which work has been stopped during the war emergency. The majority of sites are in spectacular canyons and in most cases the reservoirs created would provide means of access to outstanding scenic country which at the present time is almost wholly or entirely inaccessible to the average person. At the same time this complete harnessing would change them from great rugged rivers grinding their way down from the mountains to the sea to a series of quiet mill ponds. The rivers as Powell knew them would be gone—a definite loss.

Davis Dam and Reservoir.—Davis Dam site is located due west of Kingman, Arizona, 23 miles by existing roads, and about 67 miles below Boulder Dam, and the backwater will extend to the tailrace of the Boulder Dam power plant. At the present time the clear, cool water released by Boulder Dam offers excellent trout fishing. It would be expected that the Davis Reservoir should rival or possibly excell Lake Mead as a bass fishing area, but scenically will not compare with it. The upper third of the reservoir area from Boulder Dam south almost to Eldorado Canyon is in the lower Black Canyon, a volcanic area marked by rugged mountains and deep canyons. This section, while scenically interesting, is not comparable to the Grand Canyon section of Lake Mead, or the canyon scenery which would be made accessible by the proposed Bridge Canyon, Marble Gorge, or Glen Canyon Dams. Below Black Canyon the mountains draw back from the river and begin to flatten out. Long gravel ridges and benches lead gradually down to the river. The widest portion of the reservoir will begin about 12 miles above the dam and extend for some 8 miles, average around 3 miles wide. The lower portion of the reservoir will be in Pyramid Canyon, formed by low mountains coming in closer to the river. Creosote bush and mesquite trees are the most conspicuous of all the desert plants in the reservoir area. There are numbers of mountain sheep and a few desert deer. Beaver are very common, as are rabbits, ground squirrels and other desert rodents, upland game birds, ducks, geese, and other aquatic birds.

Since construction of Davis Dam was expected to begin at an early date, of first importance was an archeological survey of the reservoir area to determine desirable archeological work which should be done before the water began to rise. Such a survey was made by Dr. Gordon C. Baldwin in the Spring of 1943. One hundred and fifty-five archeological sites were located and Dr. Baldwin estimated there are at least 200 sites in the reservoir. He considered 15 of the sites to be of sufficient importance to be tested and at least partially excavated at a later date. Most of the sites are located on small benches or flats bordering the river. Of the 15 important sites, at least seven should be thoroughly explored. Dr. Baldwin estimated that the excavations could be completed in 8 months, and the desired work accomplished for about $8,000.

U. S. Highway 66 is scheduled to be one of the national superhighways. The present route between Kingman, Ariz., and Needles, Calif., is unsatisfactory and consideration is being given to routing it across Davis Dam. If this is done at least 182,500 cars per year would cross the dam on the basis of the 1940 traffic count. There is certain to be a demand for recreational facilities in the vicinity of the dam.

The upper two-thirds of Davis Reservoir will be within the present boundaries of Boulder Dam National Recreational Area. It would be logical to have the recreational phases of the entire reservoir area administered by one agency. Further study of recreational use and administration is required.

Bridge Canyon Dam and Reservoir.—The Bridge Canyon Dam site is in the Grand Canyon at the head of Lake Mead about 20 miles airline northwest of Peach Spring, Ariz., on U S 66 and the Santa Fe Railroad. Various heights for the dam have been considered, but the one favored by the Bureau of Reclamation at present would have a maximum water-surface elevation of 1,866. This would raise the water 666 feet above the stream-bed at the dam and place the head of the reservoir less than a mile down stream from the mouth of Kanab Creek. It would raise the water surface about 85 feet at the mouth of Havasu Creek, backing the water approximately one half mile up Havasu Canyon in Grand Canyon National Park.

The dam site and reservoir area are entirely within areas now administered by the Federal Government through the Office of Indian Affairs, National Park Service, Fish and Wildlife Service, Forest Service, and the Bureau of Reclamation. Access to the dam site is across the Hualpai

Indian Reservation, which extends along the south side of the Colorado River from the Grand Wash Cliffs on the west to National Canyon where it joins the south portion of Grand Canyon National Monument. East of the monument is Grand Canyon National Park. Boulder Dam National Recreational Area overlaps the canyon portion of the Hualpai Reservation. On the north side of the river the land is included in Boulder Dam National Recreational Area, Grand Canyon National Monument, and Kaibab National Forest.

The Grand Canyon is one of the world's outstanding recreational areas of scenic and geologic interest. As stated by Edwin McKee, Assistant Professor of Geology, University of Arizona:

> From the mouth of Nankoweap Canyon in the east to the Grand Wash Cliffs in the west—over 200 miles by river—the Grand Canyon maintains approximately the same 5,000-foot depth and a width between rims measured in terms of miles. All sections of Grand Canyon are parts of one natural physiographic unit. Although the general character and form of the canyon change greatly from the area of alternating cliff and slope and of butte and temple at one end to a canyon of nearly sheer walls at top and bottom, separated by the wide, red "Esplanade" bench at the other, it is not correct to say that one part is better than another. All parts of Grand Canyon go to form a whole and there is an imperceptible transition from one section to the next. Man-made boundaries and divisions in Grand Canyon mean nothing in indicating the relative value of different portions. It is not possible to say that one part is either inferior or superior to another; each is different but each is great and part of the entire.

Of first consideration in the recreational survey of the proposed Bridge Canyon project was the appraisal of the effect the proposed reservoir would have on existing natural conditions in Grand Canyon and Grand Canyon National Park. Frederick Law Olmsted, collaborator with the National Park Service on the survey of the recreational resources of the Colorado River Basin, has submitted a preliminary report on this subject.

> Water conditions in the canyons of the Colorado, including height of water, are, and will continue to be, far from static and constant at any given place. This is true both for localities where the water is controlled by fluctuating reservoirs and also for localities where the water is wholly uncontrolled. Under natural conditions the water level in the narrower parts of the canyon bottom (such as near the mouth of Havasu Creek) fluctuates 40 feet or more. The water level controlled by a reservoir of a given nominal elevation fluctuates even more largely and quite differently.
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> The water and its immediate banks in the upstream portions of the canyon where flooded by Lake Mead at times present a combination of physical conditions and a general appearance which are most deplorable from a recreational and scenic point of view, and similar conditions can be expected in similar parts of the Bridge Canyon Reservoir. They contrast in a very striking manner with the conditions and appearances presented at other times in the very same parts of the canyon subject to flooding by Lake Mead. The point to be made here is that there are almost equally striking differences in physical conditions and appearances between low-water and high-water stages in the parts of the canyon *not* affected by Lake Mead.
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> 1. Boat trips in the Lake Mead portion of Grand Canyon which are extraordinarily impressive experiences would be completely free from obstruction and disagreeable appearance at all times. 2. Bad accumulations of floating debris would occur in Bridge Canyon Reservoir generally during May, June and July in a limited locality downstream from Havasu Creek. They would interfere with boating, and for anyone obtaining a reasonably close view of the water would detract from the natural appearance of the canyon. It is unlikely that visitors, in general, would want to take a longer boat trip than from the vicinity of the dam to Toroweap (about 57 miles) and back, in any case. That would take them through three of the four types of inner canyon scenery and show them the lower end of the fourth. 3. After the breakup of the unsunken portions of each season's accumulation of debris, the dispersed fragments, if not controlled, would be more troublesome for boating than they have been on Lake Mead.

As to probable significant changes in the canyon in respect to elevations of water surface, physical conditions and appearance of deposits of silt, sand and other heavy material, Mr. Olmsted summed up his discussion by saying, "The differences in water surfaces and in exposed deposits, as between the canyon without a dam and the canyon in the upper reaches of Bridge Canyon Reservoir, or as between the latter with a high dam and with a low dam, may perhaps fairly be regarded as differences of degree more than of kind. There is no precise, critical point at which it can fairly be said that beyond this point any increase in height of water surface or any increase in amount of fluctuation would produce a radical change of kind in the general appearance of things in the depths of the canyon. What can be said definitely is that *some* unmistakably artificial modifications of existing conditions, scenically unpleasant in greater or less degree, will extend to whatever limit is reached by the reservoir's raising of high-water levels."

The impounding of water behind Bridge Canyon Dam to an approximate elevation of 1,866 feet will conceal few geological features that are unique or of special importance as documents of geological history, according to Edwin McKee.

The greatest loss, so far as geological features are concerned, would be in the area of volcanic activity at and west of Toroweap Valley. This is one of the most outstanding geological sections of the canyon. Edwin D McKee and Edward T. Schenk in their report entitled "Lava Dams in Grand Canyon" say, "The spectacle of lavas that have cascaded down the steep canyon walls and cinder-cones perched on the sides and brink of the chasm usually makes a profound impression on the layman, while to the geologist the problems presented are intriguing."

Toroweap Valley slopes gently toward the canyon rim and ends with a sheer cliff almost 3,000 feet above the river. The views down into the canyon are spectacular and awe-inspiring. Any height of reservoir will increase the width of the strip of water in the bottom of the canyon through submergence of the talus slopes, by an amount roughly proportionate to the height of the water above the natural river level, which is here about 1,675 feet.

The lower section of Havasu Canyon would be materially affected by raising the reservoir above the 1,772-foot elevation. Havasu Creek, an unfailing spring-fed stream of crystal-clear water, produces the distinctive feature of this locality. The notable and beautiful, though seldom seen, mingling of the blue waters of Havasu Creek with the brown water of the Colorado would be radically altered for the worse, if the full reservoir elevation is raised higher than the 1,772-foot elevation. But the more frequently visited waterfalls and other features that have made Havasu Canyon famous would not be physically affected by Bridge Canyon Reservoir.

The places now in the Grand Canyon National Park upstream from Havasu Creek that would be physically modified by raising Bridge Canyon Reservoir above elevation 1,772 are all close to the river in the bottom of the narrow inner canyon and the resulting changes would be observable almost exclusively from boats.

Mr. Olmsted said:

This section of the Grand Canyon as a whole is notable for the distinctive character of its scenery, especially as seen from certain places on the upper rim on both sides of the canyon. It was completely included from rim to rim in the portion of the Grand Canyon originally set apart in 1908 as a national monument for preservation of the noneconomic values of its unique and inspiring scenery. It was, and is worthy of selection for such a purpose.

When the Grand Canyon National Park was established in 1919, its boundaries were so drawn as to leave the entire north side of the canyon between Tapeats Creek and Havasu Creek under the administration of the Forest Service, which had previously administered all parts of the Grand Canyon set apart for preservation of its natural scenery in 1908. The investigators have found no record indicating that the omission of that area from the park was due to a deliberate and reasoned decision to reverse the earlier intention of protecting the scenery of this entire unit of the canyon from rim to rim.

If that is to remain the policy of the Government concerning this entire unit of the Grand Canyon, in accordance with the decision made in 1908 and adhered to in essence ever since, then the limitation of Bridge Canyon Reservoir to an elevation that will not encroach on that protected area should be continued, for the following points are clear, viz: A higher elevation would substantially alter natural conditions and injuriously affect the natural scenery along the Colorado River as far as the backing up of the water extends, for the sake of an exclusively economic gain, in direct contradiction of that policy. The conclusion above stated is not invalidated by the fact (*a*) that the impairment of natural scenery within the supposedly protected area would be relatively limited in extent in comparison with the entire area of the Grand Canyon that is supposedly protected, and would probably be observed by no more than a small fraction of the people who visit various parts of that entire area in order to enjoy its scenery, and (*b*) that the economic gain would be relatively large.

If, on the other hand, it is decided that the justifying reason for existence of a national park extending into the canyon downstream from Tapeats Creek is not that of protecting, in conjunction with the Forest Service, natural conditions and scenery in the Grand Canyon from rim to rim, but merely to protect Havasu Canyon Unit and adjacent areas *south* of the river; then the logical procedure would be Congressional action making a marginal modification of the present boundary of the park west of the Tapeats Creek watershed, shifting it from the north bank of the river to a contour on the south bank that would keep it clear of the prospective reservoir.

Choice between those alternative policies depends not primarily upon technical details such as have been discussed in this report, but upon broad considerations of public purpose; in the last analysis upon how much the people of the United States care about preserving the natural conditions and scenery in the portion of the Grand Canyon selected for such preservation in 1908, and whether they are able and willing to pay the economic price of such preservation.

The spectacle of a great dam under construction and after completion in the bottom of the Grand Canyon is certain to attract many visitors. On the basis of 1940 attendance figures for the south rim of Grand Canyon National Park and highway traffic counts, it is estimated that 20 percent of the automobiles traveling U S 66 go into the park. Considering the facts that the minimum side trip into the park is 118 miles, whereas, it will be only about 42 miles round trip from U S 66 to the rim of the canyon where one may look down on the Bridge Canyon Dam over 2,000 feet below, the visitor traffic into Bridge Canyon should be at least 20 percent of the traffic on U S 66. On the basis of 1941 figures this would mean that over 200 automobiles per day would make the side trip. With an average of 3 persons per car the annual attendance would be around 220,000. It is likely that travel on U S 66 will increase considerably in coming years, and bring at least 250,000 visitors per year to the Bridge Canyon Dam area. Many more will come by air and there are sites for landing fields within five miles of the canyon rim. It is possible that visitors to the dam site may reach 300,000 per year. The opportunity of driving down into the Grand Canyon or of taking an elevator from the rim down about 2,000 feet to the top of the dam and another 650 feet to the bottom of the canyon will be a great attraction. Added to this will be the opportunity for boat trips through many miles of the canyon.

Facilities to accommodate between 250,000 and 300,000 visitors per year should be planned and developed as part of this project, parking areas, overlook and observation platforms, camp and trailer grounds, restaurants, overnight accommodations, boat docks and landing fields.

There is no point on the north side of the proposed reservoir where the water will be easily accessible by land, and Peach Spring Draw offers the only opportunity on the south side. It would be comparatively easy to construct a road from Highway 66 down Peach Spring Draw to the shore of the reservoir, a distance of 20 miles. This may prove a desirable location for limited development of boat landings, parking areas, and other facilities for the recreational use of the reservoir.

Marble Canyon—Kanab Creek Project.—This proposal calls for a dam in Marble Gorge, 36½ miles downstream from Lee Ferry, which would create a reservoir with a normal water-surface elevation of 3,125 feet above sea level, approximately the elevation of the Colorado River at Lee Ferry. The reservoir at maximum elevation would be deep in the gorge to a point above Navajo

Bridge where it would spread out slightly beyond the present river. From the scenic and recreational point of view the reservoir would have little potential value except to afford easy access by boat to this section of Marble Gorge. However, the project involves a 42.5-mile diversion tunnel under the Kaibab Plateau to a power plant site at Kanab Creek.

Probably the most serious effect upon scenic and related values from building the suggested tunnel to Kanab Creek would be the curtailment of the flow of the Colorado River through Grand Canyon National Park, reducing it to a minimum arbitrary allotment for purely scenic effect. Certainly such a project should not be considered until there is a need for the power thus generated which cannot be met by other means. Then the decision should be made as stated by Mr. Olmsted in the case of Bridge Canyon Reservoir, "not primarily upon technical details—but upon broad considerations of public purpose—upon how much the people care about preserving the natural conditions and secenery in the portion of Grand Canyon selected for such preservation in 1908 and whether they are able and willing to pay the price of such preservation."

Glen Canyon project.—The Glen Canyon site is in the deep sheer walled canyon just around the bend above Lee Ferry. Preliminary figures suggest an elevation of 3,528 feet for the top of spillway gates in raised position, 401 feet above stream bed. Access to the lower end of the reservoir would be extremely difficult.

The Glen Canyon Dam would create a reservoir extending upstream 182 miles to the Dark Canyon site. At the Dark Canyon Dam site there is a possibility of raising the water 432 feet, forming a reservoir extending up the Colorado to Moab, Utah, and up the Green River almost to Green River, Utah. For the most part the Glen Canyon and Dark Canyon Reservoirs would be confined between canyon walls and have only minor effect on the scenery of the spectacular Colorado River country of southeastern Utah. Throughout this country the immediate canyon of the river is at least 1,000 feet deep and in places, such as in the vicinity of Dark Canyon, it is over 2,000 feet deep. Most of the streams and washes entering Glen Canyon have a fairly rapid fall near the Colorado, and the reservoir would not extend any distance up most of them. Back-water would extend 30 miles up the San Juan River and 14 miles up the Escalante River, but here again it would be confined in high walled canyons. Much of the country bordering the Colorado and the Green Rivers through this section of Utah is of high recreational value. It is a region of great colorful spaces, mountains, plateaus, canyons, desert, forest and weird rock formations, probably the greatest display of erosional effects in the United States, other than the Grand Canyon, and equally grand, though of a different character. In providing a means of access to this remote canyon country, the Glen Canyon Reservoir would increase rather than detract from the recreational values of the region. Power lines from the dams would detract from the enjoyment of the open country.

Moab project.—The plan includes a concrete gravity dam on the Colorado River just above the highway bridge at Moab, Utah, which would raise the water 138 feet at the dam. A reservoir at that elevation would inundate the lower slopes and bottom of an unusually scenic canyon and eliminate the existing road which runs through the canyon between Moab and Dewey, Utah. At the present time this is the only place where it is possible to drive through one of the great canyons of the Colorado River. It would be indeed unfortunate from the scenic and recreational standpoint if a dam were to be constructed that would flood this canyon section.

Dewey project.—The Dewey Dam site, 3 miles below the mouth of Dolores River and 30 miles upstream from Moab, Utah, is at the beginning of the great canyons of the Colorado River. The greater part of the reservoir area is arid, treeless, grazing land, having little or no scenic or recreational value. The principal scenic feature is Westwater Canyon, near the upper end of the reservoir area, about 12 miles long and several hundred feet deep, cut in reddish sandstone, but it is of secondary importance as compared with the canyon of the Colorado River below the dam site.

While the Dewey Reservoir would not be of special recreational importance to the immediate vicinity, since the local population is very sparse, the lower portion would be of some recreational usefulness to the residents of Moab (providing the proposed power dam on the Colorado River at Moab is not constructed), and the Westwater Canyon section would be of interest to travelers using U S 50, and to residents of the Grand Junction area.

A permanent road should be built from U S 50 to the dam site and connect with the present State Highway 128, which runs through the spectacular red canyon of the Colorado between Dewey and Moab. This would, in effect, retain the present route from Moab to U S 50 which not only is used as a short cut from Moab to Grand Junction but affords access to the remarkable scenery of this part of the Colorado River Canyon. The reservoir area is reported to contain several archeological sites, and while it seems doubtful that any unmolested sites remain, it is recommended that an archeological investigation be made prior to construction of the dam. The paleontology of the area should also be investigated.

Gore Canyon project.—This project located just below Kremmling, Colo., involves a low diversion dam near the head of Gore Canyon and a tunnel to a power plant located at the foot of the 5-mile canyon. The site has not been investigated by the survey, but it is likely that it would have little important effect on existing or potential recreational values.

Rattlesnake and Desolation Canyon projects.—The plan for development of power on the Green River includes six dam sites. The lower two, Rattlesnake and Desolation, are located in the remote section of the Green River between Green River, Utah, and Ouray, Utah, characterized by the name Desolation. Although the recreational resources of the two sites have not as yet been investigated, it is doubtful that the scenic or recreational value, either existing or potential, will be found important. General information indicates that scenically this section does not compare with sections along the Green River above Jensen, Utah, and below Green River, Utah. Certain archeological sites have been found near the reservoir areas, and a survey should be made to determine the archeological importance of the reservoir areas.

Split Mountain and Echo Park projects.—These two power sites are in Dinosaur National Monument. Functionally, Dinosaur National Monument consists of two sections referred to as the Quarry unit and the Canyon unit. The former comprises 3,000 or 4,000 acres in the vicinity of the Dinosaur Quarry and includes the original 80-acre monument. The Canyon unit, consisting of the remainder of the area, is about 200,000 acres in extent.

The geological formations in the Quarry unit are of scientific importance and of distinct scenic value, but the major significance of the unit is considered to be in the dinosaur beds.

The Canyon unit is characterized by a notable combination of geological, scenic, biological, and archeological values and by its wilderness quality. Its most spectacular features are the canyons of the Green and Yampa Rivers, where interesting geological formations and impressive landscapes are displayed in great variety. One of the exceptional attributes of the unit consists of contrasts in the geological formation and the scenic character of the canyons of the two rivers. There are also biological and archeological values of real interest. The Canyon unit possesses great importance for the part it can play as an introduction to the geology and scenery of the West, for the residents of the Middle and Eastern States. It is of national significance for the combination of its qualities; it is distinctive of its kind, and justifies its existence as a unit in the National Park System.

The Quarry unit would be little affected by the proposed projects, but the Canyon unit would be materially affected by them, depending upon their location and other influencing factors. Such facilities as dams, roads, transmission lines, and structures for administration, operation, and maintenance would more or less adversely affect natural and archeological values, but the most far-reaching alteration would be caused by the reservoirs. The Echo Park Reservoir, which would be impounded by a dam about 500 feet high, would extend upstream from the dam throughout the length of the Green River within the national monument and to a point about 30 miles by river course beyond the north boundary of the area. It would also extend up the Yampa River to a point in Lily Park east of the eastern boundary. The Split Mountain Reservoir, which would be created by a dam about 118 feet high at the head of the Split Mountain Canyon, would inundate Little, Rainbow, and Island Parks and would extend up Whirlpool Canyon to about the base of the Echo Park Dam. The Echo Park and Split Mountain Reservoirs, particularly the former, would cover wholly or in part a number of notable geological formations, would reduce the visible height of canyon walls in some sections, and would substitute long bodies of still water, widening here and there into bays or lagoons, for the natural streams and vegetations in canyon bottoms. The most radical alteration would occur in the general vicinity of Pats Hole, where the nearly vertical walls of Echo Park and Steamboat Rock, which in places rise to about 900 feet above the valley floor, would be inundated to nearly one-half their height. The notable fault in the neck of Steamboat Rock, now seen so clearly from the tip of Harpers Corner, would be partly submerged. A considerable lagoon, two or three square miles in surface area, would extend up the drainage of Pats Hole, covering the refreshing greenness of the Chew ranch locality. Farther to the east, some of the intrenched meanders of the Yampa River would largely disappear, for the sloping goosenecks separating them would be covered.

Split Mountain Canyon, Whirlpool Canyon, and the Canyon of Lodore, all on the Green River, would be adversely affected from the viewpoint of geologic and scenic values, although less materially so than the canyons of the Yampa River.

Submersion of the parks and the bottom slopes of canyons and entering draws would also affect the biota of the area unfavorably, through changes in wildlife habitats. Also a number of interesting archeological sites, particularly along the Yampa River, would be submerged. However, a good deal that is of geologic and scenic interest would remain. Some parts would be wholly unaffected, such as Jones Hole, the precipitous canyons of the Yampa River near Thanksgiving Gorge and Cactus Park, and the dramatic entrance of the Yampa River into its canyon near the east boundary of the national monument. In some sections, the reduction in the visible height of canyon walls would be a relatively small proportion of the present total height, and some of the canyons would still be impressive, as for example, Split Mountain Canyon, the portion of Whirlpool Canyon below the Echo Park Dam, the upper part of the Canyon of Lodore, and sections of the Yampa Canyon where walls would rise several hundred feet above the high-water level of the Echo Park Reservoir.

Not only would some geologic and scenic values remain, but new scenic and recreational values would be added, and even though they would not compensate in

kind for the losses described, they would be of real importance. Although artificial, the fiord-like reservoirs and their bays in the side drainages would create impressive landscapes, and they would provide avenues by which to see parts of the canyons which visitors would otherwise rarely enter. Under the proposed water-control development, the unaffected natural resources and the values could, in combination, be of national importance from a recreational viewpoint.

The policy of the National Park Service, as the administrative agency responsible for the national monument, has been and is to make the protection of the natural and archeological values of the area the controlling factor in administering it. The question of whether this policy is to be changed to permit development for water-control would require for its solution a review of all probable advantages and disadvantages by authorities superior to either the National Park Service or the Bureau of Reclamation. Before changes in the status of the Canyon Unit are authorized in order to recognize water control as the principal consideration in administering the unit, it should have been clearly and certainly shown that it would be in the greater national interest to develop the area for such use than to retain it in its natural state for its geologic, scenic and associated values and for the enjoyment of them by the Nation.

Red Canyon and Flaming Gorge projects.—The comprehensive plan lists two power dam sites above Dinosaur National Monument; the Red Canyon site about 63 miles upstream from the Echo Park site and seven miles above the mouth of Red Canyon of the Green River, and Flaming Gorge site in the lower end of Flaming Gorge, 31 miles above the Red Canyon site, and 65 miles by road from Green River, Wyo. Both sites are in scenic country on the north side of the Uinta Mountains. The Red Canyon Reservoir site is in an impressive but not outstanding canyon in the Ashley National Forest. However, the Forest Service has considered it of sufficient scenic interest to warrant building a four-mile road to an overlook parking area on the rim of the canyon some miles above the dam site which is about one mile outside of the forest. At maximum elevation the reservoir will only extend upstream about 13 miles, leaving 8 miles of the canyon in which the river falls 120 feet undisturbed. With the Flaming Gorge Dam above, the water should be fairly free of silt and fishing should be good. However, due to the sparse population of the region and the competing good fishing lakes and streams in the Uinta Mountains, this use of the reservoir would be limited.

The mile long Flaming Gorge is unusually colorful for that section, but is not unique or outstanding compared with the colorful scenery found further down the Green River. However, the combined scenic and geologic interest of Flaming Gorge, Horseshoe Canyon, and the nearby canyons of Sheep Creek, plus the reservoir would make this section of considerable recreational value. The scenic forest road over the Uintas between Green River, Wyo., and Vernal, Utah, connecting U S 30 and U S 40, goes through Sheep Creek Canyon and passes within 5 miles of the dam site.

There is certain to be a demand for recreational facilities in the vicinity of the dam. The Forest Service has provided a camp ground in Hideout Canyon on the river about 6 miles below the dam site and in Sheep Canyon. Plans for recreational use of the lower end of the reservoir should be made in cooperation with the Forest Service.

Potential Projects on Tributaries of the Green and Colorado Rivers

The comprehensive plan lists numerous reservoir sites on the tributaries of the Green and Colorado Rivers for power, irrigation, and silt control. Some of the sites have been covered by the survey of the recreational resources of the Colorado River Basin, many others are still to be investigated and in most cases final appraisal of the recreational values cannot be made until the project plans are further along.

Green division.—Of the several potential projects in the Upper Green River Basin in Wyoming, the proposed Elkhorn and Paradise units of the Sublette project would have the most important relationship to scenic and recreational values. These units lie near the foot of the western slope of the Wind River Range. They involve the proposed Kendall Reservoir (capacity 340,000 acre-feet) and the development of Burnt Lake (capacity 25,000 acre-feet) and Boulder Lake (capacity 180,000 acre-feet) for irrigation storage and power. A tunnel 1,800 feet long through the terminal moraine of Burnt Lake would tap the lake for power production. The power plant tailwater would be caught in Boulder Lake. Under the tentative plans there would be a difference of 44 feet in the level of Burnt Lake, and 460 acres in surface area between dead-storage elevation and spillway crest.

The western slope of the Wind River Range is a mountain area of such exceptional scenic quality and recreational value as to be of national importance. The finest of the larger natural lakes in the region are the Green River Lakes, at the headwaters of the Green River, within the primitive area of the Bridger National Forest, and because of their superlative scenic values, it is hoped that they will be retained permanently in their natural condition. Nearer the project areas are five other natural lakes which are but slightly less notable; New Fork, Willow, Fremont, Half Moon, and Burnt Lake, also within the National Forest but not within the primitive area. None of these lakes has been materially injured by existing water-control structures. The scenic values of Boulder Lake have been impaired by existing developments and would be suitable for further utilization.

Burnt Lake is one of the more notable and potentially valuable scenic and recreational assets of the district and it would be unfortunate, from the standpoint of such assets, to alter the natural lake level at all. It is a fortunate circumstance that, with the exception of Boulder Lake, the excellent natural resources of the western slope of the Wind River Range have been relatively little exploited. Ultimately, the region's scenic resources, if so managed as not to be impaired or expended, will prove to be one of its greatest and most lasting economic assets.

Agencies and individuals interested in development of the district should consider the exceptional possibilities of improving access to Burnt, Half Moon, Fremont, Willow, New Fork, and Green River Lakes by a scenic route or parkway lying east of the present U S 87. This road should lie near the eastern brow of ridges to take advantage of excellent panoramic views of the Wind River Range and their foreground of irrigated valleys and benches.

In the Yampa River drainage 11 sites are listed. Seven of these, have been investigated and it was found that none of them has scenic or recreational attributes of sufficient importance to require special protection or preservation, nor would the proposed reservoirs have any major recreational values. If conditions are found suitable for stocking and maintenance of fishlife, fishing would be of value locally in the case of Juniper Reservoir. Archeological reconnaissance of a portion of the Juniper Reservoir site has disclosed a number of Indian camp sites and a more complete survey of the area should be made before the dam is constructed. The other seven sites should be investigated but their recreational value is doubtful as present plans do not include any dead storage. Four are in or near national forests.

There are 11 potential irrigation reservoir sites listed for the *Uinta Basin* area. The majority of the sites are of little recreational importance with respect to scenic qualities, existing or potential. Most of them are in sagebrush or ranching lands of no great distinction. Such values as might be created would in general be of only local benefit and would result from the development of fishing if found practical and from the interest of any body of water in a semidesert landscape. The proximity of the Duchesne and Ashley Valleys to the excellent lakes and streams of the Uinta Mountains lessens the need to use the reservoir sites for recreation. Yet, it may be desirable to provide for local day use of the reservoirs near Vernal, Roosevelt, and Duchesne. In such cases the Bureau should provide for public access to the water but facilities should be furnished by local agencies.

The Hades Reservoir site within the Wasatch National Forest could be recreationally useful if planned with good conservation pools and good fishing maintained, but in view of the superior attractions of natural lakes at higher elevations, the recreational need at this site is limited. The Forest Service is the agency which should determine the extent of recreational development at this reservoir. Strawberry Reservoir enlargement is of potential recreational value to the people of the Provo Salt Lake region.

The four reservoir sites in the upper part of the Price River drainage, and the two sites on Cottonwood Creek near Castle Dale, Utah, have not been investigated as yet, but their potential recreational value is limited by the fact that only two, Mammoth and Joes Valley Dams would have a dead-storage pool. These two are located in the Manti National Forest at fairly high elevations and with proper planning should be of recreational value to the residents of the nearby valleys. This is particularly true of the Joes Valley Reservoir which would serve the residents of the semidesert Castle Dale area.

Grand division.—Of the 31 potential reservoir sites for irrigation development within the Colorado River Basin listed in the plan, the McPhee site has the greatest potential recreational value on the basis of our present information. It would have a minimum water surface of 1,530 acres at dead-storage elevation, as compared to the next two largest, Vega and Spring Creek Reservoir sites, which would each have a dead-storage pool of 90 acres. The plan of operation for all of the reservoirs calls for the maximum draw-down in September, which is not particularly favorable for recreational use during the vacation months of July and August, and the large draw-down contemplated each year would in all probability be unfavorable to fish culture. Of the 23 sites for which minimum water storage figures are available, 12 would have a minimum water surface of less than 10 acres.

Fourmile, Rifle Gap, Haystack, Vega, Spring Creek, Eggleston, Lake Brennan, Banana Ranch, and McDonough sites are in or near national forests and available data indicate they may be of potential recreational value.

The McPhee Reservoir site is in the beautiful Dolores River Valley, a short distance downstream from the town of Dolores, Colo. The natural conditions are ideal for creating an artificial lake of considerable beauty and recreational value. Fishing is good in the upper sections of the Dolores River and should be good in the reservoir. This section of the Dolores Valley is now used for picnicking, camping and fishing, and with the reservoir these uses should increase. There were 12,421 people living within easy access of the site in 1940. It is recommended that plans for development of the area include acquisition of all the shore land and the provision of recreational facilities for public enjoyment of the reservoir including boat docks, swimming beach, picnic areas, camping areas, and the relocation of the present road through the reservoir to maintain the scenic drive down the Dolores Valley. Part of the reservoir will be in the Montezuma National Forest and the Forest Service should have a hand in planning the recreational development and use.

A number of reservoirs, tunnels, and canals are planned in connection with water export projects. The majority of the projects involved would be located in high mountain country in National Forests of considerable scenic and recreational value. It is possible that some of the reservoirs would have potential recreational value. It is also likely that some scenic and recreational values would be lost. A study of this phase of the project should be made.

San Juan division.—O'Neal Park Reservoir site is in the scenic mountain country of the San Juan National Forest about 13 miles northwest of Pagosa Springs, Colo. With a minimum water surface of 1,144 acres at dead-storage elevation and an area of 1,609 acres at spillway elevation with fluctuation only 10 feet, this reservoir should have considerable recreational value.

The Teft site on the Animas River and the Hermosa Park site on the Hermosa Creek north of Durango, Colo., are also in the scenic San Juan National Forest where hunting and fishing are important recreational activities. Present plans for these reservoirs do not include a conservation pool (dead storage) without which their potential value for recreation is questionable. Further study may show that the reservoirs can be made to serve the irrigation needs and at the same time add to the attractions of this excellent recreational region.

The Lemon Reservoir site on Florida River is 15 miles northeast of Durango and 5 miles west of the Vallecito Reservoir on Los Pinos River. The plan calls for a 53-foot dam with a reservoir area at spillway elevation of 487 acres. There would be no conservation pool. In that section the Florida River is a clear fast-flowing mountain stream running through a pleasant mountain valley bordered on three sides by the San Juan National Forest. From the recreational viewpoint the impounding of the river at the proposed site would destroy much that is most attractive in a mountain stream landscape. And there is no recreational need for still water in this location since the Vallecito Reservoir can better provide this type of recreation. If there is no conservation pool, as planned, the reservoir will have little or no recreational value.

The State line dam site is located 1 mile south of the Colorado-New Mexico line, 20 miles north of Farmington, N. Mex. Although the potential recreational value of the reservoir is not great, it would provide water recreation for the local residents. Opportunity should be given for the establishment of a public beach, fishing piers, and picnic grounds at some suitable location along the shore. It is reported that there are pueblo ruins in the vicinity of the dam site. If relocation of the dam is not possible, a thorough investigation and excavation of the ruins should be undertaken before construction of the dam is started.

The potential Long Hollow Reservoir, 10 miles southwest of Durango with a 103-acre dead-storage pool and 446-acre pool at spillway level, may have some recreational value, but the planned 50-foot draw-down will detract from the scenic quality of the area and the fishermen in the Durango region will probably prefer the lakes and mountain streams in the San Juan National Forest to the north.

We are not yet sufficiently familiar with the Arboles Dam site on the San Juan and the Meadows and Monument sites in the Southern Ute Indian Reservation to comment on their recreational values. They are, however, in an area rich in archeology, and surveys of the reservoir areas should be made prior to construction of the dams.

Between Bluff, Utah, and the mouth of the San Juan River the plan lists four power dam sites. At the Bluff site, 13 miles downstream from the town there would be a 340-foot dam for power and silt control. Twenty-four miles farther down in the Goosenecks of the San Juan would be a 177-foot power dam. The Slick Horn Dam about 25 miles below would raise the water 208 feet and a 265-foot power dam at the Great Bend, 30 miles above the mouth of the San Juan, would back water to the foot of the Slick Horn Dam. Although these dam and reservoir sites on the San Juan have not been investigated so far by the survey being made by this Service, it is certain they would have adverse effects on the scenic values of this impressive section of the San Juan and that they would flood a number of sites of archeological importance. At the same time the potential recreational value would be limited.

Little Colorado division.—In the Little Colorado River Basin there are five potential reservoir sites which have potential recreational values. The Forks Dam on the Little Colorado near the town of Woodruff, Ariz., would create a water area of 3,600 acres at dead-storage elevation and 5,000 acres at spillway level, with an average water surface of 4,300 acres. A water area of that size which would have a maximum fluctuation of only 10 feet is certain to be of recreational value, even though it is in comparatively uninteresting open, grassland country. It will be used by the people in the vicinity, and attract some attention from travelers using U S 66, U S 260, and State Highway 77, as it is located only 13 miles southeast of Holbrook, Ariz., and 20 miles by existing roads from the south entrance of Petrified Forest National Monument. Holbrook had a population of 1,184 in 1940, and that same year 199,420 people visited Petrified Forest National Monument. It is possible that 8 percent or about 16,000 might visit this reservoir. Plans for the reservoir should provide for a protective strip of land around the entire reservoir and a suitable area for public recreational use where facilities for picnicking, camping, swimming, and boating may be provided. It is likely that the reservoir would be attractive to waterfowl and other wildlife of the region.

The next largest reservoir area planned is on Black Creek in the Navajo Indian Reservation, just west of the Arizona-New Mexico State line. While this reservoir is for irrigation and may be drawn down 48 feet, from a spillway elevation covering 1,900 acres to dead-storage area of only 110 acres, the average water area would be 1,000 acres. If conditions are favorable for fish life it should attract fishermen from Gallup, and also be of recreational value to the Indians on the reservation.

Plans for the Shumway Dam, located just south of the town by the same name at the edge of Sitgreaves National Forest, include a reservoir area of 540 acres at spillway elevation, and a dead-storage pool of 185 acres. It should be of considerable recreational value as it is in an area already popular for fishing, hunting, and summer vacations, and will be easily accessible from U S 60 and State Highway 77.

The Willow Creek Dam site is in Clear Creek Canyon, a couple of miles below the mouth of Leonard Canyon, about 35 miles southwest of Winslow. The reservoir would have an average water surface of 340 acres, an area of 570 acres at spillway level, and a possible draw-down of 55 feet from spillway level to dead storage. Being in the Sitgreaves National Forest at an elevation of 6,100 feet, the reservoir should be of recreational value to Winslow, population of 4,577 in 1940. Fishing will be the main attraction and provisions should be made for public access to the shore, and facilities for picnicking, camping, and fishing, in cooperation with the Forest Service.

Wild Cat Dam site is also in the Sitgreaves National Forest on Chevelon Creek, about 27 miles due south of Winslow. The reservoir would be slightly larger than Willow Creek Reservoir, and the average draw-down would be 10 feet less. It will, therefore, compete with Willow Reservoir. However, if good fishing is available at both reservoirs it would stimulate interest in the sport, and increase the number of visitors at both reservoirs.

The sections of the Little Colorado River Basin in which the five reservoir sites are located are known to contain pueblo ruins and other archeological sites of importance. Archeological surveys of each of the five reservoir sites should be made before construction of the dams is started.

Gila division.—Down on the Hassayampa River, 6 miles from Wickenburg, called the "Dude Ranch Capital," is the Box Canyon Dam site. This dam planned for irrigation and flood control would have an average water surface of 2,000 acres, but might on occasion be drawn down 90 feet to dead storage, leaving only a 440-acre lake. At spillway level 36 feet above the average, the surface area would be 2,900 acres. Located in the desert just below the rim of high country this reservoir should receive considerable recreational use by winter visitors and some year-around use by the people living in the irrigated districts west of Phoenix. The dam is 60 miles from Phoenix, and 68 miles from Prescott, via U S 89, the main north-south highway through Arizona. U S 60 and 70 join U S 89 at Wickenburg. The annual average 24-hour travel on U S 89 south of Wickenburg in 1940 was about 1,600 vehicles.

Boulder division.—In the Joshua tree country northwest of Wickenburg near Alamo is a site for a water control dam on the Williams River. Present plans indicate the reservoir would have a dead-storage pool covering 2,800 acres, while at average water-storage level the water would be 105 feet higher and cover 9,500 acres. At spillway level 11,950 acres would be flooded. Located 37 miles west of U S 89, and 32 miles north of U S 60 and 70 in sparsely populated desert country the recreational use will probably be limited to hunters and fishermen.

Virgin division.—From the recreational viewpoint the most important reservoir site in this basin is the one on the Virgin River near Virgin City, Utah. Here it is proposed to create an irrigation reservoir which will have a dead-storage pool 236 feet deep at the dam site with a surface area of 2,300 acres, while at water-storage elevation 12 feet higher there would be a 2,700-acre lake. The total reservoir area would include about 3,800 acres and the maximum fluctuation of water-level would be 32 feet. Located in the Virgin River Valley near Zion National Park this reservoir would have considerable recreational value. In 1941, 190,016 people visited Zion National Park and probably most of these people passed by the reservoir site. It is expected that the number of visitors will increase as the scenic beauty of this section of Utah becomes more widely known. Many of these visitors will use the reservoir area for picnicking, camping, swimming, fishing and boating. It is particularly important that sufficient land be acquired around this reservoir to provide ample public recreational lands and to protect the scenery. State Highway 15 will be relocated above high warterline along the north side of the reservoir. The recreational value of this section of the highway and the reservoir would be greatly increased if all the land between the road and the water were made available for public recreational use.

The Lower Gunlock Dam Site is on the Santa Clara River. Primarily for irrigation, the reservoir with a dead-storage pool of 100 acres and an average water-storage pool of 250 acres would be suitable for swimming, fishing, and boating and such recreational activities should be attractive to the people in that locality where the summers are long and warm.

The Delmue Dam on Spring Creek, although primarily for an irrigation and silt control reservoir, would be of some recreational value to the 2,682 people living in the nearby towns of Pioche and Caliente, Nev. The plan calls for an average water-storage pool of 1,000 acres, and a dead-storage pool 32 feet lower, covering 600 acres. Provision should be made for picnicking, swimming, boating and fishing.

Summary of potential recreational projects and estimated annual benefits of potential reservoirs in the Colorado River Basin

Site	Estimated construction cost of recreational facilities	Annual estimated benefits
Green division:		
Fontenelle	$17,000	$3,110
Big Basin		1,120
Flaming Gorge	41,000	9,093
Red Canyon		2,903
Columbus Mountain	9,000	2,325
Juniper	13,000	4,771
Lily Park	8,250	4,718
Pelican Lake	18,600	2,232
Starvation	25,000	8,160
Mammoth	24,500	6,461
Joes Valley	28,900	8,658
Desolation	18,700	7,430
Rattlesnake	19,000	7,430
Grand division:		
Red Mountain	19,000	6,960
Barbers Basin	15,400	7,515
Missouri Heights	15,000	5,540
Rifle Gap	22,500	9,113
Haystack	9,000	3,963
Owens Creek	6,000	1,982
Vega	6,000	1,190
Almont	7,000	2,542
Castle Creek	4,000	2,330
Tomichi	17,700	7,418
Banana Ranch	5,700	2,227
Sapinero	46,000	16,370
Spring Creek	15,400	4,980
Gorsuch	17,000	5,385
McPhee	70,000	10,050
Dewey	55,500	13,975
Glen Canyon	228,800	111,757
San Juan division:		
O'Neal Park	30,800	9,290
Arboles	23,850	7,206
Long Hollow	4,000	1,316
State Line	28,000	5,585
Monument Rocks		554
Ironton Park	13,405	5,422
Howardsville	4,500	2,646
Recapture	11,250	1,780
Mill Meadows	16,500	7,312
Torrey	6,000	1,700
Escalante	6,000	1,300
Little Colorado division:		
Shumway	13,700	1,400
Forks	34,600	6,880
Willow Creek	18,000	4,040
Wild Cat		2,800
Virgin division:		
Delmue	28,000	2,680
Virgin City	210,000	37,128
Lower Gunlock	6,000	261
Boulder division:		
Marble Canyon	38,500	12,760
Bridge Canyon	581,000	277,370
Davis	160,600	40,465
Gila division:		
Buttes	19,100	5,075
Box	157,000	24,666

A number of potential reservoirs have been omitted from the summary for one of the following reasons: (*a*) there is not sufficient information available at present to make an estimate of the potential recreational value; (*b*) present information indicates that the reservoir may be empty sometime during the year, or have so large a fluctuation as to make it undesirable for recreational use; (*c*) the existing recreational values of the reservoir area or the immediate vicinity are such that there would be a loss of recreational values or the potential recreational values of the reservoir would only compensate for the losses.

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Method Used in Evaluating Recreational Benefits of Potential Reservoirs

The method of analysis and evaluation of recreational benefits used intends to show only that if the reservoirs are formed and the conditions are suitable for fishing and other recreational uses, the recreational benefits inherent in them will be worth so much in terms of dollar value. Recreational values or benefits are, in general nonvendible; something upon which a monetary scale cannot be used. There are, however, through experience, observation and knowledge and by comparison with similar existing areas certain factors which can be appraised.

The recreational benefits have been based on the estimated attendance. The annual attendance was determined by calculating the percent of total population within 50-mile radius by existing roads that might be expected to use the area, and the number of visitors that might be expected from beyond the 50-mile radius. The percent of local population varies with the accessibility of the reservoir, the recreational values of the area, the appeal or drawing power of the area as compared with other or similar recreational features in the region and the percentage of urban population within the 50-mile radius. The following factors were considered in estimating the number of visitors from beyond the 50-mile radius: nearness of area to major highways and volume of traffic on such highways; general recognition of the recreational resources of the region; and the appeal or drawing power of the dam and reservoir as compared with other or similar recreational features in the region. In the Colorado River Basin the density of population, the recreational resources, the volume of tourist travel, and the vacation use vary to such an extent that it is not possible to use constant percentages. For example, no local attendance can be figured for Glen Canyon Reservoir. The estimated annual attendance was assumed to be 20 percent of the travel on U S 89 at Navajo Bridge, a few miles downstream from the dam site. At the other extreme is Shumway Reservoir where it is estimated that approximately 100 percent of the total attendance will be local.

Having determined the estimated annual attendance, the recreational benefits were obtained by using four factors:

(1) *Travel value.*—Travel values representing an amount that it will cost the visitor to travel to and from the area and a portion of an amount he is willing to pay for his recreation. It is assumed that it costs an average

of 5 cents per mile to operate an automobile, and that the local attendance will come by auto and truck, bring the average to five persons per automobile. At 5 cents per mile the travel value per visitor is then 1 cent per mile times the average travel distance to and from the reservoir. Travel value for the portion of the attendance other than local was included in per diem value, because it is impossible to determine how far they traveled or the percentage of their travel that can be definitely assigned to the particular area. In the case of Bridge Canyon, Marble Gorge and Glen Canyon Dams, however, a travel value was included to cover round-trip distance from major highways traveled by the portion of the visitors who would spend only a few hours at the dam.

2 *Per diem value.*—Information gathered by the Colorado Highway Planning Survey shows the average out-of-state tourist party, staying at cottage camps, to consist of 3.6 persons spending $12.25 or $3.41 per person per day. On this basis a figure of $3.40 was used in estimating the expenditures of visitors from beyond the 50-mile radius, assuming in all cases that these visitors would spend an average of one day at or near the reservoir, directly chargeable to the area. In a number of cases local visitors may be expected to stay over night in the area and tourists may spend several days. However, no per diem figure has been used for local visitors and only one day per diem is applied to other visitors.

3 *Recreational value to visitors.*—Being in an area and enjoying its features and opportunities, whether he spends money or not, is worth something to a visitor. To estimate this benefit, a direct hypothetical value of 10 cents per visitor has been used. This is the amount actually charged for admission to the State parks in several States, notably Indiana. The 10-cent figure is a conservative estimate. It should not be assumed that by using such an arbitrary value, that an entrance fee is advocated.

4 *General value.*—It was not possible at this time to determine the specific factors for evaluating the benefits to the communities through which the visitors travel and to the concessioner within the area.

For this report the value to the communities and the concessioner has been estimated as 20 percent of the travel value and the per diem value. This represents a gross profit to business. While the net may be only 10 percent, the labor, capital, and related business activities involved in sales will benefit at least 10 percent, therefore, the 20 percent total seems reasonable.

Cost of Recreation Projects

The facilities for recreational use and the costs therefore have been estimated from experience and by comparison with existing similar areas, giving consideration to the recreational opportunities available in the area and facilities deserved by the visitors.

Only by a comprehensive survey, study and planning can a more accurate estimate be made of facilities needed. It is believed that the estimated project costs will be sufficient to provide adequate development for the estimated number of potential visitors.

Annual operation and maintenance of the recreational facilities is estimated to average about 10 percent of the cost of the facilities.

FISH AND WILDLIFE SERVICE

The Colorado River Basin comprising 13 percent of the land area of the United States with a population of only four persons per square mile (or one-tenth of the national average) constitutes one of the chief recreation and primitive wildlife and fishing areas in the United States. The stream conditions vary from clear, cold, high, mountain streams to warm and often silt-laden waters at lower elevations. Because of this tremendous variety of habitat, conditions that apply in one part of the basin may not apply in another. By proper preliminary planning it should be possible to safeguard and, in some cases, to increase the abundance of both fish and wildlife.

The report touches upon 114 potential reservoirs for the Upper Basin (above Lee Ferry, Ariz.), including 26 projects that would serve for power production. There are 25 proposed reservoirs in the Lower Basin. Because of their large number and diversity these projects cannot be treated individually in this report but their main aspects will have to be considered, leaving the details to be worked out later for each individual project through actual field surveys. The Fish and Wildlife Service has made stream and lake surveys within the boundaries of six national forests and two Indian reservations in the basin.

Upper Colorado Basin

Evaluation of resources affected by the project.—The tributaries of the Green River division in the upper basin originate in high mountains. The streams are clear and cold.

The principal headwaters of Green River lie in the western slope of the Wind River range of mountains in Wyoming. Lakes at the origin of many of these streams have a variety of trout, principally cutthroat and mackinaw. In the upper reaches of the streams, the cutthroat trout is the most abundant species, being replaced by the rainbow trout at lower levels. Brook and brown trout are present, but not numerous. A fairly abundant form, which is becoming increasingly popular, is Williamson's whitefish. Below the city of Green River, Wyo., trout fishing becomes less and less important, and in the main stream within Utah the only species of importance is the

channel catfish. The California golden trout has been planted in a few of the high streams.

In the Grand division, the headwaters of the Colorado River and its principal tributaries in Colorado have cutthroat and brook trout as the main species, but at lower levels, the rainbow trout is most numerous. Brown trout are abundant in several places, notably the Gunnison River. Some miles east of the city of Grand Junction, channel catfish replace trout and become the important species thence down stream in the main river. Largemouth black bass are present also. Few fish of value are found in the reaches above and below Moab, Utah.

In the San Juan division, the upper reaches of the eastward-flowing tributaries of the Colorado River in southern Utah contain the usual forms of trout in some abundance. The main stream in this area is practically inaccessible, for no roads cross it. Its value as a fishing stream may be discounted for the present. The San Juan River and tributaries provide a satisfactory general trout habitat at the higher elevations and channel catfish habitat in the lower reaches.

Unquestionably that portion of the western slope of the Continental Divide falling within the Upper Colorado River Basin constitutes one of the greatest hunting areas in continental United States. Deer abound through most of the drainage basin and elk are numerous at the higher elevations. Moose occur in the wilderness areas of the upper reaches of the Green River and several large herds of mountain sheep are found in Colorado.

Upland game birds include several species of grouse, particularly sage grouse, which are fairly numerous along the Yampa River and the Duchesne River in Utah. Ptarmigan are found in the high mountain country of Colorado and wild turkey still exist in the upper reaches of the San Juan River of New Mexico and Colorado.

Present waterfowl habitat is rather limited, but the Colorado River is a strategic migration route and appreciable acreages of marshlands exist along the headwaters in Wyoming particularly in the vicinity of Daniel. The importance of preserving the relatively limited acreage of marshland in that part of a major waterfowl flyway is of utmost importance in the preservation of a natural resource. As conditions now are, the small acreage of such food and cover habitat is a factor in limiting the use of the flyway by waterfowl. Without such habitat, rest areas supplied by irrigation reservoirs may be of little value.

Fur bearers, with the possible exception of beaver, are of secondary importance in the basin and it is thought that the proposed reservoirs will have little effect upon them.

Effects of the projects.—In the upper tributaries fish maintenance depends to a large extent upon an ample supply of cold water and protection of the fish from being drawn into major water diversions. In the Green River below the town of Green River, Wyo., and in the Colorado River below Grand Junction, Colo., and in the San Juan below the Colorado-Utah line, the streams become silt-laden and gravel bottoms are generally replaced by sand and mud and the riffles become less numerous. This reduces the value of these portions of the streams for fish.

On these trout streams of the upper basin, it is important that the methods of operation be fully studied in the early planning stage of each project to insure that provision is made to release sufficient water from all impoundments to safeguard stream conditions adequately. In most of the reservoirs on the warmer portions of the streams, it may be advantageous to withdraw water from the lower levels of the reservoirs in order to provide cold waters.

The project plans as at present outlined do not contain sufficient data to be able to judge the effect of the individual projects so that no comment can be made at this time on the adequacy of the conservation pools or the effect of the method of operation. Reservoirs for irrigation usually contain a certain amount of dead storage for silt deposition. Even in the clear upper waters it is important that the wildlife conservation pools be made a feature of all reservoirs so that fish will not be destroyed by excessive draw downs.

Stream surveys made in previous years by the Fish and Wildlife Service showed that a great many of the existing irrigation reservoirs are either drained completely or so reduced in volume during the late summer that they are worthless for fish production. Even in cases where a conservation pool was present the extreme fluctuations in water level prohibited the growth of plant food and made the reservoirs unsuitable for fish spawning. This condition can be ameliorated both by provision for a larger wildlife conservation pool and by subimpoundments to provide permanent areas with a stable water level.

The projects outlined in the report call for a number of diversions of water from the Colorado into other basins. The exact effect of such diversions cannot be determined without specific studies but if these usually result in a great reduction in the volume of stream flow, those proposed will undoubtedly be harmful to fish and wildlife because of habitat destruction. It is possible that this may be partly compensated for by the provision of large stable level reservoirs at the points of water diversions. Such reservoirs, if they have their diversions properly screened and provisions are made for stocking, may provide fishing to some degree, but the danger exists that natural balances between tributaries, riffles, pools and other habitat factors will be so disturbed as to offset in part the advantages gained by these diversional reservoirs. As most of these diversions are at high elevation, they should be suitable for cold-water species of game fish but it is doubtful that these storage reservoirs will contain sufficient direct trib-

utary streams to provide sufficient spawning areas. Therefore, it may be necessary to provide increased hatchery facilities.

The value of these reservoirs for recreation and fishing should be protected by providing public access, and in most cases setting aside land for public use.

On the Colorado River it is not necessary to provide fishways for anadromous fish and most of the resident fish are nonmigratory except for short migrations to obtain favorable spawning conditions. Therefore, there will be but few dams if any which will require fishways. Where water is being diverted for irrigation, it may be necessary to screen many of these diversions but this will be a matter requiring study of the conditions at each specific point.

Pollution of the Upper Colorado River as a whole is negligible at present. Wastes from mines, mills, and smelters, however, threaten to create or are creating pollution problems in the vicinity of Rock Springs, Wyo., and Price, Utah. When pollutants are permitted to enter a reservoir, they have a chance to accumulate and their effect can be serious. Therefore, steps should be taken to remove or greatly to alleviate these conditions before a project is constructed below a source of major pollution.

The projects in the upper basin that are not designed for transmountain diversion will in many cases be used to provide storage to refill reservoirs many miles downstream. Certain of these reservoirs will also be utilized for power production. In both of these cases it should be possible to work out a schedule of operation that will provide for a minimum continuous release of water to maintain fishing. This will in many cases well compensate for the flooding out and the destruction of a great many miles of trout water and will be especially helpful on many streams that tend to be intermittent during the summer months over their lower courses.

Insufficient data on stream mileages involved and on the proposed reservoirs and their operation are available to the Fish and Wildlife Service on which to compute wildlife values. For 10 of the power reservoirs it is possible to evaluate migratory waterfowl values gained, but it is impossible to compute damages until the amount of natural habitat destroyed is known. Any silt reduction will result in benefit to wildlife as well as fish, depending primarily upon the management of silt deposition. The methods of reservoir operation, therefore, will be the determining factors in mitigation of damages and possible creation of benefits.

Lower Colorado Basin

Evaluation of resources affected by the project.—In the four divisions of the lower basin the cold-water fish are confined almost wholly to the higher elevations in the Virgin, Little Colorado, and Gila divisions. In the Boulder division a beautiful trout stream has been created immediately below Boulder Dam by drawing off cold, clear water from the depths of the reservoir and stocking this portion of the river with rainbow trout.

In the lower divisions of the Colorado the main Colorado River flows largely through a deep canyon and receives water chiefly from a few principal rivers that are sufficiently large to flow throughout the year. It also receives flood waters of many intermittent streams. Trout are found only at the higher elevations. Rainbow and brown trout are the chief species. After these streams flow out of the mountains, they contain catfish, bass, sunfish, crappies, channel catfish, and bonytails. A great many of these streams sink into the desert and disappear along their lower reaches. Surveys made of many of these headwater streams, having heavy fishing pressure, show them to have considerable recreational value.

In the Boulder division a rather complete survey of the river from the Nevada-California line to the Gulf of Mexico has been made by the California Division of Fish and Game. This lower section of the Colorado is characterized by warm, silty water fluctuating considerably in volume with a shifting bottom. It is very deficient in fish food due to the high turbidity, the unstable bottom, and the fluctuations in level. Fishes are not abundant except in backwaters, the small temporary lakes that are formed behind the shifting sand bars of the channel in the reservoirs, and in the main irrigation canals. The chief fishes at present are introduced varieties, most of the native fishes apparently suffered from the man-made changes in the river and are no longer abundant.

Largemouth bass, carp, catfish, and bluegill sunfish are the most abundant species in the reservoirs of the main river. Mullet are abundant as far upstream as Imperial Dam. Trout are not ordinarily found in the main river except for the stretch of from 20 to 30 miles of cold, clear water that is drawn off from the deeper portions of Boulder Dam. The main irrigation canals in the lower portions of the basin are ordinarily filled with water throughout the year and contain large numbers of fish wherever the current is not too swift. The main power reservoirs that are proposed for almost the total length of the Colorado River will flood several hundred miles of the main stream. The degree of turbidity of the water in the main Colorado River is so great due to the tremendous loads of silt carried that it is quite unproductive of fish foods. The shifting bottom also smothers food organisms. Therefore, it is felt that the desilting of the river and the formation of these tremendous lakes will undoubtedly add considerably to the fishery values of the main river.

When the upper basin reaches its ultimate development there is some possibility that the fisheries in the lower

basin may suffer from the excess quantities of alkali that will be leached out of the irrigated land and returned through drains into the river. When Davis Dam is completed it will flood the trout waters below Boulder Dam and destroy this fishery. It will have some beneficial effect, however, in reducing the silt carried into Havasu Lake.

In the Lower Colorado River basin there are 10 national wildlife refuges located in Arizona, Nevada, and California. These are for the preservation of bighorn sheep, mule deer, antelope, peccary, upland game birds, and waterfowl. A major portion of the lands within the lower basin is under Federal administration. It is on such areas, administered primarily by other agencies that the national wildlife refuges have been established and are being maintained in line with the policy of providing multiple use of each project so far as is consistent with its primary purpose. Such secondary use of areas is not so productive of results as would be the case under primary control, but these do make possible a substantial contribution to wildlife conservation. This is particularly true of rare and important forms whose range and habitats are restricted. Their continued preservation, therefore, will be dependent upon the multiple use of areas along the lower Colorado where suitable habitat and water may be provided. Likewise it is imperative that desirable habitat for waterfowl be maintained in the lower Colorado where two major continental flyways converge.

Means for mitigating losses and deriving maximum benefits.—The existing and potential wildlife resources of the Lower Colorado River Basin are well known, and in any coordinated development of the basin appropriate recognition should be given these assets.

The Fish and Wildlife Service, as indicated in the report, has established 10 wildlife refuges and 1 trout fish hatchery within the basin and recognizes the opportunities for further, needed development that is presented through the Bureau of Reclamation reservoir program. Agriculture and hydroelectrical projects are being benefited primarily by such development, but in many areas, including some of the arid and semiarid regions where conditions do not lend themselves to agriculture or other economic interests, wildlife, and recreational development offers much to the future of the states and communities concerned.

The importance of development requires that a detailed survey of the project areas be made and refuges established where location, reservoir operation, and physical features will serve to promote development of habitat for wildlife. Where conditions do lend themselves to such development, the Bureau of Reclamation should make every possible effort to operate the reservoirs with full consideration of the wildlife interests. Such operation would include limiting the minimum draw-down to an elevation that would provide a pool of sufficient depth and area to sustain fish life.

Where the operation of a reservoir requires maximum draw-down to the detriment of wildlife or its habitat, consideration should be given to construction of underwater or retaining dikes or upstream development to preserve aquatic food plants for waterfowl. Proper development of waterfowl areas will influence an increased use of this flyway and add materially to the over-all value of the Bureau of Reclamation reservoir program.

The fish-stocking demands in the area are increasing each year, and it will be necessary to construct additional facilities to meet this added demand. A modern combination trout-bass fishery station should be constructed for this purpose near Page Springs in Oak Creek Canyon about 40 miles south of Flagstaff, Ariz. The cost of such a plant would be about $105,000. In addition, it will be necessary further to develop the Williams Creek Station for the incubation of trout eggs because of the Page Spring water being too warm for incubation but ideal for rearing rainbow trout fry and fingerlings. The rainbow eggs would then be processed at the Williams Creek Hatchery and moved to the Page Spring station in the advanced fry stage. The Williams Creek development will involve one additional fish culturist and need for approximately $20,000 for expansion of the facilities.

It is desirable that, where required, fish screens of a type acceptable to the Fish and Wildlife Service be installed in the "turn-out" structures.

Recommendations

It is recommended that:

1. All reservoirs provide suitable dead storage capacity to meet the requirements for protection of fish and wildlife; such capacities to be advocated upon the basis of the surveys to be made in compliance with recommendation 12 hereinafter.

2. Release of water from all impoundages be sufficient to safeguard adequately or improve fishing conditions in streams below reservoirs through stabilized flows. To determine the minimum adequate amounts to meet fish and wildlife needs detailed surveys will be required.

3. In respect to all reservoirs, operation of the gates shall be at such rates as will give adequate protection to fish and wildlife as shown by detailed surveys to be made hereafter.

4. Diversions, where necessary, be adequately screened for fish protection.

5. Plans for each headwater reservoir be presented to the Fish and Wildlife Service for study prior to construction in order to permit determination of advisability of incorporating therein provision for fish ladders or similar devices to facilitate natural spawning.

6. Where reservoirs are to be established on streams subject to mine tailings, oil, industrial, sawmill wastes, and other forms of pollution, provisions be made to remove the hazard.

7. Engineering studies be conducted to determine the feasibility of sill dyking to provide as extensively as possible shallow lateral pools with stable water-spawning and rearing areas for fish and feeding and resting areas for wildlife.

8. Studies be made of all reservoirs to determine those, if any, which should be designated as wildlife refuge and management areas.

9. Adequate facilities be provided at each reservoir for access by the public for appropriate fishing, hunting, and other forms of recreation.

10. Engineering plans of all reservoirs provide for outlet facilities so constructed as to release water from as close to the bottom of the reservoir as is practicable.

11. Hatchery facilities be provided for such increased stocking as may be required for new reservoir construction to satisfy fishing demands. This should include doubling the present capacity of the Fish Cultural Station at Springville, Utah, for the production of legal-sized trout. It is estimated that the cost of the latter will be about $56,200. In addition, a modern combination trout-bass fisheries station should be constructed near Page Springs in Oak Creek Canyon about 40 miles south of Flagstaff, Ariz., at a cost of approximately $105,000. To supplement the facilities of this new hatchery the Williams Station should be further developed for the necessary incubation of trout eggs not possible at Page Springs, at a cost of about $20,000.

12. An allotment be established to provide for surveying the proposed reservoirs within the basin to determine their possible effects on fish and wildlife so as to mitigate damages and to increase benefits. Such a task is beyond the present personnel and appropriation limits of the Fish and Wildlife Service. To make the essential field surveys the estimated costs for the fiscal year 1946 are $132,000 for personnel and expenses.

GRAZING SERVICE

Objectives and Functions of the Grazing Service

Under the Taylor Grazing Act of June 28, 1934, as amended, the Secretary of the Interior is authorized to established grazing districts from the public domain (exclusive of Alaska) including not to exceed 142,000,000 acres of vacant, unreserved, and unappropriated public land. The primary objectives of this act are: (1) to stop injury to the public grazing lands by preventing overgrazing and soil deterioration; (2) to provide for their orderly use, improvement, and development; and (3) to stabilize the livestock industry dependent upon the public range.

The Grazing Service is the designated agency responsible for the administration of grazing districts. Operating on a decentralized plan, it is headed by the Director of Grazing, who is responsible for the conduct of policies and programs approved by the Secretary of the Interior. The Director's immediate staff consists of an assistant director, a chief counsel, and the chiefs of four major functional branches: Operations, Range Management, Range Improvements, and Land Acquisition and Control. The assistant director, who also acts as liaison officer, is stationed in Washington, D. C. The Director's office is located in Salt Lake City. Ten regional headquarters, each in charge of a regional grazier, have been established within the States affected. As of June 30, 1944, there were 60 grazing districts organized and operating, each of which is in charge of a district grazier. In each district there is a district advisory board composed of from 5 to 12 stockmen and 1 wildlife member who advise with the district grazier and make recommendations on all matters pertaining to the internal affairs of the district they represent.

Grazing districts are composed of Federal, State, and private lands, with a gross acreage of 264,609,700 acres. The break-down of land ownership in the districts as of June 30, 1944, is as follows:

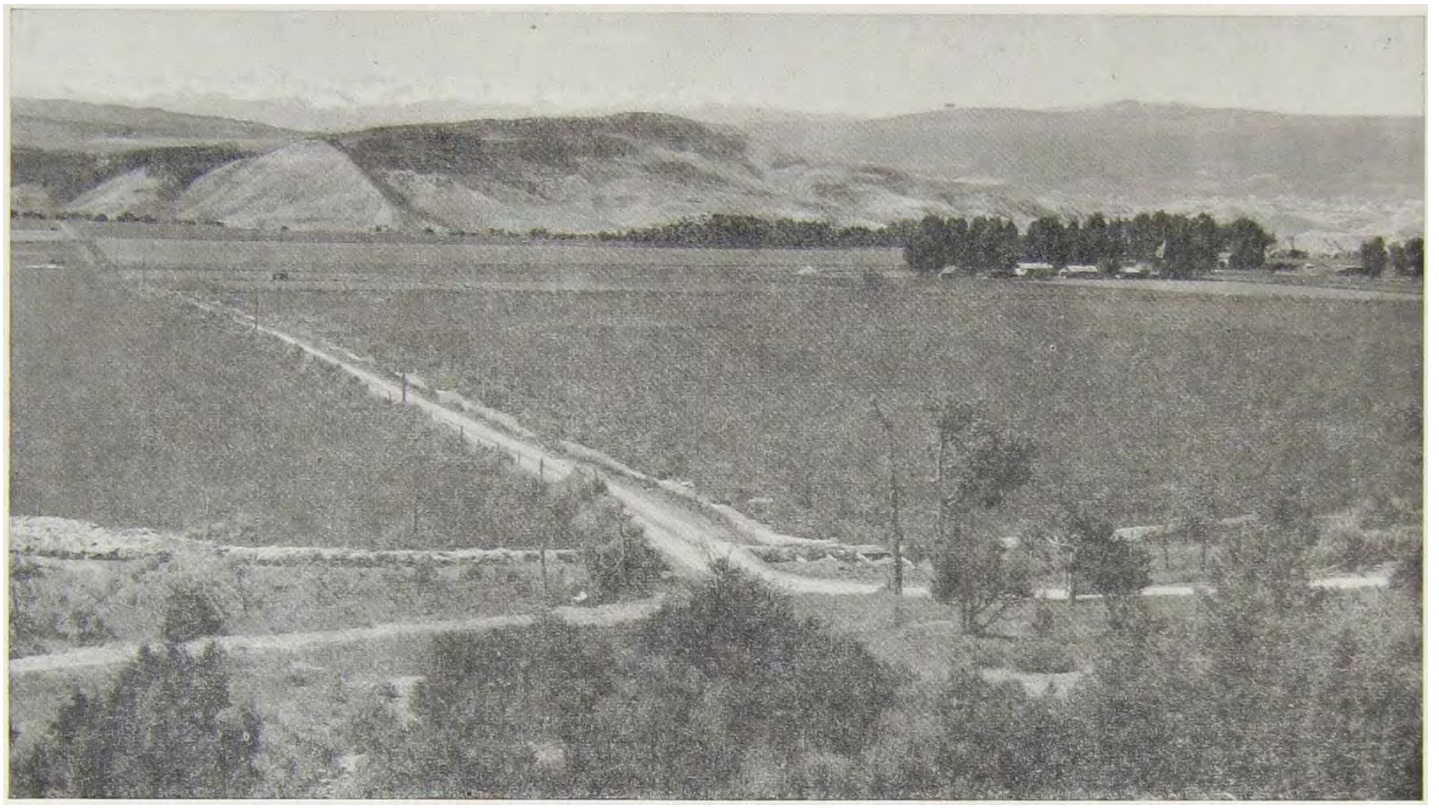
	Acres
Federal land withdrawn by establishment of grazing districts	132,281,035
Other Federal land	8,817,082
Total Federal land administered by the Grazing Service	[1] 140,898,117
Other land [2]	123,711,583
Gross area	264,609,700

[1] In addition, the Grazing Service administers 1,306,885 acres of non-Federal land within grazing districts in 6 States under leases authorized by the Pierce Act of June 23, 1938, and under cooperative agreement with the owners.

[2] Includes State, private, county, and certain withdrawn lands which the Grazing Service does not administer.

The long-time objectives of the Grazing Service are to protect, develop, and improve grazing-district lands through proper management for sustained yield and economic use; to coordinate this use with that of related lands; to cooperate fully with agencies and individuals having related interests and responsibilities; and to create and establish a practical range economy consistent with sound conservation and resource management principles.

Administration of the 60 grazing districts includes the protection and development of the natural resources and in particular the management and allocation of the use of range resources; the examination and classification of lands with respect to grazing or agricultural uses; and cooperation with agencies and individuals in the correlation of land use, development and improvement of the range resources, and in the prevention and suppression

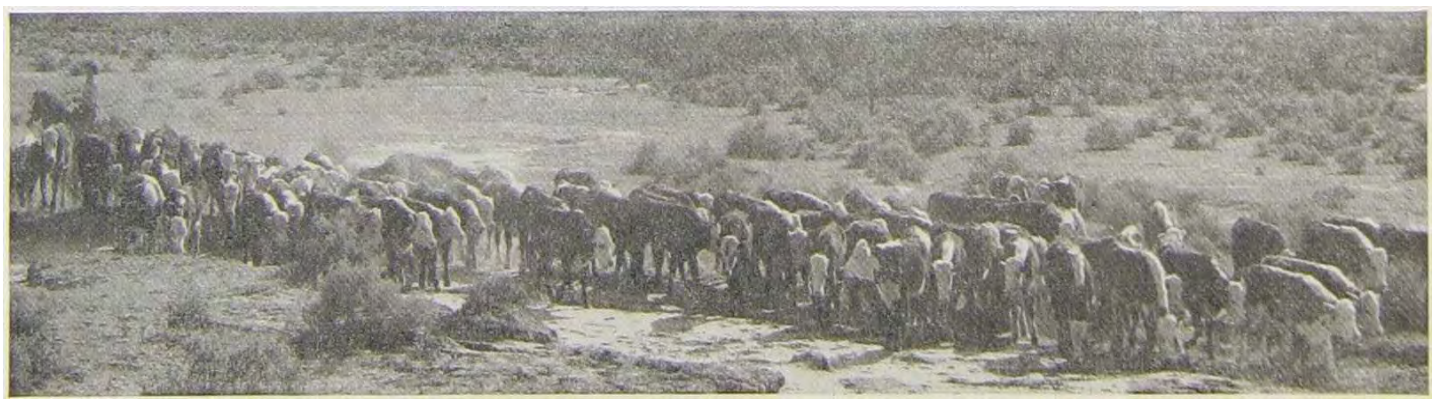


IRRIGATED HAY FIELDS UNDER UNCOMPAHGRE PROJECT

Canal carries water that transforms desert (foreground) into hay land (background)

of range and timber fires. Grazing use is made of the approximately 142,000,000 acres of Federal range during a part of all of each year by upwards of 11,000,000 livestock owned by more than 22,000 permittees. This public range use is coordinated with that of private properties as an aid to the proper and economic year-round use of both public and private lands. Without the use of the public range the values of the dependent privately owned properties would decline sharply.

In line with the control and beneficial use of all the resources involved, the Grazing Service program includes watershed protection and other related activities of predominant public interest. The proposed reclamation program in the Colorado River Basin will no doubt enlarge the benefits to be derived from the grazing land administered by this Service. Regulated range use can be augmented by the proposed program and benefits will accrue not only to the livestock industry but to the entire Nation through a greater stabilization of livestock production, conservation of the land and its resources, reduced silting of irrigation works, clearer streams, and more uniform stream flow on the watersheds.



CATTLE ON MOUNTAIN RANGE

Range cattle depend upon irrigated pastures for supplemental feed

Grazing Districts in the Colorado River Basin

General

Twenty-six of the sixty grazing districts established under the Taylor Grazing Act of 1934, as amended, are located in whole or in part within the Colorado River Drainage Basin by States as follows: Arizona, 4; Colorado, 6; Nevada, 2; New Mexico, 4; Utah, 7; and Wyoming, 3.

The grazing-district area within the basin totals 74,405,000 acres, of which 52,648,000 acres (approximately the size of Utah) are federally owned. Of the remainder, 16,030,000 acres are privately owned and 5,727,000 acres belong to the States and counties affected. The total land area administered by the Grazing Service within the basin is 50,005,000 acres. In addition to their importance for grazing, these lands are an integral part of the entire watershed to which they are closely allied. Federal lands (withdrawn for various purposes) not administered by the Grazing Service total 2,657,000 acres.

The population density is less than 2.7 persons to the square mile totaling approximately 308,000 people (1940 census) in the 26 grazing districts.

Elevations range from a few feet above sea level in southwestern Arizona, affording a year-long growing season, to more than 8,000 feet in northern foothill or mountain areas, where only a 60- to 90-day growing season prevails. Rainfall ranges from less than 5 inches to more than 20 inches, with a great proportion of the area receiving less than 10 inches annually.

Vegetation types consist of creosote bush, bursage, and desert annuals on the southern deserts; desert saltbush types in the lower areas of Utah, Colorado, and Wyoming; and sagebrush, bunch grasses, mountain meadow, woodland, and timber at the higher elevations. Seasons of range use are from year-long in the southwest to a short spring-fall or summer season in higher altitudes. Large parts of the deserts of the upper basin are grazed principally during winter months because of scarcity of stockwater supplies for use in other seasons. Grazing capacities vary widely. As a rule the perennial forage is more plentiful in the northern districts and forage production is correspondingly higher as indicated by the permitted use.

Grazing Use

Stock raising is the principal agricultural pursuit within the grazing-district area of the basin. In certain localized areas, however, some general farming, or even specialized farming, is practiced, with livestock assuming a relatively unimportant part. Throughout the basin generally most farming land is intermingled with range land. In such areas, as well as in some areas devoted strictly to farming operations, the lands are used mainly for the production of hay and feed crops to supplement range forage during seasons when range feed is not available. There is, therefore, a direct correlation between the livestock ranch, the valley farm, and the upland ranges. Even specialized crops such as sugar beets in the north and cotton in the southwest, the primary products of which are sugar and fiber, are directly related to range livestock production through their byproducts. Beet pulp, cottonseed cake, and other similar byproducts furnish an important part of the feed requirements for range livestock. Any program for the development of arable areas by irrigation must therefore take into consideration the range livestock industry where the climate, topography, and native vegetation are such that livestock production will always be an important part of the agricultural economy of the basin.

Grazing use of the Federal range is controlled by a system of permits and licenses to stock owners who also own or control private properties consisting of forage-producing lands or stock waters used in connection with the Federal range. Permits and licenses have been issued to 7,325 livestock operators for 3,486,000 head of livestock (cattle, horses, sheep, and goats) on grazing-district lands in the basin for various periods of the year. Two-thirds of the permittees and four-fifths of the livestock are in the upper basin area (above Lee Ferry), which contains 58 percent of the Federal range in the entire basin. Permitted use of the upper and lower parts of the basin is shown as follows:

	Upper basin	Lower basin	Total
Number of permittees	4,898	2,427	7,325
Number of livestock	2,913,000	573,000	3,486,000

Relationship of Range Management to Soil and Moisture Conservation

The Taylor Grazing Act of 1934, the Soil Conservation Act of 1935, and the President's Reorganization Plan No. IV of 1940 place a responsibility on the Grazing Service and the Department of the Interior to study soil erosion and surface run-off and to perform such work as may be necesary to stabilize the soil and conserve moisture in order to protect and rehabilitate areas subject to grazing administration.

Much of the silt carried in the streams of the Colorado River system and later deposited in Lake Mead or other reservoirs of the basin is picked up from the foothills and plains of the more arid portions of the basin as well as from the ravines and gorges of the steeply sloping mountain areas.

Since grazing districts are an important part of the Colorado River watershed, from which water is provided for the major reclamation projects, as well as for hun-

dreds of minor irrigation systems scattered through the basin, the protection of these watersheds is a most important function of grazing-district administraion. Watershed protection not only aids forage production for livestock use but it also promotes the conservation of both soil and moisture for the general benefit of the locality and the Nation.

The Grazing Service is undertaking to rehabilitate and promote the orderly use of lands which for the most part were abused through overstocking and exploitation during the time when the public domain was free and unregulated. Because of the advanced stages of deterioration reached by some of the lands prior to the initiation of regulated use, there is yet a sizable job to be accomplished in further protecting and improving the lands and their resources and in preventing further deterioration through the loss of forage, timber, water resources, and even the soil itself, incident to erosion and other destructive processes.

The principal means of rehabilitation and watershed protection by the Grazing Service are (1) range management and proper stocking; (2) fire prevention and control; (3) reseeding and range rehabilitation; and (4) mechanical treatments to retard erosion.

The soil and moisture conservation program has been limited during the past 3 years chiefly to maintain existing improvements, reseeding, and to related work requiring a minimum of critical materials. Extensive plans for postwar development of the range resources in this and other drainage basins have been prepared. These plans contemplate additional water developments, reseeding, fences, control of predatory animals and rodents, fire lookouts, and other fire control facilities. All of these activities are destined to have a direct influence on sedimentation of storage facilities and in the stability of important reclamation works.

Possible Effects of Additional Reclamation Development

The land pattern in the areas proposed for reclamation development is such that both tillable privately owned and public lands undoubtedly will be involved. This will result in the loss for grazing purposes of a considerable area of private and public lands in grazing districts. Such grazing losses will likely be more than offset by increased production from irrigated lands. It would appear therefore that neither the range users nor the Grazing Service would object to the decreased grazing-district range since such losses will be overcome by additional production resulting from the reclamation program.

In many instances it is probable that the development of the area through irrigation will actually relieve the remaining public ranges of a certain amount of grazing by reason of the production of more irrigated pastures and suppemental feeds for use by range livestock and farm animals, including dairy and work stock. Such additional feed can also be used to advantage in the finishing of cattle and sheep for market in localities adapted to such practices, thus providing more pounds of meat without increasing livestock numbers on the diminished acreage of range.

Local Grazing Service officials in each grazing district will furnish the Bureau of Reclamation with any needed assistance in working out practical farm and ranch units. Within the grazing-district areas proposed for reclamation development, stockmen own land and water upon which grazing privileges are based. In these areas it is felt that prior to final disposition of the public lands and water rights to new settlers a survey should be made to determine to what extent this program will disrupt or unbalance existing livestock outfits. An effort should then be made to permit operators who may lose grazing privileges as a result of the program to bring their year-long livestock operations into balance through securing some of the irrigable land and water rights if they so desire. In short, an attempt should be made to stabilize existing operations simultaneously with setting up new operational units. Failure to give such consideration may offset partially any benefits resulting from the program.

Although most of the results of the proposed reclamation program in the basin will be favorable from a Grazing Service viewpoint, there will undoubtedly be a considerable number of adjustments necessary in existing licenses and permits as a result of the program. A review of the proposed reclamation program indicates that the development program will be carried on in substantially all of the grazing districts of the basin. Accordingly, some of the public lands, which are now and which have been for a number of years in grazing allotments, will probably be removed from these allotments to be used in the reclamation program. In such instances it will be necessary to adjust grazing licenses and permits to include only areas which are not to be reclaimed for irrigation purposes.

In certain other areas new demands for public range grazing privileges will probably be made by newly created ranch and farm units lying adjacent to or in the vicinity of Federal range. Since most public ranges in grazing districts are now stocked to capacity, there is little likelihood of supplying new applicants with public-land grazing privileges except in special areas. Any activity on the part of new ranch and farm set-ups to gain public-land privileges will result in the necessary studies by the Grazing Service before any determination is made relating to demands for such privileges.

In still other areas stock ranches which have heretofore been used as base properties in connection with public-land grazing privileges are likely to be converted into farms under the proposed plan to irrigate all lands in the basin practicable of irrigation. Such conversion of hay and feed ranches into farms for the production of general

farm crops would probably lead to a considerable number of applications on the part of ranch owners to have the grazing privileges attaching to these ranches transferred to other ranches. The Federal Range Code provides for the transfer of public-land grazing privileges from one base property to another under certain conditions. It is therefore expected that some activity toward transfers of grazing privileges between base properties will result in this and other basins from the program of the Bureau of Reclamation to place new lands under irrigation.

Since complete details are lacking relating to the specific areas which will be reclaimed in the immediate future, it is impossible to make accurate estimates of all the work which will be necessary by the Grazing Service as a result of this new irrigation program. Accordingly, in addition to the three types of work above mentioned, there may be other work not now foreseen which should be given consideration in any estimate of necessary manpower and funds. In all of the new work anticipated, administrative and technical personnel of the Grazing Service will be required to make on-the-ground studies involving all licenses and permits which might be disturbed or all new applications which must be given consideration for grazing privileges. Such studies would involve both field and office work, together with statistical and narrative reports concerning the effects of the proposed irrigation plans on the grazing picture and steps to be taken to make the necessary adjustments with the least possible upset to the economy of the area generally. This additional work by the Grazing Service will also involve close coordination and planning among local representatives of both the Grazing Service and the Bureau of Reclamation in order that the programs of both agencies may be in harmony with respect to the over-all land-use situation in the affected areas.

Should the additional work to be placed on the Grazing Service be accomplished during the fiscal year 1946 as a result of the Colorado River Basin reclamation program, the full amount of money estimated as necessary for carrying on this work should be made available for use during that fiscal year. Estimated funds necessary to accomplish the Grazing Service work involved in anticipated adjustments during the fiscal year 1946 total $120,000 for the basin. This estimate is based on the premise that the program will not assume its full scope during the early stages of development.

BUREAU OF MINES

Program of the Bureau of Mines on Water Utilization

The mineral industry has an interest in the water of flowing streams as a source of water necessary for mining, milling, and extracting metals or minerals from their ores. Except for hydraulic mining, these demands are not large.

The power generated by flowing water is of great interest to the mineral industries whenever it can be generated at sufficiently low cost to compete with power at existing electrochemical centers. A very wide range of products can be made from very common raw materials and many products prepared that are almost impossible by any other technique. The emphasis must be on low cost of the power.

Whereas many mineral commodities are sparsely distributed and their mines have relatively short life, leading to the recognition by tax officials that a mine is wasting asset, the electrochemical industries are often based on raw materials available in abundance. This leads to more stable communities that can hope to survive indefinitely and not become ghost towns.

Mineral industries sometimes create nuisances in streams and the mitigation of these nuisances has included certain restrictive legislation largely by the State governments. Hydraulic mining of unconsolidated deposits of gold and other minerals is a highly efficient form of mining. However, it leaves the streams loaded with clay, soil, and heavier debris that causes annoyance to other interests farther down a stream. When planned in advance, an hydraulic mining enterprise can provide for complete or sufficient partial prevention of this nuisance. Mill tailings are not often turned directly into streams in the way they once were. While this was the cheapest way to get rid of them, history has too often recorded the profitable retreatment of impounded tailing as technologic advances made a retreatment economic. The mineral industries recognize the disposal of tailing into streams as shortsighted management and are glad to have the legislation that prevents such management by certain elements. Objectionable soluble salts like cyanides from gold mills or iron salts and acid in coal mine drainage waters are other nuisances recognized by the mineral industries and to the extent that these can be vented without injury to other interests are often allowed to continue but are best controlled only when there are certain restrictive laws designed to determine when a waste product becomes a pollution. It is the policy of the Bureau of Mines to cooperate in all possible ways to help determine these permissible limits and avoid destruction of units of the mineral economy by ultra restrictive measures.

Outside of the pollution problem the mineral industries come into little conflict with other interests in the utilization of water. The volume demanded is not large in comparison to the needs of irrigation, navigation, or the development of electric power. The existing priorities on water rights do not often conflict with mineral economy. However, its must be recognized that the average mine while of short relative life, is usually a site for more

concentrated production of wealth that builds up the community, particularly from the standpoint of transportation and similar facilities and leaves these as an inheritance to the long-lived agricultural interests. In an occasional case the water, power, and other services developed by a mining enterprise are separately operated under a separate corporation that can continue to serve adjacent communities after the mine is exhausted.

The organic act of the Bureau of Mines directs it to increase safety and efficiency in the mineral industries and prevent mineral wastes. Efficiency in the mineral industries demands conservative use of water and the utilization of water power wherever its use increases efficiency in the mineral industries. It is here that the greatest constructive effort can be exerted. Electrochemical practices of the remainder of the world are only beginning to be adopted and improved in the areas where large dams have made available low-cost power. The war has accelerated the building of dams, caused over-building of certain mineral industries like aluminum and magnesium, but only a feeble beginning has been made in the adaptation of hundreds of electrochemical and electrometallurgical techniques based on mineral raw materials. Much of the power is now developed and will soon be inviting new users. The duty of the Bureau of Mines is clear and it has organized within the last 7 years its electrotechnical laboratory at Norris, Tenn.; electrometallurgical laboratory at Boulder City, Nev.; and its electrodevelopment laboratory at Albany, Oreg., in the order named. It is part of the program to enlarge these laboratories and to work out the problems in adaptation of local conditions and local raw materials to electrical techniques. These three centers are expected to collaborate with the other services of the Government in the building up of electrochemical centers like that at Niagara Falls. While the war has provided problems and funds for plenty of constructive work these three centers should receive a regular peacetime appropriation to continue their work and help prevent another Muscle Shoals fiasco. Each laboratory can well use $500,000 per year for its regular work and special projects that demand separate appropriations for final proof should be thus separately funded.

While the programing of work like reclamation of water in streams for multipurpose use is something that can be specifically done, such a detailed program for research is difficult. Some of the researches prove fruitless and the time to arrive at an endpoint is unpredictable. The objective is definitely known and acknowledged to be desirable but the time table indefinite. What can be said is that the following main projects will be followed continuousy:

(1) Adaptation of known electric techniques to American raw materials, markets and transportation, wherever an economic result is thought possible. Example: electric melting of glass.

(2) Development of new products made uniquely possible by application of electrict power, like fused basalt.

(3) Development of metals and minerals available in abundance but not now utilized to the extent that they might, like titanium, zirconium, and other metals. The Bureau of Mines is already making a start on production of pure ductile titanium and zirconium.

Low-cost power and mineral development

The mineral industries in the Colorado River Basin constitute one of the most obvious outlets for power generated at multiple-purpose dams. Some of these industries are consumers of mechanical power for which ordinary industrial rates can be paid, but the electrochemical industries usually call for low-cost power, and commonly buy large blocks of power. Mining and processing centers using low-cost power build up communities and transportation. The communities increase demand for agricultural products of a greater variety than those that can be cultivated when there are fewer consumers near the farms. The need of attracting electrochemical industries in building up the area is so obvious that it needs no emphasis. The consideration that needs more attention is the fact that to attract industries to isolated localities the power must be priced attractively and rates should not be set at "all that the traffic will bear."

The State of Arizona is the largest copper producer and yet makes no finished copper. Electrolytic refining of most of the copper takes place almost entirely on the Atlantic seaboard with the exception of a portion that is refined near El Paso, Tex. Copper does not require much electric energy in its preparation and higher cost power can be tolerated. However, fuel is not cheap in Arizona. There is only one electric smelter of copper in the world and it is located in Finland where electric heat is used in place of fuel. An economic study of the opportunity for electric smelting and electrolytic refining in Arizona seems justified.

The metal magnesium requires a great deal of low-cost electric power for its preparation. The magnesium plant at Las Vegas, Nev., was erected hurriedly during the war and based on raw materials hundreds of miles north of the plant and with an expensive haul between mine and plant. Sea water is probably the cheapest source of magnesium oxide and magnesium chloride and is at present the most popular source. However, the hills near Las Vegas have huge amounts of dolomite of good quality, whose magnesia content might well be extracted by a number of good processes in order to make the plant attractive for permanent use. Contiguity of mine and reduction plant is of fundamental economic importance in any mineral industry.

Aluminum, another heavy power consumer, has not received the same enthusiastic attention that magnesium

TABLE CXXXV.—*Data based on U. S. Bureau of Mines exploration of mineral deposits in the Colorado River drainage basin*

Mineral area	Location: County	Location: State	Classification of deposits	Ore reserves	Tenor of ore	Important components	Method of exploration	Remarks
Manganese deposits				(1)	(2)			
Artillery Peak	Mohave	Arizona	Sedimentary	Large	Low grade	Manganese	Sampling, drilling, mining.	Reserve deposit important for future production.
Patagonia	Santa Cruz	do	Veins	Small	do	do	Sampling, trenching, mining.	Idle reserve deposits.
Parker	Yuma	do	Replacement	do	Medium grade	do	Sampling, mining.	Do.
Tombstone district	Cochise	do	Veins replacement.	do	Low grade	do	Sampling, drilling, mining.	Do.
Pershing mine	Sacuache	Colorado	Vein	do	do	do	do	Do.
Three Kids	Clark	Nevada	Replacement	Large	do	do	do	Large war-time producer. Operation handicapped by technical and operational factors.
Boulder City	do	do	do	Large	Extra low grade	do	do	Grade too low for consideration as a source of manganese.
Virgin River	do	do	do	Medium	Low grade	do	Sampling, drilling, trenching.	Idle reserve deposits.
Whedon mine	Imperial	California	Veins	Small	Medium grade	do	Sampling.	
Iron deposits				(3)	(4)			
Apache and Chediski	Navajo	Arizona	Replacement	Large	Low grade	Iron	Sampling, trenching drilling.	Idle reserve deposit.
New Planet	Yuma	do	do	Small	Medium grade	do	Sampling, drilling	Do.
Iron Mountain district (the majority of this district is outside the Colo. Basin area).	Iron	Utah	Contact metamorphic.	Large	do	do	Sampling, magneto-meter, drilling, mining.	Producer of 140,000 tons of ore per month for Colorado Fuel and Iron, Geneva Steel, Columbia Steel and several small steel operations.
Bull Valley	Washington	do	Veins	Small	do	do	Sampling, drilling.	Idle reserve deposit.
Eagle Mountain district.	Riverside	California	Replacement	Large	do	do	do	Do.
Lead, zinc, and copper deposits.				(5)				
Zonia mine	Yavapai	Arizona	Disseminated	Medium	Low grade	Copper	Sampling, trenching, drilling.	Do.
Old Reliable	Pinal	do	Breccia Pipe	do	do	do	Sampling, mining.	Do.
Aravaipa	Graham	do	Veins, contact metamorphic.	Small	Medium grade, low grade.	Lead, zinc, copper.	Sampling, drilling, mining.	Small producer.
Reward Zinc	Pinal	do	Replacement	do	Medium grade	Zinc	Sampling, drilling	Idle reserve deposit.
Amargosa	Pima	do	Breccia Pipe	do	Low grade	Molybdenum copper.	Sampling.	Do.
Christmas Copper	Gila	do	Disseminated	do	do	Copper	Sampling, drilling, mining.	Producer of 1,700 tons of siliceous fluxing ore per month.
San Manuel	Pinal	do	Disseminated	Extra large	do	do	Sampling, drilling	Virgin porphyry copper recently discovered and explored by the Bureau of Mines.
Big Four	Summit	Colorado	Vein	Small	Medium grade, low grade.	Zinc, lead	Sampling, drilling, mining.	Small producer.
Colorado Copper	Montrose	do	Disseminated	do	do	Copper	Sampling, mining	
Magnesium minerals				(6)				
Thompson magnesium.	Grand	Utah	Sedimentary	Large	High grade	Magnesium potash	Sampling, drilling	Idle reserve of magnesium-potash salts.
Miscellaneous metal and mineral deposits.				(7)				
Asbestos	Gila	Arizona	Replacement	Small	High grade	Asbestos	Sampling, mining	Limited producer of excellent quality asbestos.
Great Eastern	Clark	Nevada	Metamorphic replacement.	Medium	Extra low grade	Nickel	do	Grade of ore below operating possibilities.
Vanadium area of southeastern Utah and southwestern Colorado.		Utah and Colorado.	Replacement	do	Medium grade.	Vanadium, uranium.	Sampling, drilling, mining.	Largest producer of vanadium in the United States.

[1] Small equals 1 to 100,000 tons; medium equals 100,000 to 1,000,000 tons; large equals 1,000,000 to 10,000,000 tons; extra large equals 10,000,000 tons plus.
[2] Extra low grade equals 1 to 5 percent manganese; low grade equals 5 to 20 percent manganese; medium grade equals 20 to 40 percent manganese.
[3] Small equals 1 to 1,000,000 tons; medium equals 1,000,000 to 10,000,000 tons; large equals 10,000,000 to 100,000,000 tons.
[4] Low grade equals 40 to 50 percent iron; medium grade equals 50 to 60 percent iron.
[5] Small equals 1 to 100,000 tons; medium equals 100,000 to 500,000 tons; large equals 500,000 to 5,000,000 tons; extra large equals 5,000,000 tons plus.
[6] Large equals 100,000 tons plus.
[7] Small equals 1 to 10,000 tons; medium equals 10,000 to 70,000 tons.

has in the Colorado River Basin. The standard raw material does not occur in the basin and bauxite, if shipped from the north coast of South America through the Panama Canal would probably have to be converted into alumina, ready for reduction, at Los Angeles, as bauxite is treated in transit at Mobile, Ala., before sending the aluminum oxide up the railroad to the lowest cost power area. Cost of power is doubled by transmitting it from the power stations to Los Angeles and a pound of aluminum calls for about 10 kilowatt-hours in its production. Up to the present time alumina has had to travel to the low-cost power area for reduction.

Silicon, ferrosilicon, and silicon carbide require low-cost power, quartzite and low ash coke. In normal times all of the production is carried on at low power cost electrochemical centers where raw materials are nearby. These specifications can be met in the basin. Another consideration in connection with ferrosilicon is the fact that much

of the ferrosilicon produced is an intermediate product, used in the same plants for reducing other ores to produce low-carbon metals, alloys and ferroalloys. In this respect ferrosilicon in certain metallurgical industries is like sulphuric acid in the chemical industry, a key intermediate.

Manganese ores, generally of low grade, occur in several localities in Nevada, Arizona, and California and the Boulder City station of the Bureau of Mines has operated a pilot electrolytic manganese plant for several years, developing the fine points in technique of operation. Part of the manganese went to the mint for production of the new 5-cent pieces, designed to conserve nickel. The remainder has gone largely into tonnage tests of electrolytic manganese for the production of a number of low-carbon manganese alloys that show promise of large scale demand. As the scale of operation is increased the cost of production goes down and it should not be long before a commercial operation may be justified. The Three Kids manganese deposit near Las Vegas, Nev., is not far from the Basic Magnesium Co. magnesium plant where the necessary electrolytic equipment exists and only the tankage required by a manganese plant need be added. The magnesium plant is too large for normal peacetime demands and part of it might well be converted into a manganese plant.

Manganese ores and chromite ores can also be electrically smelted into the corresponding ferroalloys. Chromite occurs in many areas of California. Ferromanganese is required in the production of steel and finds a market in Los Angeles, San Francisco, and the other steel centers of the Southwest. Ferrochromium is needed in the chrome steels and chrome irons also made in the same areas. Electrolytic chromium is under development by the Bureau of Mines at Boulder City, Nev., and may well meet the need for a low carbon metal in production of such items as stainless steel.

These are only prominent examples of electrochemical industries that can be developed first of all for local needs and that later may reach more distant markets.

OFFICE OF INDIAN AFFAIRS

Indian Projects in the Colorado River Basin

Undoubtedly the oldest as well as the most extensive of the prehistoric Indian agriculture on the North American continent took place within the basin of the Colorado River. There is ample evidence to show that many hundreds of years ago the Indians were builders of substantial irrigation projects covering large acreages of land served by wide and numerous canals. The first recorded observations or historical accounts were those made by the Spaniards who ventured into this basin as early as the middle of the sixteenth century. The records of these explorers are replete with descriptions of Indian irrigation enterprises located at various places within the range of their travels, but the most imposing accounts were those concerning the activities of the Pimas along the Gila River and its tributaries. Elsewhere, however, throughout this whole general territory various Indians made efforts toward obtaining at least a part of their subsistence from "what they planted." With the coming of the whites and the subsequent confinement to reservations their earlier methods and customs have changed but through the assistance of the government their present agricultural activities have become considerably enlarged and modern methods are being adopted.

Within the Colorado River Basin, as defined in the text of this report, are 29 Indian reservations, 1 nonreservation Indian school, and 2 sanatoria. The Indian land totals 26,823,062 acres, of which 1,271,117 acres are in trust allotments, 24,557,040 acres in tribal ownership and 994,905 acres in Government ownership. The combined Indian population of the area totals more than 80,000, the majority of whom are full-bloods. The largest single group is the Navajos in Arizona and New Mexico, who total more than 50,000, practically all of whom are full-bloods.

These Indians and their resources in land and water rights are the special concern of the Federal Government. The Federal responsibility is specifically set out in various treaties, statutes, and agreements under which definite legal rights have been vested in individuals and tribes. There are also certain moral obligations of the Government to these Indians because of its disregard of their legal rights over a long period. These rights and obligations were recognized by the Colorado River Compact Commission as evidenced by article VII of the compact which reads as follows: "Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian Tribes." One of the Government's objectives in the development of the basin must be not only the protection of the Indian's purely legal rights but the discharge of its moral obligations as well.

With few exceptions the Indians within the Colorado River Basin exist on a much lower than average standard of living. The Federal Government is obligated to provide them with resources sufficient to enable them to attain economic independence at a level comparable with other citizens of the area. In some instances the full development of the Indian's present resources in land and water will accomplish this result. In other cases some additional resources must be acquired. Only after their economic independence at a reasonable level is attained can these Indians be expected to become integrated with the social, economic, and political life of the Nation. The guidance, protection, and assistance necessary to attain this end are Federal responsibilities.

In carrying out its obligation to establish these Indians on a firm economic base the first step of the Government should be to develop fully their present resources and educate them in the utilization and protection thereof. Many Indians are now in the armed services and many more are engaged in war work. This will undoubtedly result in an increasing number of Indians leaving the reservations permanently to engage in industry. The great majority, however, will continue to rely upon reservation resources for a livelihood. It is, therefore, urgent that all feasible Indian irrigation projects be developed fully at an early date. The need for this is so acute that unless detailed plans can be developed and construction work started immediately, conditions on most of the reservations will be such as to require the expenditure of large sums for relief or "made" work. This alternative must be avoided.

Tentative plans have been prepared over the past several years by the Irrigation Division of the Office of Indian Affairs for the development of all potentially irrigable Indian lands. Additional detail surveys and studies are required in connection with many of the projects before the ultimate areas can be defined definitely and adequate facilities designed. As the development of the Indian projects will have a material bearing on plans for the development of the basin as a whole they should be given an early priority when funds and manpower become available. The total area in Indian projects within the basin now supplied with irrigation facilities is 262,290 acres and plans contemplate expanding this area to 566,440 acres. The present average annual diversion is 1,034,303 acre-feet and the average annual diversion requirement for the ultimate area is 2,845,420 acre-feet. The areas and water use by States including non-Indian land within Indian irrigation projects are as follows:

Arizona

Within the Colorado River Basin in Arizona are 19 Indian projects containing a total of 148,070 acres now supplied with irrigation facilities. The ultimate irrigable area of these projects is estimated at about 291,055 acres making an increase of 142,985 acres for the State. The present diversion duty is approximately 610,470 acre-feet annually and the annual diversion requirement for the ultimate area is estimated at 1,671,342 acre-feet. The individual projects are described as follows:

Ak Chin.—This small project is located on the Maricopa Reservation near the town of Maricopa. The population of the reservation is 284 persons, most of whom are full-blood Maricopas. The reservation was established by Executive order of May 28, 1912. The water supply is secured from four wells equipped with electrically operated turbine pumps, installed in 1915. Approximately 1,500 acre-feet is pumped annually, and it is estimated that when the irrigated area, which is divided into small subsistence garden tracts, is cultivated more intensively the annual water requirement will increase to about 2,680 acre-feet. The distribution system consists of 10 miles of ditches and 2,600 feet of 16-inch concrete pipe. The irrigable area is 670 acres and present plans do not contemplate any material expansion on account of the relatively high cost of pumping.

Camp Verde.—This small project is located on the Camp Verde Reserve in central Arizona, the total area of which is 458 acres. The Indian population is 453. Water is secured by direct diversion from the Verde River. The present irrigable area is 170 acres, and it is planned to expand it to approximately 425 acres. The present annual diversion is 950 acre-feet and the average annual diversion requirement for the total area of 425 acres is estimated at 2,337 acre-feet.

Chin Chiu.—This small project is located on the Papago Reservation approximately 9 miles south of Casa Grande. The water supply is secured from two wells equipped with electrically operated turbine pumps installed in 1915. Approximately 615 acres are now being irrigated and present plans contemplate increasing the area to about 700 acres. The present pumping amounts to 1,550 acre-feet annually and the estimated average annual requirement for the ultimate area is 2,800 acre-feet. The estimated cost to complete the project is $5,000.

Cocopah.—This small project is located about 18 miles south of Yuma where approximately 530 acres were set aside by Executive order of September 27, 1917. Water is secured from the Yuma project of the Bureau of Reclamation through a lateral of about 100 second-feet capacity. The present annual water use is about 600 acre-feet and the estimated annual requirement for the ultimate irrigable area of 425 acres is 2,550 acre-feet. The estimated cost of completing the project is $5,000.

Colorado River.—This project is located on the Colorado River Reservation which was established by the act of March 4, 1865 (13 Stat. 559). It was on this reservation that the Federal Government made its first attempt to reclaim arid lands. The act of March 2, 1867 (14 Stat. 514), appropriated $50,000 for beginning construction of an irrigation canal from the Colorado River. Water was first turned into this canal on July 4, 1870, but due to faulty design and construction of the headgate and to the unusually high stage of the river the canal was destroyed for a considerable distance below the intake structure. Several attempts to reconstruct the canal and heading were made and it was actually used during 1871 when the stage of the river was such as to allow the diversion of water. On account of the great variation in the flow of the river, however, attempts to irrigate these lands by gravity diversion were discontinued and a pumping plant was installed in 1898. This plant was subsequently en-

larged to a capacity of 125 second-feet and has now been replaced with permanent diversion facilities.

The irrigable area extends about 45 miles north and south from near Parker to a point near the old town of Ehrenberg. The water supply is secured by direct diversion from the Colorado River at the Headgate Rock diversion dam. This is one of the major Indian projects in the Colorado River Basin and the first major project downstream from Boulder Dam.

The project is designed and is being constructed to irrigate 100,000 acres. The Headgate Rock Dam together with about 17 miles of the main canal and about the same length of the main drainage canal have been completed at a cost of about $8,000,000. Construction work was suspended at the beginning of the war with the exception of extending facilities to serve some 3,000 acres within the Poston relocation center of the War Relocation Authority. The present area supplied with distribution facilities is approximately 9,400 acres. Detail plans for extending the irrigation and drainage facilities including the construction of a small hydroelectric generating plant at a drop in the main canal, are complete. The estimated cost to complete the project for the ultimate area of 100,000 acres is $12,425,000. The present average annual diversion is approximately 56,400 acre-feet and the estimated annual diversion requirement for the ultimate area is 600,000 acre-feet.

The early completion of this project will assist materially with the rehabilitation of the Indians within the Colorado River Basin. Plans for the utilization of the area by Indians are being made in accordance with the act of March 4, 1865, which established the reservation for the Indians of the Colorado River and its tributaries. The completion of the project for the total irrigable area of 100,000 acres should be given a high priority when materials and manpower become available in the postwar period.

Fort Apache.—This project consists of several small units on the Fort Apache Reservation. Water is secured by direct diversion from White and Black Rivers and various tributary creeks. The area now being served is approximately 2,000 acres, and it is planned to extend irrigation facilities to an additional 4,000 acres, making 6,000 acres in all. The present annual diversion amounts to about 10,000 acre-feet and the estimated diversion requirement for the ultimate area is 30,000 acre-feet. The estimated cost to complete the developments is $47,000.

Fort Mojave.—This small project is located on the Fort Mojave Reservation across the Colorado River from Needles, Calif. The present project consists of 20 acres, which are irrigated by pumping. There is a total area of approximately 9,000 acres of Indian land lying along the Colorado River which will be susceptible of irrigation by pumping when low-cost power is available and the river becomes stabilized after completion of Davis Dam. This area would be particularly valuable for the production of pure seed at it is isolated from other agricultural areas. The present average diversion is 100 acre-feet and the average annual diversion for the ultimate area is estimated at 54,000 acre-feet.

Fort McDowell.—This small project is on the Fort McDowell Reservation north of Phoenix. The water supply is secured by direct diversion from the Verde River. The present area is 600 acres and it is contemplated to increase it to 1,400 acres through extension of the canal and lateral systems at an estimated cost of $16,000. The present annual diversion amounts to approximately 3,600 acre-feet and the annual diversion requirement for the ultimate area is estimated at 8,400 acre-feet.

Gila Bend.—At one time the Indians of the Gila Bend Reservation were irrigating a small area adjacent to the Gillespie project. These Indians are now mostly in the armed services or engaged in war work and the irrigated area is not used temporarily. There are 400 acres, however, which these Indians can reasonably be expected to utilize eventually. The water supply will be secured from the Gila River and the annual diversion is estimated at 2,400 acre-feet. The estimated cost of the development is $40,000.

Gila River.—Irrigation was practiced on the reservation by the Pima Indians in prehistoric times. The first historical record probably comes from the visit of Fra Marcus De Niza in 1539, who found a successful agricultural community of Pima Indians along the Gila River. Most of the irrigable lands within the reservation are included in the San Carlos project which is described separately, but approximately 7,400 acres outside the San Carlos project are being irrigated by Indians. This area is in small scattered tracts, the largest of which is the 1,080-acre Maricopa unit near the confluence of the Gila and Salt Rivers. Water for these scattered units is secured both by gravity diversion from the Gila and Salt Rivers and by pumping.

The total present irrigable area in these units is 7,400 acres, and it is planned to extend irrigation facilities to an additional 5,525 acres making 12,925 acres in all. The present annual diversion is approximately 37,320 acre-feet and the annual diversion requirement for the ultimate area is estimated at 77,955 acre-feet. The estimated cost of providing irrigation facilities for this additional area is $250,000. This additional development of Indian lands outside the San Carlos project will depend upon securing a supplemental water supply through the proposed delivery of Colorado River water to central Arizona.

Hopi.—Within the Hopi Reservation are eight small irrigation developments and several small garden tracts aggregating about 660 acres. It is planned to extend irrigation facilities to an additional 70 acres making 730 acres in all. Water is secured from miscellaneous small streams tributary to the Little Colorado River. The pres-

ent annual diversion is about 3,300 acre-feet and the annual diversion requirement for the ultimate irrigable area is estimated at 3,650 acre-feet.

Havasupai.—This small project lies in Supai Canyon near the western terminus of the Grand Canyon. A total of 175 acres is being irrigated and it is expected the area will be expanded to a total of 200 acres. Water is secured from springs and the present diversion is about 1,050 acre-feet annually. The annual diversion requirement for the ultimate area is estimated at 1,200 acre-feet.

Hualapai.—This small project is located on the Hualapai Reservation. At present 40 acres are being irrigated and it is planned to extend irrigation facilities to an additional 130 acres, making 170 acres in all. Water is secured by direct diversion from Big Sandy Creek, a minor tributary of the Colorado River. The present diversion is about 200 acre-feet annually and the annual diversion requirement for the ultimate area is estimated at 1,020 acre-feet.

Kaibab.—This small project is on the Kaibab Reservation. At present 40 acres are being irrigated from a spring. The annual diversion is estimated at 160 acre-feet and no expansion of the irrigable area or annual diversion is contemplated.

Navajo.—On the Navajo Reservation within the State of Arizona are about 45 small irrigation developments aggregating 13,740 acres. Twenty of these units totaling about 5,000 acres lie within the Little Colorado River watershed and 25 units with an area of about 8,740 acres are within the San Juan River Basin. It is planned to provide irrigation facilities for an additional 31,530 acres which will make the ultimate irrigable area within Arizona approximately 45,270 acres, about 23,265 acres of which will be in the Little Colorado River watershed and 22,005 acres in the San Juan watershed. The water supply is secured by direct diversion from miscellaneous streams and the present annual diversion is estimated at 68,700 acre-feet, of which 25,000 acre-feet is from tributaries of the Little Colorado River and 43,700 acre-feet from tributaries of the San Juan. The average annual diversion requirement for the ultimate area is estimated at 226,350 acre-feet of which 116,325 acre-feet will be from the Little Colorado River watershed and 110,025 acre-feet from the San Juan watershed.

Salt River.—This project is located on the Salt River Reservation which was set aside for use of Indians by the Act of February 28, 1859 (11 Stat. 401), and Executive order of June 14, 1879. The present irrigation project was started by the Indians in 1871 and has been improved and extended from time to time until at present the irrigable area is 9,800 acres. An additional 200 acres will be brought under the canal system within a short time, making a total project area of 10,000 acres. Water is secured through the canal system of the Salt River project built by the Bureau of Reclamation. Delivery of 17.5 second-feet constant flow is made through the Arizona Canal to lands lying north of the Salt River and 8.75 second-feet through the Utah Canal for lands in the Lehi district. In addition to this normal flow water the Indians are entitled to 20 percent of the storable water in the reservoir created by Bartlett Dam on the Verde River in accordance with a contract between the Office of Indian Affairs and the Salt River Valley Water Users' Association, dated June 21, 1935. This amounts to an average of approximately 20,000 acre-feet annually. The present diversion averages 39,200 acre-feet annually and the annual diversion for the ultimate area will average 40,000 acre-feet.

San Carlos project.—The San Carlos Indian irrigation project was authorized by the act of June 7, 1924 (43 Stat. 475–476), commonly known as the San Carlos Act. This act authorized the construction of the Coolidge storage dam on the Gila River and the merger, in whole or in part, of the 62,000-acre Florence Casa Grande project with the San Carlos project. The Coolidge Dam was completed in 1928. This dam creates the San Carlos Reservoir which has a capacity of 1,285,000 acre-feet. Water is diverted from the Gila River at the Ashurst-Hayden Dam above Florence and at the Sacaton Dam near Sacaton. In addition to the gravity supply the project operates about 85 turbine pumps which provide adequate drainage and augments the water supply for irrigation.

The project contains a total of 100,000 acres of which 50,000 acres are Indian lands within the Gila River Reservation and 50,000 acres of privately owned lands in the Florence-Casa Grande Valley. Water rights for the project lands were defined in a Federal district court decree entitled "Globe Equity No. 59" entered June 29, 1935. This decree known as the Gila River decree provides a water right with immemorial priority for 35,000 acres of Indian lands within the San Carlos project; a water right for 1,000 acres in the San Carlos Reservation with a priority second only to that of the 35,000 acres of Pima lands; water rights with varying priorities from 1868 to 1921 between privately owned lands in the San Carlos project and lands in the upper Gila Valley; and a right with a priority of not later than June 7, 1924, to the San Carlos project to store 1,285,000 acre-feet in the San Carlos Reservoir at all times.

The present average annual diversion for the project lands is about 370,000 acre-feet which has been the average flow available during the past several years. It is planned to secure a supplemental supply of about 230,000 acre-feet annually through the construction of the proposed Buttes Dam on the Gila River to store flood flows of the San Pedro River and partly from the Colorado River through facilities proposed to bring Colorado River water into the central valleys of Arizona. This will result in a total annual diversion of 600,000 acre-feet of which 450,000 acre-feet will be from the Gila River watershed and 150,000 acre-feet from the Colorado River.

The project works are complete with the exception of the proposed Buttes Dam and facilities for securing the supplemental supply from the Colorado River. The area actually irrigated each year varies with the available water supply which heretofore has been inadequate for the entire project area of 100,000 acres. The construction of these additional facilities should receive a high priority in the basin development and work started when materials and manpower become available in the postwar period.

San Carlos Reservation.—On the San Carlos Reservation 1,000 acres are under cultivation. The irrigable area includes several tracts, the principal ones being near Bylas and Calva on the Gila River and near the San Carlos Agency along the San Carlos River. Water is secured both by direct diversion and by pumping. The average annual diversion is 6,000 acre-feet. No substantial expansion either in the irrigable area or the diversion of water is contemplated.

San Xavier.—On the San Xavier Reservation near Tucson approximately 1,640 acres are being irrigated by direct diversion from the Santa Cruz River and by pumping. Irrigation was practiced by these Papago Indians before the area was first visited by Father Kino in the sixteenth century. It is proposed to increase the irrigable area from 1,640 to 1,700 acres. The present annual diversion amounts to 9,840 acre-feet and no increase is contemplated.

California

Within the Colorado River Basin in California are two Indian projects. The combined present irrigable area amounts to 7,975 acres and plans contemplate expanding this area to 22,350 acres. The present average annual diversion is 47,718 acre-feet and the diversion requirement for the ultimate area is estimated at 134,218 acre-feet. The two projects are described as follows:

Coachella Valley.—Within the Coachella Valley are three reservations which, under the Bureau of Reclamation plans, will receive water from the Colorado River through the Coachella Valley canal. These reservations are Augustine, Cabazon, and Torres-Martenez. There are at present approximately 125 acres in small tracts being irrigated on these reservations and it is planned to increase that area to 14,500 acres. The present water supply is secured from artesian wells and pumps and the average present annual diversion is 500 acre-feet. When the Coachella Valley canal is completed water for the larger acreage can be secured therefrom. The average annual diversion requirement for the ultimate irrigable area of 14,500 acres is estimated at 87,000 acre-feet. The estimated cost of providing the necessary irrigation facilities and subjugating the land is $4,350,000. This work should be accomplished as soon as possible.

Fort Yuma.—On the Fort Yuma Reservation 7,850 acres of irrigable land are included in the Yuma project of the Bureau of Reclamation. Water is delivered by the Bureau of Reclamation from its canal system. The present average annual diversion is estimated at 47,218 acre-feet. No expansion of the irrigable area or increase in diversion is contemplated. Some additional subjugation work is necessary to permit the irrigation of the total area and the economical use of water. The estimated cost of this work is $350,000.

Colorado

Within the Colorado River Basin in Colorado are two Indian projects. The combined present irrigable area amounts to 8,600 acres and plans contemplating expanding this area to 20,350 acres. The present average annual diversion is 43,000 acre-feet and the average annual diversion requirement for the ultimate area is estimated at 72,750 acre-feet. The two projects are described as follows:

Southern Ute.—On the Southern Ute Reservation 8,400 acres are now supplied with irrigation facilities of which 2,400 acres are in non-Indian ownership, and plans contemplate expanding the area to 19,850 acres of which 3,700 will be non-Indian. The water supply is secured from Pine River and tributary creeks. The present average annual diversion is 42,000 acre-feet and the average annual diversion requirement for the ultimate irrigable area is estimated at 70,250 acre-feet. The tentative estimated cost to provide irrigation facilities for the additional area is $860,000.

Ute Mountain.—On the Ute Mountain Reservation there are 200 acres being irrigated and plans contemplate expanding the area to 500 acres. The water supply is secured from Mancos Creek. The present average annual diversion is 1,000 acre-feet and the average annual diversion requirement for the ultimate irrigable area is estimated at 2,500 acre-feet.

Nevada

Within the Colorado River Basin in Nevada is one Indian project. This small project is on the Moapa Reservation and contains an irrigated area of 325 acres. It is proposed to increase this area to 600 acres. The water supply is obtained from the Muddy River. The present average annual diversion is 1,950 acre-feet and the average annual diversion requirement for the ultimate Indian area is estimated at 3,600 acre-feet. The work required to complete the irrigation facilities includes the construction of a small storage dam for irrigation and flood control. The estimated cost of this dam is $335,000, of which about $55,000 will be a charge against the Indian land, $135,000 will be allocated to flood control, and

$160,000 will be charged to the approximately 3,800 acres on non-Indian land which will be benefitted. In addition it is proposed to install a concrete pipe-distributing system for the Indian lands at an estimated cost of about $65,000.

New Mexico

Within the Colorado River Basin in New Mexico are five Indian projects aggregating 19,000 acres now supplied with irrigation facilities. It is proposed to increase this area to 133,000 acres. The present average annual diversion is 95,000 acre-feet and the average annual diversion requirement for the ultimate area is estimated at 655,000 acre-feet. The five projects are described as follows:

Jicarilla.—On the Jicarilla Reservation 800 acres are now being irrigated and plans contemplate increasing this area to 5,000 acres. The water supply is secured from LaJara and Dulce Creeks. The present average annual diversion is 4,000 acre-feet and the average annual diversion requirement for the ultimate area is 25,000 acre-feet. The estimated cost of providing irrigation facilities for the additional area is $250,000.

Monument Rocks.—Within the Navajo Reservation north of the San Juan River is a reasonably compact area of potentially irrigable land which is included in the proposed development of the Animas-LaPlata project by the Bureau of Reclamation. This potentially irrigable area totals 25,500 acres. It is estimated that the average annual diversion requirement would amount to 127,500 acre-feet. Detail surveys are required in order to define the area and prepare cost estimates. The cost of such surveys is estimated at $10,000.

Navajo.—Within the Navajo Reservation in New Mexico are about 30 small irrigation developments and several additional small projects are proposed for development. The present irrigated area aggregates 12,000 acres and the proposed additional developments total 10,500 acres making a total aggregate area of 22,500 acres. The water supply is secured from the San Juan River and numerous miscellaneous streams tributary to the San Juan River. The present average annual diversion is 60,000 acre-feet and the average annual diversion requirement for the ultimate irrigable area is estimated at 112,500 acre-feet. The development cost of these small projects including subjugating the land is estimated at about $2,000,000. Although additional surveys are required to define the areas and prepare accurate cost estimates, the cost of such additional studies will be approximately $10,000.

Shiprock.—Within the Navajo Reservation in the vicinity of Shiprock is a compact area of reasonably good land comprising 70,000 acres. Irrigation of this area would require the construction of a storage reservoir on the San Juan River together with a canal and lateral system. The Bureau of Reclamation has studied the possibility of constructing a storage dam on the San Juan River near the Colorado-New Mexico State line to form a 125,000 acre-foot reservoir, a diversion dam near Blanco, and a gravity conduit extending about 75 miles to the land. A pumping lift of about 100 feet would be required to irrigate part of the area which lies above the conduit location. The average annual diversion requirement for this project regardless of the plan adopted would be approximately 350,000 acre-feet. The estimated cost of the development is $21,000,000 or about $300 per acre.

Summary—Navajo

The need for the full and early development of all feasible irrigation projects on the Navajo Reservation is acute. Within the Navajo Reservation in Arizona and New Mexico there are approximately 30,000 acres now provided with irrigation facilities. Some of the many separate developments are merely floodwater projects and are of little value during years of extreme drought. Additional storage is required to provide a dependable water supply. Additional subjugation work also needs to be done in order to conserve water and make it possible for the Indians to carry on farming operations. With the full development of all feasible irrigation units on the Navajo Reservation in Arizona and New Mexico including the Monument Rocks area, the Shiprock area, and the miscellaneous small projects there would be a total of approximately 135,000 to 150,000 acres of irrigable land available for use by these Indians. The estimated cost of the new developments including the subjugation of land is $27,000,000 or an average of about $260 per acre for the new acreage.

Living on and adjacent to the reservation are approximately 52,000 Navajo Indians practically all of whom are full-bloods. This population comprises about 11,000 families. It is the obligation of the Government to provide these people with resources sufficient for them to attain economic independence at a reasonable standard of living. The present carrying capacity of the grazing range available to them is estimated at 611,000 sheep units. This would permit the grazing of approximately 70 sheep per family whereas at least 400 sheep per family are required to provide a minimum standard of living. Assuming that 3,000 of these Indian families will find their way into industry or otherwise secure their living off the reservation there remain 8,000 families to be provided for. With the range land divided equally they could each have not to exceed about 75 sheep per family. With the full development of all potentially irrigable lands totaling 135,000 to 150,000 acres it would be possible to assign an average of 15 to 20 acres of irrigable land to each

TABLE CXXXVI.—*Indian projects in the Colorado River Basin*

State project	Source of water supply	Irrigable area		Annual diversions	
		Present (acres)	Ultimate (acres)	Present (acre-feet)	Ultimate (acre-feet)
Arizona:					
Ak Chin	Wells	670	670	1,500	2,680
Camp Verde	Verde River	170	425	950	2,337
Chiu Chiu	Wells	615	700	1,550	2,800
Cocopah	Colorado River	100	425	600	2,550
Colorado River	Colorado River	9,400	100,000	56,400	600,000
Fort Apache	White River	2,000	6,000	10,000	30,000
Fort Mojave	Colorado River	20	9,000	100	54,000
Fort McDowell	Verde River	600	1,400	3,600	8,400
Gila Bend	Gila River	0	400	0	2,400
Gila River	Gila and Salt River	7,400	12,925	37,320	[1] 77,955
Havasupai	Spring	175	200	1,050	1,200
Hualapai	Big Sandy Creek	40	170	200	1,020
Kaibab	Spring	40	40	160	160
Hopi	Miscellaneous streams	660	730	3,300	3,650
Navajo	Miscellaneous streams	13,740	45,270	68,700	226,350
Salt River	Salt and Verde Rivers	9,800	10,000	39,200	40,000
San Carlos	Gila River	100,000	100,000	370,000	[1] 600,000
San Carlos Reservation	Gila and San Carlos Rivers	1,000	1,000	6,000	6,000
San Xavier	Santa Cruz River	1,640	1,700	9,840	9,840
Subtotal		148,070	291,055	610,470	1,671,342
California:					
Coachella Valley	Colorado River	125	14,500	500	87,000
Fort Yuma		7,850	7,850	47,218	47,218
Subtotal		7,975	22,350	47,718	134,218
Colorado:					
Southern Ute	Pine River and Creeks	8,400	19,850	42,000	70,250
Ute Mountain	Mancos River	200	500	1,000	2,500
Subtotal		8,600	20,350	43,000	72,750
Nevada:					
Moapa	Moapa River	325	600	1,950	3,600
Subtotal		325	600	1,950	3,600
New Mexico:					
Jicarilla	LaJara and Dulce Creek	800	5,000	4,000	25,000
Monument Rocks	San Juan River	0	25,500	0	127,500
Navajo	Miscellaneous streams	12,000	22,500	60,000	112,500
Shiprock	San Juan River	0	70,000	0	350,000
Zuni	Zuni River	6,200	10,000	31,000	50,000
Subtotal		19,000	133,000	95,000	665,000
Utah:					
Shivwits	Santa Clara River	70	85	420	510
Uintah	Uintah, Duchesne, Lake Fork and Whitewater Rivers.	77,000	77,000	232,000	232,000
Uncompahgre	White and Green Rivers	1,250	22,000	3,750	66,000
Subtotal		78,320	99,085	236,170	298,510
Total		262,290	566,440	1,034,308	2,845,420

[1] Includes a supplemental supply from the Colorado River in connection with the proposed Central Arizona development.

of the 8,000 families in addition to which each family could graze an average of 75 sheep. This would not solve all the economic problems of the Navajo but would raise his present standard of living considerably. Many of these Indians were in the armed services and many more were engaged in war work. Now the war is over these people must inevitably return to the reservations. Unless detail plans can be developed and construction work started on these proposed irrigation developments immediately, the conditions on this reservation will be such as to require the expenditure of large sums for relief or "made" work; this alternative must be avoided.

Zuni.—Within the Colorado River Basin is the Zuni Pueblo. On the pueblo lands 6,200 acres are now provided with irrigation facilities and it is proposed to expand the irrigated area to 10,000 acres. Water is secured from

the Zuni River, a tributary of the Little Colorado River. The present average annual diversion is 31,000 acre-feet and the average annual diversion requirement for the ultimate area is 50,000 acre-feet. Additional surveys and studies are necessary in order to define the ultimate irrigable area and prepare cost estimates.

UTAH

Within the Colorado River Basin in Utah are three Indian projects. The total present irrigated area is 78,320 acres and it is proposed to expand the area to 99,085 acres. The present average annual diversion is 236,170 acre-feet and the average annual diversion requirement for the ultimate area is estimated at 298,510 acre-feet. The projects are described as follows:

Shivwits.—On the Shivwits Reservation there are 70 acres being irrigated and it is proposed to expand the area to 85 acres. The present average annual diversion is 420 acre-feet and the average annual diversion requirement for the ultimate area is 510 acre-feet. The diversion is from the Santa Clara River.

Uintah.—On the Uintah Reservation there are 77,000 acres now provided with irrigation facilities. The average annual diversion is 232,000 acre-feet. The water supply for this project is secured from the Uintah, Duchesne, Lake Fork, and Whitewater Rivers. No expansion of the project area or increase in diversion is contemplated.

Uncompahgre.—On the Uncompahgre Reservation there are 1,250 acres now provided with irrigation facilities and it is planned to expand the irrigated area to 22,000 acres. The water supply is secured from the White and Green Rivers and several small creeks. The present average annual diversion is 3,750 acre-feet and the average annual diversion requirement for the ultimate area is estimated at 66,000 acre-feet.

SUMMARY

Table CXXXVI lists the various Indian projects by States, showing the present and ultimate irrigable areas, the present and proposed annual diversions in acre-feet, and the source of water supply.

Of the Indian projects listed, the Navajo in Arizona and New Mexico, and the Colorado River in Arizona, are of major importance in the rehabilitation of the Indians of the basin. The need for the early completion of all Indian projects is acute but the need for the full development of these two is most urgent and their completion should be given a first priority. The employment provided during the construction period will greatly alleviate the problems involved in the return of the Indians in the armed services and those engaged in war work to a peacetime economy.

GENERAL LAND OFFICE

Colorado River Basin

Since the organization of the General Land Office in 1812 the legislative framework built up in relation to public land policy has been incorporated in over 5,000 public land statutes. While many of these laws are concerned with the disposal of the public domain, much of the more recent legislation deals with the management and conservation of the remaining public lands and their resources, through leases, exchanges, and reservations.

Public domain in the Colorado Basin.—In the Colorado River Basin there are about 6,000,000 acres of unappropriated and unreserved public domain under the jurisdiction of the General Land Office. This is land area outside of grazing districts and other public land programs. The General Land Office exercises immediate and sole jurisdiction over all activities on these 6,000,000 acres. It has the major responsibility for all nongrazing activities in grazing districts and is responsible for all land titles and the administration of the mining and mineral leasing laws affecting lands in the national forests and within many other public land projects.

Within the Colorado River Basin there are eight major subareas in which the activities of the General Land Office will be largely concentrated to assist in obtaining the highest development and use of the resources in connection with the basin development program. These areas are (1) the Imperial Valley, California, (2) the lower portion of the Gila River in southwestern Arizona, (3) southern Arizona in the vicinity of Tucson, (4) central Arizona from Phoenix north to the Colorado River, (5) east central Arizona in the upper reaches of the Little Colorado River, (6) western New Mexico, (7) Duchesne and Carbon Counties, Utah, near the Green River, and (8) the Yampa River in northwestern Colorado.

There are many problems now being experienced in administering the public land in these areas largely arising from conflicts in use between irrigation and dry-farm crop production, grazing, homesites, and mining. As water and land improvements are made in the basin for expanding irrigation, power production, industrial production, and for numerous other purposes there will be many more and considerably intensified conflicts in land use. The administration of the public lands is also especially difficult and complicated due to the scattered nature of the tracts remaining in the public domain as the result of the earlier land disposal practices and the importance of many of these tracts in the utilization of adjacent lands in the localities in which they lie and in the area economy. The problem will be further complicated if large reservations of public lands for military purposes in the basin are released, requiring major readjustments in the use of large areas for peacetime pursuits.

Land classification.—Prior to designating land for a certain use, or acting upon an application for sale, settlement or exchange of public domain, it is required that such land be classified as to its suitability for the purpose intended. As a rule due to the limited staff and funds and the large area of public domain located in disconnected tracts throughout the 29 public land States, the past procedure has been mainly limited to the classification of a tract of land after an application is received from an individual or State. A few small areas of land have been classified or are in the process of classification as to the best adaptable use. While such area classifications are not static and are subject to modification, they provide a more practical basis for guiding public land policy and administration.

Only cursory information has been assembled for most of the unappropriated and unreserved public domain acreage. The absence of detailed physical and economic information has tended to handicap the General Land Office in its administration of public lands. The need for classifications embracing broader areas has become increasingly pronounced, especially for the integration of the development and use of the public lands with other lands. It is essential in the shift from war to peace and in the program for attaining the fullest development of the Colorado Basin that the land classification studies be made in greater detail and over larger areas. Considerably more detailed land classification is required to indicate better the purpose for which lands are physically and economically suited and to provide the necessary basis for determining the most feasible conservation and land management programs in line with local as well as national needs.

The physical survey will develop information on soils, relief, slope, drainage, elevation, water supply, and vegetative cover which involves considerable field work, mapping, and use of aerial photographs. Economic studies involve the relationships between those persons utilizing public and privately-owned lands; thus taking into consideration such factors as pattern of ownership, public improvements, private improvements, the type of grazing, forestry, industrial, agricultural, and other operations in the locality, and the cost and coordination of land development, utilization and management.

Coincident with and a part of land classification is the determination of which lands should be retained in public ownership and the planning of a unified management program that encourages the most productive use of these lands from a public viewpoint. Proper management encompasses policies dealing with multiple land uses, such as grazing, forestry, mining, and recreation.

The grazing of livestock is now the most important present use, but it is not in all instances the highest or the proper use, for many portions of the public lands. The most fruitful management program for grazing lands will be consolidation of ownership through planned exchanges and range improvements to promote the optimum retention of range resources after considering the protection of watersheds and the long-time benefit to stock ranches. The General Land Office has, in cooperation with lessees, made soil and moisture range improvements that enhance the value of the range resources, which is in the interest of the public as well as the individual. However, this improvement program has been on a small scale considering the total area involved and the need for such work. More specific land classification information is needed concerning areas where new sources of surface or ground water supplies can be developed to permit a better distribution of livestock on the range, and to open up areas that now have little value because of stock water problems. Extensive studies are needed on the carrying capacity of grazing land to indicate those areas where seeding programs are desirable or special precautions are required to minimize soil erosion. These studies will also denote the needs for flood control works and reservoir siltation reduction that may include the diversion and spreading of water on favorably located range lands and other measures. Irrigation development creates the need of additional land economic studies, for example, to determine the extent of disturbance on range management programs through the opening of newly irrigated lands. It is through such development that a vital need for increasing the range forage supply is created, since high feed production on irrigated lands must for the greatest economy be supplemented with grazing lands. The end result should lead the way for action programs involving (1) construction of stock-watering facilities; (2) building stock trails; (3) reseeding range lands; (4) construction of range fences; (5) rehabilitation of eroded range areas; and (6) better control of predatory animals.

Land classification on a broad basis will also bring into better focus the ownership and tenure pattern in localities concerned with composite range areas. It will provide the basis for a program designed to attain a better ownership pattern through acceleration of land exchanges that will make for better use of land and more efficient administration.

Practically no public lands remain that can be used for agricultural purposes in their natural state. Irrigation and drainage are in most instances necessary. Lands susceptible of irrigation at a cost within the reach of private enterprise have generally been reclaimed by the States, operating under the Carey Act, or by individuals or irrigation companies. The areas which may be reclaimed by irrigation through individual initiative are small and isolated. The irrigation of any considerable body of arid public land, such as commonly found in the Colorado Basin, now largely depends upon its inclusion in a project similar to those handled by the Bureau of Reclamation. Any public lands which are included in these projects are

withdrawn from other disposition by the General Land Office under the established public land laws. The problem of eliminating adverse ownership in the reclamation project areas has occurred in other river basins and it will probably be significant in the Colorado Basin. This can be alleviated through a properly planned land exchange program.

Through its land classification investigations in the Colorado Basin, the General Land Office, in cooperation with other agencies, will also endeavor to determine the extent and availability of surface and ground water supplies of those public lands capable of irrigation from the standpoint of soils and topography which are not to be included in the Bureau of Reclamation projects and ascertain the economic feasibility of irrigating these lands. Any of these lands which are found to be suitable for irrigation will be mainly utilized in connection with established farming and ranching enterprises.

The General Land Office administers sustained forest yield units on public lands in cooperation with individuals, corporations, States and their political subdivisions, and other Federal agencies. While it is not anticipated that much of the public land in the Colorado Basin will be found to be forest in character, consideration will be given to the establishment of sustained forest yield units, if feasible, for the protection of downstream lands and reservoirs from siltation and rapid water run-off and to promote improved management and utilization of any timber resources.

Technological advancement and other factors are constantly raising public lands to considerably higher uses which in the past have been considered to be practically worthless. Large areas of these lands are in demand for airfields, industrial plants and supplementary facilities for these plants, home, recreation, and business sites. The direction of public lands to these higher uses is an important phase of land classification in attaining maximum public benefits from the advanced development of the Colorado Basin.

Cadastral surveys.—As a part of the General Land Office's participation in basin developmental programs, it has been found that cadastral surveying must necessarily be expanded and accelerated to facilitate the land classification work and the activities of other participating bureaus. The amount of this work is especially dependent upon the needs of the cooperating bureaus.

The cadastral survey consists of the surveys of unsurveyed lands and the resurvey of lands surveyed many years ago for the reestablishment of boundary lines and obliterated corners. The only official surveys in the public land States are those made by the General Land Office. These surveys are a highly important function for identifying land in the basin developmental programs where dams requiring large reservoir sites and other improvements are involved.

The cadastral survey work in the Colorado Basin will not be limited to the unappropriated public domain as it is necessary in areas administered by other public agencies and even on patented lands. To promote greater efficiency in the conduct of the departmental basin programs there are indications that it might be helpful to expand the scope of the cadastral surveys to include surveys for purposes such as rights-of-way.

Mineral claims.—Title may be obtained under the mining laws for lands which contain metalliferous minerals. In many patents issued for public lands in recent years the mineral rights are reserved to the United States and the right to develop nonmetalliferous minerals may be acquired under the mineral leasing laws which are administered by the General Land Office.

Generally, the right to extract metalliferous minerals is established by a prospector through a claim which does not ordinarily come to the attention of the General Land Office until an application for patent is made or until some interest of the United States intervenes, but such claims when properly located, recorded in the applicable county office, and maintained and based on the discovery of mineral are valid. It is often found that reservoir sites include mining claims of record, though valueless for mineral and not properly maintained. The record must be cured before reservoir or other improvements can be made without danger of a suit for damages when the claim is flooded or otherwise endangered. The General Land Office makes investigations to determine validity of such claims and where the claims are found invalid conducts appropriate proceedings for the cancellation of the claim, and in many instances, at the request of the Bureau of Reclamation or other agencies, conducts investigations to determine the value of such claims as are found to be valid. There will in all probability be a pronounced need for these services in the development of the Colorado River Basin.

The right to exploit nonmetalliferous minerals, as indicated above, is handled by the General Land Office through leases. The return to the Federal Government from these leases is high, although the maintenance of the resource is the principal object in their administration.

All determinations relating to the mineral character of land are made in close cooperation with the Geological Survey.

Summary of proposed general land office program.—The General Land Office program for the Colorado River Basin will largely consist of land classification, cadastral surveys, and investigation of mineral claims.

Under the program of the General Land Office, land classification studies will be conducted primarily in the eight areas mentioned. They will be concentrated at the oustset on those areas where the departmental basin development activities demand the most immediate action. The work will be interrelated and coordinated

with the programs of other Federal agencies as well as the activities of States and counties. It is estimated that the classification can be completed for the 6,000,000 acres of unappropriated public domain in from five to six years with an annual expenditure of approximately $100,000. This figure only provides classification for small areas that may be released from military reservations. Should large areas of public land reserved for military purposes be returned to the jurisdiction of the General Land Office it may be necessary to extend the time for land classification.

Since the amount of cadastral survey work is so dependent upon the needs of the cooperating bureaus, it is difficult to estimate at this time. From the experience being gained in basin developmental programs, it is believed that the work will require annual expenditures in the Colorado River Basin during the planning and early development stage of approximately $150,000.

The work in connection with investigating and evaluating mineral claims is separate and distinct from land classification. This activity will be accomplished to a large extent at the request of the cooperating bureaus as a service function. The annual cost of the work for an expanded program in the Colorado River Basin may amount to approximately $60,000.

FOREST SERVICE

National Forests and Reclamation in the Colorado River Basin

About one-eighth of the Colorado River drainage basin is national forest land under the jurisdiction of the Forest Service, United States Department of Agriculture. These lands embrace most of the high mountains and plateaus which rim the basin. Though separated by extensive benchlands and foothills from the semiarid valley where most of the settlements are situated, the humid uplands provide a wealth of resources—especially water, but also wood, forage, minerals, wildlife, and recreation—which are essential to the economic development of the basin.

Although their areal extent is relatively small, the national forests play a disproportionately large role in basin water supplies, since they produce well over half of the annual (undepleted) water yields of the basin; and, in terms of unit yields, these forested mountain watersheds produce annual gross water yields ranging up to an acre-foot or even more per acre.

Man cannot control the amount of seasonal distribution of precipitation; but he can do much to influence the volume, quality, and duration of streamflow through a series of manipulations starting with watershed management, extending through stream developments, and ending with irrigation and domestic use at some distance from the source of the water. Of these cultural practices, watershed management stands high in importance because of the strong influence of watershed vegetation on water yields. On the one hand, vegetation reduces their total volume by consuming water, although in doing so it produces wood and forage to supply human needs; on the other hand, it influences the quality and distribution of stream flow by retarding floods and minimizing soil erosion and siltation. Hence good management involves the balanced use of forest and range resources so as to reduce water losses on the watershed and to produce a maximum volume of clear, usable water as well as to provide wood products, forage, wildlife, and recreation.

Thus it can readily be seen that water is the key resource of these national forests, and that the management of these forests for maximum production of usable water is one of the most important responsibilities of the Forest Service in the Colorado River Basin. For this reason the Forest Service has maintained as one of its dominant objectives the protection and management of the watershed lands under its jurisdiction. Wherever floods and erosion have been aggravated by misuse of these lands, good watershed management has required carefully restricted timber cutting and grazing use, or in some instances complete protection of the vegetative cover.

Recently research by the Rocky Mountain Forest and Range Experiment Station has begun to show that revised management practices on many high-altitude watersheds will not only result in an increase in stream flow but also will make available additional wood products. In a lodgepole pine forest, for example, like that which occupies about 3 million acres of water-yielding land in Colorado and Wyoming, the removal of commercially salable timber has increased the amount of water available for stream flow about 3¼ inches, or about 30 percent, over that which is ordinarily available on uncut virgin forest and without noticeable damage to the soil resource or the watershed as a productive area.

The implications of these results are clear, although their quantitative interpretation requires some qualification. If similar findings can be applied to other watersheds in the lodgepole pine type and to other high-altitude forest types in the Colorado River basin, substantial increases in water yield may be accomplished by properly managed timber cutting. As compared with the observed increases on local areas, however, their average magnitude over the national forests of the basin will be considerably smaller, because the full effect of timber cutting can be obtained on only a portion of the total area at a time. Other portions are inaccessible or must await the development of the most intensive management; others must be protected against floods and erosion; and still others will be producing a new forest after they have been cut-over. But even so, worthwhile increases in



COTTONWOOD CAMP, BIG PINEY, WYO.
High mountains in upper basin support extensive stands of timber

water yield would be obtained by any expansion on managed timber cutting. And, incidentally, millions of board feet of lumber and other forest products would be released for human use; simply because, on high-altitude forest lands, all the trees are not required to protect the watersheds.

In addition to these high-altitude forested watersheds, large areas of other watershed land at both high and low elevations are in depleted condition due to past and present overgrazing and cultivation. As a result these lands present a serious problem of erosion and siltation; a problem which is still by no means solved. However, research by the Intermountain Forest and Range Experiment Station has shown, on limited areas, that these eroding lands can be healed by changes or reductions in land use, by artificial revegetation, and by small mechanical structures often at an actual profit to the private owner. Watershed improvements such as these when extended to larger areas, will help minimize the silt content of our mountain rivers, and thus will actually increase the yield of usable, silt-free water, and will decrease excessive high irrigation project maintenance costs.

Up to now, because of limited funds and personnel, this watershed research on stream flow and soil stability problems has been restricted in scope and confined to relatively small areas. Hence the results do not yet permit broad recommendations for the management of other forests and range types or even other watersheds within a single type, because the most desirable management will change with variations in the forest, climate, and soil. Thus, in order to broaden the basis for establishing and modifying watershed-management policies, this productive research needs to be intensified and extended to other valuable water-producing areas. In addition, more information is needed on how to cut timber and graze forage in order to insure a future crop of wood and ranch products as well as water, and how to log and utilize the timber most completely and efficiently, so that private operators can afford to cut timber where and when it should be removed.

Since the production of ample supplies of usable water is intimately bound up with the other natural resources of the national forests, it is worth while also to appraise the relative importance of these other resources in the reclamation picture; to see how their use is associated with agriculture; and to evaluate the requirements of good resource management. The national forests, for example, contain nearly all of the merchantable and much of the nonmerchantable timber stands within the basin. The commercial timber volume totals about 30 billion board feet, the principal species being ponderosa pine, Douglas fir, lodgepole pine, fir, spruce, aspen, juniper, and piñon pine. These forest areas thus far have provided all of the rough lumber, posts, poles, and fuel-wood needed in the basin, but have furnished only about one-fourth of the demand for finished lumber. Inaccessibility, insects, disease, and fire have been the chief deterrents to a fuller use of the forest lands. Expansion of irrigation and related enterprises within this basin will create a demand for more timber products. Preliminary studies indicate that at least 50 percent of the finished lumber can be obtained locally, but detailed surveys and silvicultural investigations are needed to guide the more intensive utilization of the forested areas that will be required to reach this goal.

The herbaceous and shrubby forage on the national forest lands constitute an important part of the year-round food supply for a large range livestock industry within the basin. These lands are grazed by about one-third of a million cattle and 2 million sheep. A small portion of these animals graze year-long on parts of some of the forests in the lower basin. Most, however, graze on the forests only during the summer season and are then moved to adjacent ranges and farm pastures, fields, and feed lots for the remainder of the year. A dominant fact about the national forest range lands is that they are now fully stocked and in local areas are overstocked. Future



HAULING LOGS, ASHLEY NATIONAL FOREST

Timber resources will be more fully utilized with basin development

irrigation developments in the basin therefore should be planned with a view toward balancing the amount of pasturage, hay, and grain feed to be produced on the new farms with the sustained grazing capacity of the range lands.

The national forests are the home of big game, fish, and upland birds. Generally speaking there is room for more game on these lands except for restricted localities where big game populations, especially deer, have become excessive. Expansion of irrigation agriculture by regulation of stream flow and occupation of the winter grazing lands of deer will encroach upon the habitat of both fish and game. Moreover, expansion of settlement no doubt will increase the number of hunters and fishermen. These prospective impacts will require intensification of wildlife management on the national forests with a view toward eliminating local overpopulations of game and providing greater numbers on other areas which are now deficient.

The recreational opportunities on the national forests have long been an attraction for the general public. The number of forest recreationists increased by leaps and bounds during the prewar years. This trend will be revived after the war and any expansion of irrigation and related enterprises within the basin no doubt will augment this trend. The Forest Service is preparing to accommodate these visitors with adequate facilities. However, experience has demonstrated that man-caused forest fires mount rapidly with each increase in number of visitors. Obviously, any expansion of settlement within the basin which results in increased fire hazard will require intensified fire control to prevent damage to the forest, range, wildlife, recreation, and watershed protection values on the national forest lands.

The national forests already have contributed to the settlement and development of this basin area. Expansion of settlement through new irrigation and related projects will result in heavier demands upon all national forest resources. These increased demands in turn will require intensification of research, management, and protection in order that the wild lands may continue to contribute to the economy and welfare of the basin.

FEDERAL POWER COMMISSION

Power Resources of the Upper Colorado River Basin

Colorado, Utah, and Wyoming.—Water to transform through irrigation the latent soil resources of the arable portions of the Colorado River drainage in the upper basin States and the potential power, developed as a by-product of irrigation and river regulations, to transform treasures of past ages buried in the rocks of the basin into products of industry, should be the objectives of current studies by Federal and State agencies. Both the water and power possibilities are of such magnitude and importance that they should be developed simultaneously to improve the economic conditions of the area and add to the wealth of the Nation.

The use of these prime resources cannot be fully or soundly planned without a prior complete inventory of all of the other resources of the basin. There are physical limitations to the extensive use of water for irrigation within the area which are receiving study by interested agencies. The irrigation possibilities now are fairly well known. Lack of personnel during the war period has prevented the Commission's staff from as adequately studying the power possibilities and uses. Such planning activities are properly of the postwar period and are high in the list of planned studies by the Commission's San Francisco regional office.

These will include investigations of uses to which power developed in the Colorado River Basin as a byproduct of other water uses may be put; first, to extend existing industries and to create new industries within the upper basin which will make the products of the soil and mines

available for the use of man; and second, to supply the power requirements in neighboring areas, especially in the developed area along the Wasatch front. These studies will contemplate the development of the raw materials from the soil and mines as a first step only, followed by those industries and processes that produce finished products from the raw materials. The objective will be to produce through the power and material resources of the basin a balanced economy.

Coal and oil shales are presently known resources of the area capable of influencing to a great extent the basin economy. Oil and gas possibilities are now being explored. These fuels for a time may offer competition with hydroelectric developments, especially so should steam or gas turbine development permit the use of these fuels in electric production more economically than at present. Other important uses for these fuels are continuously being developed and although the extent of the deposits appears unlimited at the present time, sound economic planning may reserve these great resources for higher uses. Hydro- and fuel-electric plants, therefore, may well supplement each other in any plan of basin development.

The power possibilities inherent in the Upper Colorado should be so developed ahead of the demand as to provide an incentive for the development of the basin's resources, to make increased agricultural development possible, and to permit a fuller life for those within the area. The replacement of power now generated during the nonirrigation season in plants located on the Wasatch front by Colorado River power, appears to offer possibilities for large economic gains. Water now wasted in the Great Salt Lake could then be utilized to irrigate thousands of acres of additional lands, creating new homes and providing food for those needed to man the industries made possible by the development of the basin's resources.

The development of the power resources of the Colorado River Basin may have a profound effect on the program of development in adjoining areas, affecting power markets in Colorado, Wyoming, Idaho, and Arizona, and, by present interconnections, even in California, Montana, Washington, and Oregon. Utah at present depends in large measure for its power supply upon importations from Idaho. A survey of the power market and supply of any area must take account of conditions far distant from the immediate area under consideration.

In any broad study of the ultimate development of the Colorado River in the upper basin States, consideration must also be given to the necessary transportation system. The Upper Colorado area is completely surrounded by high mountain ranges and the major streams enter and leave through deep, impassable gorges. As the resources are developed the transportation systems must be greatly extended. Electric power may assist materially in improving and extending existing transportation facilities.

These and other possibilities are well recognized. Such analysis as is possible within the limits of the personnel available will be undertaken to the end that the power resources may contribute their full share to the development of the region without conflicting with the uses of other resources nor detrimentally affecting other important water uses.

Power Resources of the Lower Colorado River Basin

Arizona, California, Nevada, and New Mexico.—In this region water for irrigation and domestic supply is extremely valuable and must be very carefully controlled and utilized. Without development of the water resources, this region will remain forever static, mostly in the form of desert. The irrigation possibilities are vast when it is considered that only a very small percentage of this latent, fertile area is under irrigation. The highly successful irrigated areas in Arizona and southeastern California are evidence of the desirability of such development. Likewise, the long-distance transmission of domestic water to large urban areas in southern California indicates that the water of the Colorado is virtually the lifeblood of our Southwestern States.

Even after water is supplied from the Colorado to the lands or is transmitted to urban centers, there is still an enormous amount of potential hydroelectric power which should be developed along with irrigation to reduce the cost of land development and to develop a balanced economy in the region. Most of the undeveloped power projects are very large, and in some instances step construction may be in order.

The Commission's staff has made detailed studies of several power sites on the main Colorado and certain of its tributaries. Although some of the sites, for instance Bridge Canyon and Glen Canyon, are great distances from present load centers, large blocks of power could be used for pumping, and development of the large mineral (magnesium chloride and other) resources of southern Utah. The balance of this power could be transmitted to Boulder for use there, and to Arizona; and Boulder power could be transmitted in its entirety to California. Furthermore, the art of power transmission is being steadily developed, which no doubt in time will allow direct transmission to large load centers.

To develop and improve the economy of the region in all its phases and to add in the greatest measure to the wealth of the Nation should be the objective of the State and Federal planning agencies. To this end, the first step should be to collect all available information relative to the region, its resources, and its potential markets. The Commission's staff has prepared an intensive study pertaining to the economy and the development of Arizona. After the war, when manpower is available, the Commis-

sion's staff in San Francisco plans to look further into the possibilities of this and adjacent regions.

Both the irrigation and power possibilities for the Lower Colorado River are fairly well known and have been studied by several agencies; but a great deal of planning is still necessary to coordinate properly the various uses of the water to obtain the greatest over-all and equitable benefits to the States involved and to the Nation. Such studies would include investigations of uses to which power produced in the Lower Colorado River Basin, as a byproduct of irrigation and other uses, may be put. The expansion of existing industries and the creation of new industries, thereby developing the products of the soil including minerals, is the first step. This would be followed by studies of industries which would produce finished products from the raw materials, thereby obtaining, through the use of irrigation power, industries, and other uses, a balanced economy in the basin.

Extensive coal and oil shale deposits in Utah may also be an important influence in the basin economy. It may be that these fuels will offer some competition to hydroelectric development. However, it is believed that they will be found most useful in furnishing steam support to the hydroelectric developments during critical periods.

In order to provide rapid development and industrial growth in the Lower Colorado River Basin, the inherent hydroelectric as well as irrigation possibilities should be developed ahead of the demand. This will provide incentive for the development of the basin's resources and will accelerate agricultural and industrial development. Experience has shown that it is not necessary to have a large existing market before constructing hydroelectric projects. This is borne out in the case of the Columbia River Basin and the extensive TVA development.

Further possibilities of development aside from those discussed above are recognized, flood control being one of the most important. Such analyses, as are possible with the personnel available in San Francisco, will be made of the power resources taking into account the economic and orderly development of the region and the recognized higher use of water for land development, domestic supply, and other important uses.

The following reports on the Colorado and its tributaries and adjoining areas, have been prepared by the Federal Power Commission's staff:

(*a*) Report on State of Arizona's application for preliminary permit to develop power on the Colorado River at Bridge Canyon, by E. W. Kramer, May 31, 1940, and John S. Cotton, January 1, 1942. (This report also deals with, to a limited extent, Glen Canyon, Davis and Parker projects.)

(*b*) Report on Bill Williams River Project, by John S. Cotton, September 1943.

(*c*) Report on application on Mineral County, Nevada, Power system, by W. A. Froggatt, October 1942.

(*d*) Gila River Power Investigation, by Neil F. Meadowcroft, August 1943.

(*e*) Arizona Power Survey, Federal Power Commission Staff, March 1942.

Water Supply, Colorado River

APPENDIX I

Water Supply, Colorado River

Historical Flow at Lee Ferry

The Colorado River Compact made allocations of Colorado River Basin waters between the upper and the lower basin, with Lee Ferry, below the mouth of the Paria River near the Utah-Arizona boundary, the point of division.

Systematic stream-flow records have been secured at the Lees Ferry gaging station on the Colorado River above the mouth of the Paria River since June 1921 and on the Paria River at its mouth since October 1923. The sum of the records secured at these two stations determines the flow at the point "Lee Ferry" described in the Colorado River Compact. To determine the flow at this point prior to the period of record at Lees Ferry estimates were made, using the results of stream-flow measurements on the principal tributaries (Colorado at Cisco, Utah; Green at Little Valley, Utah; and San Juan at Farmington, N. Mex.) since 1897 and on the main stem of the Colorado River at stations below Lees Ferry, where records have been maintained as follows:

Hardyville, Ariz., May 1905 to September 1907.
Yuma, Ariz., Since January 1902.

For the years 1897–1901, inclusive, the estimated flow at Lee Ferry is based entirely on the records of the principal tributaries, with due allowance for unmeasured gains between the points of measurement on these tributaries and Lee Ferry. For the years 1902 and 1921, inclusive, the estimate considered both tributary flows and flows at downstream gaging stations, with due allowance for both measured and unmeasured gains and losses between Lee Ferry and the point of measurement. When basing the estimate on the Yuma record, allowances were made for the flow of the Gila River at its mouth and for diversions by the Yuma project.

The following table shows the recorded and estimated annual flows of the Colorado River at Lee Ferry for the years 1897–1943, inclusive. It also shows the combined flows at the principal tributaries and at the main stem base station used in making the estimates. Because of the numerous estimates necessary in extending the record, the flow for any individual year may be considerably in error, but the long-time average flow is believed to be reasonably correct.

TABLE CXXXVII.—*Recorded and estimated historical discharges—Colorado River at Lee Ferry*

Calendar year	Main-stem station		Sum of Colorado River at Cisco, Green at Little Valley, and San Juan at Farmington (thousand acre-feet)	Historical flow, Colorado River at Lee Ferry [1] (thousand acre-feet)
	Name of station	Recorded flow (thousand acre-feet)		
1897 [2]			18,721	19,797
1898 [2]			12,206	12,948
1899 [2]			16,925	17,899
1900 [2]			11,996	12,686
1901 [2]			12,925	13,668
1902 [2]	Yuma, Arizona	7,959	8,245	8,454
1903 [2]	do	11,328	12,550	12,346
1904 [2]	do	10,118	12,505	11,675
1905 [2]	do	19,712	13,800	15,290
1906 [2]	Hardyville, Ariz	19,162	18,131	18,656
1907 [2]	do	21,547	20,755	21,179
1908 [2]	Yuma, Ariz	13,688	10,852	12,065
1909 [2]	do	25,975	20,543	23,295
1910 [2]	do	14,335	12,392	13,583
1911 [2]	do	17,840	14,688	16,473
1912 [2]	do	18,406	17,686	18,393
1913 [2]	do	11,748	12,394	12,581
1914	do	20,684	18,206	19,868
1915	do	14,641	10,964	12,396
1916	do	23,140	16,865	18,380
1917 [2]	do	20,598	19,918	20,436
1918 [2]	do	13,158	13,373	13,775
1919 [2]	do	10,747	9,980	10,611
1920 [2]	do	21,444	18,764	20,387
1921 [2]	do	19,428	18,728	19,572
1922				16,198
1923				16,868
1924				11,707
1925				12,412
1926				13,080
1927				17,549
1928				14,714
1929				19,632
1930				12,414
1931				6,229
1932				15,180
1933				9,750
1934				3,966
1935				10,283
1936				12,145
1937				12,006
1938				15,661
1939				8,872
1940				7,617
1941				17,888
1942				14,809
1943				11,435
Average				14,400

[1] Determined in following manner: 1897–1901, estimated from flow of principal tributaries; 1902–1921, estimated from flow of principal tributaries, and flow at main-stem station; 1922 and 1923, flow at Lee Ferry increased by estimated discharge Paria at mouth; and 1924–1943, Colorado at Lee Ferry plus Paria at mouth.

[2] Flow at one or more base stations on principal tributaries estimated in whole or part by comparison with records elsewhere on stream.

TABLE CXXXVIII.—*Acreage irrigated above Lee Ferry*

Year	Colorado	New Mexico	Utah	Wyoming	Totals	Rounded totals	Source of data
1899 [1]	323,000	15,000	77,000	100,000	515,000	515,000	Census.
1902	417,839	20,467	80,778	118,566	637,650	638,000	Do.
1909 [1]	615,000	32,000	169,000	195,000	1,011,000	1,011,000	Do.
1919	766,532	43,825	332,984	211,507	1,354,848	1,355,000	Do.
1922	800,000	42,000	370,000	235,000	1,447,000	1,447,000	Reclamation.
1929	856,413	40,253	324,681	228,699	1,450,046	1,450,000	Census.
1935 [2]	767,060	32,190	276,630	236,070	1,311,950	1,312,000	Reclamation.
1939	844,494	36,178	305,628	273,971	1,460,271	1,460,000	Census.

[1] Estimated from Census data by counties.

[2] Field surveys conducted during years 1932 to 1938, inclusive.

Past Upstream Depletion at Lee Ferry

The historical discharges shown in the preceding table represent the flow of the Colorado River as it occurred each year. If the same meteorological and climatological conditions of any particular year had occurred in the past, prior to the inception of irrigation development, the resulting stream flow would have been greater by an amount equal to past depletions due to irrigation consumption, reservoir evaporation losses, and transmountain diversions from the basin.

The history of past irrigation development in the Colorado River watershed above Lee Ferry is shown in the following table, which was taken largely from reports of Bureau of Census and from field surveys conducted by the Bureau of Reclamation.

With the exception of the 1935 areas, which were determined by plane-table surveys in the field, information on the area irrigated for each year reported was secured largely from information furnished by individual farmers, irrigation organizations, and State officials. The results are in fairly close agreement with the actual field survey made by the Bureau of Reclamation in 1935 (work in progress from 1932 to 1938, inclusive).

Since the Census data are available for a number of years, these have been used as the basis of estimating the past depletion due to irrigation within the basin. A uniform rate of increase in irrigated area has been assumed for the intervening years shown by the Census figures, except that all of the increase between 1919 and 1929 was assumed to occur between 1919 and 1922. The acreage irrigated since 1939 has been assumed to be the same as that shown by the Census as irrigated in 1939.

From experimental data on Reclamation and other projects the average annual depletion for the area irrigated above Lee Ferry has been estimated at 1.5 acre-feet per acre. In years of high run-off there is a tendency for overdiversion of stream flow, with a corresponding increase in depletion, particularly when reservoirs are available; conversely, in years of low run-off there are declines in the normal quantities of water available for diversion with a corresponding decrease in depletions. Allowances have been made for these conditions and for the year-to-year regulatory effect of the reservoirs by varying the normal depletions by an amount which is proportional to one-half of the divergence of the annual undepleted flow at Lee Ferry for the year in question from the mean annual undepleted flow.

In 1945 there were 80 reservoirs in the Upper Colorado River Basin having capacities of 1,000 acre-feet or more, with an aggregate storage capacity of about 1,080,000 acre-feet. In addition there are numerous small reservoirs of less than 1,000 acre-feet capacity each. No separate allowance has been made in this study for evaporation losses from the existing storage reservoirs above Lee Ferry. As indicated by the preceding table the acreages reported irrigated by the Bureau of Census in 1929 and 1939 are somewhat in excess of the acreage determined by actual field survey by the Bureau of Reclamation in 1932–38. In view thereof the past irrigation depletion, computed as described herein, is assumed to be adequate to include past evaporation losses from reservoirs above Lee Ferry.

Transmountain Diversions

Data on transmountain diversions now exporting water from the Colorado River watershed above Lee Ferry are summarized in the following table:

TABLE CXXXIX.—*Transmountain diversion above Lee Ferry*

Name of diversion	Basin where water is used	First year of operation	Present average annual diversion (acre-feet)
Grand River Ditch	South Platte	1903	19,000
Moffat Tunnel [1]	do	1936	27,000
Jones Pass Tunnel [2]	do	1940	6,000
Busk-Ivanhoe Tunnel	Arkansas	1925	5,900
Wurtz Ditch	do		2,000
Twin Lakes Tunnel [3]	do	1935	32,000
Tarbell Ditch	Rio Grande	1914	2,000
Daniel Creek Ditches	Bonneville		4,000
Strawberry Valley	do	1913	66,000
San Pete	do	1936	8,000
Miscellaneous small diversions. [4]	Various	Various	14,000
			185,000

[1] Project under construction. Average diversion for 1936–43, inclusive.
[2] Project not fully developed. Average diversion for 1940–43, inclusive.
[3] Project not fully developed. Average diversion for 1935–43, inclusive.
[4] Earliest diversion made in 1880.

To make allowance for the tendency to overdivert in years of high run-off and for shortages in years of low run-off the actual diversion for any particular year is assumed to deviate from the normal by an amount which is proportional to one-half the deviation of the undepleted stream flow at Lee Ferry from the normal.

TABLE CXL.—*Estimated virgin flow Colorado River at Lee Ferry*

[Thousand acre-feet]

Calendar year	Historical flow Colorado River at Lee Ferry	Estimated normal depletions		Estimated actual upstream depletion	Estimated virgin flow at Lee Ferry
		Irrigation within basin	Export from basin		
1897	19, 797	650	5	741	20, 538
1898	12, 948	711	5	658	13, 606
1899	17, 899	772	5	836	18, 735
1900	12, 686	834	5	764	13, 450
1901	13, 668	896	5	853	14, 521
1902	8, 454	957	6	751	9, 205
1903	12, 346	1, 036	6	948	13, 294
1904	11, 675	1, 118	11	1, 005	12, 680
1905	15, 290	1, 197	21	1, 230	16, 520
1906	18, 656	1, 276	21	1, 450	20, 106
1907	21, 179	1, 358	21	1, 655	22, 834
1908	12, 065	1, 437	21	1, 327	13, 392
1909	23, 295	1, 516	21	1, 960	25, 255
1910	13, 583	1, 568	21	1, 535	15, 118
1911	16, 473	1, 620	22	1, 740	18, 213
1912	18, 393	1, 671	22	1, 902	20, 295
1913	12, 581	1, 724	30	1, 646	14, 227
1914	19, 868	1, 774	35	2, 127	21, 995
1915	12, 396	1, 826	55	1, 760	14, 156
1916	18, 380	1, 878	85	2, 225	20, 605
1917	20, 436	1, 929	105	2, 449	22, 885
1918	13, 775	1, 982	105	2, 058	15, 843
1919	10, 611	2, 032	115	1, 890	12, 501
1920	20, 387	2, 080	115	2, 651	23, 038
1921	19, 572	2, 127	115	2, 652	22, 224
1922	16, 198	2, 175	115	2, 457	18, 655
1923	16, 868	2, 175	115	2, 508	19, 376
1924	11, 708	2, 175	115	2, 120	13, 828
1925	12, 411	2, 175	115	2, 171	14, 582
1926	13, 080	2, 175	115	2, 221	15, 301
1927	17, 551	2, 175	117	2, 560	20, 111
1928	14, 714	2, 175	120	2, 350	17, 064
1929	19, 632	2, 175	120	2, 723	22, 355
1930	12, 414	2, 175	120	2, 175	14, 589
1931	6, 229	2, 175	120	1, 707	7, 936
1932	15, 180	2, 175	120	2, 386	17, 566
1933	9, 750	2, 175	120	1, 973	11, 723
1934	3, 966	2, 175	120	1, 535	5, 501
1935	10, 283	2, 190	135	2, 043	12, 326
1936	12, 145	2, 190	160	2, 212	14, 357
1937	12, 006	2, 190	170	2, 212	14, 218
1938	15, 661	2, 190	180	2, 508	18, 169
1939	8, 872	2, 190	180	1, 973	10, 845
1940	7, 617	2, 190	180	1, 878	9, 495
1941	17, 888	2, 190	185	2, 688	20, 576
1942	14, 809	2, 190	185	2, 447	17, 256
1943	11, 435	2, 190	185	2, 180	13, 615
Mean	14, 400	1, 786	87	1, 870	16, 270

Virgin flow at Lee Ferry

Table CXL shows the estimated normal depletions due to irrigation development and transmountain diversions, the estimated past depletion above Lee Ferry (differing from the sum of estimated normal depletions by annual adjustments explained in preceding paragraphs) and the virgin (or reconstructed undepleted) stream flow at Lee Ferry for the 47-year period 1897 to 1943, inclusive.

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Net Inflow between Lee Ferry and Boulder Dam

Between Lee Ferry and Boulder Dam there are about 55,000 square miles of drainage area, most of which is desert plateau. The two main tributaries in this area, the Little Colorado and Virgin Rivers, arise in the mountains and high plateaus bordering the basin; however, their principal source of run-off is from the torrential rains, which are characteristic of this locality. The Colorado River also receives water from numerous creeks and washes and from springs along the bed and sides of the deeply entrenched river channel.

From a study of the characteristics of the drainage area and by comparing discharges at Lee Ferry, Bright Angel (Grand Canyon), and Boulder Dam for the relatively short period when these stations were operated concurrently, prior to the storage of water in Lake Mead, it is concluded that about one-half of the net inflow between Lee Ferry and Boulder Dam occurs between Lee Ferry and Bright Angel.

The average annual discharges at these stations during the 21-year period 1923 to 1943, inclusive, are as follows:

	Acre-feet
Colorado River at Bright Angel	12, 988, 000
Colorado River at Lee Ferry (below Paria)	12, 582, 000
Net gain Lee Ferry to Bright Angel	406, 000

The estimated net gain from Lee Ferry to Boulder Dam in this period would be twice the gain to Bright Angel, or 810,000 acre-feet. With due allowance for the average annual depletion in this period by reason of irrigation development to the extent of about 60,000 acres on the tributaries between Lee Ferry and Boulder Dam, the average gain under virgin conditions in the 21-year period, 1923 to 1943, inclusive, would be about 900,000 acre-feet annually.

During the period 1923 to 1943, inclusive, the run-off from this region was somewhat below the long-time mean as indicated by the following comparisons:

TABLE CXLI.—*Comparison of average annual flows—long-time period with 1923–43 period*

Stream	Period used to determine long-time average annual flow	Average annual flow (thousand acre-feet)		Flow 1923–43 in percent of long-time mean
		Long-time period	Period 1923–43, inclusive	
Estimated undepleted flow, Colorado River at Lee Ferry	1897–1943	16, 270	14, 800	91
Salt River at Granite Reef Dam [1]	1895–1943	1, 484	1, 264	85
Virgin River at Virgin City, Utah	1909–1943 [2]	161	143	89

[1] Discharges corrected for storage changes in upstream reservoirs and past upstream irrigation depletions to reflect natural conditions.
[2] Fragmentary records prior to 1926.

From this comparison it is estimated that the inflow to the Colorado River in the 1923–43 period was about 85 percent of the long-time average. Thus the normal annual net gain, Lee Ferry to Boulder Dam, under virgin conditions would be 900,000 divided by 0.85 or 1,060,000 acre-feet annually.

Virgin flow at Boulder Dam Site

The long-time average virgin stream flow at Boulder Dam site, for the period 1897 to 1943, inclusive, is determined by adding to the longtime average virgin stream flow at Lee Ferry the estimated net gain under virgin conditions as follows:

	Acre-feet
Average virgin flow at Lee Ferry	16,270,000
Average virgin gain to Boulder Dam site	1,060,000
Average virgin flow at Boulder Dam site	17,330,000

Inflow between Boulder Dam and mouth of Gila River

The area drained by the Colorado River between Boulder Dam and the mouth of the Gila River is typically desert country broken near the Colorado River by several small mountain chains. Only one permanent stream, the Williams River, enters the Colorado in this region. The remaining area is drained by washes, dry except for short periods following heavy localized rains.

Discharge records are available of Williams River at a point about 12 miles above the mouth (drainage area 5,140 square miles) for the years 1913 to 1915 and 1929 to 1943, inclusive. The average annual discharge in these periods was 110,000 acre-feet.

Precipitation data in this vicinity and run-off of the Verde River at McDowell during the period of run-off record on the Williams River, in comparison to the long-time averages, are given in the following table:

TABLE CXLII.—*Precipitation and run-off near Williams River*

Location	Average for years 1913-15 and 1929-43, inclusive	Long-time average	Average of short period in percent of long period
Precipitation at Prescott, Ariz.	19.42 inches	18.85 inches	103
Precipitation at Seligman, Ariz.	11.37 inches [1]	11.96 inches	95
Precipitation at Kingman, Ariz.	10.94 inches	11.31 inches	97
Precipitation at Parker, Ariz.	5.76 inches [2]	5.45 inches	106
Run-off Verde River at mouth.	485,000 acre-feet.	553,000 acre-feet.	88

[1] 1 full year and occasional months estimated to complete record.
[2] 1 year (1937) estimated from incomplete records.

Data presented in the preceding table indicate that average recorded flow of the Williams River is about equal to the long-time average.

From available topographic maps of the States of Arizona, California, and Nevada the drainage area between Boulder Dam and the mouth of the Gila, other than the Williams River, which likely contributes to the Colorado River following periods of intense precipitation, is measured as 4,500 square miles. The unit rate of run-off from this area is considerably less than that of the Williams River watershed. The long-time average annual run-off from such area is estimated to be 40,000 area-feet annually, making a total average annual inflow between Boulder Dam and the mouth of the Gila (exclusive of the Gila River) of 150,000 acre-feet.

Losses Under Virgin Conditions in Colorado River Between Boulder Dam and Mouth of Gila River

Under natural conditions there was loss resulting from: (1) Seepage to adjacent valley lands, from which it is subsequently largely evaporated; (2) water entrapped in sloughs and former river channels during floods and later evaporated; (3) evaporation from the stream surface; and (4) possible seepage losses to underlying strata.

In addition to natural losses, water is lost by man's activities from: (1) Depletions due to irrigation consumptive use in the Colorado River valley; (2) water diverted out of the natural watershed to the metropolitan district near Los Angeles and the Imperial Valley, Calif.; and (3) evaporation losses from reservoirs back of Parker, Imperial, and Laguna Dams.

Since it is desired to determine losses under virgin conditions and since the discharge records at Boulder Dam largely reflect the results of a regulated river, the losses between Boulder Dam site and the mouth of the Gila River are based on measured losses between Topock and Laguna Dam (Yuma record corrected for flow of Gila at mouth and diversions for Yuma project), for the 12-year period 1923 to 1934, inclusive, with an estimated loss, based on comparison of physical conditions, between Boulder Dam and Topock.

Average annual discharges at Topock and Laguna, during the 12-year period 1923 to 1934, inclusive, compare as follows:

	Acre-feet
Colorado River at Topock	13,300,000
Colorado River at Laguna Dam	12,610,000
Net annual loss and use between Topock and Laguna	690,000

The average run-off during the 12-year period of study is somewhat less than normal. It is to be expected that over a long period the losses would be somewhat greater. A figure of 700,000 acre-feet annually has been adopted

as representing the long-time net loss and use between Topock and Laguna Dam.

Depletions due to the irrigation of lands in the Parker and Palo Verde Valleys are estimated to be 120,000 acre-feet, which subtracted from the total loss leaves a natural net loss of 580,000 acre-feet. This loss occurs despite inflow to the river previously estimated at 150,000 acre-feet, so that the actual natural loss between Topock and Laguna Dam is 730,000 acre-feet.

The Colorado River Valley sections between Boulder Dam and Topock and between Topock and Laguna Dam compare as follows (prior to construction of Parker and Imperial Dams):

TABLE CXLIII.—*Comparison of sections of Colorado River Valley above and below Topock*

Feature	Between Boulder Dam and Topock	Between Topock and Laguna Dam	Areas above Topock in percent of areas below Topock
Stream channel area.[1]	11,000 acres	25,000 acres	44
Valley floor area [1]	80,000 acres	250,000 acres	32
Irrigated area	None	35,000 acres	0
Tributaries entering Colorado River.	Minor washes.	Williams River and small washes.	------

[1] Measured from river survey sheets of Colorado River below Black Canyon, published by the U. S. Geological Survey in 1927.

Considering that all of the valley floor areas are not inundated every year, it is believed that channel losses from the region above Topock will be about 40 percent of the channel losses below Topock or about 300,000 acre-feet annually. This added to losses below Topock makes the total natural channel losses between Boulder and Laguna Dams 1,030,000 acre-feet annually.

Virgin flow, Colorado River at Laguna

The average annual virgin flow of the Colorado River at Laguna Dam (above mouth of Gila) is estimated as follows:

	Acre-feet
Virgin flow, Colorado River at Boulder Dam	17, 330, 000
Plus tributary inflow, Boulder Dam to mouth of Gila	150, 000
Less natural channel losses	1, 030, 000
Virgin flow, Colorado River at Laguna Dam (above Gila River)	16 450, 000

Virgin flow, Gila River at Yuma

Throughout the Gila River Basin, the securing of stream-flow records is made difficult by violent floods, shifting channels, and sand and silt. Except in the Phoenix area, where extensive irrigation development has been made, there are no reliable long-time records of the Gila River and its tributaries. Using the available records, which are often fragmentary, and never fully reliable, estimates have been prepared of the virgin stream flow of the Gila River at its mouth (Dome or Yuma, Ariz.) for the years 1897 to 1943, inclusive. The results of the calculations are shown in table CXLII. The method used is briefly outlined as follows:

(*a*) The annual inflow above the irrigated area surrounding Phoenix was determined by extending the records on the Salt River at Granite Reef Dam (fairly reliable estimates) and on the Gila River at Kelvin (estimates subject to considerable error). From a study made in 1934 of fragmentary records of tributaries entering the Phoenix area below the Granite Reef Dam and the Kelvin gaging station, the unmeasured inflow below the two base stations is estimated to equal 45 percent of the annual unregulated run-off of the Verde River at its mouth.

(*b*) The base records of the Salt and Gila Rivers were corrected for past irrigation depletions and past storage changes and evaporation losses from reservoirs to reflect conditions as they would have been prior to irrigation development. Past upstream irrigation depletions were assumed to vary uniformly between amounts at various periods as follows:

TABLE CXLIV.—*Past upstream irrigation depletion, Gila and Salt Rivers*

Year	Gila River above Kelvin (acre-feet)	Salt River above Granite Reef Dam (acre-feet)
1899	42, 000	12, 000
1909	85, 000	12, 000
1922	77, 000	12, 000
1933	79, 000	12, 000
1943	79, 000	12, 000

(*c*) An estimate was made of the channel losses, prior to irrigation development in the Phoenix area. Direct determination of such channel losses is impossible because of the lack of discharge records prior to the initiation of irrigation development. By comparing the physical conditions of the stream channels in the Phoenix area above Gillespie Dam (located at the lower end of the Phoenix area) with stream channel conditions along the Gila River between the Gillespie Dam and the mouth of the Gila River, it was estimated that natural channel losses in the Phoenix area would bear the same relationship to measured inflow at Granite Reef and Kelvin as natural channel losses below Gillespie Dam bear to the flow at Gillespie Dam. By subtracting the natural channel losses, thus determined, from the estimated virgin inflow to the Phoenix area, there was determined the virgin (or natural) flow of the Gila River at Gillespie Dam.

The channels of the Gila and Salt Rivers in the Phoenix area compare with the Gila River channel below the Gillespie Dam as shown in the following table:

TABLE CXLV.—*Gila River Channel characteristics and climatological data*

	Area between Gillespie Dam and mouth	Phoenix area
Length of river channel:		
Gila River	145	Above Salt River 90 miles
		Below Salt River 35 miles
Salt River		40 miles
Total	145 miles	[1] 165 miles
Average river gradient:		
Gila River	4 feet per mile	6 feet per mile.
Salt River		9½ feet per mile.
Average	4 feet per mile	7 feet per mile.
Climatological data:		
Average annual precipitation	5 inches	9 inches.
Average annual temperature	72 degrees	69 degrees.

[1] In addition to Gila and Salt River channels, water will be lost from tributary channels such as Agua Fira, Hassayampa, and Queen Creeks.

(*d*) Using concurrent records of Gila River discharge at Gillespie Dam and at the mouth (Dome, Ariz.) for the period August 1921 to December 1934, and making due allowances for the small irrigation use in this area and for the fact that flows at Gillespie Dam were largely controlled by storage during the period of concurrent record, a curve was defined which shows the relationship between annual (unregulated) discharges at Gillespie Dam and annual channel losses between Gillespie Dam and the mouth of the Gila River. The curve was applied to the entire period to determine channel losses.

The channel losses, thus determined, subtracted from the computed natural (or virgin) flows at Gillespie Dam, give the virgin flows of the Gila River at its mouth. The basic computations are summarized in table CXLVI.

While these estimated virgin flows may not be entirely dependable, they are the best that could be made from available information on stream flows. For the purpose of this study the average virgin flow at the mouth of the Gila River has been rounded to 1,270,000 acre-feet annually.

Virgin flow, Colorado River at International Boundary

The long-time average annual virgin flow of the Colorado River at the International boundary is estimated by adding to the virgin flow at Laguna Dam the virgin flow of the Gila River at the mouth as follows:

	Acre-feet
Average annual virgin flow, Colorado River at Laguna Dam	16,450,000
Average annual virgin flow, Gila River at mouth	1,270,000
Average annual virgin flow, Colorado River at International boundary	17,720,000

TABLE CXLVI.—*Estimated virgin flow of Gila River at mouth (thousand acre-feet)*

Year	Flow of Salt River at Granite Reef	Flow of Gila River at Kelvin	Unmeasured natural inflow to Phoenix area	Total natural inflow to Phoenix area	Natural loss in Phoenix area	Natural flow of Gila River at Gillespie Dam	Natural loss of Gillespie Dam to Gila River at mouth	Natural flow of Gila River at mouth
1897	[1] 1,289	605	231	2,125	550	1,575	501	1,074
1898	[1] 537	401	97	1,035	372	663	302	361
1899	[1] 514	302	98	914	345	569	272	297
1900	[1] 269	[1] 274	52	595	262	333	193	140
1901	[1] 765	[1] 352	136	1,253	415	838	348	490
1902	[1] 442	[1] 223	99	764	302	462	240	222
1903	[1] 436	[1] 266	98	800	314	486	248	238
1904	527	[1] 336	121	984	355	629	290	339
1905	5,542	[1] 1,582	821	7,945	904	7,041	900	6,141
1906	2,396	[1] 688	360	3,444	690	2,754	659	2,095
1907	2,021	[1] 1,013	337	3,371	685	2,686	650	2,036
1908	1,828	[1] 483	270	2,581	610	1,971	564	1,407
1909	1,736	[1] 395	262	2,393	588	1,805	540	1,265
1910	930	[1] 206	216	1,352	416	936	376	560
1911	[1] 2,143	521	326	2,990	650	2,340	612	1,728
1912	[1] 1,041	535	187	1,763	502	1,261	443	818
1913	888	310	160	1,358	430	928	374	554
1914	1,350	1,342	167	2,859	651	2,208	598	1,610
1915	2,490	1,487	306	4,283	760	3,523	728	2,795
1916	5,301	1,716	435	7,452	901	6,551	885	5,666
1917	2,819	420	384	3,623	702	2,921	673	2,248
1918	1,018	250	258	1,526	444	1,082	408	674

[1] Basic run-off record estimated in whole or part.

TABLE CXLVI.—*Estimated virgin flow of Gila River at mouth (thousand acre-feet)*—Continued

Year	Flow of Salt River at Granite Reef	Flow of Gila River at Kelvin	Unmeasured natural inflow to Phoenix area	Total natural inflow to Phoenix area	Natural loss in Phoenix area	Natural flow of Gila River at Gillespie Dam	Natural loss of Gillespie Dam to Gila River at mouth	Natural flow of Gila River at mouth
1919	2,201	949	375	3,525	697	2,828	666	2,162
1920	2,478	627	440	3,545	691	2,854	670	2,184
1921	1,826	536	170	2,532	616	1,916	558	1,358
1922	1,569	189	339	2,097	534	1,563	501	1,062
1923	1,754	575	325	2,654	610	2,044	573	1,471
1924	967	299	140	1,406	443	963	380	583
1925	693	303	143	1,139	388	751	330	421
1926	1,334	493	241	2,068	546	1,522	492	1,030
1927	1,927	366	417	2,710	607	2,103	582	1,521
1928	643	214	153	1,010	353	657	300	357
1929	1,025	338	188	1,551	462	1,089	409	680
1930	857	420	158	1,435	446	989	384	605
1931	1,360	577	224	2,161	560	1,601	507	1,094
1932	2,045	534	390	2,969	635	2,334	610	1,724
1933	701	304	107	1,112	390	722	315	407
1934	372	256	84	712	285	427	220	207
1935	1,516	481	255	2,252	560	1,692	520	1,172
1936	1,109	328	146	1,583	472	1,111	410	701
1937	2,101	511	408	3,020	640	2,380	615	1,765
1938	971	232	222	1,425	414	1,011	385	626
1939	749	263	136	1,148	410	738	320	418
1940	1,070	462	126	1,658	490	1,168	515	653
1941	3,491	1,250	557	5,298	808	4,490	790	3,700
1942	884	288	147	1,319	427	892	355	537
1943	974	288	143	1,405	440	965	380	585
Average	1,508	527	244	2,279	527	1,752	480	1,272

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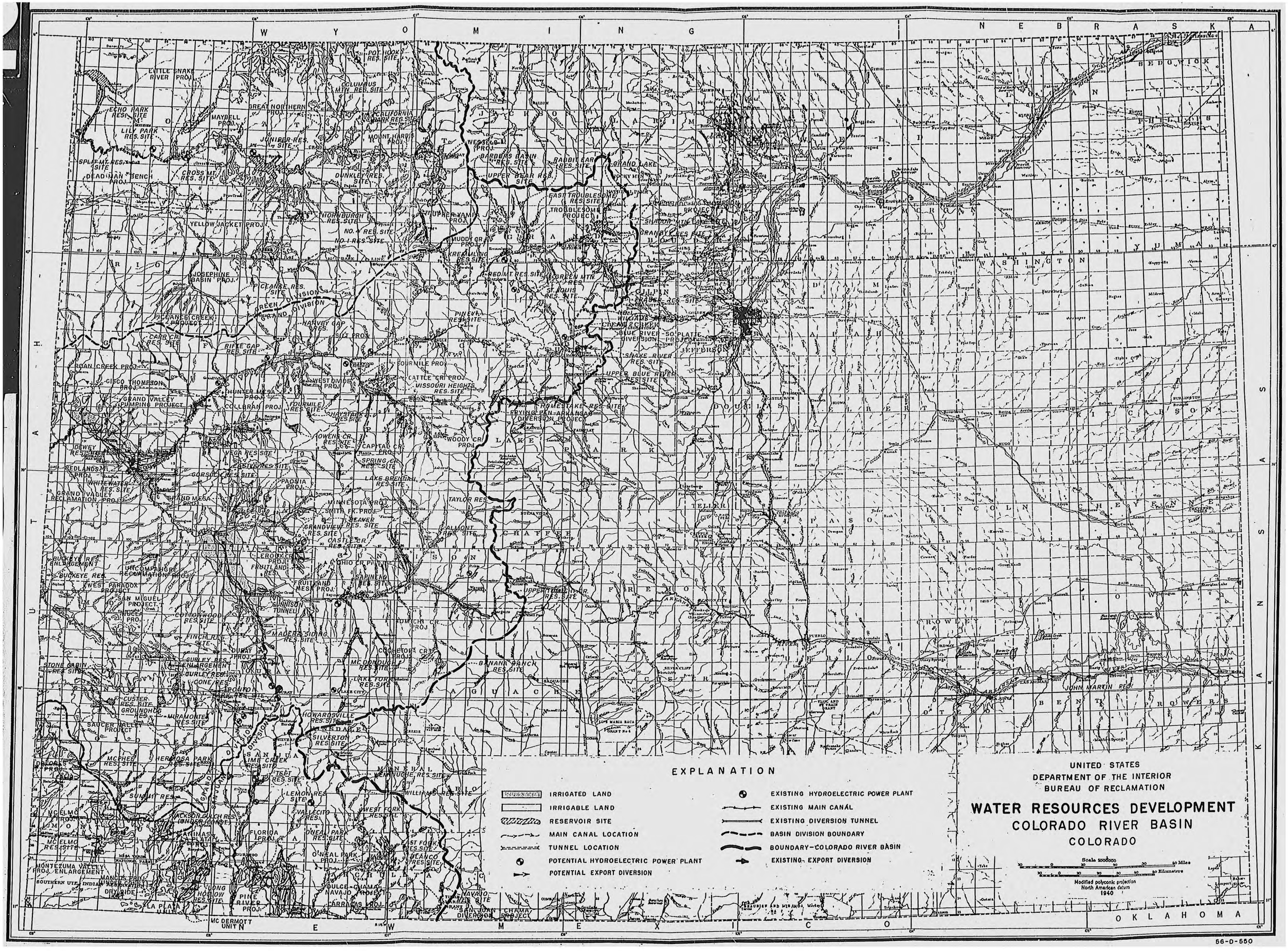
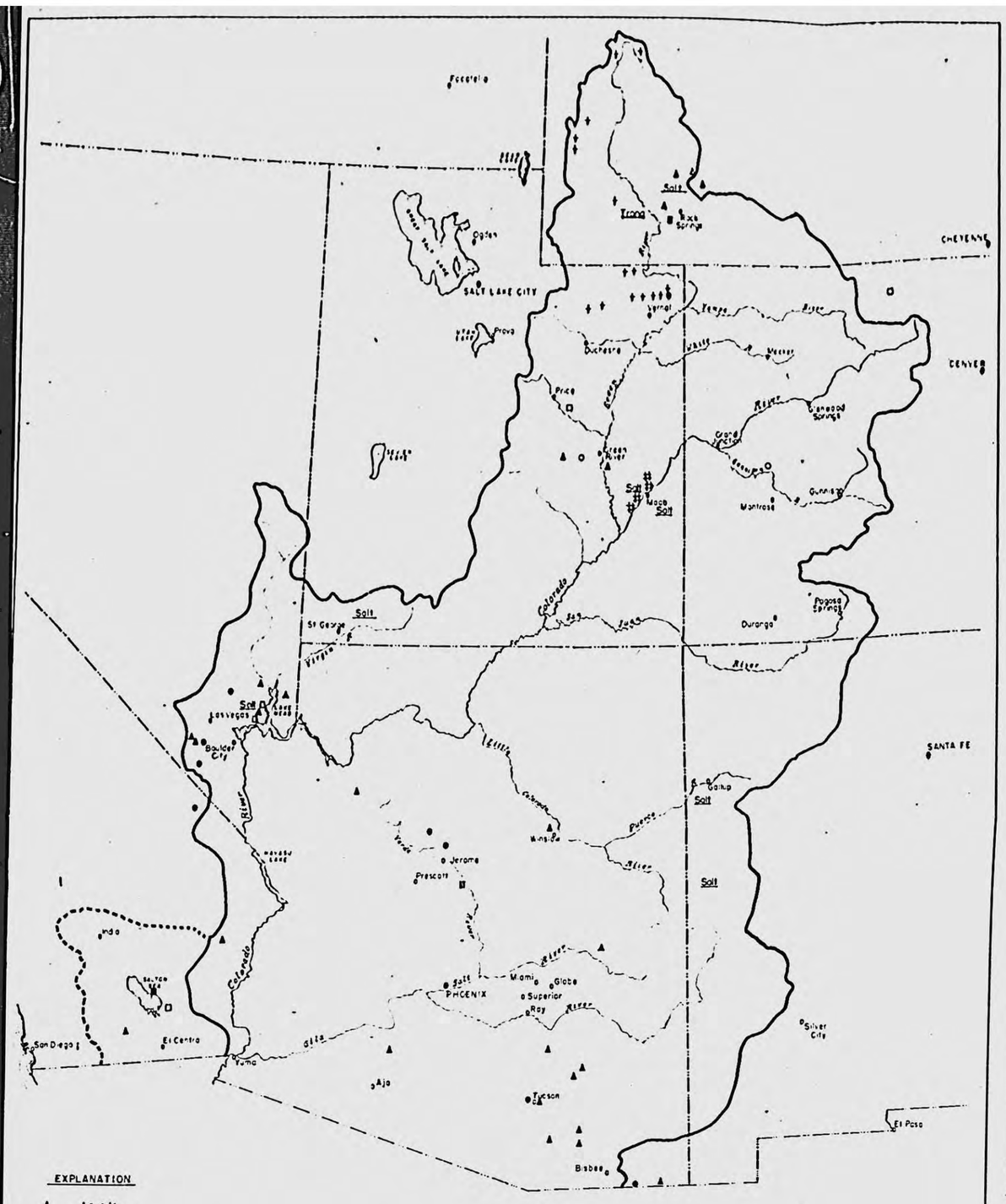
APPENDIX II

Eleven Colorado River Basin Maps

TITLES

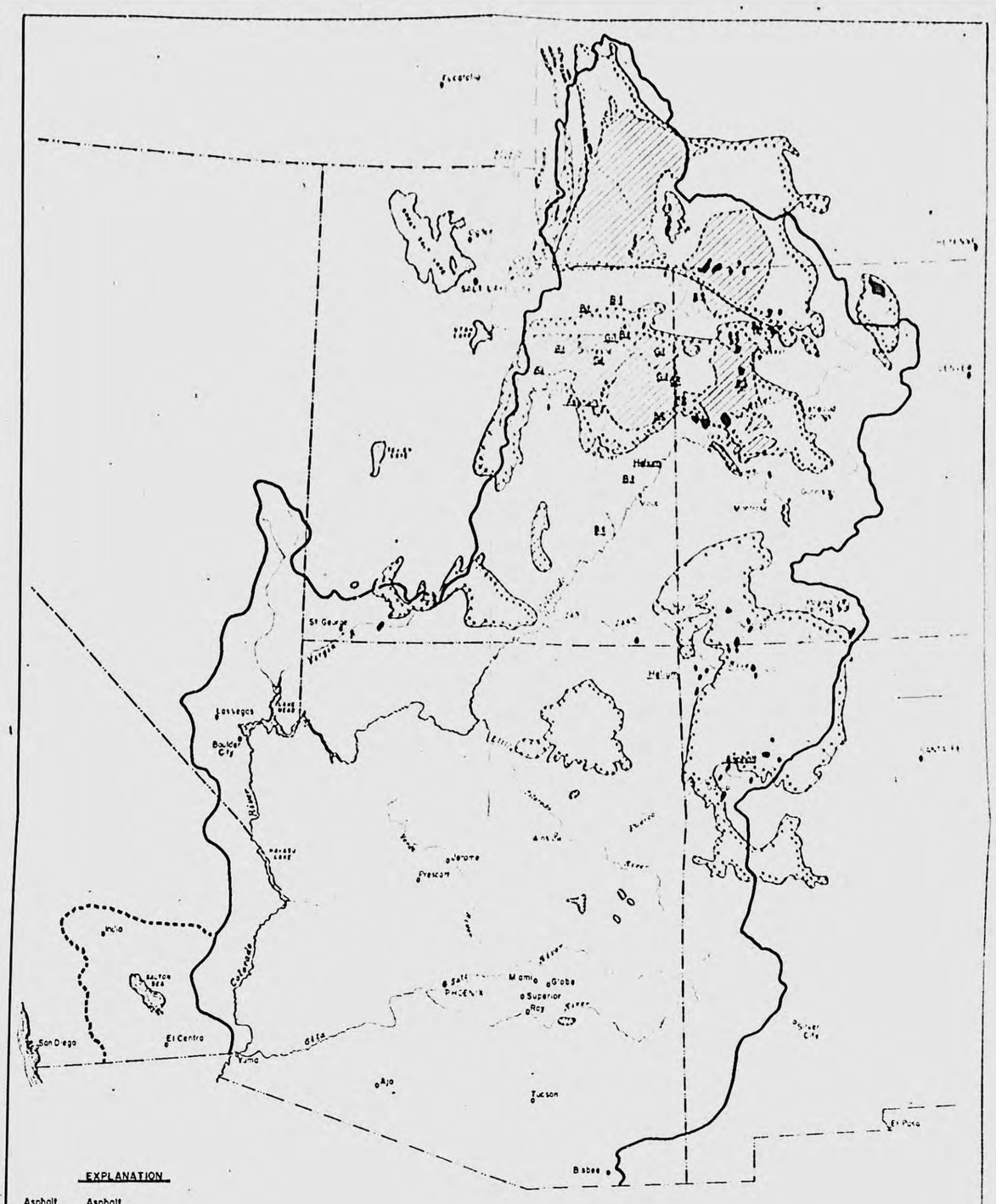
Water Resources Development—Colorado River Basin—Arizona
Water Resources Development—Colorado River Basin—California
Water Resources Development—Colorado River Basin—Colorado
Water Resources Development—Colorado River Basin—Nevada
Water Resources Development—Colorado River Basin—New Mexico
Water Resources Development—Colorado River Basin—Utah
Water Resources Development—Colorado River Basin—Wyoming
Principal Power Systems—Existing and Potential—Colorado River Basin
Conservation Areas and Facilities—Colorado River Basin
Mineral Resources—Colorado River Basin (two maps)


WYOMING
NEBRASKA
UTAH
NEW MEXICO
KANSAS
OKLAHOMA
ARIZONA
LITTLE SNAKE RIVER PROJ.
POT HOOK RES. SITE
COLUMBUS MTN. RES. SITE
ECHO PARK RES. SITE
MAYBELL PROJ.
GREAT NORTHERN PROJ.
CALIFORNIA PARK RES. SITE
LILY PARK RES. SITE
JUNIPER RES. SITE
MOUNT HARRIS PROJ.
WESTLAKE PROJ.
SPLIT MT. RES. SITE
CROSS MT. RES. SITE
DEAD MAN BENCH PROJ.
DUNKLEY RES. SITE
BARBERS BASIN RES. SITE
RABBIT EAR RES. SITE
GRAND LAKE
UPPER BEAR RES. SITE
EAST TROUBLESOME RES. SITE
TROUBLESOME PROJECT
WILLOW CR. PROJECT
SHADOW MTN. LAKE RES.
GRANBY RES.
UPPER YAMPA PROJ.
NORTHBURGH RES. SITE
YELLOW JACKET PROJ.
NO. 4 RES. SITE
NO. 1 RES. SITE
MUDDY CR. PROJ.
KREMMLING RES. SITE
RED MT. RES. SITE
GREEN MTN. RES.
ST. LOUIS RES. SITE
JOSEPHINE BASIN PROJ.
CLEARS RES. SITE
GREEN DIVISION
GRAND DIVISION
PICEANCE CREEK PROJECT
HARVEY GAP RES.
SILT PROJ.
PINEY RES. SITE
WILLIAMS FK. RES.
CRAIG-CHERRY CR. DIVERSION PROJECT
SO. PLATTE DIVERSION PROJECT
CARR CR. RES. SITE
RIFLE GAP RES. SITE
JEFFERSON
ROAN CREEK PROJ.
FOURMILE PROJ.
SNAKE RIVER RES. SITE
CISCO THOMPSON PROJ.
WEST DIVIDE PROJ.
CATTLE CR. PROJ.
MISSOURI HEIGHTS RES. SITE
UPPER BLUE RIVER RES. SITE
GRAND VALLEY PUMPING PROJECT
THUNDER MESA PROJ.
COLLBRAN PROJ.
FOURMILE RES. SITE
HAYSTACK RES. SITE
HOMESTAKE RES. SITE
IRVING-FRYINGPAN-ARKANSAS DIVERSION PROJECT
DOUGLAS
OWENS CR. RES. SITE
CAPITAL CR. PROJ.
WOODY CR. PROJ.
LAKE
PARK
TELLER
EL PASO
LINCOLN
CHEYENNE
DEWEY RES. SITE
REDLANDS PROJ.
VEGA RES. SITE
EASTLER RES. SITE
SPRING CR. RES. SITE
GORSUCH RES. SITE
PAONIA PROJ.
LAKE BENNETT RES. SITE
WHITEWATER RES. SITE
GRAND VALLEY RECLAMATION PROJ.
GRAND MESA PROJ.
MINNESOTA PROJ.
SMITH FK. PROJ.
TAYLOR RES.
BEAVER RES. SITE
GRANDVIEW RES. SITE
CASTLE CR. RES. SITE
ALLISON PROJ.
CHAFFEE
BUCKEYE RES. ENLARGEMENT
UNCOMPAHGRE RECLAMATION PROJ.
BUCKEYE RES.
LEROUX CR. PROJ.
FRUITLAND RES.
OHIO CR. PROJ.
WEST PARADOX PROJECT
FRUITLAND MESA PROJ.
SAPINERO RES. SITE
UPPER GUNNISON DIVERSION TUNNEL
SAN MIGUEL PROJECT
GUNNISON TUNNEL
FREMONT
ARKANSAS RIVER
ROWLEY
COTTONWOOD RES. SITE
MADERA SIDING RES. SITE
TUMBLE CR. PROJ.
FINCH RES. SITE
DURAY PROJ.
COCHETOPA CR. PROJ.
GURLEY RES. ENLARGEMENT
ST. MC DONOUGH RES. SITE
BANANA RANCH RES. SITE
STONE CABIN RES. SITE
GURLEY RES.
GONE RES.
LAKE FORK RES. SITE
LAKE CITY
CUSTER
CUSTER RES. SITE
GROUNDHOG RES.
MIRAMONTE RES. SITE
HOWARDSVILLE
SAUCER VALLEY PROJECT
SILVERTON RES. SITE
SAN JUAN
LIME CREEK RES. SITE
MINERAL
MC PHEE RES. SITE
HERMOSA PARK RES. SITE
TRET RES. SITE
LEMON RES. SITE
KEMNUCHE RES. SITE
WILLIAMS FK. RES. SITE
SUMMIT RES.
VALLECITO RES.
WEST FORK RES. SITE
MC ELMO PROJ.
JACKSON GULCH RES. (UNDER CONST.)
FLORIDA PROJ.
LA PLATA
MC ELMO RES. SITE
ONEAL PARK RES. SITE
EAST FORK RES. SITE
BLANCO RES. SITE
ONEAL PARK PROJ.
ARCHULETA
MONTEZUMA VALLEY PROJ. ENLARGEMENT
MANCOS PARK (UNDER CONST.)
SOUTHERN UTE INDIAN PROJ.
LONG HOLLOW RES. SITE
PINE RIVER PROJ.
SOULCE-CHAMA DIVERSION PROJECT
NAVAJO RES. SITE
NAVAJO PROJ.
FARMINGTON
SAN JUAN-CHAMA PROJECT
MC DERMOTT UNIT
JOHN MARTIN RES.
LONG MARIA RACA GRANT No. 6
TIPTON LAND AT TRAIL GRANT
BENT
PROWERS
KIOWA
BACA
KIT CARSON
CHEYENNE
BEDWICK
PHILLIPS
YUMA
WASHINGTON
LOGAN
SEDGWICK
BURLINGTON
EXPLANATION
IRRIGATED LAND
IRRIGABLE LAND
RESERVOIR SITE
MAIN CANAL LOCATION
TUNNEL LOCATION
POTENTIAL HYDROELECTRIC POWER PLANT
POTENTIAL EXPORT DIVERSION
EXISTING HYDROELECTRIC POWER PLANT
EXISTING MAIN CANAL
EXISTING DIVERSION TUNNEL
BASIN DIVISION BOUNDARY
BOUNDARY-COLORADO RIVER BASIN
EXISTING EXPORT DIVERSION
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
WATER RESOURCES DEVELOPMENT
COLORADO RIVER BASIN
COLORADO
Scale 1:000000
30 0 30 60 Miles
30 0 30 60 Kilometers
Modified polyconic projection
North American datum
1940
56-D-550



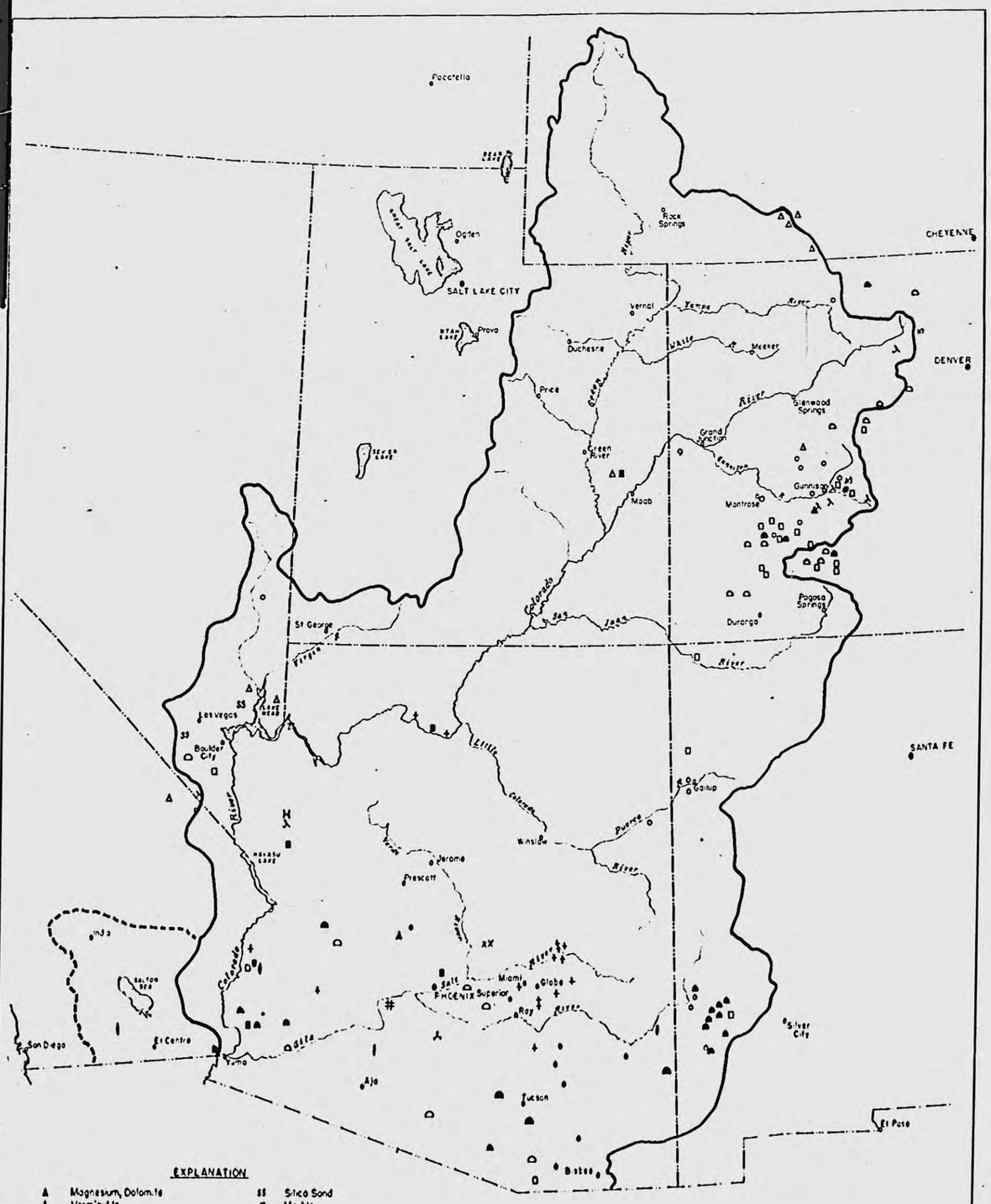
EXPLANATION

- Leucite
- Gypsum
- Limestone
- Sulphur
- Sodium Sulphate
- Carbon Dioxide
- Phosphate
- Potash



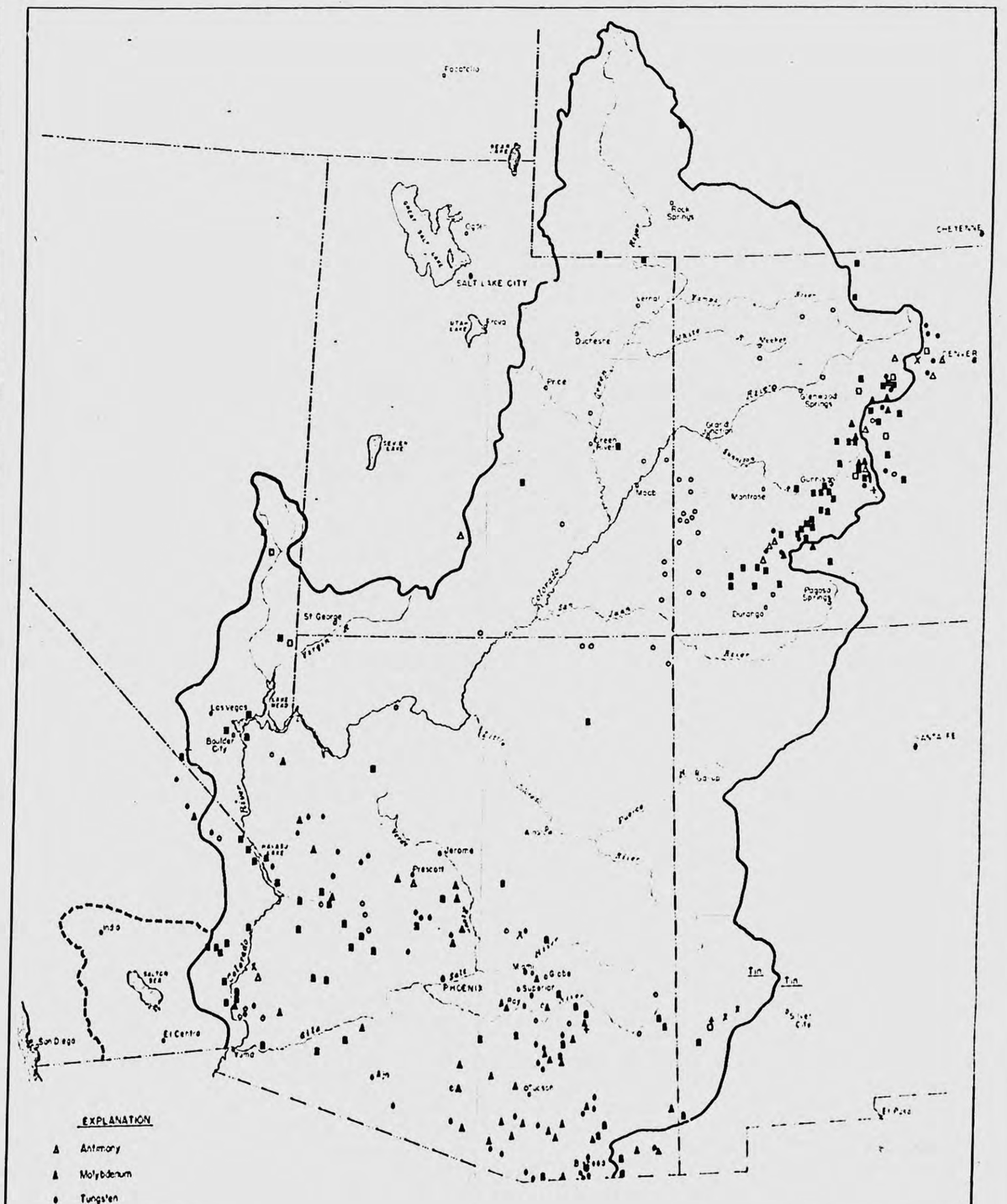
EXPLANATION

Asphalt	Asphalt
Bit	Bituminous Sandstone
Gil	Gilsonite, Ozokerite, Wurtzilite
Helium	Helium
	Approximate area of oil shale beds
	Oil and/or gas fields
	Coal



EXPLANATION

	Magnesium, Dolomite
	Vermiculite
	Diatomite
	Clay
	Kyanite, Andalusite, Sillimanite, etc
	Aluminite and other aluminum bearing ores
	Asbestos
	Celestite
	Dumortierite
	Pyrophyllite
	Barite
	Mica
	Corundum
	Graphite
	Fluorspar
	Feldspar
SS	Silica Sand
M	Marble



EXPLANATION

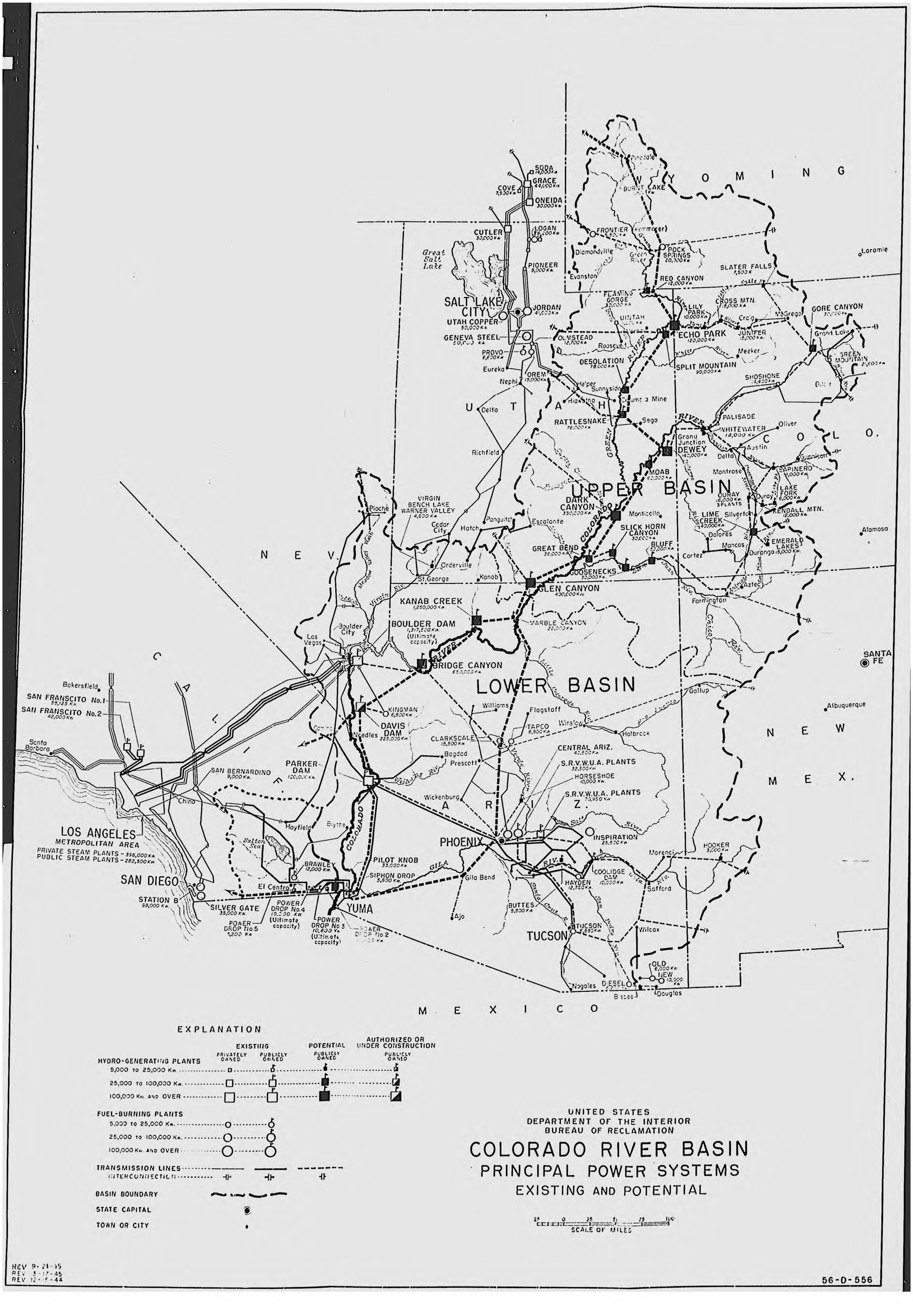
	Antimony
	Molybdenum
	Tungsten
	Uranium, Vanadium, Radium
	Manganese
	Nickel
	Cobalt
	Mercury
	Beryllium
In	Tin

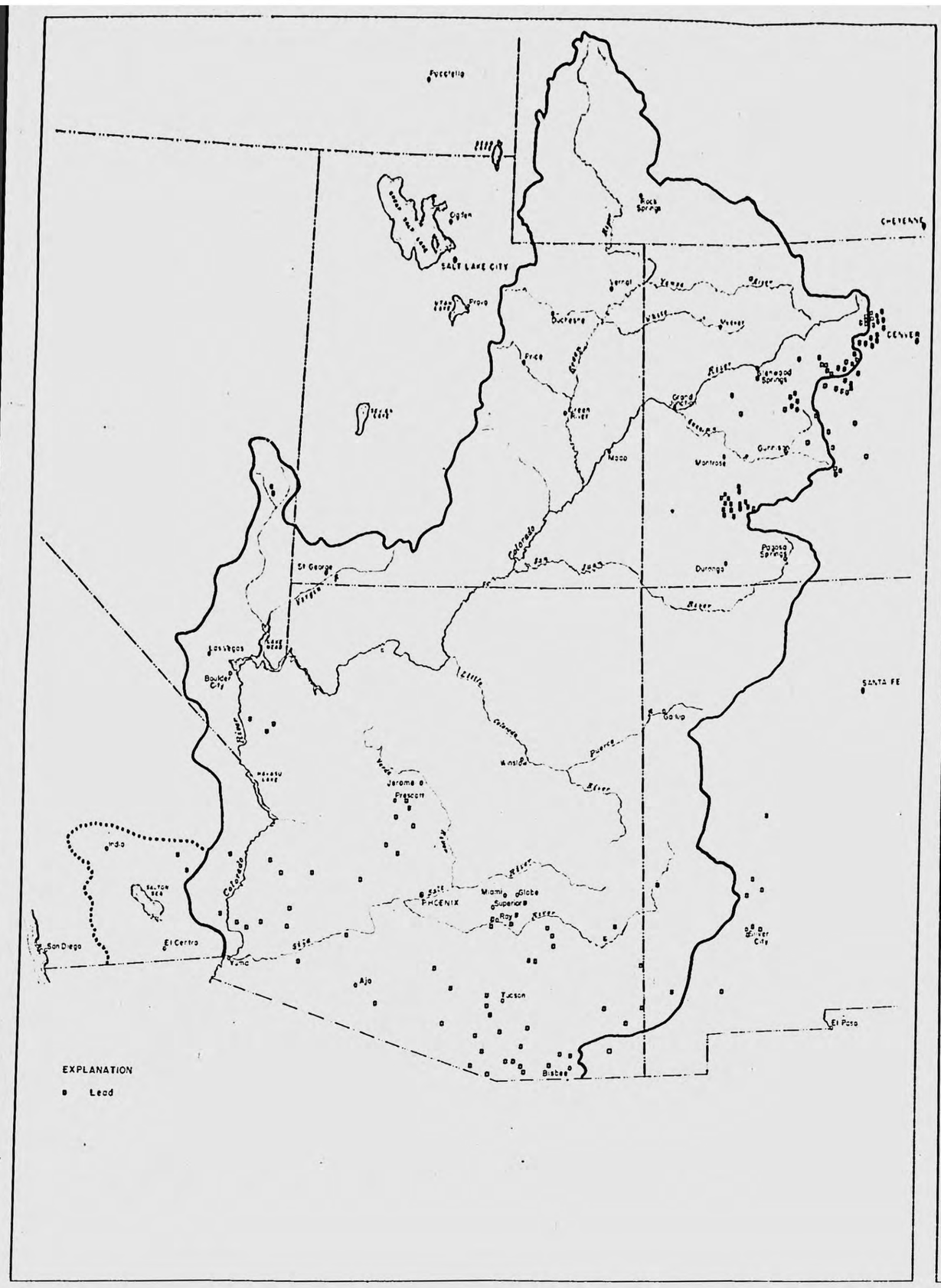
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

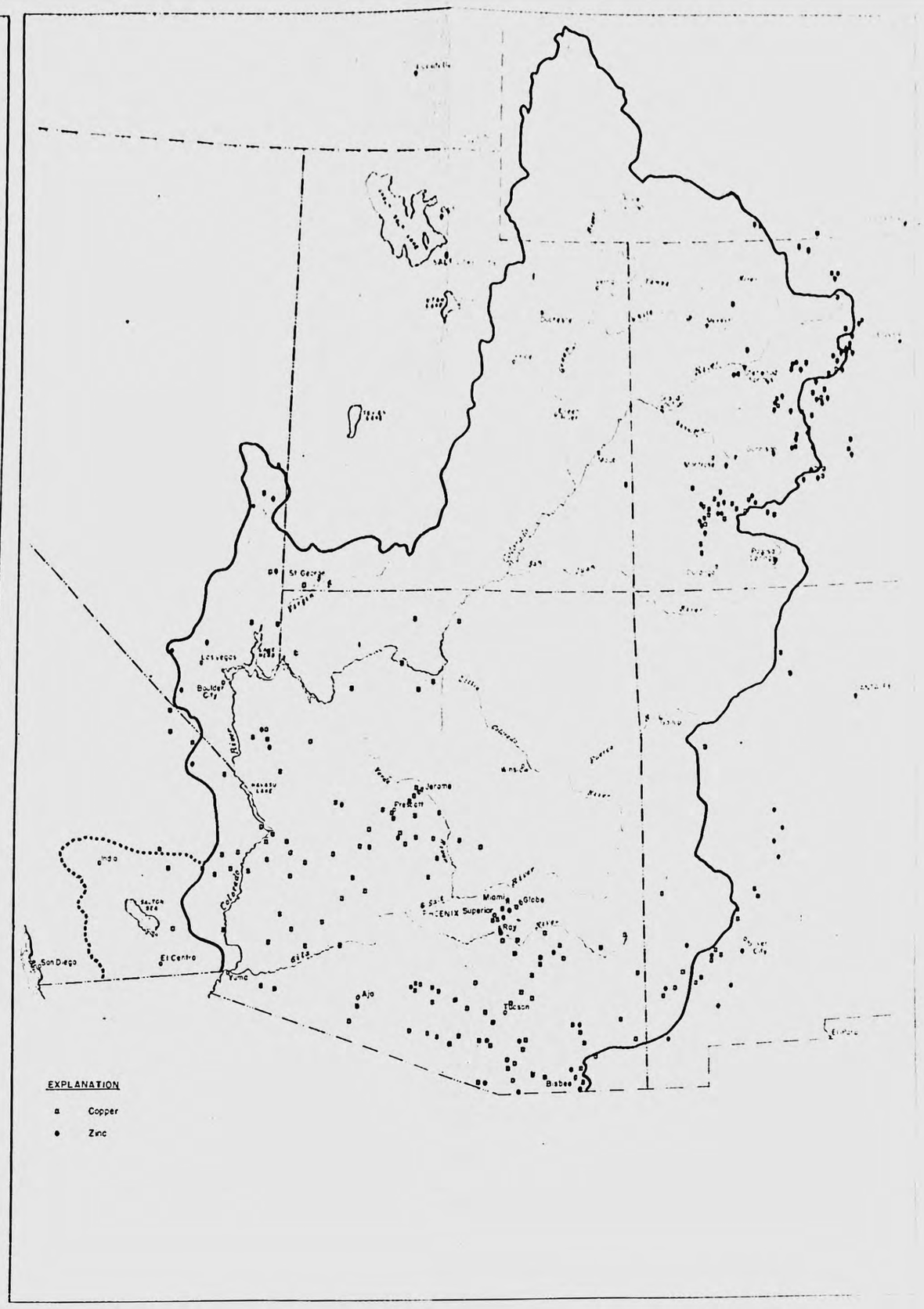
MINERAL RESOURCES

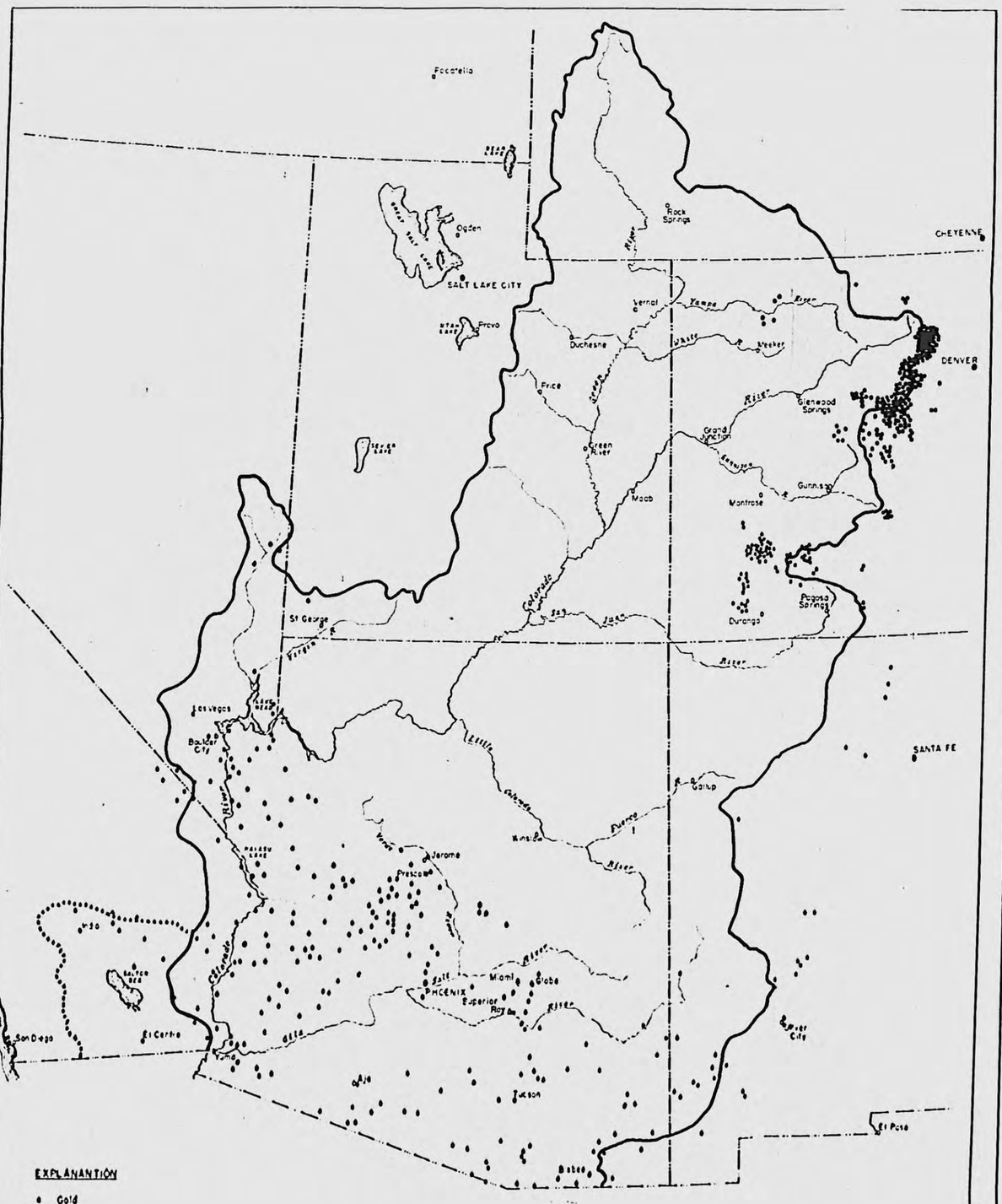
COLORADO RIVER BASIN

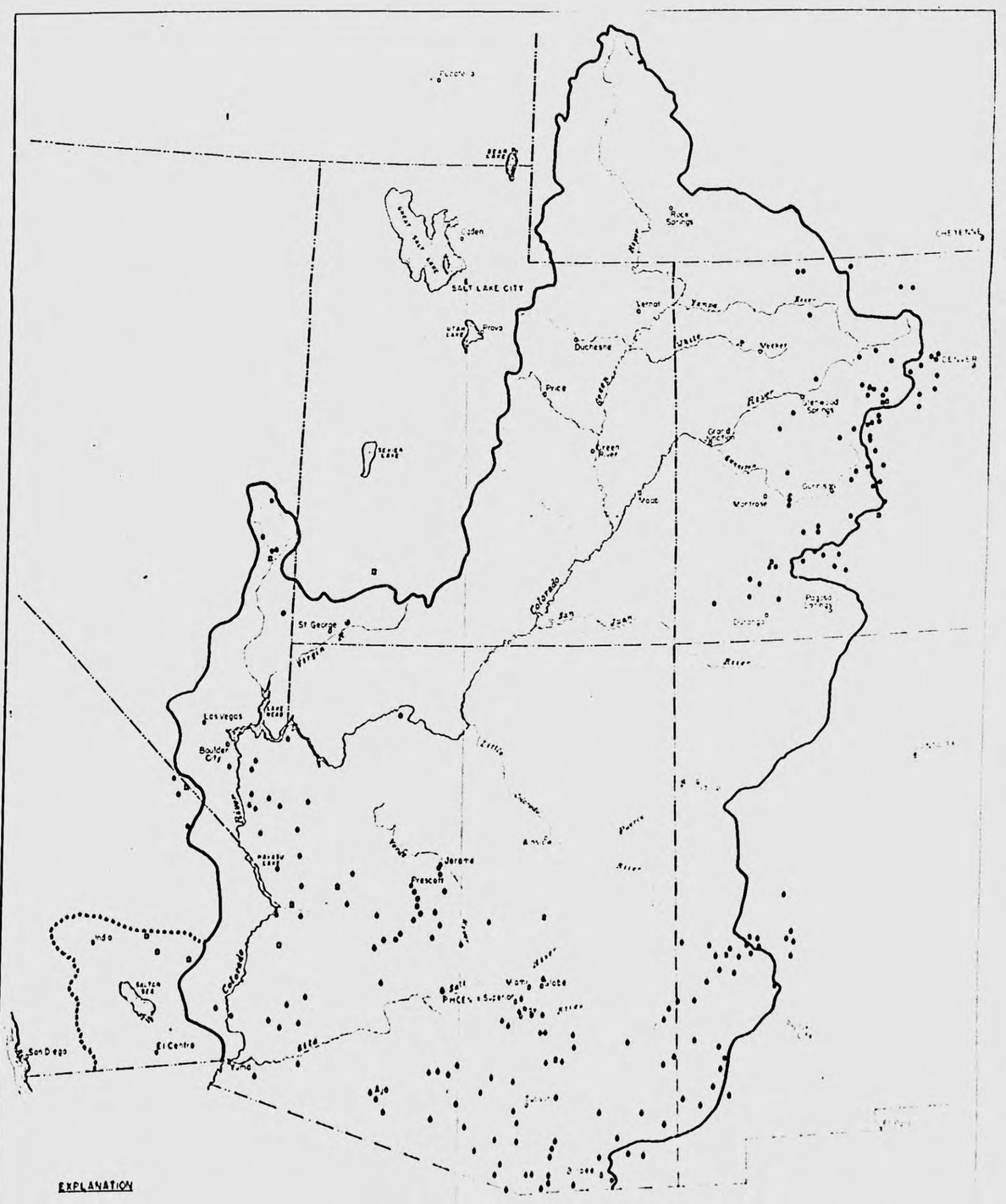
66-D-550


W Y O M I N G
SODA 19,000 Kw
GRACE 44,000 Kw
COVE 7,500 Kw
ONEIDA 30,000 Kw
CUTLER 30,000 Kw
LOGAN 16,200 Kw
PIONEER 5,000 Kw
Great Salt Lake
SALT LAKE CITY
JORDAN 41,000 Kw
UTAH COPPER 50,000 Kw
GENEVA STEEL 50,000 Kw
OLMSTEAD 12,700 Kw
PROVO 6,600 Kw
Eureka
Nephi
OREM 15,000 Kw
Pinedale
BURNT LAKE
FRONTIER (Kemmerer)
Diamondville
Green River
Evanston
ROCK SPRINGS 20,000 Kw
SLATER FALLS 7,500 K
Laramie
RED CANYON 12,000 Kw
FLAMING GORGE 30,000 Kw
UINTAH
LILY PARK 10,000 Kw
CROSS MTN. 18,000 Kw
Craig
McGregor
GORE CANYON 30,000 Kw
ECHO PARK 120,000 Kw
JUNIPER 15,000 Kw
Grand Lake
GREEN MOUNTAIN 21,600 Kw
Roosevelt
DESOLATION 78,000 Kw
Meeker
SPLIT MOUNTAIN 90,000 Kw
SHOSHONE 13,500 Kw
Helper
Sunnyside
Hiawatha
Columbia Mine
U T A H
Delta
RATTLESNAKE 76,000 Kw
Sego
PALISADE
WHITEWATER 12,000 Kw
Oliver
Grand Junction
DEWEY 140,000 Kw
Austin
Delta
Gunnison
C O L O.
Richfield
MOAB 60,000 Kw
Montrose
SAPINERO 5,000 Kw
UPPER BASIN
DARK CANYON 350,000 Kw
OURAY 16,000 Kw 3 PLANTS
Ouray
LAKE FORK 6,000 Kw
KENDALL MTN. 12,000 Kw
LIME CREEK 40,000 Kw
Silverton
Monticello
SLICK HORN CANYON 30,000 Kw
Dolores
Mancos
Cortez
EMERALD LAKES 15,000 Kw
Durango
BLUFF 63,000 Kw
GREAT BEND 35,000 Kw
GOOSENECKS 33,000 Kw
Alamosa
Pioche
VIRGIN BENCH LAKE WARNER VALLEY 4,500 Kw
Cedar City
Panguitch
Hatch
Escalante
Aztec
Farmington
N E V.
Orderville
St. George
Kanab
GLEN CANYON 400,000 Kw
KANAB CREEK 1,250,000 Kw
MARBLE CANYON 22,000 Kw
BOULDER DAM 1,317,500 Kw. (Ultimate capacity)
Las Vegas
Boulder City
BRIDGE CANYON 650,000 Kw
SANTA FE
LOWER BASIN
Gallup
Albuquerque
Williams
Flagstaff
KINGMAN 6,900 Kw
DAVIS DAM 225,000 Kw
Needles
TAPCO 8,500 Kw
Winslow
Holbrook
CLARKSDALE 15,500 Kw
CENTRAL ARIZ. 42,500 Kw
Bagdad
Prescott
S.R.V.W.U.A. PLANTS 32,500 Kw
HORSESHOE 10,000 Kw.
PARKER DAM 120,000 Kw
SAN BERNARDINO 9,000 Kw.
Wickenburg
S.R.V.W.U.A. PLANTS 70,950 Kw
A R I Z.
N E W M E X.
Bakersfield
SAN FRANSCITO No. 1 59,125 Kw
SAN FRANSCITO No. 2 42,000 Kw
Santa Barbara
Chino
Hayfield
Blythe
Salton Sea
LOS ANGELES METROPOLITAN AREA
PRIVATE STEAM PLANTS - 336,000 Kw.
PUBLIC STEAM PLANTS - 282,500 Kw.
PHOENIX
INSPIRATION 25,500 Kw
HOOKER 3,000 Kw
Morenci
BRAWLEY 12,000 Kw.
PILOT KNOB 33,000 Kw
SIPHON DROP 5,600 Kw.
GILA
Gila Bend
COOLIDGE DAM 10,000 Kw
HAYDEN 12,750 Kw.
Safford
SAN DIEGO
El Centro
STATION B 99,000 Kw.
SILVER GATE 35,000 Kw.
POWER DROP No. 4 19,200 Kw (Ultimate capacity)
POWER DROP No. 5 5,200 Kw
POWER DROP No. 3 10,600 Kw. (Ultimate capacity)
POWER DROP No. 2
YUMA
Ajo
BUTTES 5,800 Kw
TUCSON 6,650 Kw
TUCSON
Wilcox
OLD 6,000 Kw
NEW 10,000 Kw
Nogales
DIESEL
Bisbee
Douglas
M E X I C O
EXPLANATION
EXISTING
PRIVATELY OWNED
PUBLICLY OWNED
POTENTIAL
PUBLICLY OWNED
AUTHORIZED OR UNDER CONSTRUCTION
PUBLICLY OWNED
HYDRO-GENERATING PLANTS
5,000 TO 25,000 Kw.
25,000 TO 100,000 Kw.
100,000 Kw. AND OVER
FUEL-BURNING PLANTS
5,000 TO 25,000 Kw.
25,000 TO 100,000 Kw.
100,000 Kw. AND OVER
TRANSMISSION LINES
INTERCONNECTION
BASIN BOUNDARY
STATE CAPITAL
TOWN OR CITY
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER BASIN
PRINCIPAL POWER SYSTEMS
EXISTING AND POTENTIAL
25 0 25 50 75 100
SCALE OF MILES
REV 9-21-45
REV 3-17-45
REV 12-15-44
56-D-556









UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MINERAL RESOURCES
COLORADO RIVER BASIN

56-D-557

IDAHO

WYOMING

NEVADA

UTAH

COLORADO

ARIZONA

NEW MEXICO

CALIFORNIA

Pocatello

Preston

Bear Lake

Logan

Pinedale

Kemmerer

Rawlins

Rock Springs

Green River

Ogden

Evanston

GREAT SALT LAKE

CHEYENNE

Elko

SALT LAKE CITY

Vernal

Steamboat Springs

Utah Lake

Provo

Duchesne

Meeker

DENVER

Price

Glenwood Springs

Leadville

Grand Junction

Sevier Lake

Green River

Delta

Gunnison

Moab

Montrose

Tonopah

Pagosa Springs

Durango

St. George

Kanab

Las Vegas

Boulder City

BOULDER DAM NATL RECREATION AREA

SANTA FE

Gallup

Flagstaff

Kingman

Winslow

Holbrook

Needles

Prescott

San Bernardino

Reserve

Salton Sea

STATE PARK

PHOENIX

Clifton

San Diego

El Centro

Yuma

Tucson

Tombstone

El Paso

EXPLANATION

	NATIONAL	STATE EXISTING	STATE PROPOSED
FORESTS			
PARKS		●	▲
GAME REFUGES			
MONUMENTS		●	▲
INDIAN RESERVATIONS			
GRAZING DISTRICTS			
POTENTIAL RESERVOIR			

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONSERVATION AREAS AND FACILITIES
COLORADO RIVER BASIN

10 0 20 40 60 80 100
SCALE OF MILES

U.R.

DENVER, COLORADO-OCT. 1944 56-D-555

WATER RESOURCES DEVELOPMENT
COLORADO RIVER BASIN
ARIZONA

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

EXPLANATION

- IRRIGATED LAND
- IRRIGABLE LAND
- RESERVOIR SITE
- MAIN CANAL LOCATION
- TUNNEL LOCATION
- MAIN PIPE LINE LOCATION
- HYDROELECTRIC POWER PLANT AUTHORIZED OR UNDER CONSTRUCTION
- POTENTIAL HYDROELECTRIC POWER PLANT
- EXISTING HYDROELECTRIC POWER PLANT
- EXISTING MAIN CANAL
- BASIN DIVISION BOUNDARY
- BOUNDARY BETWEEN UPPER & LOWER BASINS
- BOUNDARY - COLORADO RIVER BASIN

46-D-548

UTAH

COLORADO

OKLAHOMA

TEXAS

ARIZONA

SAN JUAN

RIO ARRIBA

TAOS

COLFAX

UNION

HARDING

MORA

SANDOVAL

SANTA FE

SAN MIGUEL

VALENCIA

BERNALILLO

GUADALUPE

TORRANCE

QUAY

CURRY

DE BACA

ROOSEVELT

CATRON

SOCORRO

LINCOLN

CHAVES

OTERO

EDDY

LEA

GRANT

HIDALGO

DONA ANA

LUNA

MONUMENT ROCKS RES. SITE

MEADOWS RES. SITE

STATE LINE RES. SITE

ANIMAS-LA PLATA PROJECT-MONUMENT ROCKS UNIT

ANIMAS-LA PLATA PROJ-MCDERMOTT UNIT

ARBOLES RES. SITE

PINE RIVER PROJECT

HOGBACK PROJ.

ANIMAS-LA PLATA PROJ LA PLATA UNIT

ANIMAS-LA PLATA PROJ-MEADOWS UNIT

HAMMOND PROJECT

FRUITLAND PROJECT

SOUTH SAN JUAN PROJECT

SHIPROCK PROJECT

IRRIGATED AND POTENTIAL NAVAJO INDIAN PROJECTS

SAN JUAN DIVISION

LITTLE COLORADO DIVISION

NAVAJO RESERVOIR

NAVAJO INDIAN RES.

RAMAH RES.

ZUNI RES.

PESCADO RES.

HOOKER RES. SITE

CENTRAL ARIZ. PROJECT SAN FRANCISCO UNIT

CENTRAL ARIZ. PROJECT NEW MEXICO UNIT

CENTRAL ARIZ. PROJECT DUNCAN-VIRDEN VALLEY UNIT

GILA RIVER

SAN FRANCISCO RIVER

SAN JUAN RIVER

RIO GRANDE

PECOS RIVER

CANADIAN RIVER

CIMARRON RIVER

CANADIAN RIVER

NAVAJO NATION

JICARILLA APACHE RESERVATION

CARSON NATIONAL FOREST

CARSON NAT. FOREST

SANTA FE NATIONAL FOREST

SANTA FE NAT. FOREST

CARSON NATIONAL FOREST

CIBOLA NATIONAL FOREST

MANZANO NATIONAL FOREST

MANZANO NAT. FOR.

LINCOLN NATIONAL FOREST

LINCOLN NAT. FOREST

GILA NATIONAL FOREST

GILA NAT. FOREST

DATIL NATIONAL FOREST

DATIL NAT. FOR.

MESCALERO APACHE INDIAN RESERVATION

GILA CLIFF DWELLINGS NATIONAL MONUMENT

GRAN QUIVIRA NATIONAL MONUMENT

EXPLANATION

- IRRIGATED LAND
- IRRIGABLE LAND
- RESERVOIR SITE
- MAIN CANAL LOCATION
- POTENTIAL EXPORT DIVERSION
- POTENTIAL HYDROELECTRIC POWER PLANT
- EXISTING HYDROELECTRIC POWER PLANT
- EXISTING MAIN CANAL
- BASIN DIVISION BOUNDARY
- BOUNDARY BETWEEN UPPER & LOWER BASINS
- BOUNDARY - COLORADO RIVER BASIN

Scale 1:6000000

Modified polyconic projection
North American datum
1940

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WATER RESOURCES DEVELOPMENT
COLORADO RIVER BASIN
NEW MEXICO

88-D-852

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WATER RESOURCES DEVELOPMENT
COLORADO RIVER BASIN
UTAH

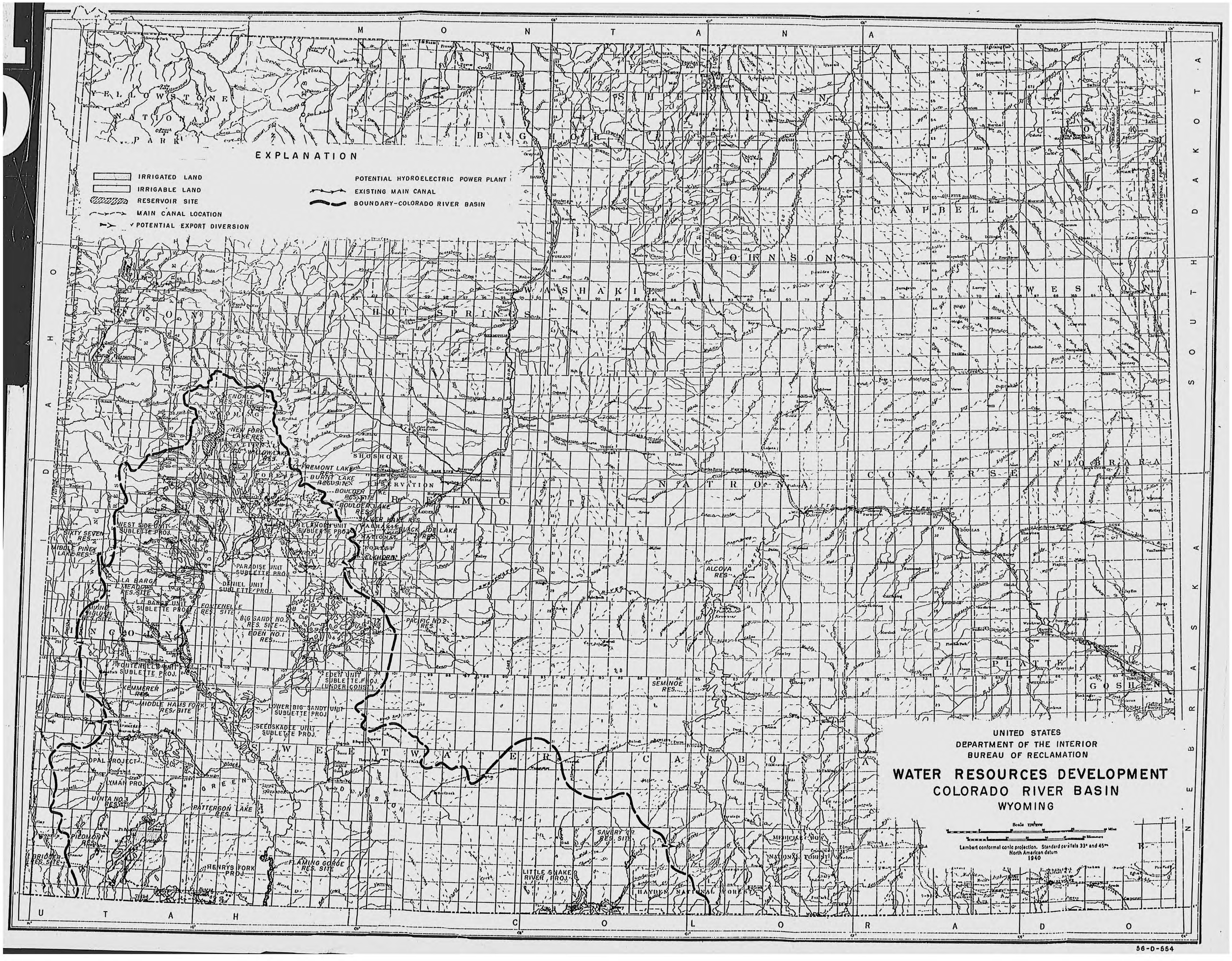
EXPLANATION

- IRRIGATED LAND
- IRRIGABLE LAND
- RESERVOIR SITE
- MAIN CANAL LOCATION
- TUNNEL LOCATION
- POTENTIAL HYDROELECTRIC POWER PLANT
- POTENTIAL EXPORT DIVERSION
- EXISTING HYDROELECTRIC POWER PLANT
- EXISTING MAIN CANAL
- EXISTING EXPORT DIVERSION CANAL
- BASIN DIVISION BOUNDARY
- BOUNDARY BETWEEN UPPER & LOWER BASINS
- BOUNDARY–COLORADO RIVER BASIN

State boundaries

Modified polyconic projection
North American datum
1940

56-D-863


EXPLANATION
IRRIGATED LAND
IRRIGABLE LAND
RESERVOIR SITE
MAIN CANAL LOCATION
POTENTIAL EXPORT DIVERSION
POTENTIAL HYDROELECTRIC POWER PLANT
EXISTING MAIN CANAL
BOUNDARY-COLORADO RIVER BASIN
MONTANA
SOUTH DAKOTA
NEBRASKA
COLORADO
UTAH
IDAHO
YELLOWSTONE NATIONAL PARK
SHERIDAN
BIG HORN
CROOK
CAMPBELL
JOHNSON
WESTON
WASHAKIE
HOT SPRINGS
TETON
SHOSHONE
FREMONT
NATRONA
CONVERSE
NIOBRARA
PLATTE
GOSHEN
LINCOLN
SWEETWATER
CARBON
GREEN
DIVISION
NEW FORK LAKE RES.
FREMONT LAKE RES.
BURNT LAKE RES.
BOULDER LAKE RES.
SILVER LAKE RES.
BLACK JOE LAKE RES.
ELKHORN RES.
WEST SIDE UNIT SUBLETTE PROJ.
SIXTY SEVEN RES.
MIDDLE PINEY LAKE RES.
PARADISE UNIT SUBLETTE PROJ.
DANIEL UNIT SUBLETTE PROJ.
LA BARGE MEADOWS RES. SITE
LA BARGE UNIT SUBLETTE PROJ.
FONTENELLE RES. SITE
BIG SANDY NO. 2 RES. SITE
EDEN NO. 1 RES.
PACIFIC NO. 2 RES.
ALCOVA RES.
FONTENELLE UNIT SUBLETTE PROJ.
KEMMERER RES.
MIDDLE HAMS FORK RES. SITE
EDEN UNIT SUBLETTE PROJ. (UNDER CONST.)
SEMINOE RES.
LOWER BIG SANDY UNIT SUBLETTE PROJ.
SEEDSKADEE UNIT SUBLETTE PROJ.
OPAL PROJECT
LYMAN PROJ.
UINTA NO. 3 RES.
PATTERSON LAKE RES.
PIEDMONT RES.
BRIDGER RES. SITE
HENRYS FORK PROJ.
FLAMING GORGE RES. SITE
LITTLE SNAKE RIVER PROJ.
SAVERY CR. RES. SITE
HAYDEN NATIONAL FOREST
MEDICINE BOW NATIONAL FOREST
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
WATER RESOURCES DEVELOPMENT
COLORADO RIVER BASIN
WYOMING
Lambert conformal conic projection. Standard parallels 33° and 45°
North American datum
1940
56-D-554

OREGON

IDAHO

HUMBOLDT NATIONAL FOREST

HUMBOLDT

ELKO

HUMBOLDT NATIONAL FOREST

BLACK ROCK DESERT

QUINN RIVER

SILVER STATE

PERSHING

LANDER

EUREKA

HUMBOLDT NATIONAL FOREST

WHITE PINE

NEVADA NATIONAL FOREST

CALIFORNIA

UTAH

ARIZONA

CHURCHILL

STOREY

LYON

ORMSBY

DOUGLAS

MINERAL

NYE

ESMERALDA

LINCOLN

TOIYABE NATIONAL FOREST

MONO NATIONAL FOREST

NEVADA NATIONAL FOREST

DELUGE RES. SITE

PANACA VALLEY PROJ.

WHITE RIVER RES. SITE

MOAPA VALLEY PROJ.

VIRGIN DIVISION

BOULDER DIVISION

LAS VEGAS PUMPING PROJ.

LAKE MEAD

VIRGIN BAR PUMPING PROJ.

BOULDER DAM

DAVIS RES. PUMPING PROJ.

DAVIS DAM (SITE)

FORT MOHAVE PROJ.

EXPLANATION

- IRRIGATED LAND
- IRRIGABLE LAND
- RESERVOIR SITE
- MAIN CANAL LOCATION
- HYDROELECTRIC POWER PLANT AUTHORIZED OR UNDER CONSTRUCTION
- EXISTING HYDROELECTRIC POWER PLANT
- BASIN DIVISION BOUNDARY
- BOUNDARY-COLORADO RIVER BASIN

Modified polyconic projection
North American datum
1929

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WATER RESOURCES DEVELOPMENT
COLORADO RIVER BASIN
NEVADA

56-D-551

MADERA
FRESNO
KINGS
TULARE
KERN
INYO
SEQUOIA NATIONAL PARK
OWENS LAKE
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
SAN BERNARDINO
RIVERSIDE
IMPERIAL
ARIZONA
SANTA BARBARA CHANNEL
SANTA CRUZ ISLAND
SAN PEDRO
LAKE MATHEWS
HAVASU LAKE
PARKER DAM
COLORADO RIVER INDIAN RESERVATION
COLORADO RIVER AQUEDUCT
BOULDER CANYON PROJECT ALL AMERICAN CANAL SYSTEM COACHELLA VALLEY UNIT (UNDER CONSTRUCTION)
HAYFIELD RES.
PALO VERDE MESA PROJ.
PALO VERDE IRRIGATION DISTRICT
SALTON SEA
BOULDER CANYON PROJECT ALL AMERICAN CANAL SYSTEM WEST MESA UNIT (UNDER CONSTRUCTION)
BOULDER CANYON PROJECT ALL AMERICAN CANAL SYSTEM EAST MESA UNIT (UNDER CONSTRUCTION)
IMPERIAL DAM
LAGUNA DAM
SAN VICENTE RES.
EL CAPITAN RES.
MURRAY RES.
SAN DIEGO PROJ.
IMPERIAL IRRIGATION DISTRICT
ALL AMERICAN CANAL
BOULDER CANYON PROJECT - ALL AMERICAN CANAL SYSTEM - PILOT KNOB UNIT (UNDER CONSTRUCTION)
MEXICO

EXPLANATION

- IRRIGATED LAND
- IRRIGABLE LAND
- MAIN CANAL LOCATION
- HYDROELECTRIC POWER PLANT AUTHORIZED OR UNDER CONSTRUCTION
- POTENTIAL EXPORT DIVERSION
- EXISTING EXPORT DIVERSION
- EXISTING MAIN CANAL
- BOUNDARY - COLORADO RIVER BASIN
- BOUNDARY - COLORADO RIVER SUB-BASIN
- EXISTING - HYDROELECTRIC POWER PLANT

Scale 1:1,000,000
A.F. Pomeroy, Cartographer
Compiled 1979

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WATER RESOURCES DEVELOPMENT
COLORADO RIVER BASIN
CALIFORNIA

88-D-849

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
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RG 0037

STATE ENGINEER

UPPER COLORADO RIVER COMMISSION

General Correspondence

1945-54

BOX 1

DS 1718

UPPER COLORADO RIVER COMMISSION
Correspondence
1946

State of Wyoming

STATE ENGINEER'S OFFICE

Cheyenne
December 27, 1946

DEC 1946
RECEIVED
ATTORNEY
GENERAL

Mr. Harry W. Bashore
Chairman, Upper Colo. R. Compact
Mitchell, Nebraska

Dear Mr. Bashore:

At a meeting held in Rock Springs last Saturday, the Wyoming Upper Colorado River Compact Commissioners discussed the proposed compact and I was directed to send out the letter which we have sent you a copy.

The group thought the compact draft should come from the Federal Representative as it did in the case of the Yellowstone.

After considerable discussion, it was decided that the practical solution of meeting the obligation at Lee Ferry was to close all transmountain diversions until the obligation is met. We feel if the Bureau of Reclamation know the obligation ~~that~~ is to be met in this manner, that they will plan our reservoir system so it will never be necessary to close any diversions.

Enclosed copy of the draft as approved by the Rock Springs meeting is sent you at the request of the group for your personal information.

I wish each State would come out with what they believe their reasonable needs and equitable share are to be. This would at least give us a basis for argument. So far, we have had no basis.

With very best wishes and the Season's Greetings, I am

Sincerely yours,

L. C. Bishop, State Engineer
and Interstate Streams
Commissioner for Wyoming

LCB:MN
Enc.

cc; Mr. O'Marr ✓

L130
G9-1
V-1

RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Arizona - Colorado - New Mexico - Utah - Wyoming

●

NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

●

SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

WATER RESOURCES
CENTER ARCHIVES
MAR 1966
UNIVERSITY OF CALIFORNIA
BERKELEY

●

Authorized and Approved
For Reproduction
by the
Commission

292.185 U7

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME I

Record of Preliminary Governors' Meeting, and
for Commission Meetings No. 1-5, inclusive

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD OF MEETING NO. 5

December 1, 2, 3 and 4, 1947

** NOTE **

(Meeting No. 5 of the Upper Colorado River Basin Compact Commission was scheduled to be held in Santa Fe, New Mexico. Accommodations for the meeting were unavailable for the dates intended, and Meeting No. 5 was transferred to Denver, Colorado.)

Shirley-Savoy Hotel
Denver, Colorado

MEETING NO. 5
Denver, Colorado
(Transferred from Santa Fe, N. M.)

December 1, 2, 3 and 4, 1947

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Nellie T. Bush — Secretary, Colorado River Commission of Arizona, Parker, Arizona.
J. E. Bush — Parker, Arizona.
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Chas. L. Patterson — Chief Engineer, Colorado Water Conservation Board, Denver, Colorado.
Joan S. Breitenstein — Attorney for the Colorado Water Conservation Board, Denver, Colorado.
Frank C. Merriell — Colorado River Water Conservation Board Grand Junction, Colorado.
August P. Gumlick — Chairman of the Denver Water Board, Denver, Colorado.
Glenn G. Saunders — Attorney for the Denver Water Board, Denver, Colorado.
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R. J. Steinbruner — Reporter, DENVER POST, Denver, Colorado.
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UTAH:

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C. O. Roskelley	State Engineer's office, Salt Lake City, Utah.
Thomas W. Jensen	Utah Water and Power Board, Mt. Pleasant, Utah.
Edward W. Clyde	Special Assistant Attorney General, Salt Lake City, Utah.
J. A. Howell	Attorney, Ogden, Utah.
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WYOMING:

Norman B. Gray	Attorney General of Wyoming, Cheyenne, Wyoming.
H. T. Person	Consulting Engineer, Laramie, Wyoming.
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Joe L. Budd	Assist. Commissioner on Upper Colo. River Basin Compact Commission, Big Piney, Wyoming.

BUREAU OF RECLAMATION:

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J. A. Ketnig	Planning Engineer Region 7, Denver, Colorado.
John R. Riter	Chief, Hydrology Division, Denver, Colorado.
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UNITED STATES GEOLOGICAL SURVEY:

M. T. Wilson	District Engineer, Salt Lake City, Utah.

PROCEEDINGS

The meeting was called to order by Chairman Bashore at ten o'clock a.m., Monday, December 1, 1947, in the Centennial Room of the Shirley-Savoy Hotel, Denver, Colorado.

THE CHAIRMAN: I notice that all members of the Commission are present and the meeting will now come to order.

Gentlemen, at the last meeting of the Commission in Cheyenne, you indicated that certain matters were to be considered at the next meeting, which was to be held in Santa Fe but arrangements had to be made for holding the meeting here in Denver. Consequently the things that are to be considered at this meeting are:

First, the report of the Engineering Advisory Committee. This Engineering Advisory Committee was appointed on July 31, 1946, at Salt Lake City to get together and analyze data in order that the Commission might properly negotiate a compact. This Engineering Advisory Committee went to work and outlined a program of studies and later reported to the Commission in some detail as to the program which the Committee proposed to undertake. The Commission approved the program of the Engineering Advisory Committee and at your last meeting in Cheyenne, you decided that you wanted a report from that Committee today.

Now there are other matters to be considered by the Commission at this meeting.

No. 2 might be a report of the Legal Advisory Committee, which was appointed by the Commission to make a study of the basic structure of the compact.

Then under No. 3 would come the matter of considering the position of the various departments of the Federal Government, which have been expressed in writing to your Chairman. At the last meeting the Commission requested that the Chairman furnish copies of such communications to the members of the Commission in order that the members might have time to consider these communications from the Federal departments and have some questions or ideas to express at this meeting and possibly might wish to have further information for a clarification as to the position of the various departments of the Federal Government, which your Chairman represents.

These are matters to come before the Denver meeting of the Commission. I believe this is Meeting No. 5 and unless there is an objection we will so designate it as Meeting No. 5.

The Chairman of the Engineering Advisory Committee is Mr. J. R. Riter of the Bureau of Reclamation and unless there is objection, the Commission would now like to have the report of the Chairman of the Engineering Advisory Committee. Mr. Riter.

(Mr. Riter distributes to members of Commission, "December 1, 1947 Progress Report, Engineering Advisory Committee to Upper Colorado River Basin Compact Commission," consisting of 61 pages and 30 pages of tables.)

THE CHAIRMAN: Gentlemen, the Chairman of the Engineering Advisory Committee has submitted his report in writing. He has furnished each member of the Commission a copy of the report. The report consists of a document about an inch thick with charts, graphs, maps, and tables.

MR. RITER: Mr. Chairman, I have supplied a copy of the report to each member of the Commission and also supplied additional copies with the intention that they would be supplied to the Engineering Advisory Committee. If the Commission desires we could arrange to prepare a few additional copies of this report.

I have attempted to summarize the report in a 3-page letter which I have bound to the first part of the report and then a table. If it is agreeable with you I would like to read the letter. I think it summarizes the work that we have done. The remaining portions of the report are details and tabulations. Whatever your pleasure is--

THE CHAIRMAN: Mr. Riter, the Chairman will rule that we would like to hear the summary of the report if you will read it.

MR. RITER: All right.

"Denver, Colorado, December 1, 1947

Upper Colorado River Basin Compact Commission:

Gentlemen:

Pursuant to instructions given at your September 8, 1947 meeting, a report on the activities of your Engineering Advisory Committee has been prepared and is enclosed herewith. Studies proposed by the Committee in their report of August 31, 1946 which were approved by action of the Commission at the Santa Fe meeting on September 17, 1946, involve: the preparation of base maps to show the locations of present and potential irrigation developments within the Colorado River Basin and stream gaging stations and drainage areas upstream from Lee Ferry; water contributions by states, involving the tabulation of streamflow records at key gaging stations, the extension of records by estimates, estimation of runoff from unmeasured areas, estimation of present depletions above key gaging stations, state lines and Lee Ferry and estimation of channel losses along the main Colorado River and principal tributaries above Lee Ferry; and studies of river and reservoir operation to determine the extent to which the Upper Basin can make use of its allocated water supply during drought cycles and still meet its compact obligation at Lee Ferry.

While the Committee made considerable progress toward completion of the work assigned to them, we did not complete our assignment. The transmitted report is a progress report and sets forth, in detail, the work completed to date and the present status of the remaining uncompleted assignments. The present status of the assigned tasks are briefly summarized in this letter.

Maps.

The transmitted report contains copies of the state maps of Arizona, Colorado, New Mexico, Utah, and Wyoming, from the 1946 report of the Bureau of Reclamation showing the locations of present and potential irrigation projects within the Colorado River Basin. The report contains a general map, prepared by the Colorado Water Conservation Board showing the locations of key gaging stations and drainage areas for various portions of the Upper Colorado River Basin.

Drainage Areas.

Conflicting published figures on drainage areas above gaging stations were resolved by measuring from the best available maps of the area. The report contains a tabulation (page 45) showing by states the drainage areas above key gaging stations and the drainage areas of ungaged runoff between key gaging stations and state lines. The total drainage area above the Lee Ferry Compact Station was measured as 108,939 square miles.

Historic Streamflows.

The period 1914 to 1945, inclusive, was adopted as the study period. Historic streamflows at key gaging stations were compiled, and extended by estimates. A brief description of the methods used in estimating each of the streamflow records and tables showing monthly and annual discharges at the key gaging stations are presented in the report. Average annual historic runoff at the selected key gaging stations for the study period, 1914 to 1945, inclusive, are summarized in the attached table. In the course of the study, it was decided not to extend the records at a few of the stations listed in the committee report of August 31, 1946. On the other hand, it was found necessary for purposes of estimating to compile the discharges at a few other stations not listed in the August 1946 report.

Runoff from Ungaged Drainage Areas.

Study has been made of the net inflow between key gaging stations on the Colorado River and tributaries and various methods of estimating channel losses have been investigated. After the Committee decides on appropriate values for channel losses, it will be possible to estimate the runoff from the ungaged drainage areas by adding to the net inflow between gaging stations the estimated channel losses. Rates of runoff per square mile estimated by this method will be compared with estimates by other methods.

Channel Losses.

Study has been made of channel losses between the Lees Ferry gaging station and the combined flows of Colorado River at Cisco, Utah; Green River at Green River, Utah; and San Juan at Bluff, Utah, by comparing the concurrent daily records at the indicated gaging stations with due allowance for travel time between the upstream gagings at Lees Ferry and inflow from seeps, springs, and tributaries as determined from short-time records and miscellaneous measurements made by the Geological Survey. The channel losses were also estimated by measuring from the available maps the water areas of the channel and the areas of water consuming vegetation along the channel and application of appropriate unit rates of evaporation and stream depletion. Similar studies are being made for the San Juan between Rose and Bluff and for the Colorado River above Cisco, Utah and the Green River above Green River, Utah. Channel losses were found necessary in the depletion studies hence the Committee deemed it advisable to study losses on the tributaries in addition to the main streams listed in the report of August 31, 1946. The Committee has not adopted figures to represent an estimate of channel losses.

Streamflow Depletions.

It was previously believed that the Bureau of Reclamation Report on the Colorado River of March 1946 could be used in the determination of streamflow depletions by states and above Lee Ferry. Rates per acre

used in the report were computed by the Lowry-Johnson method which involves examination of daily climatological data to determine total day degree of heat units during the growing season. The Committee found it desirable to determine unit rates of stream depletion at many more sites than were used in the Bureau of Reclamation Report and computed for the time period 1914-49 instead of 1931-40. The Committee believed that the Lowry-Johnson method should not be used since it is too cumbersome. A study was made of basic data underlying the Lowry-Johnson method, and a relationship prepared between stream depletion and mean temperatures for the period, April to September, inclusive. Consultation services of Mr. H. F. Blaney, eminent authority on consumptive use with the Department of Agriculture, have been, and are being utilized to determine unit rates of depletion for application at the site of use.

The Committee believes that water withheld upstream from Lee Ferry would cause a reduction in loss in conveyance from the site of use to Lee Ferry, and that the resultant reduction in channel loss constitutes a salvage as compared with original conditions of flow and, therefore, can be credited against depletion at sites of use. The Committee has set about to determine the portion of the area now irrigated which was naturally irrigated from the stream prior to irrigation by man and upon which a growth of vegetation existed, of similar water consuming nature as at present. It is the belief of the Committee that natural losses from such irrigated areas should be deducted from present losses to determine the streamflow depletion as a result of man's activities. The Committee is also making estimates of the incidental areas located adjacent to irrigated areas, which would consume water applied to such irrigated areas. Realizing the importance of these studies, the Committee has directed their efforts toward an early completion of the depletion studies. Although results to date have been gratifying there remains a considerable number of decisions to be made and work to be done.

The Committee has assembled and tabulated in the report basic climatological data for use in estimating unit rates of depletion in various portions of the basin. It has also assembled data on present irrigated areas, by states, above key gaging stations and above Lee Ferry. These data were taken largely from field surveys made in 1935-1938 by the Bureau of Reclamation, supplemented by knowledge of the individual committee members. The tentative figures of present irrigated acreage by states above Lee Ferry found by the Committee are as follows:

Arizona	Colorado	New Mexico	Utah	Wyoming	Total
9,840	790,606	38,705	275,440	236,675	1,351,266

River and Reservoir Operation Studies.

Before these studies can be completed, it will be necessary to finish the studies of streamflow depletions and water contributions by states. Data pertaining to evaporation losses and physical characteristics of the known reservoir sites are being assembled for use in making these studies.

Respectfully submitted,
John R. Riter, Chairman,
Engineering Advisory Committee.*

MR. RITER: On page 4 there is a tabulation which accompanies my letter, which summarizes the averages for the period 1914 to 1943, the mean historic flows at key gaging stations in the first column. There

is also a column of the drainage areas in square miles.

Following the letter of transmittal there is the body of the report which explains in detail the methods used in arriving at the streamflow extensions. Then in the back part of the report following page 61, there are a number of tables which present the data summarized, the data prepared by the Committee. There is an envelope in the back of the report which contains the maps submitted by the Committee.

Mr. Chairman, I know we did not complete our job. This is a report of what we have done and of what we have left to do.

THE CHAIRMAN: Well, the Chairman is of the opinion that the members of the Engineering Advisory Committee have worked diligently on the matter and I don't think the Committee can be criticized for not having made more progress. If there is any criticism to be made anywhere it in the opinion of the Chair would fall on the Commission itself for outlining such an ambitious program without any regard to the time which might be necessary to complete it.

However, gentlemen, you have heard Mr. Riter's brief summary of his report. What are the wishes of the members of the Commission? I might say, do you wish this report to be embodied in the official records of the Commission or what disposition do you wish to have made of it?

(Discussion off the record.)

COM. BISHOP: I make a motion that the report be received by the Commission for study.

COM. CARSON: Second the motion.

COM. WILSON: Will you read that motion?

(Motion read.)

COM. STONE: I will second that motion.

THE CHAIRMAN: It is moved and seconded that the report be received by the Commission for study. (Thereupon a vote was taken and the motion of Com. Bishop carried unanimously.) Off the record. (Discussion off the record.)

THE CHAIRMAN: Mr. Riter, it is the understanding of the Chair that the engineering report which you have submitted has been unanimously agreed upon by the members of the Engineering Advisory Committee; is that correct?

MR. RITER: It is correct to this extent, sir, that at our last meeting of the Engineering Advisory Committee, at which meeting Mr. Tipton was not present with us, we discussed a draft of the report in substantially the same form that it has been presented to your Commission. At the last meeting of the Engineering Advisory Committee, a number of editorial changes were suggested. We in the Bureau of Reclamation made the editorial changes suggested by the Committee and then I, as Chairman of the Committee, prepared the first three sheets of the report which I submitted and signed. I prepared that as a summary of the entire report and I did not have opportunity to clear that summary with all members of the Engineering Advisory Committee and that is why I signed it myself rather than having all signatures on that letter.

THE CHAIRMAN: Frankly, Mr. Riter, that explanation was very good. Are there any further comments on the engineering report?

COM. STONE: Off the record. (Discussion off the record.) It is suggested by the Commissioner from Colorado that the members of the Commission be given an opportunity if they see fit to call upon their respective engineering advisers on the Engineering Advisory Committee to make any supplementary statements respecting this report which they care to make.

THE CHAIRMAN: The Chairman thinks the suggestion by Com. Stone is in order, and in fact I think it is well understood that any member of the Commission can call on his advisers for any information that he may desire in regard to the details of this report.

COM. STONE: Colorado wishes to call upon Mr. Patterson.

MR. PATTERSON: The only comments I feel like submitting at this time are to support Mr. Riter's position that he finds himself in. We have, Mr. Chairman, as I understand it--and I will speak now for myself--approved this report as an engineering committee. We haven't had a meeting since the final draft was prepared to read each word and figure in it and formally by motion commit ourselves; but the Committee has gone over a previous draft of this report and has edited it and I think practically all the suggestions of each member of that Committee, as nearly as it was possible for Mr. Riter to do so, have been carried out.

May I explain that the initial draft we thought spent too many words and too many pages explaining how we calculated streamflow records, for example, rather than to just submit the results of our assembly of records and our estimates where required to complete that record. So we have asked Mr. Riter and the Bureau people to boil that portion of the report down much shorter than it was in the originally presented form.

The idea of a summary, which some suggested, and the idea of a letter of transmittal, which others suggested, have been handled by Mr. Riter in the only way I think it was possible, namely, to try to consolidate both the summary and the letter of transmittal into one letter that he has prepared. Personally I see no objection whatsoever to his letter of transmittal. I believe it is strictly in accord with what I believe are the ideas of all of the engineering members of this committee. If there are any that don't agree with that they can so express themselves.

My only point is that this is, I believe, the best progress report that our Committee acting on the basis of complete understanding is able to present at this time.

THE CHAIRMAN: Thank you, Mr. Patterson. Does the Commissioner from Arizona wish to call on his engineering adviser?

COM. CARSON: Not at this time, Mr. Chairman. It seems to me that the best way to get at this is finally to give these various members of the Commission an opportunity to go over this report with their advisers and probably tomorrow again have questions to ask Mr. Riter or any of these engineering advisers. As far as I am personally concerned this is the first time I have seen it and I don't have any intelligent understanding of it now at all. I think we could make time by permitting that.

MR. RITER: Mr. Chairman, may I be permitted to say something at this point?

THE CHAIRMAN: Mr. Riter.

MR. RITER: There was no representative of Arizona present at our

last meeting of the Engineering Advisory Committee. However, we did send a draft of the report to Mr. Ralph Meeker, who has been working with us, and he replied that he had no suggestions to offer, so I took it therefore that so far as the Arizona representative on the Engineering Advisory Committee was concerned the body of the report was satisfactory to him.

COM. CARSON: That isn't what I meant. What I am getting at is the substance of the report. We have nothing now we want to call on any engineer for.

THE CHAIRMAN: The Commissioner from Utah. Do you want to call on anyone?

COM. WATSON: At the present time Utah has no comments.

THE CHAIRMAN: Wyoming?

MR. PERSON: I have no comment.

THE CHAIRMAN: New Mexico?

COM. WILSON: To the Commission at the present time I will say this: As I understand this report--it has been made by the Engineering Advisory Committee--the report sets forth facts which presumably the Commission will consider in attempting to determine an allocation of the water. At the present time, of course I haven't had an opportunity to read it. I assume it is authentic--the engineers have prepared it--and it will serve the purpose intended. Mr. Bliss is here and if he wants to make any comments on what Mr. Riter has said, he may make them.

MR. BLISS: Mr. Chairman, I have little to add except to point out that which is obvious, that the Committee has completed only a portion of what was on their original agenda. A great deal of work has been done on some of the items but they are not complete and ready for the report at the present time.

MR. RITER: Mr. Chairman.

THE CHAIRMAN: Mr. Riter.

MR. RITER: From conversations going around the table there seems to be a little doubt in my own mind whether or not you want the Engineering Advisory Committee to complete their studies. We had planned to go right ahead and get as much work performed as is possible to do to complete the assignment given us in Santa Fe a year ago, and I presume that is the intent of the Commission. I presume we should continue to work diligently to try to complete the assignment given us.

THE CHAIRMAN: Mr. Riter, I think your remarks are very much in order. We were going to come to that in a few minutes as soon as we found out whether there was any serious disagreement between the members of the Engineering Advisory Committee on the report. Of course, we understand that when you have a committee at work the report is generally a matter of compromise, but whether there is any serious disagreement or not is the reason for this discussion as our Chair sees it.

MR. RITER: May I assure you--

THE CHAIRMAN: Just a moment, Mr. Riter. Mr. Patterson of Colorado made a very clear statement about Colorado's position on it and I think the

other members have also, and I think we can assume now that the Engineering Advisory Committee are unanimous in what they have brought before the Commission, substantially so at least.

Now the question you have raised is something for the Commission to consider. Whether that can be considered properly at this time or not the Chair is in doubt because the report comes to the Commission this morning cold, you might say; the members do not know what is in it. And until that matter is considered further, I don't know whether the Commission is prepared or willing to take action on the matter of the further studies and any modification of the program or not. The Chair will be very glad to have some expression on that now from the members of the Commission.

COM. STONE: Are questions in order before that matter is discussed? I should like to ask Mr. Riter a question.

THE CHAIRMAN: Go ahead, Judge Stone.

COM. STONE: Mr. Riter, would you point out to the Commission specifically what are the items of study yet to be completed? In reading this report I note the one specific item which you mention under "River and Reservoir Operation Studies." My question is: Are those the only matters yet remaining to be studied under the assignment heretofore given by the Commission to the Engineering Advisory Committee?

MR. RITER: No, sir. The principal item that we have to complete is the matter of determination of present depletions by states and at Lee Ferry. Now that involves also a consideration of channel losses. And then in addition, we have got to make some decisions among ourselves and come to some mutual understandings regarding the runoff from these unmeasured drainage areas in order that we can determine the contributions, both historic and natural contributions, by each individual state. That was one of the tasks we suggested be completed. I don't know in how much more detail you want those discussed but those are the principal items.

COM. STONE: Taking up that last item mentioned under "River and Reservoir Operation Studies," page 3, what arrangements have been made by the Engineering Advisory Committee to do that work?

MR. RITER: Well, we will do it when we get to it. That is one of the items we have more or less held in abeyance until we could get settled some of the--what we considered--basic information.

COM. STONE: My question goes to a matter which arose in my mind after reviewing the reports which you sent out to the members of the Commission. Do I understand that you have a special subcommittee on this last item?

MR. RITER: No, sir, we don't. We have a special subcommittee appointed to study and report on depletions. That in my opinion is the biggest job remaining to be performed by the Committee. That is one of the most controversial. A year ago, being a member of the Bureau of Reclamation, naturally I had quite a bit of pride of authorship in the Bureau's report and I assumed that such report would just be adopted without argument. A matter of engineering judgment entered into the preparation of that particular report on depletion and I found that other members of the Committee had been giving that particular subject serious thought and they had some ideas that were different from ours. We operate on democratic principles and we are earnestly seeking the truth as near as we can deduce it from the information we have.

COM. STONE: May I ask this further question: You say that is the most important job yet remaining to be done by the Engineering Advisory Committee?

MR. RITER: That is right.

COM. STONE: What in your opinion is the relative importance of that job with respect to the making of a compact?

MR. RITER: Oh, well, now, I honestly don't know what the basis of the compact is going to be. From the discussions I take it that one element at least you will want to consider in the making of a compact is where the water comes from and what the present uses are and then if the Bureau of Reclamation has made an error in our assumptions in determining unit rates of depletion, you or your individual advisers for each individual state can use the new information deduced or arrived at by the Committee to convert water that you expect to be allotted to you to irrigated lands.

In other words, for the past 25 years we in the Bureau of Reclamation have assumed that a foot and a half per acre per year average over the entire Upper Colorado River Basin is a pretty good figure to represent the rate of depletion on irrigated lands. Well, I don't know now whether that is a foot and a half, a foot and three-tenths, or a foot and seven-tenths. That may make a big difference on what you hope to accomplish ultimately.

COM. STONE: Are we to understand that there is some difference of opinion in the Engineering Advisory Committee as to whether the Bureau's method was the proper one or not?

MR. RITER: Yes, there is. That is the reason we organized this committee to study the subject, to go right to the basis, to begin from the ground up.

COM. STONE: Well, in any question of the development of the Colorado River--and I would think in a compact that is very important--from your engineering knowledge and experience would you say that question of depletions is an important one?

MR. RITER: Well, if you are going to hold me to an engineer, not a promoter, I would say yes; but if you let me be a promoter, I would say no.

THE CHAIRMAN: Mr. Riter, the Chairman would like to ask you a question: After these studies are all made on this question of depletion, what in your opinion would be the maximum error that might be possible in that after this study?

MR. RITER: The maximum error?

THE CHAIRMAN: Yes, after the study is made. Of course, if the Chairman understands it, this depletion rate will vary according to the altitude and so forth.

MR. RITER: That is right.

THE CHAIRMAN: We will get the average figure.

MR. RITER: That is right. Mr. Chairman, we have compiled some tentative figures which the Committee has not yet adopted--they are strictly unofficial--and it looks as though there might be a difference between 25 or 35 percent from what the Bureau reported. I will tell you one reason, one basic

reason, why that difference came in:

In the Bureau when we estimated depletion we measured the total area irrigated under the canals. Then we applied what we thought was the proper unit rate of depletion. In arriving at the proper unit rate of depletion we tried to size up in our own minds where the lands had a full water supply; and then we tried to size up in our own minds the area of land adjacent that would be irrigated incident to the actual application of water. You know from your long years of experience as an irrigator if you apply water to a hundred acre tract you irrigate considerably more than 100 acres. Your drainage returns will cause irrigation of borrow pits and along drains. We tried to consider all those factors.

However, there is one factor we did not consider which the Engineering Advisory Committee has picked us up on: There are certain areas that were naturally irrigated before man came in there and built irrigation canals. I don't have a figure to give you today as to what extent that is, but it is a considerable area.

Well now, in the judgment of members of the Engineering Advisory Committee who have studied this problem, instead of charging against the acreage irrigated the total area under the ditch times the unit rate of depletion, we should have subtracted off a rate of depletion which was practically equal to the unit rate of depletion for full irrigation. I have in mind particularly a lot of these meadow lands in Wyoming and Colorado, for example, that were located close to the stream and were irrigated by Nature. That was one correction. I am not admitting though the Bureau figures are wrong until I get all the figures to go by. There is a difference of opinion.

The Bureau of Reclamation in our studies, we stopped at the land. We said there was practically no difference in the use at the land and the use at Lee Ferry. In our report we said we were measuring depletion at Lee Ferry but we were measuring it at the land. We assumed no difference because of transmission losses. We assumed that if we had 100,000 acre feet of stream depletion, at the site of use, that we could subtract 100,000 acre feet of the flow at Lee Ferry. That statement has been challenged and justly so. I think we should look into it. It may only be 90 percent, 80 percent, or some other percentage. I don't know exactly. But we want to study that question.

Then I am going to open up another question to you--

THE CHAIRMAN: Pardon me just a moment, Mr. Riter?

MR. RITER: You think I have said too much?

THE CHAIRMAN: No, sir, your explanation has been very informative but if the Chairman understands you, you haven't answered his question yet.

MR. RITER: You mean I have beat all around the bush without coming to the point?

THE CHAIRMAN: You have stated that there might be a difference of opinion of 25 to 35 percent between the depletion shown in the Bureau report and that made up by the Engineering Advisory Committee. My question was, what would be your estimate or guess as to the minimum error that might be in this final report on depletion, or maximum error, whichever you want to call it.

MR. RITER: The final report? We won't admit there is any error

in it if we agree to it unanimously.

COM. WILSON: May I ask some questions?

THE CHAIRMAN: Yes, Mr. Wilson.

COM. WILSON: Mr. Riter, on page 14 of the Colorado River Report in your Table I., you show potential stream depletions in the Colorado River Basin.

MR. RITER: Yes, sir.

COM. WILSON: In the first column you have the present depletion for the Upper Basin and the Lower Basin.

MR. RITER: That is right.

COM. WILSON: Now for the Upper Basin the subtotal is 2,199,800 acre feet, which is the Bureau's estimate of the stream depletions of the Upper Basin. Now I would like to ask you if this Engineering Advisory Committee has yet arrived at any figure that will be comparable to that 2,199,800?

MR. RITER: No, sir, we have not. That is one of our remaining incomplete tasks. As I said before, I have a certain pride of authorship in the Bureau figures and I naturally assumed everybody else would see these figures the way I did, but I was disillusioned in that respect.

COM. WILSON: You don't know whether the Engineering Advisory Committee will come out with a figure that is more than this or less than this?

MR. RITER: No, sir.

COM. BISHOP: Mr. Chairman, could I ask a question? I would like to ask Mr. Riter, isn't it a fact that this information that you are talking about on the area that was irrigated prior to depletions caused by activities of man, that this won't be deducted from this amount and make our present depletions less? Won't it have a tendency to do that?

MR. RITER: Mr. Bishop, it indicates it is going to go in the direction of less, yes, sir. How much I can't tell you. There are lots of elements of judgment that we will have to thrash out among ourselves. Now instead of perpetuating a figure that has been used for 25 years if that figure is wrong, we want to come out with a reliable figure that all states and the Bureau can agree on.

COM. BISHOP: That has got to include the Lower Basin States, I believe--

MR. RITER: No.

COM. BISHOP: --because this depletion in the Upper Basin certainly affects them.

MR. RITER: Well, Mr. Bishop, we are trying to get factual information.

COM. BISHOP: Yes, I know.

MR. RITER: Of course, there is a fine-haired legal interpretation that somebody is going to have to make some day. As engineers we are trying to

get the depletion, what we feel the engineering works actually deplete the streamflow. But there is a legal question on which the lawyers are going to have to work. Take a man who irrigates land under a ditch and that land was previously irrigated by Nature. Legally under the Colorado River Compact, is the state in which that land is located charged with the total depletion or just charged with the difference in depletion? That is a problem for the lawyers but the engineers don't have to worry about it. All we are trying to find out is the difference because that is an engineering problem.

COM. STONE: May I ask a question? You started out to say that there was another matter which was involved in this question of depletion. Will you explain what that was?

MR. RITER: Yes, I will tell you what that is, Judge. Maybe we don't have as big a stream to divide up as we thought we had in 1922, because we arrive at the undepleted flow by adding to the recorded flow our estimate of present depletions. The historic flow certainly is going to be fixed once we determine what that is, and then if instead of adding 2,000,000 acre feet to it, for example--the figure now derived by the Engineering Advisory Committee at Lee Ferry is an average of 13,789,000 acre feet in round numbers, that is historic flow; the figure derived by the Bureau of Reclamation is 2,200,000 acre feet of present uses--if we add the two together that means that the virgin flow at Lee Ferry is 15,989,000 acre feet.

Now for example let's take an extreme case. Suppose the Bureau missed that figure. Suppose we overestimated by 700,000---just supposing now, I am not giving that as a fact but just supposing--then the virgin flow at Lee Ferry instead of being 15,989,000 acre feet will only be 15,289,000 acre feet. That simply means, sir, that there is no surplus water in the Colorado River as I see the analysis.

In other words, it may have a more far-reaching effect than we can now appreciate. Maybe we don't have 7,500,000 acre feet left in the Upper Basin by the time we satisfy the bottom rights of the Lower Basin and satisfy the obligation to Mexico. I can see it could lead to a lot of speculation or controversy or discussion. That is the other point I had in mind, Judge Stone.

COM. STONE: That answers my former question then that this question of depletion is of tremendous importance to the making of a compact.

MR. RITER: Well, I think it is.

COM. STONE: May I ask another question? In this letter of transmittal you refer to Mr. Blaney and say that: "Consultation services of Mr. H. F. Blaney, eminent authority on consumptive use with the Department of Agriculture, have been, and are being utilized to determine unit rates of depletion for application at the site of use." For the advice of the Commission, tell us who Mr. Blaney is and what arrangements are being made, what work he is doing, what work you think he should be called upon to do in the future.

MR. RITER: Mr. Blaney is with the Department of Agriculture, Soil Conservation Service. He spent practically his entire life, his entire professional career, analyzing use of water by agriculture. The Committee felt that we wanted some outside confirmation besides our own judgment when we had arrived at a figure for depletion.

Mr. Blaney has not been too active in it. We have only invited him to one of our meetings. He has agreed to act in a consulting capacity to the

Engineering Advisory Committee on factual information. Mr. Blaney wants to keep his skirts pretty clear of any legal interpretations or any implications that he might be--well, after all he still wants to maintain his position of neutrality and he wants to be adviser on factual information. We invited him to attend one of the meetings of the Engineering Advisory Committee and he sat in on our discussions when this problem of depletion was discussed. He has agreed to assist us by reviewing our report, but he wants to work with the Engineering Advisory Committee as I understand it. In other words, I am not too clear in my own mind whether he will be adopted as a member of our committee or just be a consultant. In any event, we want him to review our work before we submit it to you gentlemen on stream depletions.

THE CHAIRMAN: Off the record. (Discussion off the record.)

COM. STONE: Mr. Chairman, I move that the Commission express its full confidence in the press and in order that they may have appropriate background that they be permitted to sit in the meetings of the Commission except at such times as the Commission may find it necessary to call an executive session, and that the reporters be left free to prepare and send out their own copy, to contain such matters as they see fit except on such matters as the Commission may see fit to ask that no publicity be given at the time.

COM. BISHOP: I second that motion, Mr. Chairman.

THE CHAIRMAN: You have heard the motion. Any further discussion on the motion? (No response. Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

COM. STONE: I move that the Commission recess to reconvene at two o'clock.

(Second. Thereupon a vote was taken and the motion of Com. Stone carried unanimously.)

(11:55 a.m. Noon Recess.)

(2:00 p.m. Meeting resumed.)

THE CHAIRMAN: The Commission will come to order. Before recess Mr. Riter was explaining Mr. Blaney's connection with the work of the Engineering Advisory Committee in reply to a question by Judge Stone. Judge Stone, do you wish to develop any further thought along that line?

COM. STONE: I think that question was answered, Mr. Chairman. However, I have another question to ask Mr. Riter.

THE CHAIRMAN: Very well, sir.

COM. STONE: Mr. Riter, on page 53 of the report and for several pages thereafter the question of stream depletions is analyzed by the Engineering Advisory Committee. I note there that there is included the matter of transportation losses--if I may put it that way--between the point where a state delivers the water produced in that state and Lee Ferry.

MR. RITER: Yes, sir.

COM. STONE: Will you explain the significance of that matter?

MR. RITER: Yes, it has two significant applications at least. One application: The original intention was to use the matter of channel losses through the State of Utah to permit the Engineering Advisory Committee to estimate the contributions of the State of Utah to the Colorado River Basin. It would be unfair if we figured the contributions of the other states, Wyoming, Colorado and New Mexico, for example, at their point of discharge into the State of Utah and then subtract the sum of the inflows to the State of Utah from the outflow from Utah in order to get Utah's contribution. We felt in fairness to Utah we should calculate the channel losses for those so-called common carrier streams and make an appropriate allowance so that all states would contribute to channel losses. That was one purpose.

And then looking forward to a time when the Compact would be negotiated we had in mind possibly that each state would agree to deliver certain quantities of water to state lines and then we have in mind--I am speaking now of the provision of the Compact which requires the Upper Basin to deliver an average of 7,500,000 acre feet at Lee Ferry--we have in mind that the Compact will subdivide that obligation and there is the question of working up operating agreements.

And then there was another matter. We believe, from the action that the Upper Basin States have taken, that under the Compact the Upper Basin is entitled to deplete the flow at Lee Ferry by 7,500,000 acre feet annually. Now from our study of channel losses we know that if we have a large streamflow that the channel loss is greater than it is if we have a small streamflow. From the standpoint of depletion that simply means this: That the sum of the depletions at the point of use--whether this be irrigation of land or transmountain diversion or whatever other use you have--if you add all those up and then make an allowance for the fact that if you deplete the streamflow, there is a certain amount of water withheld from the channel and by virtue of withholding water from the channel you are going to have a saving in the channel losses. We hope to compute a relationship between annual streamflow and annual channel losses in order that we can estimate the amount of water that would be salvaged by virtue of using water in the Basin instead of letting it flow downstream past Lee Ferry.

As we envision the ultimate development in the Upper Basin, assuming that there is water supply to make that development, if the Upper Basin depletes the flow at Lee Ferry by 7,500,000 acre feet annually--the actual so-called use of water--the aggregate of all the uses will be 7,500,000 acre feet plus the salvaged channel losses. Now I have not personally made studies as to how much that salvage is but other members of the Committee have made studies and they feel that there is a substantial salvage, probably as much as a half a million acre feet a year. It may be that or it may be less. But that is one point that we wish to study.

Incidentally, in the comments of certain of the states on the Bureau's report, they criticized us for not allowing for salvage. The Bureau did not do it. However, I can point out to you a good example of that and that is the case of Arizona and the Gila River Basin. We have made studies on the Gila River and we find that there is a salvage of about a million acre feet a year in the Gila River by virtue of using the water. In other words, the uses in the Phoenix vicinity are in the neighborhood of 2,300,000 acre feet and we calculate about a million acre feet of those uses are secured by preventing water from being lost in the sandy beds of the Gila River between Phoenix and the Colorado River.

As we see it it is a matter of degree. Chances are in the Upper Basin it will not be as much as it is in the Gila Basin but we feel it is a quantity which should be determined and should be accounted for. Does that

answer your question, Judge Stone?

COM. STONE: Yes.

MR. RITER: That is a further elaboration on it.

COM. WATSON: Will you explain, Mr. Riter, how you figured that salvage in the Gila of the million acre feet?

MR. RITER: What we did down there, Mr. Watson--it has been some time since I reviewed the studies--but we compared concurrent records of the streamflow at the mouth of the Gila River and in the Phoenix vicinity and worked up a relationship between the discharge in the Phoenix vicinity and at the mouth of the River so we could determine how much channel loss there was.

COM. WATSON: That doesn't include pumping?

MR. RITER: No, that is just loss in the natural channel. It has been some time since we made those studies and I think the Bureau is continuing the studies to see whether it is exactly a million or whether it is a little more or a little less. But the studies we made were made in 1934 and they have been brought up to date.

COM. WATSON: How much has been pumped at Gillespie and elsewhere?

MR. RITER: Well, I don't have the exact figures on that today, Mr. Watson. As I recall the pumpage is in the neighborhood of a million acre feet a year in the Phoenix vicinity. Mr. Carson may be able to confirm that if he remembers it.

COM. WATSON: That is my recollection because I talked to two underground water engineers down in Phoenix and that was their conclusion.

MR. RITER: This million acre feet we figured as salvage is not limited only to the channels below the Phoenix area. But having determined the unit rate per mile of channel, we calculated the length of the channel through the Phoenix area, the Salt River and the Gila River, and some of those minor tributaries. So we made an estimate of what the channel losses were before man came in there to develop the stream.

COM. WATSON: What did you figure was your return flow from irrigation, that is, you used a foot and a half or two and a half feet?

MR. RITER: No, I don't think we analyzed it that way, Mr. Watson. We tried to calculate the loss per mile of channel--the original loss per mile of channel. Then we compared the loss per mile of channel to the length of the channel and made an estimate of the amount of water that was lost under virgin conditions. In other words, the quantity we were trying to build up was what the virgin flow was, that is, the undepleted flow at the mouth of the Gila, and we got an average figure of a million three hundred thousand acre feet, and the virgin flow into the Phoenix area was about 2,300,000 acre feet. So we concluded the difference was channel losses which we had salvaged.

COM. CARSON: Which you had partially salvaged, wouldn't you say? There is still a lot of losses there in the Phoenix area.

MR. RITER: Yes.

COM. STONE: Mr. Riter, one of the principal reasons then for this study which you have just described in answer to my question is to envision the

proposition that a state in making deliveries of water to make up the average annual amount of 7,500,000 acre feet should not be credited with the amount which passes the state line but the amount of water originating in the state and to be delivered by a state, arriving at Lee Ferry, is that correct?

MR. RITER: Well, if I understand your question correctly, Judge, yes. As we envision it you are going to have to write some operating rules for your compact and in writing your operating rules you are going to have to allow and make appropriate provisions for channel losses on the water that you might deliver at your state line.

COM. STONE: To put it another way, to get it right out in the open, if a state was given credit for the amount of water which passes the state line in making deliveries at Lee Ferry, then Utah would absorb the channel losses?

MR. RITER: That is right.

COM. STONE: And so it is necessary to determine those channel losses for the protection of the state through which this water passes on the way to Lee Ferry?

MR. RITER: That is right.

COM. STONE: Is that right?

MR. RITER: That is right. I think we can illustrate it by a simple figure. For example, and strictly for example, say that Wyoming undertook to deliver a million acre feet of water in any one year at Lee Ferry. That means that in order to assure that water would get through Utah to Lee Ferry, Wyoming would have to deliver at the Wyoming-Utah State Line, one million acre feet plus a pro rata share of the channel losses through the State of Utah.

COM. STONE: That same rule would apply to Colorado?

MR. RITER: That same rule would apply to Colorado, yes, sir.

COM. BISHOP: Mr. Riter, did I understand you to say that your studies show that the percentage of loss is greater with a large amount of water going down a river than a small amount?

MR. RITER: The total losses.

COM. BISHOP: Oh, the total would be some larger, but don't you think all Wyoming and Colorado should be charged with is the difference over and above what it took to get the amount of water down that was already going there?

MR. RITER: Mr. Bishop, we have not yet worked up a relationship between streamflow and channel losses. We have some tentative average figures which we are not yet ready to report on. But in looking at those averages and looking at the losses year by year, we find that there is in general a relationship between magnitude of streamflow and channel losses. In other words, in years of high runoff the losses are greater than they are in years of low runoff, generally speaking. But the Committee is not ready to present at the present time to the Commission for your consideration, a definite formula that we are ready to recommend.

THE CHAIRMAN: Mr. Riter, are these losses that you are talking about recoverable or nonrecoverable, and in what stretch of the stream are you talking about?

MR. RITER: The losses are partially recoverable, Mr. Bashore.

THE CHAIRMAN: Above or below Lee Ferry?

MR. RITER: Above Lee Ferry.

COM. WATSON: I would like to make this observation: Is not Mr. Bishop's conclusion based more or less on a fallacy because the State of Wyoming wouldn't take care of its loss from Linwood to Lee Ferry proportionately because Utah is furnishing a wet bed for the water of yours that would be evaporated and lost to flow down. Therefore you would have to take care of that portion of the loss that Utah takes in furnishing a wet channel.

COM. BISHOP: The projects they have proposed there won't permit any water to go down to Lee Ferry.

MR. RITER: Of course this matter of channel losses is also tied up intimately with the problem of main stem reservoirs. Main stem reservoirs will introduce some new losses over and above the old losses.

COM. STONE: Mr. Riter, you said the Committee had reached no conclusions as yet. You have been working on that as evidenced by your report?

MR. RITER: That is right.

COM. STONE: May I inquire whether you know now how much more work it will take to arrive at some formulas or recommended formulas by the Engineering Advisory Committee?

MR. RITER: Well, if you don't have me translate that in terms of man years--

COM. STONE: I am not asking for man years; just give us an idea about how much more work remains to be done. You have done some work?

MR. RITER: That is right.

COM. STONE: How much more work is required to come out with some recommended formulas?

MR. RITER: Well, I don't know exactly how to answer your question.

COM. STONE: Well, is it a big job or a small job or have you gotten fairly well along with the job?

MR. RITER: The biggest job is arriving at an agreement among ourselves on what is proper to use. If Mr. Patterson were given the assignment or if I were given the assignment we could work it up on short order, but we must coordinate our views with other people. Tied up with this matter of channel losses is also estimated inflow from unmeasured drainage areas. The two have to be considered together.

I can only answer your question this way: It is not what I consider a tremendously large job. We have run into some tough problems on the San Juan in particular to rationalize our estimate of losses. In other words, we make an estimate based on the information we have and then we sit back and look at

it and see if it looks reasonable.

We have made estimates of the main stems below Green River, Utah; below Cisco, Utah; and below Bluff, Utah, down to the Lee's Ferry gaging station. I think that our estimate of losses is fairly rational. We have attempted a similar analysis for the San Juan but we find some losses in there we just don't understand, we can't account for them. I don't know yet how we are going to resolve it. It is a matter of making a decision with the data available and that is the best information we can present when we get to it. I don't know whether Mr. Patterson would care to elaborate on it or not. If you would I would be very happy to have you do so.

MR. PATTERSON: I would like to if you will permit me to.

THE CHAIRMAN: Go ahead.

MR. PATTERSON: This question of channel losses, as Mr. Riter has indicated, is related to a lot of other questions including the amounts of water contributed particularly by New Mexico and Utah. The question of time when you can finish one of these things is purely a matter of guessing on the question of how uniform your various methods of calculation come out.

On this lower reach down to Lee Ferry it happened that the two methods of calculating that channel loss were in substantial agreement. One of those methods is based upon streamflow records. The other is based upon areas exposed to evaporation and it happened that the two subcommittees working independently came up with figures substantially in agreement for that stretch of about 500 miles of river. Then we proceeded to work upstream from Green River, Utah to Linwood, and up the Colorado above Cisco, and up the San Juan River above Bluff, because we still have common carrier sections of rivers in all three of those major tributaries.

Now, here is where we got stalled and are having to do some additional work: The two methods didn't check on the San Juan above Bluff and they don't check on the Colorado above Cisco. The question then that confronts any engineer is which of the two widely differing results we feel is the one that we can recommend to you for your use as being dependable information. And until the inconsistency of those two methods of study in that instance are understood and worked out and something can be agreed to by us, we have nothing that we could report to you except figures that you would have to debate yourselves as to which one you would use.

So we can't say definitely when we are going to run into those conflicting results and the need for additional study and an approach from a different way.

COM. WATSON: Is that based on a lack of data, Mr. Patterson?

MR. PATTERSON: A lack of accurate and complete information of course is one reason for considerable work in all schedules that we have tackled. But in this case I doubt if it can be attributed to lack of information because we did have the daily flow values for some of the years on these two streams where these inconsistencies showed up and we did have information about the water areas exposed to evaporation and the adjoining bottom land areas that were also water consuming in character. So that it is not accounted for there wholly by lack of adequate data but it is one of those things that is simply a hurdle which we have reached here which requires further study and consideration before our minds are in agreement as to what is a figure we can give you that you can depend on.

MR. RITER: You might mention too, Mr. Patterson, in the operation of the Committee so far, we have been unanimous on the figures we have agreed on.

MR. PATTERSON: Yes, I think that is true, that there has been nothing yet that the Committee has tackled but what everything we have done has been satisfactory to every member of that Committee and meets his own viewpoint as to the thing to do. That includes both the presentation of this report and this assembled basic data and the withholding of things that we are not yet ready to report on. That does not mean that we have among ourselves any controversy of any personal nature. It isn't attached in any way to the possible effects of this difference upon any one state. It is purely a matter of engineering differences of opinion growing out of subcommittee studies that are not as yet in agreement.

MR. GILES: May I ask, your subcommittees are representative of all the states involved?

MR. PATTERSON: That is right, and they are participated in, every committee, by the representatives of the Bureau of Reclamation.

COM. WATSON: May I refer to your question of reservoirs again that you just mentioned?

MR. RITER: Yes.

COM. WATSON: Is it not proper in studying these reservoir sites to figure that they are containers that stop Wyoming's water, Utah's water, and Colorado's water in its course down to Lee Ferry to meet our obligations at Lee Ferry during dry years? There are those great reservoirs, the containers which actually contribute to utilizing the water that we have and that we are obligated to deliver, more than we may use among ourselves beneficially.

MR. RITER: Mr. Watson, that has been my concept of the problem, yes, sir. Of course, that particular phase of the problem, I am sorry we are not ready to report on, but I am speaking for myself now. I have always had that in mind, the reservoirs would be common property. I would like to illustrate that with a few figures if I may--if I can find them.

The average recorded flow of the Colorado at Lee Ferry during the low ten-year period 1931 to 1940, was 10,200,000 acre feet. Now if we assume for the purpose of illustration that our share of the Mexican Treaty obligation plus the obligation to deliver water at Lee Ferry would add up--just for argument purposes--to 8,200,000 acre feet, then by deduction that means that if we have no reservoirs, we can only utilize 2,000,000 acre feet of additional water supply--that is, the difference between 10,200,000 and 8,200,000.

Well, now, if we should build reservoirs in that period which would release an average of 2,000,000 acre feet of stored water to the stream, that means we could then expand our uses by 2,000,000 acre feet. That is my concept of it. There may be some other angles that I haven't exactly, properly evaluated but in my concept those main stem holdover reservoirs are common property and all states are interested in them.

COM. WATSON: And wouldn't it further be the case, Mr. Riter, that those reservoirs would serve as a means to develop power and the profits from that power would go towards paying Wyoming's expenses for their projects and Colorado's expenses for their projects and Utah's expenses for our projects inasmuch as we are unable to fulfill the requirements of the Bureau of Reclamation 100 percent? In other words, inasmuch as we have to be subsidized, won't those reservoirs help us all in a community way to pay our way?

MR. RITER: Speaking as a promoter, yes.

COM. STONE: I would like to ask a question: When is Mr. Riter a promoter and when an engineer?

MR. GILES: Mr. Chairman, may I follow that comment up a little bit? I would like that definitely explained if he cares to.

MR. RITER: As an engineer I would like to see all the facts gathered. As a promoter and a member of the Bureau of Reclamation, I would like to see the states come to a quick agreement, select a list of projects and give them to the Secretary of the Interior and say, "Mr. Secretary, we have agreed among ourselves we can build these projects that will use up 'x' amount of water, and we will not squabble up to here. We can surely build these amounts of projects."

Gentlemen, I will repeat what I said at Salt Lake City: As long as we continue to fight among ourselves and argue and do not build projects, the water is going downstream and the people downstream are only human beings and if water is running by their doors, whether they be located in California or the Republic of Mexico, they are going to be tempted to use that water. I am very sincere in my promotional activities. I do want the states to get together and agree as soon as possible whether we have a compact or whether we don't have a compact, on a group of projects that we can promote and build.

COM. WATSON: Mr. Riter, the reason I made the reference to the reservoirs and their usefulness was that we seem to be taking an attitude here that it is the contribution entirely that governs by each state. We admit that that is a factor but this other factor that we have just brought up, furnishing the containers for the conservation of that water, is equally important and therefore we don't wish Utah to be misunderstood by its silence to acquiesce in the fact that contribution is the main thing. It is one of the things and only one. There are other factors just as important.

MR. RITER: I think the Commissioners have that well in mind, Mr. Watson.

COM. STONE: I don't think anyone contends, Colorado doesn't contend, that contribution is the sole factor. There are many factors that have to be considered in reaching equitable apportionment.

THE CHAIRMAN: I don't see how you gentlemen can argue these questions without completion of these studies and it seems to me we ought to be consistent. I would like to ask you a question, Mr. Riter.

MR. RITER: All right.

THE CHAIRMAN: What happens to these channel losses? What are the causes of channel losses, first; and what happens to the channel losses, second?

MR. RITER: Well, as nearly as we can deduce at present, Mr. Chairman, the losses that we have analyzed are due entirely to evaporation and transpiration. In the canyon portions--

THE CHAIRMAN: Pardon me. Let me interrupt you right there. That kind of loss could not be recoverable.

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MR. RITER: Except to this extent: If you have a smaller quantity

of water going down the stream you reduce the area exposed to evaporation and transpiration so to that extent you can recover them.

THE CHAIRMAN: You can't recover an evaporation loss certainly.

MR. RITER: Mr. Chairman, for example, a stream has a cross section and the higher your stage the greater the water surface area exposed. And then in certain cases during high flood stage, the stream overflows its banks and part of the water becomes entrapped in sloughs, a part of it seeps into the flats, and then when the stream recedes, the water is not immediately drained out and then it supports a tremendous growth of vegetation and some of it is lost by evaporation. If you control it by use of water upstream and the quantity of the streamflow is decreased, that means then that the area of the channel is decreased, the area subject to evaporation, and it means also that the frequency of overflow and the magnitude of overflow is decreased.

MR. GILES: What you mean, Mr. Riter, is that it is compensated, not recovered?

MR. RITER: Well, it is reduced.

MR. GILES: You can have compensation by reduction, can't you?

MR. RITER: I don't understand your terms, General.

MR. GILES: You are attempting to explain to the Chairman that a loss is not a loss, as I get you.

MR. RITER: That is right.

MR. GILES: And you are compensating that loss by another consideration which you have just explained.

MR. RITER: Maybe--I don't pretend to be a lawyer. I can't answer your questions.

COM. WATSON: You prevent the loss.

MR. RITER: We prevent the loss.

THE CHAIRMAN: I think that is the understanding.

MR. GILES: I understand it too.

COM. BISHOP: Mr. Riter, isn't it a fact that this matter of channel losses is a matter that is impossible of accurate determination?

MR. RITER: You are an engineer, Mr. Bishop.

COM. BISHOP: I am asking you because you are supposed to be an expert.

MR. RITER: Thanks, but I don't pretend to be an expert. It is true that there is no such thing as precision but we have approached the problem from at least two different methods and in the case of the main stem study, our two different approaches gave consistent results. They were within the realm of what we considered accuracy. So for that reason we had a great deal of confidence in our derived results. They are not precise from the standpoint of precision but they are within the realm of engineering accuracy.

COM. STONE: You mean by that that you could reach a reasonable degree of accuracy?

MR. RITER: That is right. And the eight of us in the Committee were reasonably reconciled that the results were rational. In other words, we could account for them.

COM. BISHOP: Mr. Riter, didn't you consider that the report of the Bureau of Reclamation was within a reasonable degree of accuracy on those matters?

MR. RITER: Well, now, I told you before I have pride of authorship in the Bureau report. I think it is within reasonable accuracy, yes, but I think I may have been owner blind. Other engineers who are just as competent as I am and have had much more experience have challenged the findings. Tom McClure before he died--I am sorry he died when he did because I never did find out what was exactly in his mind--Tom McClure felt we had underestimated the present uses in New Mexico by virtue of not allowing, as I understand it, for losses on return flow.

Frank Merriell, an engineer who has spent his lifetime in Western Colorado, and he knows Western Colorado like a book, has made an analysis similar to ours and he comes out with a considerably smaller answer than we found for Colorado. So in the light of that, I can't close my eyes to the findings of these other engineers.

At the time the Bureau made a study, I worked independently. We had engineers familiar with the areas work independently and we had the figures checked. It seems to me that the differences are too great so we shouldn't let them pass without investigating them to see what the right answer is. I am sorry that we didn't agree but we just didn't so the thing to do is get the facts and derive an answer that we can all subscribe to. Certainly I am the last one to admit the Bureau report is wrong. Maybe I am going to be the tough one of the Committee to convince.

MR. PATTERSON: Mr. Bishop, on that point, if I can supplement Mr. Riter's statement and help defend him a little bit, I think it is just bluntly when the Bureau report was gotten up the question of channel losses before Lee Ferry was ignored. It just wasn't taken into account.

Now answering your question about whether it is possible to measure channel losses, we assume that these records of streamflow that have been compiled by the Federal agencies and the states are reasonably accurate, are acceptable for use, and yet we know that they are not perfect. There are, as you know, allowable, recognized degrees of departure from perfection even in the streamflow records themselves. Now channel loss as measured by hydraulic methods, streamflow records, is measurable to the extent that it is merely the difference between two measured quantities. It is calculated from the other process of area times evaporation rates. And in all of this work where it is possible to do it, we are trying to check every conclusion before it is put out in all of the reasonable ways in which that check can be carried out. None of them are perfect. The basic records we start with are not perfect. But it is a class of engineering information that is acceptable and dependable for investments in the future and commonly they are made on the basis of this kind of record.

COM. BISHOP: We are willing to accept any method that has any reasonable degree of accuracy. We would like to go ahead and get a compact. believe there is anyo

more anxious to get it done than I am because I have devoted my life to these kind of things and I don't expect to be here much longer. I would like to see this done right away.

MR. WALLACE: Off the record. (Discussion off the record.)

MR. RITER: I don't know whether I have answered you fully or not, Mr. Bishop, but that is about the best explanation I can give to you.

COM. STONE: Since you were one of the authors or one of those who worked on the report of the Bureau of Reclamation, you don't question Mr. Patterson's statement that in your report the Bureau didn't make any estimation whatever of these channel losses?

MR. RITER: No, sir. I will say definitely we did not. I am frank to admit we didn't. I am more or less reconciled to the omission this way, that if we salvaged any channel losses we would lose it again in main stem reservoirs. That is the way I reconciled my own thinking to that deficiency.

MR. GILES: You still feel that way?

MR. RITER: To a certain extent, yes, sir.

COM. WATSON: Have you reached the point now where you can tell us what the losses on the main stem reservoirs might be?

MR. RITER: I am still using the figure, 800,000 acre feet, round numbers. That is new loss over and above present losses. The Bureau has the figure about 831,000, but I like to deal in round numbers so I call it 800,000.

MR. LARSON: Is that gross loss or net loss?

MR. RITER: That is net loss over and above present losses. What do you say it is?

MR. LARSON: It is too high.

MR. RITER: Mr. Larson challenges my statement. I don't know whether you want to answer Mr. Watson's question or not.

THE CHAIRMAN: Gentlemen, it seems to me you are getting into details which are not appropriate for the Commission to handle. That is a matter for the Engineering Advisory Committee as I understand it to dispose of and bring it before the Commission.

MR. RITER: The Engineering Advisory Committee has not made a study of reservoir losses. I gave that strictly as my own figure.

THE CHAIRMAN: The Chair would like to see a full development of the ideas here looking forward to the action which this Commission should take in regard to further work of the Engineering Advisory Committee. Now I don't know whether you members of the Commission have all the information that you feel that you should have in regard to the further work of this Engineering Advisory Committee or not. If you haven't now is the time to develop your information.

COM. BISHOP: Mr. Chairman, I have prepared a little statement here for the State of Wyoming. It might give you something to argue about and it might help you to get started with your negotiations. With your permission--

THE CHAIRMAN: Pardon me just a minute, Mr. Bishop. I don't want to bar anything but I wonder if this is an appropriate time or not. I would like to dispose of things in order. We haven't disposed of the future of this Engineering Advisory Committee yet. I would like to do that and then consider your proposition if that would be satisfactory to you.

COM. BISHOP: It might make some difference on what you would want to do with the Engineering Advisory Committee.

THE CHAIRMAN: Very well.

COM. BISHOP: If the group would approve of what we propose.

THE CHAIRMAN: Very well, Mr. Bishop, go ahead.

COM. BISHOP: It seems to me that the most troublesome item that confronts this Commission is the transmountain diversion that are proposed.

As I view the situation, if 3,000,000 acre feet or more of water is transported from the natural basin as now proposed, the 2,300,000 acre feet additional left for consumption will be of no benefit to any of us as it will be taken up in reservoir evaporation and channel losses.

It was on account of the insistence of some of the Upper Basin representatives on the Colorado River Compact Commission that transmountain diversion of water be allowed that caused the Lower Basin States' representatives to insist on a guarantee of an average of 75,000,000 acre feet of water in continuing ten-year periods. This was a mistake that can well wreck the entire plan of the development of the Upper Basin unless we face the facts and keep the amount of water to be transported from the Basin within reasonable limits.

May I suggest for your careful consideration, gentlemen:

(a) That the compact be made to provide that not to exceed 25 percent of the allocation of any state be transported from the natural basin.

(b) That the compact provide for closing of a portion of the transmountain diversions necessary to make good any obligation at Lee Ferry.

That is an easy matter for the administration under the compact to handle according to the way these men have told me the thing would be handled As I understand it, they are going to know pretty well if a year comes along that is going to be a short year and they might have to cut down 5 percent or 10 percent on their amount of water that could be allowed for transmountain diversion. My first thought was that it would all be shut off but as we have thought it over in Wyoming this is the idea we have.

We believe this is a fair and equitable solution of the most difficult item to be considered in these negotiations.

Unless some simple solution such as this is provided the problem of meeting the obligation at Lee Ferry at once becomes complex and a matter that, to me, seems impossible of practical solution.

That is all.

MR. GILES: Let's hear No. 1 again, Mr. Bishop, or (a).

COM. BISHOP: Now this percent, when I say 25 percent--this is just a thought. Maybe you would want to make it 15 or make it 30 or make it 50. I am not insisting on anything; I am just giving you an idea of something to work on. So far I don't think we have had many ideas.

(a) That the compact be made to provide that not to exceed 25 percent of the allocation of any state be transported from the natural basin.

Now, gentlemen, what I have in mind is this: Over in Colorado they have got the Colorado-Big Thompson and they have got gathering ditches that go around there and take the water and that is all right and I don't object. But the water that is left in those tributaries, a lot of it will never reach the main stream and it will never do anyone any good and we should know what percent it is possible to take out.

Wyoming is willing to sign on the dotted line. We want about 200,000 acre feet of water for transmountain diversion and we will sign on the dotted line to scale ours down to take care of the obligation at Lee Ferry. And it is our position that it is morally wrong to take water from a basin which is needed within that basin and this will take care of the situation, gentlemen, and it looks to me like it is something for the engineers to think about, to work out something along this line that will do the job.

COM. WATSON: May I ask Mr. Bishop a question?

THE CHAIRMAN: Pardon me just a minute. I think that perhaps our reporter would like about five minutes' rest.

(3:05 p.m. Recess.)

(3:15 p.m. Meeting resumed.)

THE CHAIRMAN: Now the Commission will come to order.

COM. WATSON: I would like to ask Mr. Bishop if all of the Lower Basin or most of the Lower Basin doesn't utilize their water on the basis of transmountain diversion?

COM. BISHOP: Mr. Watson, I don't think it makes any difference to us how the Lower Basin uses their water.

COM. WATSON: Then why should it make any difference between ourselves how we use our apportioned water if we furnish the water guaranteed at Lee Ferry?

COM. BISHOP: Well, as I said before, we believe it is morally wrong to take water out of the basin that is needed within the basin. If it weren't for the transmountain diversions there would never be any shortage of water at Lee Ferry according to my judgment so why not have the transmountain diversions set up so they will take care of it. And these engineers, if they know that has to be done, will make their studies so that there will never be any shortage for the transmountain diversions I don't believe.

COM. STONE: May I ask you this question, Mr. Bishop: Is it any concern of Colorado how Wyoming uses its share of the water which may be apportioned to Wyoming provided Wyoming makes its agreed deliveries of water at Lee Ferry?

COM. BISHOP: I would say that it would if transmountain diversion was going to cause Colorado to have to turn water down to make good that obligation at Lee Ferry.

according to the estimates of the engineers, approximately 135,000 acre feet a year. Those are old projects and one of them has a priority date I believe of 1892, isn't it?

MR. BREITENSTEIN: The early '90's.

COM. STONE: At least it is the early 1890's. And this Commission would not have the authority to impose restrictions within a state against such exportation. After all, it gets back, it seems to me, to the policy within a state as to how it shall use its share of water and how it is going to make deliveries at Lee Ferry under any compact which may be negotiated and approved.

COM. BISHOP: It is only water that is to be divided under the compact, Judge, that I propose to regulate to take care of the obligation at Lee Ferry. I don't propose to stop any present transmountain diversions. We have some in Wyoming and of course we don't allow them in Wyoming except where the water is not needed in the basin. We try to keep the basin taken care of before we allow the water to be used without the basin.

COM. STONE: I repeat my question and it is not the purpose of argument but for the purpose of a question for your consideration: What concern is it of Wyoming how any other state uses its water so long as that state does not exceed its apportionment and makes deliveries at Lee Ferry which may be imposed by compact?

COM. BISHOP: It makes this difference, Judge: If you make that transmountain diversion amount of water so great that there is no water left for use within the basin, it naturally affects Wyoming.

COM. STONE: It doesn't affect Wyoming in the least, does it, if Colorado does not exceed its use of water apportioned by a compact and if Colorado or any other state that may be involved makes its deliveries at Lee Ferry because that would leave to Wyoming the apportionment of water to Wyoming and would leave to Wyoming its obligation to make deliveries at Lee Ferry and no more?

COM. WATSON: What would you think of this proposition, Mr. Bishop: Suppose that in Utah there was a power plant built on the main stem of the River and that there was a transmountain diversion into Utah where the beneficial use would be very high; suppose that project could pay for itself through the sale of electric power and in addition some of the profits from the sale of that electric power could be used for building of the Seedskadee project, would you object to that?

COM. BISHOP: No, not at all.

COM. WATSON: In that case you have a transmountain diversion tied in with a local development of power on the River in which a contribution would be made to Wyoming through a power pool to pay for its projects. That would be tied in with a transmountain diversion.

COM. BISHOP: When enough reservoirs are built on the main stem and tributaries at strategic locations, there probably will never be a shortage at Lee Ferry that will need water other than water stored for that purpose.

COM. WATSON: What if those reservoirs were built on the main stem of the River, power was developed and the power went over into Utah where 80 percent of the market is for power, and those profits from that power helped to build most of your projects in Wyoming; would you object to that?

COM. STONE: Isn't that the affair of Colorado and not the affair of this Commission?

COM. BISHOP: I think so.

COM. WATSON: May I ask Judge Stone a question? Judge, what is the attitude of Colorado concerning the transmountain diversion at Big Thompson? Do you figure that that is subject to your obligation at Lee Ferry?

COM. STONE: You have got a two-pronged question. I want to say this, that Colorado-Big Thompson water would have to come within Colorado's apportionment of water and Colorado would be obligated to make any deliveries at Lee Ferry which Colorado agreed to make in a compact.

COM. WATSON: And if necessary you would cut off Colorado-Big Thompson to fulfill that obligation if we were living in time of a drought?

COM. STONE: That would be a question for Colorado to determine. We have a priority system in this state and we feel that it would be no concern of any other state what water we turned down to Lee Ferry or what projects were cut off. To a certain degree that would be determined by priorities. In another degree it would be affected by such agreements or arrangements which are made under state policy with respect to projects that are constructed as reclamation projects and under some authorization by Congress.

That is, after all, a question of each state adopting its own policies for the use of its share of water as finally determined, and each state would be obligated as a state, as a sovereign state, to meet its commitments for deliveries of water at Lee Ferry under any compact which would be consummated. It seems to me that you can't tie that to any project or any basin, but in order to make a compact workable you must rely upon the sovereign states that are responsible for and must be looked to in order to carry out any compact that is made.

COM. BISHOP: Judge, I would like to ask you a question: Isn't it a fact that in the State of Colorado you make the transmountain diversion of water secondary to the use of water within the basin?

COM. STONE: No, that is not a correct statement. You have first got to consider that we have applicable in this state the priority doctrine. Secondly, you have got to consider the policy of the state with respect to Federal projects that are authorized by Congress. You must draw a distinction between those projects that are authorized by Congress under certain conditions and projects that might be built by, let us say, private enterprise.

But as to the Colorado-Big Thompson project and similar projects that are authorized by Congress, we have followed the policy and principle of setting up those projects in a manner that their operation will protect the present and prospective uses of water within the basin of the Colorado River. But we conceive that to be a matter of state policy and not a matter which is the concern of other states so long as we meet any obligation imposed by compact relative to delivery of water at Lee Ferry and so long as we use water within any amount which is apportioned to the state.

COM. BISHOP: It would seem to me if that policy would be a good thing for Colorado it would be a good thing for the Upper Basin as a whole.

MR. GIBBS: Mr. Chairman, I don't want to impose on the Commissioners

prerogative but I think early in the consideration of this problem I was given the privilege of the floor when I felt that I had something to say that was pertinent.

I am directing myself to Mr. Bishop's proposal, not in criticism of the contents, but procedure. I don't think your proposal at this time is in order. You would have the Commissioners setting up a formula to which the engineers would conform, as I got your statement a while ago. I don't believe that is the function of this Committee. I believe it is the function of this Engineering Advisory Committee strictly to produce facts, data, on which or from which the Commission will determine a formula and a basis for the apportionment.

COM. BISHOP: Mr. Giles, we wouldn't need those depletion studies if you would work it out this way. The shutting off of the transmountain diversions if and when there was liable to be a shortage would automatically take care of it.

MR. GILES: Of course, I can't agree with that position. I believe you have got to proceed with the report of this Committee. And getting back to the point that the Chairman asked some information on sometime ago, Mr. Riter, in my opinion neither you nor Mr. Patterson, with all due deference to you, have properly answered the question of the Chairman. How much time would it take to develop the information on channel losses in the area that you spoke of where you have reached an impasse? Do you have data to secure it? Is it necessary to secure further data? Or is it a mere disagreement among the engineers as to the formula that should be used?

COM. STONE: Grover, may I correct a word you used?

MR. GILES: Yes.

COM. STONE: I don't believe either Mr. Riter or Mr. Patterson meant to convey the idea they reached an impasse.

MR. GILES: I mean an impasse in the sense of a hurdle.

COM. STONE: I think they simply meant that the Committee had not yet had time enough to work out a formula and that thus far in their consideration of this matter there had been no disagreement, but it was necessary to find a formula which they all could agree upon.

MR. GILES: I think we understand each other, Judge Stone. I ineptly used the word "impasse."

COM. STONE: Yes.

COM. WATSON: May I ask Judge Stone a question?

THE CHAIRMAN: Yes.

COM. WATSON: What is the difference between the obligation of the State of Colorado to a reclamation project and a project built by private enterprise?

COM. STONE: Colorado has adopted what we refer to as the 1937 Conservancy District Act. That Act was set up primarily for the purpose of creating districts which would have the authority to deal with a Federal agency, such as the Bureau of Reclamation, in executing an acceptable repayment contract. The Act as amended in 1941 I believe, or it may have been 1943, sets up a

principle that must be observed by a conservancy district set up to enter into a repayment contract involving a transmountain project. And in the case of the Colorado-Big Thompson project, the project was authorized by Congress subject to an agreement expressed in Senate Document 80, which prescribed the conditions under which that project could be built and operated.

Now such a procedure as that would not be involved by a private group or a municipality that financed the project itself unless that municipality or that private group agreed themselves to be bound by such an arrangement. Does that answer the question?

COM. WATSON: Yes, sir.

MR. PATTERSON: May I explain one step further I believe for Mr. Bishop or Mr. Watson, that that Act provides that the plans for that project shall provide for the facility such as compensating or replacement storage on the Western Slope.

And I want to elaborate just a little further: We don't expect to build projects that can't divert and use water; and in order that these present projects like the Colorado-Big Thompson can continue, even during a period when their junior rights under state law would prevent them from diverting water, they replace that river flow for the senior Western Slope people out of reservoirs they built as a part of their project.

The same thing must happen here. The Upper Basin can't go far in the future without building reservoirs that will operate to release water during these drought cycles in order that irrigation projects and diversion projects upstream can continue to function. That is the purpose of them. And instead of shutting off projects, we are going to rely on these reservoirs to make good on the obligations at Lee Ferry.

MR. ROLLINS: Mr. Chairman, is it permissible for someone sitting down this far to say a word?

THE CHAIRMAN: I think so, Mr. Rollins.

MR. ROLLINS: I am just wondering if it was upon the insistence of Congress under the terms of your Big Thompson project that the rights of the land owners and water users on the Western Slope were protected. If so, wouldn't they likewise insist on any future transmountain diversions either in Colorado or any other state?

COM. STONE: That policy didn't arise out of Congress. That policy arose within the State of Colorado itself.

MR. ROLLINS: As between the two slopes?

COM. STONE: And it is necessary and we conceive it to be good policy to protect the present and prospective uses within the basin.

COM. BISHOP: That same plan you have, Judge, extended, would be exactly what I proposed for the whole basin for the protection of the basin. It seems to me that the basin is entitled to protection the same as the part of it which is in Colorado.

COM. STONE: Mr. Breitenstein calls my attention to a consideration which perhaps Mr. Bishop does not seem to appreciate. We have transmountain diversion projects in this state, existing projects, which export, I believe

according to the estimates of the engineers, approximately 135,000 acre feet a year. Those are old projects and one of them has a priority date I believe of 1892, isn't it?

MR. BREITENSTEIN: The early '90's.

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COM. WATSON: What if those reservoirs were built on the main stem of the River, power was developed and the power went over into Utah where 80 percent of the market is for power, and those profits from that power helped to build most of your projects in Wyoming; would you object to that?

COM. BISHOP: No, that would be perfectly all right. I still think that the water that is taken out of the basin should be made secondary and I do believe that this Compact Commission has the authority to make it so.

THE CHAIRMAN: Gentlemen, your Chairman doesn't want to be arbitrary and cut off discussion on this question. It seems to me Mr. Bishop's proposal has been rather thoroughly discussed. Perhaps it can be disposed of by a motion.

COM. BISHOP: Mr. Chairman, I didn't propose it as a motion. It is just something to talk about and think about. I would like to hear somebody make a counterproposal. I think that is how we make a compact, find out what the other fellow wants and find out if it is acceptable.

COM. WATSON: I have a very short answer to Mr. Bishop's proposal. May I give it?

THE CHAIRMAN: Yes, sir.

COM. WATSON: I think Judge Stone has answered Mr. Bishop in making a counterproposal and that is it is the business of each state itself as to what it shall do with its water, whether it shall use it in projects along the River or use it by transmountain diversion.

THE CHAIRMAN: It seems to me, gentlemen, that that is pretty evident that this Commission, which is a negotiating body only, would certainly be assuming a lot if it attempted to tell any state what it could do with its allotment of water. Now Mr. Bishop, though, thinks that this might affect the future work of the Engineering Advisory Committee. As he is a member of this Commission, his ideas certainly must be given consideration. I think the matter has been rather fully discussed and you might leave the matter for further consideration at some later meeting of the Commission and proceed at this time in the matter of what disposition shall be made of the Engineering Advisory Committee, what is the future program for this Committee if any.

COM. WATSON: Mr. Chairman, do you call for a motion on that?

THE CHAIRMAN: Well, it is up to the Commission to do whatever they like about it.

COM. WATSON: I move that the Engineering Advisory Committee remain intact and that it be authorized to proceed to the completion of those items enumerated on pages 53 to 59 of its report filed with the Compact Commission this morning and listed therein as being incomplete and needing further study.

COM. BISHOP: I will second that motion.

THE CHAIRMAN: Motion has been made and seconded. Now, gentlemen, I hope you realize that motion means that the Committee will simply go ahead and study. You say nothing about time. Possibly nothing can be said about time. But people ask a lot of questions about the negotiation of this compact and it seems to me none of the Commissioners are in very good position to give anybody any indication of when this matter may be disposed of, the report of the engineers.

COM. WATSON: May I ask a question, Mr. Chairman?

THE CHAIRMAN: Yes, sir.

COM. WATSON: Would it be well to incorporate in that motion that within a certain limited time, say ninety days or 120 days, that Engineering Advisory Committee report back to this Commission?

COM. STONE: May I also ask this Commission, when we have an engineering committee that is working diligently as this one, meeting at least once a month, and where the Federal Government Bureau of Reclamation has contributed as much help as it has and all the states have contributed help, are we in any position to put a time limitation or is it appropriate to put a time limitation on a committee that is doing the very best job it can? It seems to me that unless you assure to this committee more men, more help, that we are in a pretty poor position to dictate how soon and how fast they shall do this work so long as they are working as diligently as they are now.

COM. WATSON: Couldn't we have a progress report within that time limit?

COM. STONE: That would be possible.

COM. WATSON: Then if they are not through they can have more time.

THE CHAIRMAN: Gentlemen, if your questions are directed to this Chair, I want to say this: This Committee was set up about thirteen months ago and your Chairman at that time insisted on something in the way of an estimate of time and the Commissioners didn't think well of that suggestion. I am bringing it up at this time so that you will understand and so that we will all understand that if it is your wishes that there is no time limit set on the work of this Engineering Advisory Committee, they will work along and do the best they can and the Commission will have to wait until this information is collected and will patiently wait for the collection and compilation of this further information. That is the reason your Chairman is bringing this question up at this time.

COM. BISHOP: Mr. Chairman, Wyoming will go along with you on the proposition of setting a time limit there. We appreciate very much the work that has been done by this engineering subcommittee. They have done a fine job. And while I don't agree with delaying a compact until they are done, I do think we should go along with them and I would like to have their estimate on how long it will take and then I would like to help them in every possible way to meet that obligation within the time. I am sure Professor Person and our group at the University would go along and cooperate, won't you, Professor?

MR. PERSON: Yes.

COM. BISHOP: In every possible way to hurry it up.

COM. WILSON: Mr. Chairman, I believe there is a motion before the Commission. I understand that the motion was to continue the Engineering Advisory Committee intact and instruct them to continue with their investigations as they indicated they could do based on the progress report that has just been filed. May I speak on that motion just a moment?

THE CHAIRMAN: Yes, sir, Judge.

COM. WILSON: New Mexico has spoken very little and perhaps we might be better off if we continue to do so, but first I would like to say that I feel that we should continue this Committee. But I could detect, I think, in the attitude of the Chair and remarks the Chairman has made in previous meetings, that there is a little bit of disappointment a compact can't be arrive at without continued delay which is involved in the continuation of the studies of

this Engineering Advisory Committee.

I think we all realize and the questions that have been asked here this morning indicate that the work the Committee is doing is important and it is going to require a great deal of work and a great deal of study to arrive at any conclusions they are willing to recommend to this Commission. In spite of that I will say I think the Committee should continue.

But I am not sure that when that is done, this Commission has reached a basis upon which an allocation can be made of the water allocated to the Upper Basin States. So far I have heard nobody suggest any fundamental basis upon which an allocation should be made. Suppose you continue these studies and get the stream depletions and the channel losses and how much each state contributes, have you then gotten down to a basis where you can say, "These things furnish the fundamentals upon which we can make an equitable apportionment of the water among the four states, including Arizona?"

I think we cannot point to any statements that have been made by any member of this Commission suggesting a definite allocation except perhaps a form of compact that Mr. Bishop submitted at a meeting not long ago for the consideration of the Commission. Now that compact that he submitted did have in it a suggested allocation, so much for New Mexico, so much for Wyoming, so much for Colorado and so much for Utah. I inquired at that time upon what basis Mr. Bishop arrived at the figures included in the proposed allocation. Somebody said something about a percentage basis. And so far as I know there has been no principle laid down that would justify that allocation or any other allocation that has been suggested. When we get all this engineering data, are we going to be in any better position that we are in now to try to determine upon what basis the water shall be divided among the states?

Now so far as I have thought--and I am saying this so maybe other members of the Commission will give me some answers to questions that I can't answer--I have studied a few compacts that have been made in the past. The Treaty we made with Mexico--the committee that was studying on that--I think we read every compact that was made in the United States and some foreign countries. We tried then to evolve a principle upon which an equitable division of waters might be made between states or between nations. I think Judge Stone will bear me out when I say the only conclusion that any of us could come to that approached a principle to be derived from those compacts was that they nearly always recognized present uses. Then when that was done, the water that would take care of potential uses was divided on some basis, peculiar to the particular locality.

Now the way I see this thing, if there is a way to make an allocation before we spend another year in getting important data that you probably will need when you go to formulating a compact to be administered, would be to decide now within the next few months, is there a basis on which this water can be divided that can be supported by each person in his own state when he goes before his legislature?

How could I go into the Legislature of New Mexico and say, "Mr. Bishop proposed this kind of an allocation: New Mexico, 450,000 acre feet; Colorado 4,000,000 acre feet; Wyoming, 1,200,000 acre feet, Utah 1,800,000 acre feet"? If the members of my legislature ask me, "How do you justify that? We sent you up there to try to negotiate a compact. Explain that to us, why that difference." Where am I going to find the answer? Nobody has suggested it yet in any of these meetings.

Now I have this to say about what I think is a principle and which [illegible] would be preferable, Mr.

Bishop, to the plan you submitted: On page 14 of the Report on the Colorado River, there is a column that I referred to this morning in the question I asked Mr. Riter, which has in one column, present depletion in the Colorado River Basin. In the Upper Basin it shows present depletions of 2,199,800 acre feet. Now in general terms we can say that is equivalent to present uses, I think. Now I believe that in negotiating any compact under the circumstances here that any state would be unreasonable that didn't recognize present uses. I believe I could explain that to my legislature and any other member of the Commission could explain that to his legislature, that we had to recognize present uses.

Now, if these are the figures, whether they are the figures that the Committee rectifies or whether we take these exact figures doesn't make any difference; but when you have recognized present uses as represented by this column under "Present depletion," we must assume that we have 7,500,000 acre feet of water to divide. I don't believe we can change that. We have got to assume that is correct and we are to divide that much water if it is available. If that water doesn't exist we can't divide it. So I think we have a right to assume there is 7,500,000 acre feet of water to be divided and if we assume that this much has already been used or is being used at the present time, you can subtract 2,199,800 from the total supply of 7,500,000; then you have taken care of present uses and you can divide the balance among the states.

Arizona has already made a statement to this Commission as to the amount of water it would be satisfied with. I think we can take that figure and add that to these depletions. Then you have a little smaller amount to divide.

Then upon what basis are you going to divide that, gentlemen? I would like somebody to tell me why four sovereign states to whom this quantity of water was allocated in perpetuity by the original Colorado River Compact, should not stand on the basis of equality. What reason can you give to say that after we have taken care of present uses that New Mexico or Wyoming, perchance, should have a much, much smaller quantity than Utah or Colorado?

Now the only answer I can think of would be that if you can convince me and Mr. Bishop that we couldn't possibly use that much and it would be a waste of water to allocate it to us, you would be justified in taking it and giving it to some other state. I think that, gentlemen, is the only thing that would justify any allocation after you have taken care of present uses other than on the basis of dividing by four.

Then you will say that might give New Mexico and Wyoming, or Utah even, water that they couldn't use. I do not think this would be true. There is no reason why you can't put in the compact that 15, 20, or 25 years from now you can review its provisions and if any state has been allocated water that can't be used, then change the allocations.

Now I believe if you approach it along that line you might arrive at a division of the water before spending another year or two years getting engineering data, and I say the engineering data is necessary but I don't believe it is so necessary to making an allocation. I know that the Chairman has toyed with that idea that there ought to be some way to divide this water without taking too much time and then get all the engineering data you need for administering the compact, but I believe the Chairman has given up.

I say those things because I have been thinking along those lines and if there is any other basis that each sovereign state can stand upon, I would like to know what it is.

COM. BISHOP: Mr. Chairman since the basis for the draft that I submitted has been mentioned by Judge Wilson, I would like to explain that the principal basis used by Wyoming in securing those figures was found in the depletion proposed in the 1945 tentative report of the Bureau of Reclamation, which, I would like to add, proposes a total depletion of 7,656,000, which is practically the amount of water we are trying to divide.

THE CHAIRMAN: Well, gentlemen of the Commission, the Chairman appreciates the remarks of Judge Wilson. He certainly expresses his ideas clearly and concisely regardless of whether you agree with him or not, and those ideas are appreciated by the Chair. Are there any further remarks?

COM. WATSON: Mr. Chairman, speaking for Utah, I will say that we agree with the principles enunciated by Judge Wilson, namely, that there should be a division of the water during the time this engineering data is being assembled.

COM. STONE: May I in view of Judge Wilson's statement make this suggestion: His statement was based solely on the question of apportioning the water. There was no reference whatsoever in his statement as to the determination of the obligations to deliver water at Lee Ferry. I apprehend that these states, whether we like it or not, are obligated under the Colorado River Compact to deliver on the average 7,500,000 acre feet of water each year at Lee Ferry. This Engineering Advisory Committee is now engaged in matters which go to that question. And if on the basis of these engineering studies we don't have 7,500,000 acre feet to divide, we ought to know it.

I apprehend that the determination of obligations at Lee Ferry is of more importance, if we intend to carry out the Colorado River Compact, than the apportionment of the water because the apportionment of the water is dependent to a considerable degree upon the obligations and ability to meet the obligations at Lee Ferry.

THE CHAIRMAN: Well, Judge Stone, the Chair would like a little information. Possibly someone can furnish it. Would it make any difference whether the 7,500,000 is there if the water was divided on a percentage basis, percentage of whatever is there? Of course, I would say also, though, that we must resolve it down to the tributaries as to benefits and obligations in each state. I have asked a question and also made an observation. Now can anybody answer that first question or does anybody think he has an answer?

COM. STONE: My answer to it is that there is not yet sufficient information available upon which a state can pass judgment on the apportionment of this water unless we accept some arbitrary basis of equal division over and above present uses; and it seems to me that there are many factors that have to be considered in making an equitable apportionment of water.

Personally I would not expect that we are going to take a year or two years to go into all the refinements of these studies. Furthermore, I believe that we can suggest questions and matters which must be determined by this Commission that are going to take considerable time and there is no reason why we shouldn't be going ahead with those matters while this Engineering Advisory Committee is working. And possibly when we get those questions answered and agreed upon, the Engineering Advisory Committee will be ready to give us the figures and the data upon which we can reach final conclusions.

THE CHAIRMAN: Gentlemen, we mustn't lose sight of the fact that there is a motion before the Commission. I don't want to cut off any

discussion of the motion. Whenever you are ready for the question you may call for it.

COM. STONE: If there is no further discussion I call for the question.

COM. CARSON: Mr. Chairman, I am not sure I entirely understand the motion. It related to pages in this report as I understood it, especially pages 53 to 59, inclusive. In glancing hastily through it I don't find the reference to the report on the flow of interstate tributaries at state lines and the uses that are being made in each of the states from that tributary source or the potential uses of that tributary in each state.

MR. RITER: Mr. Carson, it is not the intention of the present Engineering Advisory Committee to deal with potentialities. We are trying to deal with--

COM. CARSON: Have you set up in here anywhere or do you propose to report on the flows at state lines of interstate tributaries with present uses from those tributaries?

MR. RITER: Yes, sir. I think probably the reference should have been over to page 61. Page 59 kind of chops off part of the job.

COM. STONE: I understood that went to page 61, didn't it?

COM. CARSON: Mr. Watson desires to amend it to go to page 61. Does that include then the question of tributary flows at state lines and the present uses within the states of that tributary water?

MR. RITER: Well, it isn't defined in those terms, Mr. Carson. It just mentions contributions by states but we will of necessity have to analyze it by tributaries.

COM. CARSON: I think from my point of view it is very important that we do have that flow of interstate tributaries at state lines and at least the present uses in each of the states on that tributary. I think at the last meeting of this Commission it was suggested that each member of the Commission look over the Bureau report as to potential uses on those tributaries and be prepared to discuss it if there was any question about it. With that motion amended as it has been amended I am ready for the question.

MR. PATTERSON: Mr. Watson, may I suggest we gave you bad advice when you asked how to cover that, by saying 59. It was intended to cover everything under this heading of "Analysis," including 60 and 61, all of the text. Would that remedy your motion? There was no intention to cut that last part. If you could change your motion to read 61 instead of 59--

COM. WATSON: Mr. Chairman, before you place the question may I make just a comment on the motion?

THE CHAIRMAN: Certainly.

COM. WATSON: It is the State of Utah's desire to see this Engineering Advisory Committee go ahead and continue its studies. We will lend them all adequate help that it is possible. However I think upon the passage of this motion it would be well for each state to make a statement to the Commission explaining the basis upon which a compact should be made. New Mexico refers to present use and wants the water divided equally. Wyoming refers to the 1945 depletion as set out in the Bureau of Reclamation report. Colorado wants water

contribution to be considered. Utah wants potential and present use. Now wouldn't it be well for each state to make a written statement to the Commission setting out the basis upon which it would like to make a compact?

COM. STONE: That goes to a question of procedure which should be decided upon after we dispose of this motion I should think. Question on the motion as amended.

THE CHAIRMAN: Well, before you vote on that motion the Chair would like to feel sure that when these engineering studies are completed that you will have the data in such shape that each state can say that its obligation at Lee Ferry and its benefit in the allocation will be outlined for the tributaries. I may be confused on that but it seems to me in the final compact it will have to be specified how much of so many hundred thousand acre feet or "X" percent of the water available must come out of the tributaries of each state. Now may I ask you, Mr. Riter, if that will be available. In the continuation of these studies, will that be made available?

MR. RITER: Well, it may not be made available in the exact detail which you want. We are studying the Colorado River and its tributaries. Now we have taken what we considered the principal tributaries and we will of necessity have to analyze the tributary in order to get the sum total of the whole. Our objective is to determine the contributions by states and I understand Mr. Carson desires, from the interrogation he gave me at Santa Fe about a year ago, the contributions by states and by tributaries.

I believe that we will have a reasonably close answer to what you want. It may not be in as great detail as you would like to see it, but we will probably have to amend the studies as we go along and as the Compact Commission makes headway and makes up its collective mind on the form the compact will take. I can foresee that we may have to make some additional studies to give the Compact Commission additional information.

THE CHAIRMAN: Are you ready for the question? (Question is called for. Thereupon a vote was taken and Com. Watson's motion as amended carried unanimously.)

COM. WATSON: Mr. Chairman, may my suggestion be considered now in the matter of procedure, that each state enumerate the facts it considers necessary in arriving at a compact?

THE CHAIRMAN: Go ahead, Mr. Watson.

COM. WATSON: I move that each state, excepting Arizona, render to this Commission a statement tomorrow morning containing the basis on which it thinks a compact should be made as well as factors that are important.

THE CHAIRMAN: Is there a second to Mr. Watson's motion?

COM. WILSON: I will second it.

THE CHAIRMAN: Are you ready for the question?

COM. STONE: No, Mr. Chairman. I move to amend that motion to provide that the Commission, after we have disposed of the consideration of the statements of the Federal agencies according to the order of procedure outlined by the Chair when we convened, limit our action at this time to a consideration of the factors involved and not a statement of the apportion-

ment and I assume the obligations at Lee Ferry, which is encompassed by Mr. Watson's motion.

In support of that amendment may I explain the reason for it. First, as to the order of procedure: The Chair outlined an order of procedure for us at the beginning of this meeting today, this session; and he suggested after we disposed of the engineering report we take up the report or the comments of the Federal agencies. Those comments have been prepared and submitted to this Commission. It seems to me that we should in any logical order follow that suggested by the Chair, that that be the next item to be considered at this session, and after that has been disposed of then we can take up other matters.

I am heartily in favor of making as much progress as possible. I don't believe that any state is in a position or should be in a position to make a statement encompassed by Mr. Watson's motion until the factors involved have been taken up and discussed and considered. And Colorado is willing to proceed with a consideration of the factors but does not want to be committed now to making a statement of its position on the question of the allocation of water or of the determination of the deliveries at Lee Ferry. I therefore submit my amendment that it be limited to consideration of the factors.

THE CHAIRMAN: Com. Watson, do you accept the amendment?

COM. WATSON: Yes.

THE CHAIRMAN: Does the second accept the amendment?

COM. WILSON: I will accept it.

THE CHAIRMAN: Are you ready for the amended motion?

COM. STONE: My idea was that after we got through with these statements of the Federal agencies that we would start in on it, see how far we get at this meeting.

COM. WILSON: In other words, it would be factors that should be considered in making an equitable division of the water?

COM. STONE: Factors and questions that are involved, yes.

COM. WILSON: Without regard to date that might be necessary to carry out the compact?

COM. STONE: And without regard to any state taking a position of policy as to the apportionment of water but merely to discuss and consider the factors that are involved.

COM. WILSON: I think that is all right.

COM. WATSON: The question is on the amendment, Mr. Chairman?

THE CHAIRMAN: Are you ready for the question on the amended motion? (Question is called for. Thereupon a vote was taken and Com. Watson's motion as amended carried unanimously.)

Now, gentlemen, you have disposed of the matter of the continuance of the work of the Engineering Advisory Committee. Before this Commission adjourns it is the opinion of the Chairman that you should decide on when you want to have a progress report, at least from the Engineering Advisory Committee, and that probably will involve the time and place of the next meeting of the

Commission. I mention that at this time so we will not overlook it.

COM. STONE: Mr. Chairman, it seems to me that we shouldn't limit our activities to the time we get that report. I think we have got a lot to do if we take up these factors and I again reiterate that I do not believe that we are in a position to put a limit on this Committee. I don't believe we can be in a position to judge how long it will take and since this Engineering Advisory Committee is working as expeditiously as possible with all the help it has got, I assume our motion disposed of that.

THE CHAIRMAN: Very well, that may be the wishes of the Commission, that the matter is disposed of in that form.

(4:40 p.m., December 1, 1947, Recess.)

Denver, Colorado
December 2, 1947
9:00 o'clock a.m.

(All Commissioners present excepting Com. Wilson of New Mexico; Mr. John H. Bliss, State Engineer of New Mexico, sitting in for Com. Wilson.)

THE CHAIRMAN: The meeting will come to order. The first item to be considered this morning is the report of the Legal Advisory Committee. I believe Mr. Charles Carson is the Chairman of that Committee.

COM. CARSON: Yes.

THE CHAIRMAN: Mr. Carson, are you ready to submit your report?

COM. CARSON: The Legal Advisory Committee has been studying individually the question of compacts and going over compacts. We sent out two drafts that everybody has had. We of course have no form to submit to the Commission and can't have until the Commission tells us what to write and when it does we will be able to put it in shape I think fairly quickly. People are getting their ideas in shape.

There is one thing that we thought probably should be in any compact that is finally written, the administration of any treaty or compact. The machinery I think should be incorporated in the compact itself and an agreement as to the administration of the treaty or compact if such is necessary. But with that we can't proceed to write any compact until we know what to write. Everybody is individually studying his own idea of what should be in a compact and getting language to meet whatever the Commission finally tells us to write.

THE CHAIRMAN: Mr. Carson, will you name the members of that Legal Advisory Committee?

COM. CARSON: Well, they are Jean Breitenstein, Attorney General Gray, Mr. Edward Clyde of Utah, Judge Wilson of New Mexico and myself, and Mr. Will of the Bureau of Reclamation, your adivser.

THE CHAIRMAN: Have you finished, Mr. Carson?

COM. CARSON: Yes.

THE CHAIRMAN: I wonder if any of the members of this committee

have anything to add to the Chairman's statement. Mr. Breitenstein?

MR. BREITENSTEIN: I have nothing to add. In my opinion the Legal Advisory Committee cannot draft any provision of the compact unless it is first directed by the Commission itself as to the principles involved in any particular section of the compact the Commission wants drafted. It would be presumptuous in my opinion for the Legal Advisory Committee to try to write a compact for the Commission.

THE CHAIRMAN: Of course, if we carry that reasoning out to a finality we will find ourselves travelling in a circle.

MR. BREITENSTEIN: If the Commission will tell us what particular provisions they want drafted--

THE CHAIRMAN: It seemed to be the opinion yesterday that the Commission couldn't move out of this charmed circle until the engineers finished their report, and now we hear that the Legal Advisory Committee can't do anything until the Commission agrees on something.

MR. BREITENSTEIN: Mr. Chairman, I don't agree with that line of reasoning at all. It seems to me that there are any number of questions which have to be resolved by the Commission and which can be considered in advance of any report of the Engineering Advisory Committee. If the Commission has once determined upon the principles which it wants put into language of the compact, tell the Legal Advisory Committee what they are, the Legal Advisory Committee I feel confident will draft the language, but the Legal Advisory Committee doesn't make the decisions.

THE CHAIRMAN: That is fine, Mr. Breitenstein. Do you anticipate that subsequent to the submission of the factors to be considered by each state Commissioner, that the Legal Advisory Committee will be in a better position then to do its job?

MR. BREITENSTEIN: If those factors are resolved by the Commission itself, yes.

THE CHAIRMAN: Yes, sir. Well, that is pinning it right down. That is the answer that I thought you would give. Mr. Clyde of Utah.

MR. CLYDE: I have only this to add, Mr. Chairman: We discussed last night that the committee individually or collectively is available to do research, render legal opinions on any special problem that the Compact Commission cares to refer to it for study, but I agree wholeheartedly with Mr. Breitenstein that the decisions have got to be made by the Compact Commission before we can draft the language to put into effect the principles which they say are controlling. I don't think the Compact Commission will have to prescribe every detail, point out every boundary line for us before we can submit a rough draft compact, but as of the present time I at least know of no principle that all of the Compact Commissioners will agree upon that we could write down in the form of a compact for submission, and that any attempt on our part to do so usurps from the Compact Commission the right which it has to make the decisions as to what it wants to have controlling.

So I think the whole Legal Advisory Committee is available and willing to do research and render opinions on any problem that the Commission will refer to us and ask for advice on it. But as far as presenting a compact to them now I think it is impossible.

THE CHAIRMAN: Well, the Chairman then infers from your remarks that

there are certain things to be done by the Commission before the Legal Advisory Committee can perform its function and we will bear that in mind as we proceed in our deliberations.

Mr. Will, do you have anything to add?

MR. WILL: I have nothing to add, Mr. Chairman.

THE CHAIRMAN: Is there further discussion of the position taken by the Legal Advisory Committee? Any questions that anyone desires to ask? (No response.) If not, I believe we are ready to pass to the next item on our agenda, and that's the consideration of the communications from the Federal agencies.

About two months ago the Chairman furnished the reporter the original letters from the Federal agencies. That was done at the request of the Commission. The reporter, Miss Price, made copies and furnished them to each Commissioner presumably for study.

(The communications above referred to are as follows:)

"THE SECRETARY OF THE INTERIOR
WASHINGTON

Nov. 12, 1946

My dear Mr. Bashore:

By letter dated October 1, 1946, you advised that you had been appointed the representative of the United States to participate in the negotiations of the States of the Upper Colorado Basin, looking to an interstate compact supplementary to the Colorado River Compact of November 24, 1922, and requested the views of the Department as they relate to problems coming before the Compact Commission.

Attached is a brief memorandum outlining the specific interests of the action agencies of the Department, except those of the Office of Indian Affairs, in problems which may come before the Compact Commission. In addition, I am advised that you and other members of the Compact Commission have copies of the Department's proposed comprehensive report on the development of the water resources of the Colorado River Basin for irrigation, power production, and other beneficial uses, outlining in detail the interests and programs of the Department.

The statement outlining the interests of the Office of Indian Affairs in problems coming before the Compact Commission has not as yet been submitted to the Department for final consideration. However, it is expected that the statement will be received shortly; and, after a consideration thereof in the Department, it will be sent you at the earliest practicable date.

The Department of the Interior is vitally interested in the development of the entire Colorado River Basin in such a manner as will procure the maximum national benefits from the use of water, both on the land and in the form of power, with due regard to the interests of the Indians, the fish and wildlife resources, and the scenic and recreational features. The Department is also interested in the unified development of the Colorado River. No projects should be proposed or undertaken that will not fit into the comprehensive plan for the river or that will increase the costs or reduce the expected benefits of the final development. The Department, therefore, would like to have all proposals

analyzed from this viewpoint and believes that your own report on the compact should relate the proposal that is made to the full development of the river.

Sincerely yours,

(Signed) Oscar L. Chapman
Acting Secretary of the Interior

Mr. Harry W. Bashore,
Federal Representative and Chairman,
Upper Colorado River Basin Compact Commission,
Mitchell, Nebraska.

Enclosure 284"

"INTERIOR DEPARTMENT VIEWS AS THEY MAY RELATE TO PROBLEMS COMING BEFORE THE UPPER COLORADO RIVER COMPACT COMMISSION a/

November 1946

Bureau of Reclamation

The interests of the Bureau of Reclamation in the water of the Colorado River Basin center around the operation and maintenance of existing Federal Reclamation projects, including all features thereof, and the construction, operation, and maintenance of additional Federal Reclamation projects in that and adjacent basins to the end of accomplishing the fullest practicable and economic development of the basin's water and other resources. Assurance of water supply for such purposes is necessarily of the deepest concern to the Bureau of Reclamation, and that agency, therefore, views present efforts at a compact among the Upper Basin States with utmost interest. It hopes that negotiation and ratification of a satisfactory compact may be completed at the earliest practicable date.

Potential projects, together with further indications of the interests of the Department, are shown in the departmental basin report of June 6, 1946, and attachments thereto.

National Park Service

The National Park Service administers 17 national parks and monuments wholly or partially within the Upper Colorado River Basin, having a gross area of 771,137 acres. Under Congressional mandate, the parks and monuments are administered so as "...to conserve the scenery and natural and historic objects and wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Water rights involving the use of 62.50 second-feet of water in the 17 National Park Service areas have been perfected to the stage of permit, license, or decree, in conformity with the water laws of the several States. The visitors to these areas totaled approximately 932,000 persons in 1941 and 1,059,000 in 1946. Most of the travel was by private automobile, and the number of registered passenger cars decreased 15 percent between the two dates. The trend of increasing attendance has no apparent limit, and there is a possibility of acceleration as air travel becomes more common. The water demand, therefore, is subject to unpredictable increase. In addition, State parks and related types of recreational areas, and the recreational areas which will be developed in conjunction with the reservoirs being

a/ Not including those of the Office of Indian Affairs.

constructed or planned by the Bureau of Reclamation and the Corps of Engineers will require additional quantities of water proportionate to their use. For these reasons, the National Park Service favors a flexible compact which will not prematurely limit the allocation of land and water to the multiple purposes for which developments are being made.

The Service cooperates with other Federal and State agencies in planning for their park, parkway, and recreational-area programs, and serves them in an advisory and consulting capacity in all phases of their park and recreation problems. Of special significance in this connection is the planning for the protection, development, and use of the recreational resources of reservoir projects under control of the Bureau of Reclamation and the Corps of Engineers.

In 1941 the Service undertook a survey of the recreational resources of the Colorado River Basin as part of the studies and investigations for the formulation of a comprehensive plan for utilizing the waters of the entire basin. These investigations embrace the entire basin in order to assure that adequate protection is given the existing scenic, scientific, historic, and recreational resources, and that full advantage is taken of the additional recreational potentialities which may be made available through the construction of reservoirs proposed within the basin, with a minimum interference with present scenic and recreational features. Several areas in the National Park System in the Upper Colorado River Basin, including Rocky Mountain National Park and Dinosaur National Monument, would be directly affected by certain water-control proposals. A report on this survey is virtually completed and is expected to be available within the coming year.

National Park Service areas in the Upper Colorado River Basin, as of June 30, 1946, are listed in the following table:

	Total Area (acres a/)	Established
Arches National Monument, Utah	34,250	April 12, 1929
Aztec Ruins National Monument, N. Mex.	25.88	January 24, 1923
Black Canyon of the Gunnison National Monument, Colo.	14,465	March 2, 1933
Bryce Canyon National Park, Utah	36,010	June 8, 1923
Canyon de Chelly National Monument, Ariz.	83,840	February 14, 1931
Capitol Reef National Monument, Utah	36,393	August 2, 1937
Chaco Canyon National Monument, N. Mex.	21,478	March 11, 1907
Colorado National Monument, Colo.	18,311	May 24, 1911
Dinosaur National Monument, Utah & Colo.	209,744	October 4, 1915
Holy Cross National Monument, Colo.	1,392	May 11, 1929
Hovenweep National Monument, Utah & Colo.	299	March 2, 1923
Mesa Verde National Park, Colo.	51,333	June 29, 1906
Natural Bridges National Monument, Utah	2,650	April 16, 1908
Navajo National Monument, Ariz.	360	March 20, 1909
Rainbow Bridge National Monument, Utah	160	May 30, 1910
Rocky Mountain National Park, Colo.	259,416	January 26, 1915
Yucca House National Monument, Colo.	10	December 19, 1919

Fish and Wildlife Service

The Upper Colorado River Basin, because of the high value of fish and wildlife resources, and because failure to give them adequate consideration in a basin-wide plan of water development would result in large

a/ Gross area includes 34,744 acres of non-Federal lands

and irreplaceable losses, is an area in which the Fish and Wildlife Service has a great interest.

Fishery values, particularly for trout in the tributary streams, are extremely high. Fur-animal and upland-game values are also high. With regard to big-game values, the basin equals or surpasses those of any area of comparable size in the United States. The economic importance of these resources, measured in terms of sales of hunting and fishing licenses, sales of sporting goods, and tourist, angler, and hunter expenditures in the field total millions of dollars. In addition to these measurable values, there are vast esthetic and recreational values associated with fish and wildlife which cannot be expressed adequately in monetary terms.

The natural water courses are the most important single factor in the wildlife habitat of the Upper Colorado River Basin. Hence, any plan for allocation and development of water, to be truly comprehensive, must give full consideration to conservation and enhancement of fish and wildlife values.

Following is an annotated list of particulars concerning interests of the Fish and Wildlife Service in the basin.

Fish

The tributaries of the Upper Colorado River rise in the mountains of Colorado, Wyoming, and Utah. The clear, cold streams and associated lakes provide excellent fishing for cutthroat trout, rainbow trout, mackinaw trout, and brook trout. In the warmer, silt-laden waters of the main stem of Colorado River and Green River, the channel catfish is the principal species.

There is no Federal fish hatchery in the basin, but a number of hatcheries maintained by States are important in supplementing natural propagation in waters situated on Federal lands. The hatcheries, all devoted to culture of trout, are as follows:

Wyoming	Daniel
Colorado	Glenwood Springs
do.	Steamboat Springs
do.	Pitkin
do.	Cedaredge
do.	Durango
Utah	White Rocks
do.	Loa
do.	Fish Lake

Water-development plans should provide for protection of these plants or for replacement of values lost.

Waterfowl

Present waterfowl habitat in the basin is limited, but the Colorado and Green Rivers offer opportunities for development of additional feeding areas which would increase the number of birds. The Stewart Lake Refuge, maintained by the State of Utah at the confluence of Ashley Creek and Green River, is an example of a successful area of this kind. The only Federal refuge in the basin is the Strawberry Valley Refuge, Utah, which is maintained by the Bureau of Reclamation, Department of the Interior, for waterfowl and sage hens. The Fish and Wildlife Service desires to establish refuges on Granby Reservoir and on Lower Gunnison River, Colorado, on San

Juan River, New Mexico, and on Green River, Wyoming. Water-development plans for the basin should give special consideration to the protection of the small existing areas of marsh suitable for waterfowl.

Upland Game

Upland game birds include several species of grouse, particularly the sage hen, which is fairly numerous along the Yampa and Duchesne Rivers. Ptarmigan are found in the high mountain country of Colorado, and wild turkeys still maintain small numbers in the upper reaches of the San Juan River in Colorado and New Mexico. Pheasants are abundant in the region about Vernal, Utah, and provide hunting for a large number of hunters.

Big Game

Undoubtedly, the mountainous parts of the Upper Colorado River Basin constitute one of the outstanding areas for big-game hunting in the United States. Deer abound in most of the basin and elk are numerous in the higher elevations. Moose are found in the wilderness areas of the headwaters of Green River. Several large herds of mountain sheep occur in Colorado, and remnants elsewhere in the basin.

Trans-mountain Diversions

A number of proposed water-development projects involve the diversion of water from the Upper Colorado River Basin to adjacent watersheds. In general, the Fish and Wildlife Service views such diversions with misgivings, for they tend to detract from values in the originating basin without creating commensurate values elsewhere. Another danger lies in the possibility of extending the range of undesirable species of fish.

Pollution

Pollution of the Upper Colorado River is negligible at present. However, wastes from mines, mills, and smelters threaten to create problems in the vicinity of Rock Springs, Wyoming, and Price, Utah. When certain pollutants are permitted to enter reservoirs, they may accumulate and reach lethal concentrations. For that reason, provisions should be made for abatement before a reservoir is constructed below a major source of pollution.

Lower Colorado River Basin

Water-development programs for the Upper Colorado River Basin should give due attention to the water requirements of the Lower Colorado. The Fish and Wildlife Service has a major interest in the Lower Colorado River Basin, for it administers in that region eleven wildlife refuges with a combined area of 4,335,920 acres.

Bureau of Land Management

The Bureau of Land Management has no special water interests within the Upper Colorado River Basin that would materially affect, or be affected by the larger water developments which have been planned by the Bureau of Reclamation and other Federal agencies, since this Bureau makes no direct diversions from the Colorado River.

Water developments on the Federal range consist solely of stock-watering facilities in the form of small earthen reservoirs, water wells,

and spring developments. Loss of water incident to these developments is practically negligible, consisting of a comparatively small amount of consumption and evaporation. This small loss is materially offset by certain advantages which will accrue to the larger reclamation developments, such as retarding runoff, reducing erosion, and decreasing transition of silt.

Stock-water developments which might in any way affect a larger development may very readily be modified or adjusted to accommodate the interests of those concerned. Moreover, it is anticipated that thousands of acres of present range land will be included within future reclamation developments. These lands, of course, will be reclassified to the higher use of agriculture.

Geological Survey

Article V of the Colorado River Compact provides as follows:

"The chief official of each signatory State charged with the administration of water rights, together with the Director of the United States Reclamation Service and the Director of the United States Geological Survey shall cooperate, ex-officio:

(a) To promote the systematic determination and coordination of the facts as to flow, appropriation, consumption and use of water in the Colorado River Basin, and the interchange of available information in such matters.

(b) To secure the ascertainment and publication of the annual flow of the Colorado River at Lee Ferry.

(c) To perform such other duties as may be assigned by mutual consent of the signatories from time to time."

The Geological Survey suggested that a provision in the proposed compact of similar import and specifically naming the heads of the Bureau of Reclamation and the Geological Survey in association with appropriate officials of the affected States will be helpful in assuring the collection of adequate water facts for dealing with problems of the Upper Basin.

The conditions of the compact will have a deep influence on the future development of the States of the Upper Colorado River Basin, and it is most important that they be established in the light of all available and relevant information concerning the Colorado River Basin waters and their economic utilization. The Geological Survey in its capacity as a Federal fact-finding agency in the fields of geology, topography, and hydrology, as well as in fulfillment of the responsibility implied in Article V as above quoted, will be pleased, to the fullest extent practicable, to assist in the effective application of its accumulated information to the problems involved and to place at the disposal of Mr. Bashore its facilities for collecting needed additional information.

Bureau of Mines

The Bureau of Mines' main interest in the water resources of the Colorado River Basin is for the development of power for mining and metallurgical industries. The major problems of water rights in dispute between the upper and lower basins are of very little interest to it. However, it is concerned also with the use of water for transportation, for direct use in mining and metallurgical enterprises, and for domestic use for mining communities, together with the resultant problems of pollution, sedimentation, and water

treatment. The program of the Bureau of Mines on water utilization is quite fully outlined in the Department's report on the Colorado River, copies of which are available to the Compact Commission.

Compiled November 4, 1946, from statements furnished by the interested agencies."

"UNITED STATES
DEPARTMENT OF INTERIOR
Office of Secretary
Washington

OLU 753.4

November 20, 1946

Mr. Harry W. Bashore,
Federal Representative and Chairman,
Upper Colorado River Basin Compact Commission,
Mitchell, Nebraska.

Dear Mr. Bashore:

By letter dated November 12, 1946, Acting Secretary Chapman sent you a memorandum outlining the Interior Department views as they may relate to problems coming before the Compact Commission of the Upper Colorado Basin.

An error has been noted in the material relating to the interests of the National Park Service. In the fifth line of the fourth paragraph on page one of the memorandum, it is stated that "Most of the travel was by private automobile, and the number of registered passenger cars decreased 15 percent between the two dates." The word "decreased" should have been "increased." The National Park Service advises that the figures compiled from the reports from the various areas show that there were approximately 27,425 more automobiles in 1946 than in 1941.

Will you please make the above correction in the material sent you.

(Signed) Lee Muck
Chairman,
Water Resources Committee."

CC: Mr. Demaray

"THE SECRETARY OF THE INTERIOR
WASHINGTON

Nov. 27, 1946

My dear Mr. Bashore:

Under date of November 12, in response to your letter of October 1, you were advised concerning the views of the bureaus and offices of the Department of the Interior as they may relate to the problems which are under consideration by the Upper Colorado River Basin Compact Commission. The views of the Office of Indian Affairs were not included in that communication since the report of that agency was not available at that time.

The views of the Office of Indian Affairs have been incorporated in a memorandum dated November 25, 1946, from Assistant Commissioner Zimmerman, Office of Indian Affairs, to the Executive Officer, Water

the amount of Upper Colorado River Basin water that is required for irrigation of the Indian lands. Two copies of this memorandum and tabulation are attached.

If the Department can be of further assistance to you in connection with your negotiations with the interested States looking toward the formulation of a compact, please advise me.

Sincerely yours,

(Signed) C. Girard Davidson
Assistant Secretary of the Interior.

Mr. Harry W. Bashore,
Federal Representative and Chairman,
Upper Colorado River Basin Compact Commission,
Mitchell, Nebraska.

Enclosure 288."

"UNITED STATES
DEPARTMENT OF THE INTERIOR
Office of Indian Affairs

Nov. 25, 1946

MEMORANDUM

TO: Mr. W. G. Hoyt, Executive Officer
Water Resources Committee

FROM: Commissioner of Indian Affairs

SUBJECT: Departmental Views on Problems Confronting the Upper Colorado River Basin Compact Commission

Complying with your Memorandum of October 11 with which you enclosed a copy of letter dated October 1 to the Secretary from Mr. Harry W. Bashore, the following information and data, which express the views of this Bureau, are submitted for inclusion in the proposed Departmental statement.

On June 7, 1946, the Department approved "A Comprehensive Report on the Development of the Water Resources of the Colorado River Basin for Irrigation, Power Production, and Other Beneficial Uses in Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming", prepared under the supervision of the Bureau of Reclamation, dated March 22, 1946. That report is otherwise known as "Project Planning Report No. 3-8-2." Pages 347 to 359 thereof contain a detailed description of Indian irrigation projects in the Colorado River Basin.

In an effort to assist the Upper Colorado River Compact Commission, the Indian Bureau (based on its surveys completed to November 1, 1946) has prepared a one page summary of Indian irrigation projects in the Upper Colorado River Basin, a copy of which is enclosed. It is our position that the water rights for these Indian reservation lands were perfected rights to the beneficial use of waters of the Colorado River system long prior to 1922, and that, by the provision of Article VIII of the Colorado River Compact "they are not impaired" by that compact. It is also our position that these Indians' perfected rights were specifically recognized by Article VII of the

An examination of the tabular summary will disclose that of the eleven projects described, only Numbers 5, 6, and 8 are new. Item 8, the Shiprock Project on the Navajo Reservation, while listed as a new project, so far as construction and actual irrigation features are concerned, is actually an old project in that the Indian Bureau has carried it on its program of projects for approximately 30 years. The Indian Irrigation Service and others have made reconnaissance surveys from time to time in an effort to locate suitable reservoir sites and establish feasible canal locations that would enable the Navajo Indians to irrigate all their good land within the limits of practicability. The ultimate acreage shown in "Item 8" has been carefully studied for quality and all of it is class 1 or class 2 soil.

Item Number 7 covers units where the Navajos have been irrigating since 1903, and in some of the units probably before that date.

Item 2 in the tabulation refers to the Pine River Project, with adjudicated rights established by a Federal Court decree wherein the United States, as guardian of the Indians, was awarded a priority of July 25, 1868.

Item 9 covers the Uintah Project in Utah where the United States and the Secretary of the Interior, as Trustee for the Indians, were awarded the first and prior right to divert and use the waters of the Uintah, Lake Fork, and White rivers for irrigation and domestic purposes, by Federal Court decrees in which the Indians, through their guardian, were awarded a priority "that antedates the third day of October, 1861." The Indians also own the first and prior right to divert and use water from Duchesne River, with an 1861 priority for the irrigation of about 17,453 acres of their land.

The United States District Court in Colorado and Utah, in the cases above-mentioned, followed the law established in the leading case of Winters v. United States (207 U.S. 564, 52 L.Ed. 340) that the Indians, or their sovereign guardian for them, are entitled to divert and use waters from streams bordering, running through, or arising on their reservations, with a priority as of the date a reservation was created, and that such right entitles them to use enough of the waters thus described, as may be required to irrigate their lands adequately.

Under that doctrine, which has been the rule of law for the last forty years, the Indians of each reservation enumerated on the enclosed tabulation, own the right to divert and use enough water from the streams mentioned in the tabulation to irrigate their lands, with a priority as of the date their respective reservations were created.

Surveys made by the Indian Bureau and completed to November 1, 1946, show the acreages of irrigable Indian lands in the Upper Colorado River Basin dependent upon a water supply from the Colorado River and its tributaries in the amounts shown in the enclosed tabulation. The priorities for these rights for the acreage shown are believed to represent the minimum needs of the Indians, and are fully justified under the doctrine of the Winters case. It is believed that the respective states recognize these prior rights of the Indians and that they will continue to cooperate with the Department by conceding such priorities.

This Memorandum and the tabulation are submitted in order that those engaged in negotiating a compact or agreement to effectuate an equitable division among the states entitled to use of Colorado River

water apportioned to the Upper Basin by the terms of the Colorado River Compact, may continue the negotiations with full knowledge of the respective Indian Reservation irrigation requirements.

In the preparation of the Departmental statement for submission to Mr. Bashore, it is urged that the contents of this Memorandum and the tabulation be incorporated, so that the Upper Basin representatives may have our best estimate of the amount of Upper Basin water that is required for irrigation of the Indian lands.

(Signed) William Zimmerman
Assistant Commissioner."

Enclosure"

SUMMARY INDIAN IRRIGATION PROJECTS
UPPER COLORADO RIVER BASIN
BASED UPON SURVEYS TO NOV. 1, 1946
ESTIMATED DIVERSIONS AND STREAM DEPLETIONS IN ACRE FEET

ITEM	STATE	PROJECT	SOURCE OF WATER SUPPLY	PROJECT AREA-ACRES PRESENT	PROJECT AREA-ACRES ULTIMATE	ANNUAL DIVERSIONS PRESENT	ANNUAL DIVERSIONS ULTIMATE	STREAM DEPLETIONS PRESENT	STREAM DEPLETIONS ULTIMATE
1	Ariz.	Misc. units Navajo Res.	Misc.springs & streams arising on Navajo Res.	8,740	22,000	43,000	110,000	10,000	25,000
		TOTAL ARIZONA.		8,740	22,000	43,000	110,000	10,000	25,000
2	Colo.	So. Ute Res.	Pine River & creeks	8,400	19,850	25,000	58,000	15,100	35,000
3	"	Ute Mt. Res.	Mancos River	200	500	1,000	2,500	400	1,000
		TOTAL COLORADO		8,600	20,350	26,000	60,500	15,500	36,000
4	N. M.	Jicarilla Res.	LaJara & Dulce creeks	800	5,000	4,000	25,000	1,200	7,000
5	"	Animas LaPlata Monument Rocks Unit	Animas & LaPlata rivers	-	25,500	-	127,500	-	50,000
6	"	So. San Juan	San Juan River	-	22,000	-	110,000	-	25,000
7	"	Misc. units Navajo Res.	Misc. springs & streams arising on Navajo Res.	12,000	22,500	60,000	112,000	14,000	25,000
8	"	Shiprock Proj. Navajo Res.	San Juan River	-	117,000	-	585,000	-	260,000
		TOTAL NEW MEXICO		12,800	192,000	64,000	959,500	15,200	367,000
9	Utah	Uintah Proj. Uintah Res.	Uintah, Ducheane, Lake Fork & White rivers	77,000	77,000	232,000	232,000	115,000	115,000
10	"	Misc. units Navajo Res.	Misc. springs & streams arising on Navajo Res.	175	1,220	800	6,000	300	2,000
11	"	Uncompahgre	White & Green rivers	1,250	22,000	3,750	66,000	2,000	40,000
		TOTAL UTAH		78,425	100,220	236,550	304,000	117,300	157,000
		TOTAL BASIN.		108,565	334,570	369,550	1,434,000	158,000	585,000

"WAR DEPARTMENT
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON

Refer to File No. ENGWF

5 November 1946

Mr. Harry W. Bashore
Federal Representative and Chairman
Upper Colorado River Basin Compact Commission
Mitchell, Nebraska

Dear Mr. Bashore:

Further reference is made to your letter dated 1 October 1946 to the Secretary of War in which you request, in connection with your duties as representative of the United States and Chairman of the Upper Colorado River Basin Compact Commission, a statement concerning interests and views of the War Department with respect to matters that may be affected by the negotiations. In my reply of 8 October 1946 I stated that your letter had been referred to the Division Engineer of the South Pacific Division for a report and that upon receipt of his reply you would be furnished a statement setting forth the Department's interest in the subject negotiations. That report has now reached this office.

It is understood that the Colorado River Basin states above Lee Ferry, Arizona, are to enter into negotiations with a view to apportioning the waters of the Upper Colorado River Basin among the respective states and that such apportionment shall admit of compliance with terms of the Colorado River Compact dated 24 November 1922. Since the sole purpose of the conferences is to apportion waters among the upper basin states, such negotiations are not considered within the purview of this Department. The Department is interested in the Compact negotiations, however, insofar as such negotiations may affect the development of plans which may be undertaken later for the utilization of the waters of the Upper Colorado River Basin. Parts of the Upper and Lower Colorado River have been declared navigable. The navigability of certain reaches of the Colorado River is not considered important at this time since it seems unlikely that navigation problems would be made an issue and such problems might better be resolved when construction plans are being considered.

The Department would also be interested in the engineering plan on all projects involving storage for flood control. The War Department's interest in flood control is based on the Act approved 22 June 1936 and amendments thereto and the Act of 22 December 1944 which require that the Secretary of War prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly, or in part, with Federal funds provided on the basis of such purposes and the operation of any such project shall be in accordance with such regulations.

If additional detailed data concerning the Department's interest in the Compact negotiations are desired, it is suggested that you communicate directly with Colonel Robert C. Hunter, the District Engineer at Los Angeles District, whose address is: 751 South Figueroa Street, Los Angeles 55, California.

Sincerely yours,

(Signed)R. C. Crawford
Brigadier General
Acting Chief of Engineers."

"DEPARTMENT OF AGRICULTURE
Washington

November 22, 1946

Mr. Harry W. Bashore
Federal Representative and Chairman
Upper Colorado River Basin Compact Commission
Mitchell, Nebraska

Dear Mr. Bashore:

Thank you for the opportunity afforded us, by your letter of October 1, 1946 to Secretary Anderson, to indicate the views of the Department of Agriculture on the problems confronting the Upper Colorado River Basin Compact Commission.

This Department feels that in advising the Commission you might well be guided by the following:

1. The waters of the Upper Colorado Basin should be utilized in such a way that the maximum possible benefit will accrue to the people of the United States.

2. Next to human consumption the highest use to which these waters may be put is the development and stabilization of agriculture.

3. The decisions of the Commission will, in a large measure, irrevocably fix the future agricultural economy of a vast region. In other words, the Commission has been made responsible for agricultural planning of a basic and momentous nature. It is important, therefore, that the agricultural problems and potentialities of the region be thoroughly explored and appreciated by the Commission.

4. Because of the far-reaching agricultural implications of the Commission's task, it should invite the advice and assistance of the agricultural agencies of the States concerned and, to the extent that interstate agricultural problems are involved, should draw upon, through you, the services of the Department of Agriculture.

I realize the limited usefulness to you of the very general guiding principles suggested. For this reason, I want you, as the representative of all interested Federal agencies, to feel at perfect liberty to ask this Department for any information or assistance you may require. I feel that our experts can be particularly helpful in advising you upon the agricultural factors which are involved including the relative agricultural merits of the lands on which the waters of the Upper Colorado Basin might be used and in forecasting the agricultural effects of contemplated projects. In our opinion, these are matters that should be given full consideration by the Commission.

To provide you with easy access to the information and advice obtainable from this Department, I am arranging for a member of my staff to get in touch with you in the near future. He will ascertain your desires and will serve as a convenient channel to all agencies of the Department.

Sincerely,
(Signed) Charles F. Brannan
Assistant Secretary."

"FEDERAL POWER COMMISSION
Washington 25

Feb. 12, 1947

Mr. Harry W. Bashore,
Federal Representative and Chairman
of the Upper Colorado River Basin
Compact Commission,
Mitchell, Nebraska.

Dear Mr. Bashore:

With reference to your letter of October 1, 1946 relative to the negotiations by the States of the Upper Colorado River Basin of an interstate compact supplementary to the Colorado River Compact of November 24, 1922, I submit the following statement of views on the problems involved.

The interests of the Federal Power Commission may be summarized as follows:

The Commission (subject to the provisions of the Boulder Canyon Project Act and the Colorado River Compact) is authorized by Section 4 (e) of the Federal Power Act to issue licenses for hydroelectric power developments on the Colorado River, as a navigable water of the United States, and, prior thereto, to issue preliminary permits under Section 4 (f) and rule upon declarations of intention under Section 23 (b) of the Federal Power Act. The Commission also has comprehensive investigatory authority under Sections 4 (g), 7 (b) and 311 of the Federal Power Act which includes, in addition to various other phases of hydroelectric power development, the investigation, within the scope of its powers, of any occupancy of, or evidenced intention to occupy, the bed of the river, for the purpose of developing hydroelectric power and the issuance of such order as it may find appropriate, expedient, and in the public interest to conserve and utilize the navigation and water resources of the region. The Commission also has investigatory authority under various flood control and rivers and harbors acts, beginning with the Flood Control Act of 1938, for the purpose of making recommendations for the installation of penstocks or other similar facilities adapted for possible future use in the development of hydroelectric power in projects authorized to be constructed by the War Department by such acts. Furthermore, under the Federal Inter-Agency Agreement, dated December 29, 1943, the cooperative procedures of the Commission with respect to river basin work were broadened to include cooperative consideration of the water resources development plans and project studies of the Department of the Interior and the Department of Agriculture.

As the equitable division of the water of the Upper Colorado River Basin between the States of the Upper Basin is a condition precedent to its development for hydroelectric power and other water utilization and no alternative to such a compact is apparent except litigation between the several States in the Supreme Court of the United States, the Commission favors the early negotiation of such an interstate compact.

The first question which has to be resolved in such a negotiation would appear to be as to the nature of the compact.

Section 19 of the Boulder Canyon Project Act gives consent to the seven states of the Colorado River Basin to negotiate compacts supplemental to the initial Colorado River Compact of 1922 but apparently does not give consent to a compact by a lesser number of states, such as, those of the Upper Colorado Basin. The Upper Colorado River Basin is defined in Article II (f) of the Colorado River Compact of 1922 to mean "those parts of the

states of Arizona, Colorado, New Mexico, Utah and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located within the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters derived from the System above Lee Ferry." Only Colorado, New Mexico, Utah and Wyoming, however, are named as "States of the Upper Division", as distinguished from the "Upper Basin". California and Nevada, being States of the Colorado River Basin, and Arizona, a State having part of its territory in the Upper Colorado Basin, though not named as a State of the Upper Division, accordingly would have to be parties to any interstate compact negotiated under Section 19 of the Boulder Canyon Project Act. Cf. Transcript of Proceedings - Governors Conference in re The Colorado River Compact held in The House of Representatives, Capitol Building, Cheyenne, Wyoming, on Monday, July 12, 1946, page 32.

As alternative to a compact between all seven states of the Basin would be a compact between the five states of the Upper Colorado River Basin. There would seem to be no legal objection to such a compact, but it would appear to require further initial authorizing legislation, including an act of Congress giving consent, and the usual ratifying legislation, including an act of Congress approving the Compact when negotiated.

The next questions, after the form of the compact has been decided, would appear to relate to the legal basis for allocation of water to the Upper River Basin States and the priorities between the various uses of water.

With regard to the allocation of water of the whole Colorado River Basin, Article III (a) of the 1922 Compact apportions to the Upper Basin in perpetuity "the exclusive beneficial consumptive use of 7,500,000 acre feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist" and guarantees delivery to the Lower Basin from the Upper Basin, for its exclusive beneficial consumptive use, of an equal amount of water. Article III (c) provides that the needs of the United States of Mexico shall be supplied first from the waters which are surplus over and above the amounts allocated to the Upper and Lower Basins by paragraphs (a) and (b) of Article III, and, if such surplus shall prove insufficient for this purpose, then the burden of such deficiency shall be equally borne by the Upper Basin and the Lower Basin, and, whenever necessary, the States of the Upper Division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d). It is provided in paragraph (d) of Article III that the States of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre feet for any period of any 10 consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this Compact. Paragraph (e) of Article III provides that the States of the Upper Division shall not withhold water and the States of the Lower Division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural purposes. It is finally provided by paragraph (f) of Article III that a further equitable apportionment of the beneficial uses of the entire river system unapportioned by paragraphs (a), (b) and (c) may be made in the manner provided in paragraph (g) at any time after October 1, 1963, if and when either Basin shall have reached its total beneficial consumptive use as set out in paragraphs (a) and (b). These provisions fix the maximum and minimum limits of the water available for apportionment among the States of the Upper Basin.

There is at present a further minimum guarantee of 1,500,000 acre

feet to Mexico (from the lower river) under the Mexican Water Treaty, ratified November 8, 1945, delivery of which, in case of drought or serious accident to the hydraulic works in the United States, may be curtailed pari passu with the curtailment of uses in the United States.

Any compact negotiated obviously will have to conform to and make provision for carrying out these allocations and guarantees.

With regard to the priority of uses of water, the compact makes express provision. By Article IV of the Compact, the use of the waters for agricultural and domestic uses is given highest priority. Agricultural uses include irrigation. Domestic uses may be said to include household, stock, municipal, mining, milling, industrial, and other like purposes. Uses for the development of power are subject to the priority of agricultural and domestic uses, but uses for domestic, agricultural, and power purposes have priority over navigation. The interests of the Federal Power Commission, as has been pointed out, primarily relate to power development and navigation. These provisions (taken in conjunction with state law) must govern any compact allocations as between different types of projects and uses of water within each state.

It is provided by paragraph (c) of Article IV of the Compact that the provisions of the Article shall not apply to or interfere with the regulation and control by any State within its boundaries of the appropriation, use and distribution of water. Section 18 of the Boulder Canyon Project Act also contains a saving clause as to rights which the states had on December 21, 1928, except as modified by the Colorado River Compact or other interstate agreement.

Because of the provisions of the Boulder Canyon Project Act, the Colorado River Compact of 1922 and other applicable provisions of law, the drafting of a supplemental interstate compact for the Upper Colorado River Basin has been carefully circumscribed as to allocations of water available for division among the States concerned and as to priority of water uses. In bargaining for shares of the available water, however, the States are free, within the circumscribed limits, to consider contemplated projects on a competitive basis, rank them according to their relative merit, and according to adaptability for early or later development. It is generally considered that the Colorado River has now reached a second stage of development, for which plans may now be made, but that it is not now practicable to plan, except in a preliminary way, for later stages of development.

From the viewpoint of the federal government, it is essential, of course, within the restrictions of existing law, to make provision in the supplemental compact for protection of the rights and interests of the United States, its permittees and licensees in the Colorado River as against the States. The interstate compacts adopted in recent years and the acts of Congress ratifying with them, beginning with the Republican River Compact (57 Stat. 86), suggest provisions useful for this purpose.

In accordance with established procedures of the Federal Inter-Agency River Basin Committee, the Commission has been given opportunity to review and comment on the comprehensive proposed report of the Secretary of the Interior, prepared, pursuant to the Boulder Canyon Project Act and the Boulder Canyon Project Adjustment Act, under the supervision of the Bureau of Reclamation and dated March 1946, which deals with the development of the water resources of the Colorado River Basin for irrigation, power production, and other beneficial uses in the seven Basin States.

This report presents for consideration 134 potential projects or units

of projects, most of which are multiple-purpose developments, for use of water within the natural drainage basin of the Colorado River, and also discusses potential projects for the transmountain diversion of water from the Colorado River Basin to adjacent basins. The report embodies an excellent description of the area, its physical and economic development, and the future possibilities for the region, and provides a practically complete inventory of water projects necessary for the full development of the water resources of the Colorado River Basin. Although the report does not set forth any comprehensive plan for the utilization of the waters of the Colorado River system for irrigation, electric power, and other purposes, it should serve as a useful guide in the selection of projects that will ultimately comprise such a plan and furnish a basis for further investigation by all agencies and states concerned. As the report makes clear, there will not be sufficient water for all of the 134 projects within the basin and for the prospective transmountain diversions and future studies will be necessary for final conclusions in these matters.

The Commission's regional office in San Francisco is at present engaged in the preparation of two reports relating to the electric power requirements in the Upper Colorado River Basin. These reports cover: Utah Power Requirements Survey, which is being prepared jointly with the Colorado River Committee of Utah and deals with the present and future electric power supply and the probable future power requirements of the state of Utah: and Colorado River Power Market Survey, which comprises a study of the power market in Utah, and Arizona, and portions of southern California, eastern Nevada, southeastern Idaho, southwestern Wyoming, and western Colorado.

These surveys have as their primary purposes the estimation of the future power requirements of the Upper Basin States and the determination of the possibilities of developing the water resources of the several states to supply these requirements and at the same time promote the economic and industrial development of the states. The report on these surveys should have an important use in complementing and supplementing further studies of the water conservation and power possibilities of the basin.

The purpose of the Federal Power Commission is to make a thorough investigation of the water power potentially available in the Upper Colorado River Basin and its relation to industry and agriculture, present and prospective. Power potentialities and water conservation for irrigation and other uses are both of great importance and benefits therefrom should be realized simultaneously. It is desirable that water power development be so programmed that an abundant supply of electric power will always be readily available or in immediate prospect, to attract industry to the region and give needed impetus to agricultural development. The water resources of the region should, of course, be developed in accordance with a well considered, coordinated plan expected to result from investigations now under way and in contemplation.

The Commission will continue its cooperation with the Bureau of Reclamation relative to development of the Colorado River Basin, and will gladly cooperate in every way desired with the Upper Colorado River Compact Commission in connection with the drafting of the proposed compact, by making available engineering data and personnel and the experience of its members in acting as representatives of the United States in the negotiation of other interstate compacts.

Sincerely yours,

(Signed) Nelson Lee Smith

Chairman."

"EXECUTIVE OFFICE OF THE PRESIDENT
BUREAU OF THE BUDGET
Washington, 25, D.C.

Nov. 15, 1946

My dear Mr. Bashore:

I have received your letter dated October 1, 1946, requesting information as to the views of Federal agencies regarding the deliberations of the Upper Colorado River Compact Commission.

It would appear that, in addition to the agencies mentioned in your letter, the International Boundary and Water Commission, United States and Mexico, of the Department of State, may be interested because of its treaty responsibilities, in the outcome of your negotiations. I would suggest that you communicate direct with the Commissioner at El Paso, Texas, to obtain his views.

This office will be pleased to cooperate insofar as possible with the Upper Colorado River Compact Commission and would appreciate being informed of decisions reached in your negotiations.

Very truly yours,
(Signed) James E. Webb
Director

Mr. Harry W. Bashore
Federal Representative and Chairman
Of the Upper Colorado River Basin
Compact Commission
Mitchell, Nebraska."

"INTERNATIONAL BOUNDARY & WATER COMMISSION
United States and Mexico
First National Bank Building
El Paso, Texas

Office of the Commissioner
United States Section

December 24, 1946

My dear Mr. Bashore:

This will acknowledge receipt of your letter of December 10, 1946, in which you requested a statement of my views with respect to negotiations of the States of the Upper Colorado River Basin looking to an interstate compact supplementary to the Colorado River Compact of November 24, 1922.

My interest in this matter, as you have pointed out, is because of the responsibility of this Section of the Commission in carrying out the provisions of the Mexican Water Treaty of February 3, 1944, in so far as they relate to the Colorado River.

I presume that the principal if not the sole purpose of the proposed interstate compact is to allocate among the States of the Upper Colorado River Basin the waters which were apportioned to that Basin as a whole by the Colorado River Compact of November 24, 1922. The only official interest which this agency, as a representative of the United States, would have in these negotiations and in the proposed compact is to safeguard the interests of the United States in complying with the Mexican Water Treaty. Article III (c) of the Colorado River Compact provides for the supplying of any water allocated to Mexico "first from the waters which are surplus over and

above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then, the burden of such deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d)".

It seems to me that the proposed compact should specifically recognize this obligation and make provision for meeting the Upper Basin's share thereof, first out of the surplus and second out of the allocation to the States of the upper division as that allocation may be apportioned among them under the proposed compact. Such a provision must necessarily take into account the further apportionment contemplated by paragraph (f) of Article III. A specific provision of this nature would be preferable to, and perhaps render unnecessary, a general provision recognizing the rights and obligations of the United States such as is found in Article XVI of the Rio Grande Compact of March 18, 1938.

In the future administration of the "extraordinary drought" provision of Article 10 of the Treaty the United States Section should have all available information with respect to flows, diversions, and consumptive uses of water in the Colorado River Basin in the United States. Doubtless the proposed compact will provide for the interchange of such information by the signatory States. If so, it would be helpful if provision were made for making this information available periodically to this Section.

Other than these I presently have no suggestions to make, but I should be glad to have your views, not only as to these suggested provisions but as to any other which may occur to you as being desirable or necessary to protect the interests of the United States, particularly in so far as is concerned its Treaty obligations to Mexico.

I appreciate being given the opportunity to present my views.

Sincerely yours,
(Signed) L. M. Lawson
Commissioner.

Honorable Harry W. Bashore,
Federal Representative and Chairman,
Upper Colorado River Basin Compact Commission,
Mitchell, Nebraska."

THE CHAIRMAN: Now you have had those letters for a considerable time and the Chair assumes that you have studied them and may wish to consider them at this time. In fact, that was the understanding when your request was made, that they would be considered at a subsequent meeting.

In order to get the matters before the Commission I believe the Chair will have to call on some member of the Commission to present these various positions of the departments of the various Federal agencies as he sees it. Off the record. (Discussion off the record.)

The Chair now calls on Com. Stone to present Colorado's views in connection with the position taken by the various Federal agencies.

COM. STONE: I have carefully examined the statements which were presented here on behalf of interested Federal agencies and I find that

those statements are general in their nature. There is a general statement presented by the Secretary of the Interior. Attached to that statement is a general statement on behalf of the Bureau of Reclamation, National Park Service, Fish and Wildlife, Bureau of Land Management, Geological Survey, and Bureau of Mines. Later and after the general statement was presented on behalf of the Secretary of the Interior and the agencies of that Department, there was presented a statement by the Office of Indian Affairs.

There is also a statement by the War Department, the office of the Chief Engineer at Washington, D. C.; a statement by the Department of Agriculture; and one by the Federal Power Commission.

These statements are, in my judgment, not very helpful to the Commission. I should say they are largely innocuous. They do not, except for possibly the statement of the Office of Indian Affairs, present any information or position on behalf of the Federal agencies.

The specific interest of any Federal agency except possibly the Office of Indian Affairs, is not pointed out in any single statement. Some question is raised in the statement of the Federal Power Commission relative to the authority under which this Commission is acting in the absence of a specific act authorizing the making of this compact. That question has been resolved by this Commission at its organization meeting and in our organization meeting the Commission by its action disagreed with the Federal Power Commission on that subject. The Federal Power Commission however does not press the point.

All of the Federal agencies indicate a desire, a willingness, to assist the Commission in every way possible. We have eminent evidence of that fact on behalf of the Bureau of Reclamation, which the Commission greatly appreciates.

Referring again to the statement of the Office of Indian Affairs, there is attached a table which is helpful. That table presents the present and potential developments by the Indian Service on various tributaries in the Upper Colorado River Basin. It also sets forth the project areas of the Indian projects and the present diversions for those projects, the estimated ultimate required diversions, and in the last two columns submits the depletions of Colorado River water which will be required for the development of the Indian lands. The first of the last two columns sets forth the present depletions, which total 158,000 acre feet; and the estimated ultimate depletions, which total 505,000 acre feet. These depletions are also subdivided to show the amount in each of the five states of the Upper Basin.

It is estimated according to this table that the ultimate diversions for the Indian lands is 1,434,000 acre feet. Those figures will be very helpful to the Commission in the apportionment of water and the consideration of the apportionment of the obligations at Lee Ferry.

It is also noted that the Office of Indian Affairs discusses questions of law relative to the claim of the Indians to water in the Upper Colorado River Basin and seems to base largely at least, its claim on the case of Winters v. United States, a case which I am sure is understood or the principles at least are understood by the members of this Commission. So that statement is helpful in two respects: It gives an indication of the basis of the legal claim of the Office of Indian Affairs to water of the Colorado River for the Indians, and it indicates the present and prospective development of Indian lands in the Upper Colorado River Basin envisioned by the Office of Indian Affairs.

It is my position--feeling at least--that the Commission should have

from these Federal agencies the answer to two specific questions which are not answered by any of these statements except possibly the statement of the Office of Indian Affairs. The first one would be: What rights to the use of Upper Colorado River water does any particular agency have or claim on behalf of the United States? Second: What particular provision and what particular language should be incorporated in an Upper Colorado River Basin Compact to protect the right to the use of Upper Colorado River water held or claimed by any agency on behalf of the United States? Ultimately in my judgment those two questions must be answered by interested Federal agencies.

And in conclusion I propose that the Commission submit those two specific questions to these Federal agencies. We no doubt will find when we start to write the language of a compact that these Federal agencies will have much to say concerning the language which either does or does not specify the particular interest held or claimed to be held by a Federal agency.

THE CHAIRMAN: Thank you, Judge Stone. Com. Carson, what do you have to add to the statements that have been made?

COM. CARSON: I don't know, Mr. Chairman, that I can add anything to what Judge Stone said. I think it is true that before the compact is finally written and agreed on it is necessary that we clear with the Federal agencies because of the necessity of its ratification by Congress. If there is any question in the minds of any members of the Commission as to any particular agency and its position, I think it should be cleared somewhere along during the course of the negotiation of the compact so that we know what their claim is and what they desire in it. Otherwise, if we negotiated a compact, they might defeat its ratification in Congress. I think it is necessary that we understand what they want and they understand what we are doing.

But it is a question of timing there as to when it should be done. I confess I don't know on the timing. I should say we should clear it as best we can as we go along and then when we finally write up a draft of the compact, that we submit it to them at that time, get their approval on it before we finally execute it, or get suggestions at that time for changes also.

COM. STONE: May I ask Mr. Carson a question? You know it is only human nature to have a certain pride of authorship. If this Commission adopts certain language relating to the interests and claimed rights and interests of the Federal Government and then submits it to the Federal agencies, there will be more difficulty in adjusting language which is proposed by this Commission than if in advance we have the specific language which these Federal agencies desire.

COM. CARSON: I don't have any objection to the submission of any question you want to submit to them, Judge. Don't misunderstand me there. What I mean is that we better clear it as we go and then after that, when we rough out a draft, I think we should submit it too and see whether or not we have conformed with their ideas.

COM. STONE: I submit that proposal on the basis of experience in the Arkansas River Compact, which is now under negotiation. That plan was followed there and it has worked very well because those specific questions were answered, language prepared to comply with them, and then resubmitted to the Federal agencies, and it is a means of starting the ball to rolling and accomplishing something definite right at the beginning of the formulation of a compact.

THE CHAIRMAN: The Chairman would like to know if any of the Co
Members have a copy of the letter which was written to these various agen
by your Chairman, the Federal Representative? Off the record. (Discussi
off the record.)

The Chair would like to know from you, Judge Stone, and you, Com
Carson, if this general procedure that you have outlined applies to all th
Federal agencies. As I recall it, the War Department was rather specific i
its position. The Department of Agriculture, while it indicates its desire
to be very helpful, seemed not by inference even to claim any interest in t
waters of the Colorado River, and it might be possible that you could elimin
a few of these agencies from your general proposal.

COM. STONE: That is possible, Mr. Chairman. It may well be that i
reviewing these letters it would not be necessary. However, I think that all
of the agencies would be interested in the specific language which is designed
to protect the rights to the use of water claimed or which may be claimed by a
agency on behalf of the United States.

COM. BISHOP: Mr. Chairman, I would like to state at this point that
the draft presented by Wyoming contains all of the paragraphs heretofore re-
quired by Federal agencies in compacts with which Wyoming has had to do.

COM. STONE: Mr. Bishop, I would like to say to you that in the recent
Arkansas River Compact, language of that type which appeared in former compacts,
and one of them was a Wyoming compact, was not acceptable to the Federal
agencies. So I don't think we can generalize and say just because it was ac-
ceptable on one river it would be acceptable on another river. Every river is
different and there are different interests.

COM. BISHOP: I don't disagree with your statement; I just wanted to
bring it to your attention that the draft that we have does have all of those
that have heretofore been required and it seemed to me it is a basis to start
our negotiations on even though you don't agree with any paragraph of it.

THE CHAIRMAN: The Chair would like to be excused for a moment to see
if he can find a letter written to these various Federal agencies and while I
am making a search for that letter, I will ask Com. Carson to preside.

ACTING CHAIRMAN CARSON: Is there any further discussion on this
question of Federal agencies?

COM. BISHOP: I don't object to the idea; in fact, I will go along
with you. I just wanted to call your attention to the fact that this matter
had been given consideration by Wyoming.

ACTING CHAIRMAN CARSON: Mr. Watson of Utah?

COM. WATSON: It seems to me that there is a question concerning our
obligation to the Indian tribes that will ultimately come up before this Com-
mission and that is whether or not it is an obligation of the entire Colorado
River Basin to the Indian tribes, whether the Lower Basin takes care of its
Indians and the Upper Basin takes care of its Indians, or whether each state
should take care of the Indians within that state. These questions are bound to
arise. I don't know the answer to them.

COM. STONE: That is largely a matter among the states rather than
one which might be acceptable to the Federal agencies.

COM. WATSON: If the obligation to all the Indians in the Basin is

an obligation of all of the states, wouldn't that problem have to be considered?

COM. STONE: I think so. But, Mr. Watson, my point was that if we had specific language we could better analyze our own ideas insofar as the effect not only on the rights and interests of the states but also the claimed rights and interests of the Federal Government. I would just like to mention this specific instance. I think experience is always a fairly good teacher and it was found in the Arkansas River Compact that the language which was incorporated, and which followed largely, on one particular point at least, some language in the Belle Fourche Compact--it did include some particular reference to situations on the Arkansas River--but when that same language acceptable to the Federal Power Commission was submitted to the Corps of Army Engineers and the Department of the Interior, there was objection to it.

ACTING CHAIRMAN CARSON: Mr. Bliss, what do you think of that idea of asking these specific questions Judge Stone suggests?

MR. BLISS: Mr. Chairman, I would like to observe this, that New Mexico is vitally interested in the Indian problem particularly. If you will take the tabulation which Judge Stone has referred to you will see that substantially two-thirds of the entire proposed consumption of water by the Indian Service will be made in New Mexico according to their present outlined program. I have no objection to requesting the Federal agencies for their statement as suggested by Judge Stone.

COM. CARSON: Judge Stone, I would like to suggest that you make a motion and designate the agencies requested to appear.

COM. STONE: Very well. Is that motion in order, Mr. Chairman, or do you have something you want to submit first?

THE CHAIRMAN: I would like at this point to read into the record a letter which was written by your Chairman and the Federal Representative to the various Federal agencies. I have before me the letter dated October 1, 1946, to the Director of the Bureau of the Budget:

"My dear Mr. Webb:

By letter dated July 17, the President appointed me the representative of the United States to participate in the negotiations of the States of the Upper Colorado River Basin looking to an interstate compact supplementary to the Colorado River Compact of November 24, 1922, and to make a report to the Congress on the proceedings and on any compact or agreement entered into by these States.

I can best represent the interests of the United States and advise the representatives of the States if I am fully informed of the views of all Federal agencies that have an interest in the outcome of the negotiations. To this end, I have addressed requests for their views to the Secretaries of War, Agriculture, and Interior, and to the Chairman of the Federal Power Commission. I have not been able to think of any other Federal agencies that are likely to be interested. If you know of any, I will appreciate your apprising them of my appointment and asking them to let me have, directly or through you, a statement of their views on the problems before the conference by November 11.

I will, of course, be glad to receive your and their help and advice at any time; it will be particularly useful to me, however, if

I can have at least a summary statement by the date I have mentioned in the preceding paragraph.

Sincerely yours,
(Signed) Harry W. Bashore,
Federal Representative and Chairman
of the
Upper Colorado River Basin Compact Commission."

A letter similar to this went to all of the agencies. As a result of this letter the Bureau of the Budget suggested that I write to the Chairman of the International Boundary and Water Commission, Mr. Lawson, and he replied. On December 10, 1946, I sent a letter to the Hon. L. M. Lawson, American Commissioner, International Boundary and Water Commission, United States and Mexico, El Paso, Texas:

"My dear Mr. Lawson:

By letter dated July 17, the President appointed me the representative of the United States to participate in the negotiations of the States of the Upper Colorado River Basin looking to an interstate compact supplementary to the Colorado River Compact of November 24, 1922, and to make a report to the Congress on the proceedings and on any compact or agreement entered into by these States.

I can best represent the interests of the United States and advise the representatives of the States if I am fully informed of the views of all Federal agencies that have an interest in the outcome of the negotiations. It has occurred to me that the International Boundary and Water Commission, United States and Mexico, of the Department of State, may be interested, because of its treaty responsibility, in the outcome of the negotiations. Will you not, therefore, be good enough to let me have a statement of your views as soon as practicable?

I will, of course, be glad to receive your help and advice, and to confer with your or your representative at any time."

That letter went to Mr. Lawson and you have his reply, and similar letters went to all of the agencies mentioned and you have their replies.

COM. STONE: Mr. Chairman, I did neglect in reviewing these to mention the International Boundary and Water Commission. The reply is here.

Mr. Chairman, I make this motion: That the Commission respectfully request the Chairman, who is the Federal Representative on this Commission, to direct a letter to all of the Federal agencies that have heretofore been contacted by the Chairman, asking them to answer two specific questions, namely: What right to the use of Upper Colorado River water does the agency have or claim on behalf of the United States? Second: What particular provision and what particular language should be incorporated in any Upper Colorado River Basin Compact to protect the right to the use of Upper Colorado River water held or claimed by an agency on behalf of the United States?

And that in connection with the letter addressed to the Office of Indian Affairs, that agency be asked to appear by its own representative at some future meeting of the Commission.

THE CHAIRMAN: Does the Chair hear a second to the motion as proposed?

COM. BISHOP: Mr. Chairman, I will second the motion. I would like to change just one word, "what right if any".

COM. STONE: That is all right.

COM. BISHOP: I will second it.

THE CHAIRMAN: Is there further discussion of the motion?

MR. BLISS: Mr. Chairman, I appreciate what Judge Stone has suggested that probably the proper thing would be to call a representative of the Indian Service in to discuss the Indian situation.

COM. STONE: Isn't this another way of finding out? At least we will have a better idea of their position.

MR. BLISS: Undoubtedly.

THE CHAIRMAN: The Chairman is a little bit in doubt about the wording of your motion, Judge Stone. I believe you can accomplish what you are after by a little different wording, and not being a lawyer I hesitate to comment too freely on it. But it seems to me it is not quite appropriate to request, in the form that your motion has it at least, a Federal agency to come before a body of this character for cross examination.

COM. STONE: It has been done frequently on other compacts. As a matter of fact, it has been my observation it is the usual practice. I recognize fully that a Federal agency may refuse to do so and there is nothing we can do about it but it has been my observation that these Federal agencies are cooperative in this matter.

COM. WATSON: They surely do that with the Reclamation Service.

THE CHAIRMAN: The point is if you would word your motion a little bit differently I think you would accomplish what you are after.

COM. STONE: I have no pride of authorship. If you want to use some softening words--

THE CHAIRMAN: "Invite"?

COM. STONE: --"invite", I certainly would incorporate it. Insert the word "invite" in my motion and strike the word "request." I see what you are getting at. Perhaps that is too blunt a way to put it. I think your suggestion is good, use the word "invite" instead of "request."

THE CHAIRMAN: Does the Commissioner who seconded the motion agree to that?

COM. BISHOP: I will accept it.

THE CHAIRMAN: Any further discussion of the motion?

MR. BLISS: It has been suggested, Mr. Chairman, that legal as well as engineering advice from the Office of Indian Affairs be solicited.

COM. STONE: I am willing to incorporate that in my motion.

COM. BISHOP: I accept it.

MR. GILES: Judge Stone, I am wondering about the wisdom of having the Chairman direct your specific questions in writing to these agencies if you are going to invite them to come in and discuss them. Is it only the

Office of Indian Affairs that you had reference to there?

COM. STONE: No, the two questions which I submitted go to all of the agencies. I can't see what is wrong in doing that. It merely makes it specific.

MR. GILES: I don't think there is anything wrong. I was just wondering about the strategy.

COM. STONE: The Chairman is merely transmitting the suggestion of this Commission and as Federal Representative it seems to me he is the appropriate person to do it.

MR. GILES: Well, he is the appropriate person to make the invitation that you speak of but you are also asking him to direct specific questions to them now which you want answered in writing.

COM. STONE: That is right.

MR. GILES: And in addition to that you are inviting representatives here to discuss with you the problem.

COM. STONE: That applies only to the Office of Indian Affairs.

MR. GILES: That was what I was--

COM. STONE: That doesn't apply to the others.

MR. GILES: I see. That clears it up, Judge.

COM. STONE: I take it that the Commission may want to invite other agencies later but at the present time the motion only goes to the Office of Indian Affairs except as to the specific questions and the Commission is suggesting to the Federal Representative that he ask them to submit answers to those questions.

THE CHAIRMAN: Miss Price, will you read that motion now again?

COM. STONE: Will you insert those words, "invite" instead of "request", and as to the Indian Service, "including legal as well as engineering," and the words, "if any."

THE CHAIRMAN: Read the motion now as it has been amended.

(Motion by Com. Stone, amended, read as follows: I therefore make this motion: That the Commission respectfully request the Chairman, who is the Federal Representative on this Commission, to direct a letter to all of the Federal agencies that have heretofore been contacted by the Chairman, asking them to answer two specific questions, namely: What right if any to the use of Upper Colorado River water does the agency have or claim on behalf of the United States? Second: What particular provision and what particular language should be incorporated in any Upper Colorado River Basin Compact to protect the right if any to the use of Upper Colorado River water held or claimed by an agency on behalf of the United States?

And that in connection with the letter addressed to the Office of Indian Affairs, that agency be invited to appear through its own representative at some future meeting of the Commission to discuss both legal and engineering phases of the asserted claims of the Indians.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

COM. STONE: I would like, Mr. Chairman, to direct a question to a man who we all recognize has had a lot of experience with Federal agencies, Mr. Will, and ask if there is anything there, any language, which he thinks ought to be changed.

MR. WILL: I don't think there is anything in that language to which any Federal agency could possibly take offense, Judge.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion as amended carried unanimously.)

THE CHAIRMAN: In accordance with the action of the Commission yesterday to the effect that each Commission would make a submission for his state of a list of the factors to be considered in the negotiations, it appears to the Chair we are now ready for this submission provided the states are ready.

COM. WATSON: Mr. Chairman, since I made the motion may I make the comment?

THE CHAIRMAN: Yes, sir.

COM. WATSON: The representatives of the State of Utah are still working on this problem and we ask for a little more time to get that matter perfected so we can present our case to the Commission, either later this afternoon or at some meeting during this session.

THE CHAIRMAN: In line with your suggestion, Com. Watson, it may be that none of the states are ready at this time.

COM. STONE: Mr. Chairman, I wish to say that Colorado I think proposed the amendment to limit Mr. Watson's motion to a statement of factors. Colorado is ready to submit for the consideration of the Commission those factors. I am not too sure that what we have in mind is appropriately described as factors. It might be it would include other matters, or matters other than factors. It includes matters which in our judgment must be considered by this Commission before any final conclusions can be reached on an apportionment of water and the determination of the respective obligations of the states to make deliveries at Lee Ferry.

It is the view of Colorado that we want to aid in expediting this compact. We believe there is a lot of work for the Commission to do and we expect to submit matters which we think can be discussed and considered in advance of any further engineering report; and those matters we are ready to submit and I should like to ask Mr. Breitenstein to submit them.

THE CHAIRMAN: That is fine, Com. Stone. We will go right ahead, Mr. Breitenstein.

MR. BREITENSTEIN: This has to be an oral presentation. We did not have time to put it in written form for submission at this time, so I will have to do my best on an oral statement.

So far as the allocation of the beneficial consumptive use of the water between the states is concerned and so far as an agreement on a formula for deliveries at Lee Ferry is concerned, those are matters which involve further engineering investigations as we see them. One other matter definitely involves further engineering investigations. It is a matter which we feel

has not been considered and that is the method of measuring beneficial consumptive use. Obviously it does no good to apportion between the states the beneficial consumptive use of any amount of water unless there is some method provided for measuring the beneficial consumptive use.

Passing those matters which we feel involve further engineering study, there are certain matters which we believe can be considered. The first and probably the most important of all is what administrative provisions shall be incorporated in the compact? It occurs to us that the compact cannot possibly be a satisfactory document unless it contains some provisions relative to administration. That in itself raises other questions:

What shall be the form of the administrative agency? What members shall there be on the administrative agency? What power shall the administrative agency have? And in that regard specifically, shall the administrative agency have the power to adopt rules and regulations, or shall it have some restricted power to adopt rules and regulations?

Then if you have an administrative agency there will probably have to be some fulltime employees. How shall the expenses of those employees be met? Will the United States participate in meeting such expenses?

Another matter which has come up in other compacts with which we are concerned is a question of whether or not the compact shall operate for a fixed term or in perpetuity.

Another question which we believe merits consideration is: What provisions shall be made for a definition of the rights and obligations of the United States? And as a corollary to that a question of: How shall water uses made by the United States or any of its agencies be charged? Shall they be charged to the state in which the water uses occur or in some other manner?

Then in connection with the Upper Basin, we know from the report made by the Bureau of Reclamation that projects are contemplated for construction in one state for the benefit of another state. When you get into such projects you have several questions which come up according to our experience in other compacts. One is whether or not the power of eminent domain may be exercised in one state to obtain property for use in a project solely for the benefit of another state. Another question which has arisen in connection with another compact is: What, if any, reimbursement shall be made to a state in which a project is located for the benefit of another state for taxes lost to the state in which the project is located?

Then another is: What method of charging water uses shall be made when diversions, storage, storage releases, reservoir evaporation and like conditions take place in one state either for the sole benefit of that state or for the joint benefit of one or more states? Then probably as important a question as any is: What is the administrative control over diversions, storage and release of storage in one state for the benefit of another state?

Another factor which we must consider is the fact that there is a compact existing between Colorado and New Mexico over the La Plata River. It seems to us that some consideration must be given here as to the recognition of that existing compact.

Then you have an overall problem which has been suggested many times as to how the tributary basins shall be treated. For example, I apprehend that New Mexico may desire to have Colorado make agreements in connection with the use of San Juan River water as most of the supply of New Mexico may come from Colorado production in the San Juan Basin. That same situation, however, exists

on other tributaries. You have the Little Snake River which goes back and forth across the line between Colorado and Wyoming, with diversions in each state for use in the other states. Then you have interstate tributaries between Utah and Wyoming and between Colorado and Utah. While these involve engineering matters it seems to us that some agreement must be made as to whether or not the upper state on any of those tributaries is under any obligation to maintain any particular flow in that tributary.

There are a number of other matters. One, of course, is: How shall main stream reservoir evaporation losses be charged? We all know the report of the Bureau contemplates a number of main stream reservoirs. Now obviously it wouldn't be fair to charge all that reservoir evaporation loss to the state in which the reservoir is constructed, but if it isn't charged to that state, how shall it be charged? Reservoir evaporation as we all know involves a lot of water and unless there is some method evolved of charging those evaporation losses, that will be the source of future controversy.

In connection with the same problem: How shall these main stream reservoirs be controlled? Who determines when you store water in those reservoirs and when you release water? Power plants are contemplated on those main stream reservoirs. In making the releases are you to be controlled by the desire of the power customers to have power or are you to be controlled by the desire of irrigation users to have holdover storage so that their uses may not be cut off?

Another matter which is probably legal is: How shall beneficial consumptive use be defined? I know that in one compact several days were spent in trying to arrive at a definition of consumptive use. Now in the Colorado River Compact you have the term, "beneficial consumptive use," which brings in another factor upon which there may not be immediate agreement: When is a use beneficial and when isn't it?

Another factor is whether or not the compact shall contain a provision giving any order of preference as between uses of water. You know the Colorado River Compact does. Shall we adopt the same provisions or shall we perhaps depart from them?

The engineers have mentioned the matter of conveyance losses of water. While it is fine to know there are conveyance losses of water, you have to determine two other matters it seems to me in order to have a complete compact: One is how these conveyance losses shall be measured; and another is how they shall be charged.

And the engineers have said there is salvage of water by upstream uses. Well, now, how shall that salvaged water be divided?

Of course in connection with all these things there is one which perhaps I should have mentioned sooner and that is: What powers shall be given an administrative agency to maintain the required flows at Lee Ferry? That goes back to your question of the administrative agency if one is decided upon. What is the extent of the powers which it has in requiring any state to deliver water?

That brings up another question as to whether or not the responsibility of maintaining the required flows falls upon the states or upon certain tributary basins in the states, or upon individual projects or groups of projects.

Another matter which perhaps goes into engineering matters is

whether or not beneficial consumptive use shall be divided solely between the states or as to whether or not there shall be a subdivision as between basins in the states.

Another matter which I think merits consideration is whether or not any division between the states shall be subject to future adjustment in the event that any state does not make full beneficial consumptive use of its share within a stated period. We are concerned here with the development to the full. est extent possible of a natural resource and if in the future it is found that one of the states doesn't use up all its share why should not that water then be used by another state?

Other matters which I think must be considered: What if any provisions existing in the Colorado River Compact must be carried over into this compact?

Another matter growing out of the Colorado River Compact and the Mexican Water Treaty relates to the supplying of the Mexican share in the event of deficiencies. How shall they be divided between the states?

Another matter which arises out of the Mexican Water Treaty relates to the provision for the flows to Mexico being cut down in times of extraordinary drought. Do we want to have anything in this compact which would relate at all to that provision of the Mexican Water Treaty?

These matters which I have mentioned are all of them matters which have been presented to me in connection with my discussions with water users all over the State of Colorado. Since the last meeting of the Commission I believe I have talked to representatives of every section of the State in which there is an interest in the Colorado River water. These questions are not just my own; they are questions which have been asked me. So far as a ratification of the compact in Colorado is concerned I feel that the Colorado Commissioner must be prepared to answer these questions; and it is my humble suggestion that many of them can be considered and determined without any delay resulting from the lack of completion of the study of the engineers. Thank you.

THE CHAIRMAN: Thank you, Mr. Breitenstein.

MR. BREITENSTEIN: Oh, yes, there is one matter I didn't mention which Judge Stone has just called to my attention. One question which comes up quite often in our discussions is whether the allocation of beneficial consumptive use of water between the states will be upon the basis of acre feet or a percentage. That is one of the first questions which is asked in any discussion of the matter and it is one of course which must be determined.

THE CHAIRMAN: At this point I believe we will recess for five minutes in order to give our reporter a rest.

(10:50 a.m. Recess.)

(11:10 a.m. Meeting resumed.)

THE CHAIRMAN: Gentlemen, we will come to order. Is the Utah Commissioner ready to submit his statement in regard to the factors to be considered by the Commission?

COM. WATSON: Mr. Chairman, as I understand, this Commission will be sitting Thursday morning. We will have a statement ready at that time.

THE CHAIRMAN: Very well. The Commissioner from New Mexico.

MR. BLISS: Mr. Chairman, the Commissioner is not here this morning and I believe we should postpone our statement until Thursday.

THE CHAIRMAN: The Commissioner for Wyoming.

COM. BISHOP: Mr. Chairman, Wyoming's group will meet during the lunch hour and be ready to report at two o'clock.

THE CHAIRMAN: Is the Commissioner for Arizona prepared at this time to submit his statement of the factors to be considered by the Commission in negotiation of the compact?

COM. CARSON: No, sir.

THE CHAIRMAN: At what time will the Commissioner for Arizona be prepared?

COM. CARSON: I don't know that I will. I am going to listen for a while here.

THE CHAIRMAN: The Commission will meet again Thursday and do you think it would be possible to get a list ready by that time?

COM. CARSON: Yes.

THE CHAIRMAN: Very well. Off the record. (Discussion off the record.)

COM. STONE: Mr. Chairman, there is one question submitted by Colorado which has been heretofore discussed to some extent. It is an important one, relatively simple as compared with some of the others, namely, the question of whether any apportionment of water shall be on an acre-foot basis or shall it be on a percentage basis. We do not mean that we attempt now to determine the percentage, but what is the basis, percentage or acre-foot basis? That is a question which because of previous discussion seemed to be appropriate to take up at this time and Colorado raised the question. I should like Mr. Breitenstein to lead off just to lay a basis for discussion.

THE CHAIRMAN: The Chair feels that that is a very good suggestion, Com. Stone, and we will be glad to have Mr. Breitenstein start the discussion on this question of acre-foot vs. percentage allocation.

MR. BREITENSTEIN: In the Colorado River Compact, of course, the acre-foot measure is used in the apportionment of the rights between the states. Now we come along twenty odd years after the Colorado River Compact and hear the engineers say perhaps there wasn't as much water in the Colorado River as the negotiators of the Colorado River Compact thought there was. That immediately raises the point as to whether or not we shall fall into the same error, if it was an error in which they fell in making a division between the basins.

The engineers have expressed doubt as to the total amount of water which will be available for use in the Upper Basin. That is a matter of course for them, not for any lawyer to talk about. But since the amount of water which may be available is an uncertain quantity, it seems to me--and I am expressing a personal opinion here--that from the standpoint of each of the states involved, the most satisfactory method of allocating the water is in terms of percentage and those terms of percentage can apply regardless of the amount of water which is available. And if you use terms of percentage rather than fixed acre-foot quantities, then you have a flexible method of

apportionment which can apply under all conditions and the proportion or the ratio or whatever the engineers call it is always the same.

So from my own standpoint it seems clear to me that there are great advantages in the use of the percentage method and no advantages for the use of the acre-foot method.

THE CHAIRMAN: Mr. Breitenstein, will you elaborate a little bit on that percentage question with regard to obligations on the part of the states and also with respect to the percentage relationship to the interstate tributaries?

MR. BREITENSTEIN: Well, now, you are getting down into refinements where perhaps an engineer should be talking rather than a lawyer.

THE CHAIRMAN: No, I think we will all appreciate what you have to say.

MR. BREITENSTEIN: First, I draw a distinction between the allocation of beneficial consumptive use to the states and the division between the states of the obligation to maintain the required minimum flows at Lee Ferry. It seems to me both of those can better be defined in terms of percentage rather than in terms of acre-foot quantities.

Now I have got to confess that in thinking of percentages I am thinking about states as a whole and not tributary basins within a state. It is my idea that the obligation as to deliveries at Lee Ferry is, to use the words of Mr. Carson, a joint and several obligation of the States of the Upper Division; and while it is a joint and several obligation, nevertheless as between the states of the Upper Division those obligations should be in some manner fixed. Obviously it wouldn't be right to require the State of New Mexico to deliver 500,000 acre feet of water. But regardless of what formula is devised it seems to me that formula should be on a basis of a percentage.

On the tributaries you come into another problem. On the La Plata River Colorado already has a compact which requires the delivery at the State line of amounts of water which are determined by the flows at an index station upstream. That is an existing compact which has been litigated in the United States Supreme Court. On other tributaries there is no such comparable situation. It may be that a lower state on certain tributaries will take the position that the upper state must maintain certain minimum flows at the State Line. I don't know about that. That is for the Commission to determine.

That may apply to all tributaries or it may apply only to selected tributaries, but regardless of what determination is made on that, it seems to me that the uses made in the upper state on such tributaries are uses which go to make up the total percentage of use to which the state is entitled, and the state-line deliveries go to make up the percentage of that state in providing the required minimum flows at Lee Ferry.

So it seems to me the matters of the various tributaries can easier be handled on a percentage basis, much more easily than on an acre-foot basis. If you required the delivery of fixed amounts of water in acre feet at the state line, you might run into a situation where Mother Nature just didn't produce that much water upstream. You are liable to run into trouble on that.

I feel that perhaps in discussing these matters I am treading on the toes of the engineers and I am no engineer, I am just a lawyer on this thing, Commissioner.

THE CHAIRMAN: Thank you very much, Mr. Breitenstein. That is a very

clear statement on that question. The Chair would like to hear a further discussion.

COM. BISHOP: Mr. Chairman, that is a matter that Wyoming has given considerable thought to and we agree with Mr. Breitenstein that the allocation should probably be made on a percentage basis; however, it is quite necessary to mention the 7,500,000 acre feet on account of the wording of the Colorado River Compact according to my judgment, and I think the compact should probably provide that, for instance, a state gets a certain percent of 7,500,000 acre feet. Well, they are entitled to that percent of the total available supply.

Now here is a situation which you will find that will come up and that is, some years one basin is much shorter of water than another. One basin will get 100 percent of their percent where it isn't available in another basin. And as long as the obligation at Lee Ferry is taken care of, that is rather immaterial I would think.

THE CHAIRMAN: Thank you, Mr. Bishop. Off the record. (Discussion off the record.) New Mexico?

MR. BLISS: Chairman Bashore, allow me to at least raise a question about the operation of such a proposal. I think Mr. Breitenstein's suggestion has merit; however it seems to me that in a good many cases--and I have in mind particularly the situation between Colorado and New Mexico--there will have to be in addition to the Upper Basin Compact, the subcompact or at least an agreement between Colorado and New Mexico as to the allocation of the waters of the San Juan River.

Now my question goes to this point: How will the obligation of Colorado and New Mexico, for example, be determined as between the two states? Or, to enlarge it, how will the obligation of any state to deliver at Lee Ferry be determined? Will it be determined on some percentage basis or will the obligation of any state be determined on the basis of delivery of water at the state line in accordance with some index inflow of virgin water in the upper watershed of the stream in question? That was done in the case of the Rio Grande Compact in which the obligation of the two states of the upper part of the Rio Grande Basin to deliver is based on the inflows available for delivery and those obligations are in terms of acre feet, specific quantities.

I don't know just how that would fit into the obligation to deliver on the basis of percent. I am just raising the question; I am not saying it could not be done.

MR. BREITENSTEIN: May I say a word in answer to that?

THE CHAIRMAN: Go ahead, Mr. Breitenstein.

MR. BREITENSTEIN: First, I endeavor to recognize in the statement I have made that so far as particular tributaries are concerned, there may be an obligation agreed upon by an upper state to maintain certain minimum flows at the state boundary. When I made that statement I had in mind the San Juan River because I apprehend New Mexico is going to at least ask for the right to use some of the water that is originated in Colorado in the San Juan River.

MR. BLISS: I think you are right.

MR. BREITENSTEIN: In regard to that it would seem to me that

some use of the inflow index method might possibly be an acceptable method. However, so far as the maintenance of the required minimum flows at Lee Ferry is concerned, in the situation involved in the allocation between states of the water of a tributary such as the San Juan, to me there is no problem.

Say that in a certain year we are 10 percent short in making the minimum deliveries at Lee Ferry. That would be 750,000 acre feet, say. Now the obligation to make up those deficiencies, it seems to me, should be upon the basis of percentage, that each state should have the obligation of making up a certain percentage of that deficiency; and to me that can be easily worked into a situation such as Mr. Bliss was talking about.

COM. STONE: May I ask Mr. Bliss a question? Mr. Bliss, you said that probably there would have to be a separate arrangement between New Mexico and Colorado on the San Juan. That would be one method, a separate compact. But is it not conceivable that the situation can be taken care of as a part of this compact by some method such as suggested or indicated by Mr. Breitenstein? My question to you is: Does it necessarily follow that that cannot be taken care of in this compact?

MR. BLISS: No, I think you are correct, that it could be incorporated in the general compact.

THE CHAIRMAN: It occurs to the Chairman that the Republican River Compact takes care of that question very well. Of course it did it on an acre-foot basis. But the Republican River Compact specified the obligations and the benefits on the tributaries.

MR. BREITENSTEIN: That is right.

MR. BLISS: The need for agreements between states on specific tributaries is obvious. If Colorado were assigned any given percentage and elected for example, if it were physically possible, to take it all out of the San Juan, we would be in tough circumstances in our state.

COM. STONE: I think that would be manifestly unfair and in my judgment shouldn't be left to the good will of Colorado. The state situated as New Mexico is, in all justice ought to have explicit assurances either through this compact or a separate compact. And for the present it seems to me we ought to at least try to incorporate it in this compact because we all know the difficulties that arise in making any compact and we ought to attempt to take care of all these matters that can be taken care of in this Upper Colorado River Basin Compact.

MR. BLISS: That of course is not peculiar in New Mexico. It involves Colorado and Wyoming.

COM. STONE: I am just using that as an example.

THE CHAIRMAN: The Chair would respectfully suggest to each Commissioner that they examine the Republican River Compact in thinking of the question of the tributaries. Com. Carson.

COM. CARSON: Well, it seems to me that the percentage can work out very well. I think on those interstate tributaries, when a percentage is agreed to between these states, then they would have to break that down as to what part of that percentage would come out of one of these interstate tributaries and it would work out very well.

MR. BLISS: Supposing, Mr. Carson, that an interstate tributary betwe

New Mexico and Arizona, for example, were involved; we would be required to deliver to you some very small percentage of water based on the general delivery. Com. Bishop has pointed out that in the basin in many years the amount of water available varies considerably and if our available water supply is entirely inadequate we couldn't possibly deliver even though the water over the basin in general were sufficient to make those deliveries. That phase of the problem will certainly enter into the picture.

COM. CARSON: Yes, but then you can cover that as well by percentages as you could by any other method, couldn't you?

MR. BLISS: Perhaps.

COM. CARSON: The question here is whether it should be by percentage or specified acre feet. It would seem that the percentage would be equitable and fair.

MR. BLISS: I assume that in all these deliveries some latitude will be allowed.

COM. BISHOP: As I see it, Mr. Chairman, if and when the necessary storage reservoirs are completed the water will be there to take care of the obligation and the administrative agency should be authorized to determine what reservoirs to use the water from. It seems to me that that matter will be well taken care of eventually. In the meantime as I see it there is going to be plenty of water going on down to the Gulf of California.

THE CHAIRMAN: The Chairman may be not too clear on the trend of this discussion but apparently the thought is that you might by some provision in this compact be able in a year of shortage on one tributary to relieve that shortage at Lee Ferry by greater contribution from another tributary. If I understand that correctly that seems to be very complicated and would introduce very serious complications.

COM. BISHOP: Mr. Chairman, I would just like to mention the fact that the tree ring studies show there was a period I believe of 30 to 35 years that the San Juan was practically dried up. It seems to me it is such a big proposition we have got to have sufficient reservoirs to hold the water to take care of it and not impose on the San Juan, for instance, or maybe next time it will be the Green River that goes dry--the Green River hasn't however according to the tree ring studies. But I believe the future will prove that those things do happen. You are going to need the large storage capacity to take care of our obligation and where the water comes from makes very little difference after it gets in storage.

MR. BLISS: I would like to ask Mr. Breitenstein a question if I may. You suggest that the division be made on the basis of percentage; is that a percentage of each year's available water at Lee Ferry or the 10-year obligation or--

MR. BREITENSTEIN: In my opinion it should be a percentage of the available III.(a) water supply for the particular year.

COM. BISHOP: That is my idea exactly.

MR. BREITENSTEIN: Yes.

MR. BLISS: Then in any case where the available water supply were normal, say--supposing some stream was only 50 percent normal, it would be required to deliver a normal supply on the basis of your--

COM. BISHOP: It would if it was available.

MR. BREITENSTEIN: Of course, you have got to differentiate between the allocation of consumptive use of water and the division of the obligation to maintain the minimum flows at Lee Ferry. Obviously the water supply in each tributary basin is not the same each year. However, there should be no question of curtailment arise unless there is a deficiency at Lee Ferry and you would have the right to use the available water supply up to the percentage that is fixed and wouldn't worry about shutting off until you run into a deficiency.

So far as dividing it between two states, say Colorado and New Mexico, that to me is a separate problem from the division between all of the states of the beneficial consumptive use of the available water supply in terms of percentage and the division between the states of the obligation to meet Lee Ferry deficiencies in terms of percentage. As between Colorado and New Mexico I don't know enough about the factual situation to determine what would be a fair method of division. The Chairman has suggested the method used in the Republican River Compact. To me that raises another question as to how you are going to measure the consumptive use of that water. It might be--I don't know--that on the San Juan some simpler method could be devised by use of index stations as you have on the Rio Grande and on the La Plata.

But to me that is a separate problem from the one which I started in to discuss as to the allocation of consumptive use and the division of obligations on the basis of percentages and to me the percentage basis has the advantage of flexibility and will minimize the administration of the stream by whatever agency is set up to administer it, and will minimize the possibility of future controversies between the states.

COM. STONE: I think what Colorado has in mind in this discussion is simply this, that at the present time we can't get into all of the details as to how it will affect various tributaries or will work out, but whether as a matter of principle the Commission could agree tentatively that this appears to be the best method for the apportionment of the water and with appropriate relation to the delivery of water at Lee Ferry, and that that would be something of a directive to the Engineering Advisory Committee which would be an aid no doubt to their studies in determining upon what final action we should take, and that final action would necessarily be controlled to some extent at least by the application of this principle to the facts within the basin. In other words, that we wouldn't agree now that is an unalterable rule, but tentatively and on the basis of the facts that are known, we will attempt to make progress by agreeing upon the percentage method as against the method of a given acre-foot allocation. It seems to me we might find on some of these tributaries that some provision would have to be made to work out the equity between given states.

COM. WATSON: Judge Stone, doesn't the fact that the water must be delivered at Lee Ferry over a period of ten years solve the contribution of each tributary in the basin so that where there is a lack in one tributary, the other tributary may make up for it?

COM. STONE: That is possible and there is another question involved there, Mr. Watson, the question which I think was more or less touched upon by the Chairman, that this whole question as to deliveries at Lee Ferry is somewhat related to the question of whether the obligations at Lee Ferry shall be by states or by basins or by projects, another question which we raised in the list which Colorado submitted.

THE CHAIRMAN: The Chair would like to hear from one of the members of the Engineering Advisory Committee on this subject at this time. We will

adjourn pretty shortly but before adjournment I would like to hear from Mr. Patterson of Colorado.

MR. PATERSON: I wonder under the discussion whether it is more advantageous to define the relative rights and obligations, and actually that is a brief statement of what you are undertaking to do. Your rights are relative; your obligations are relative. Therefore, the percentage system is very well adapted to expressing those relative rights and obligations.

On the other hand, I think it has been pointed out here and if I had been asked before to comment I would have gotten into a discussion with my copartner, the attorney for our Board, by saying that when you say "percentage" you have got to say percentage of what, and if you do say of what, it becomes a quantity.

The suggestion is made here that we undertake to divide the 7,500,000 acre feet of average annual beneficial consumptive use that is allocated by the existing compact among the four states of the Upper Basin--in this case the five states--to divide the use among five states. Of course that is related to the water supply. The Engineering Advisory Committee is not going to give you the answer that you are seeking through this discussion. We are going to try to tell you how much water there is in this river and from each of these states, the objective being to avoid some error on your part of obligating a state to deliver some water at Lee Ferry when Nature doesn't produce it in that state, and conversely, of allocating a right to divert and use and consume water to a state where it can't be used and therefore it will be wasted. So we are hoping to minimize that type of allocation and get a relation between these percents or these quantities and the thing that you are dealing with, namely, the water.

I want to point out just one thing from an engineering viewpoint and I am not speaking now for the Engineering Advisory Committee but merely as an individual. Our minds have been running almost exclusively to a consideration of the water supply from the standpoint of its long-time average. That is an important determination. Nature fluctuates the amount of water widely from year to year and by cycles. The assumption that goes with that determination of long-time average is that ultimately we are going to have reservoirs to equate that flow to that long-time average and therefore make it all available for use and consequently your dealing with the apportionment of use can be on a long-time basis.

On the other hand, this apportionment of the obligation is something that is wholly intermittent in character. It is meaningless except in a dry cycle of ten years and there you deal with a total quantity over a total ten-year period. Nobody knows in advance what the tenth year of that cycle is going to provide, what Nature is going to provide. Consequently, if at the end of nine years there is a potential shortage, it is essential that we have water impounded in reservoirs that can be released in that tenth year to meet that 75,000,000 acre feet obligation upon which the Lower Basin are basing their plans for the future.

It may be before we are done with this study that the Engineering Advisory Committee will conclude we will have to present to you information concerning the water supplies available in these ten-year drought cycles such as we had in the '30's in addition to information as to long-time averages; and that correspondingly, you will want information about how much does land consume in a period of water supply deficiency as compared to normal or average conditions? How much are reservoir losses under these drought cycle conditions? How much are you likely to export under those conditions as compared to long-time averages?

Personally I feel our Engineering Advisory Committee should immediately undertake their studies of the remaining work on both bases in order that you will have more complete information as to both the apportionment of use and the apportionment of delivery obligations. I feel that there is a good deal of thinking about them. Some seem to feel these two things are one and the same, others that they are unrelated.

From a physical standpoint it is very apparent that if a person knew how much water came out of each state or each tributary or did come out in an average year before man interfered with it, it would be very possible to say that if your development, your use, doesn't exceed a certain amount, it will necessarily follow that the unconsumed water of that state or that tributary or whatever you are dealing with will necessarily pass on down the river. So that there is a very definite relation between the one and the other.

Now I am not suggesting by this comment that your percentage schedule should be identical in both cases--don't misunderstand me on that. But I do think it would be folly to set up one that might be entirely in conflict with the possibility of living under the other schedule. So you have brought up a question I think at a very opportune time and I think your discussion of it and your final decision on it will be very helpful to us as engineers in proceeding with the character of the information which we complete and present to you.

THE CHAIRMAN: Thank you, Mr. Patterson. I would like to ask you just one question: If the Commission should decide at least tentatively that they will proceed on a percentage allocation basis as it relates to obligations and benefits, would that affect the studies of the Engineering Advisory Committee in any way? Would it be helpful or otherwise?

MR. PATTERSON: I will have to speak for myself again, Mr. Chairman, because I personally feel it won't make much difference, that we still have the problem of determining physical facts as to water supply. I think the bearing will be the other way, it will be indirect in this way:

You may now tentatively assume that the various percentages to each state for use will be based upon the assumption that we all together will use the 7,500,000 acre feet mentioned in the existing compact, but when you consider the delivery obligation along with it you may finally conclude that it won't be possible for you collectively to reach that amount considering the obligation of delivery. The two must not be separated from that standpoint.

Now let me explain a little further there. I feel you must know about the water and we must go ahead on that matter, and while this percentage arrangement would be one that I think ultimately the Commission and the Engineering Advisory Committee should cooperate in its discussion so that we can be as helpful as possible, I think we have got to watch this sort of a matter: As I see the percentage arrangement it could lead to this sort of difficulty, the progessive development of the basin toward whatever goal or ultimate limits water supply may fix, might proceed faster in one state than it did in the other and so that when you reached the halfway point one state would be beyond its percentage and some other state for lack of development would not have reached its percentage; and unless you have provisions for that you might find the percentage rule worked against the program of progressive development simply because the state who did go along with its development would exceed the percentage which ultimately it will have of a larger quantity. You could take care of that.

On the other hand I feel also that percentages as such are meaningless. They must be based upon something you can compute back in terms of water or else a state will not know in quantities of water what projects come within its share. It is not sufficient to say a percentage of all that is in the basin;

it has got to be reduced finally to the quantity of water which is within its percentage of the total water. So I am cautioning you that you could go too far on the use of percentage and find it was inconvenient or obstructive to your development.

COM. STONE: I would like to ask Mr. Patterson a question.

THE CHAIRMAN: I would like to comment just a minute, Judge Stone, before I forget it. Mr. Patterson has pointed out a very important phase of this in regard to the one state exceeding another in the rate of development. As your Chairman understands it, though, that might be taken care of in the compact itself, and if not taken care of in the compact it would be an obligation of the Commissioner of Reclamation and the Secretary of the Interior when a project is proposed for a certain state, to make a statement to the committees that that project falls clearly within the allotment of that state under the terms of this compact which may be ratified.

MR. PATTERSON: I think it could be handled that way. I am not objecting to percentage; I think it is an ideal thing. But I do want you to recall that the obligation at Lee Ferry on delivery is a fixed, stated quantity of water and in some way or other the people up above Lee Ferry are going to have to see that that quantity of water gets down there some way. How they divide up that obligation is a matter I think we have got to look at this way, that actually--expressed briefly--the objective of this whole compact is to divide up these two things, a right to use water and an obligation to deliver water on some proportionate basis that is in accordance with Nature and is equitable among the states. We are all trying to share proportionately and equitably in the amount of water available and also in the shortages we are all going to be confronted with.

COM. STONE: Mr. Chairman, following up your question--

THE CHAIRMAN: Just a moment, Judge Stone. I believe we should recess until two o'clock to give our reporter a breathing spell. Is two o'clock all right?

COM. STONE: Would a brief question be out of order? It follows your question.

THE CHAIRMAN: Very well.

COM. STONE: Mr. Patterson, if the Commission were to tentatively adopt--not finally but tentatively--the percentage basis, would not some progress be made by the Engineering Advisory Committee in checking to ascertain whether the percentage basis is workable?

MR. PATTERSON: I think we would have a very definite chore implied if not actually assigned to see how those tentative figures would fit in with physical conditions.

COM. WATSON: Mr. Chairman, will you allow a little observation or are you too hungry?

THE CHAIRMAN: We will come back together again at two o'clock.

(12:05 p.m. Recess.)

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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2	D, E	18	Z, AA
3	F, G	19	AB
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5	I-1_pgs i-88	21	AD
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10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
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16	Y-1_pgs i-81	32	BG, BH, BI

(2:00 p.m. Meeting resumed.)

THE CHAIRMAN: Will the Commission come to order. Before lunch Mr. Watson desired to make an observation or submit a question. Mr. Watson, you now have the opportunity.

COM. WATSON: What I wish to say, Mr. Chairman, is merely an observation on what Mr. Patterson so thoroughly analyzed when he discussed the division of water on a percentage basis. He showed that if we went too far even in that division we might find certain inadequacies or inequalities that would develop, showing that the division by percentage may not be perfect. The question arose in my mind if that were true, that a clause could be inserted in the compact stating that as between states of the Upper Basin there should be no priorities set up as to the water apportioned to the Upper Basin States by the Colorado River Compact. In that way there would be no race as to development. The states of slower development would then be protected in their rights.

THE CHAIRMAN: Gentlemen, at this point I desire to mention that we have with us this afternoon two gentlemen from the Office of the Chief of Engineers of the War Department. They are in Colorado at the invitation of the State of Colorado and are here at this meeting not in any official capacity but merely as observers and as persons who desire to learn something about the negotiations in regard to this Compact. Mr. Johnson and Mr. Friend of the Office of Chief of Engineers, will you gentlemen stand up just a moment, please? (Applause.)

MR. FRIEND: Correction, Mr. Chairman. Of the District Office at Los Angeles.

THE CHAIRMAN: Of course that comes under the Office of Chief of Engineers?

MR. FRIEND: Yes.

THE CHAIRMAN: I stand corrected as to detail but not as to the general operation of the District Office as being under the Office of Chief of Engineers.

Now pardon me, Mr. Watson, did you complete your statement?

COM. WATSON: It was merely in the form of an observation.

THE CHAIRMAN: Yes. Did the Chairman overlook anybody in asking for comments on the question of the allocation by the percentage method? The Chair would like to ask Mr. Riter, the Chairman of the Engineering Advisory Committee, the same question that was propounded to Mr. Patterson this morning, which is briefly this: that if the Commission tentatively at least agrees to work towards an allocation of the water on a percentage basis, will that have any influence on the work of the Engineering Advisory Committee, either in the way of retarding the work, prolonging it or shortening it, or if not in those respects, in what respects if any?

MR. RITER: It will not obviate the need of completing the work that has been assigned to us. We feel that is basic and should be completed. As I said, it will just be an added task that the engineers will work out but we anticipate we will get numerous added tasks as the work progresses.

THE CHAIRMAN: Will you please elaborate a little bit on the added burden this is going to create for the Engineering Advisory Committee? The Chairman doesn't understand.

MR. RITER: It is not an added burden, just an added consideration and added job. You see our activities so far have been directed towards defining the contributions by states and tributaries of the flow of the Colorado River at Lee Ferry and also defining the channel losses. Ultimately we will study the effects of reservoir operations. Now we haven't as yet indulged in any thoughts as to how the water would be divided. We anticipate however before the Compact is negotiated that the Commission will ask us to make additional studies on a number of assumptions the Committee would outline. I anticipate this percentage theory is a theory the Commission will want us to study. I don't know what form the Commission may ask us to study, whether they will make suggested percentages by states or whether they will ask us to try out a number of percentages.

THE CHAIRMAN: Well, Mr. Riter, is it a fact or is it a fallacy that regardless of whether the allocations of benefits and responsibilities are made on an acre-foot basis or on a percentage basis, you will have to do the same character of work in the Engineering Advisory Committee? Is that true or false?

MR. RITER: The work outlined so far must be completed regardless of how the Commission decides it is going to divide the water.

THE CHAIRMAN: Well, that still doesn't answer the question of the Chairman.

MR. RITER: I am trying to straighten you out, sir.

THE CHAIRMAN: If you will just answer the question that will straighten the Chairman out. Possibly the members of the Commission are straight on it. Will you please read the question? (Question read.)

MR. RITER: That is an involved question; I still don't understand it. I will answer it this way: Regardless of how you want to divide the water you will not have relieved us of the burden of completing the task that has been previously outlined.

THE CHAIRMAN: Off the record. (Discussion off the record.)

MR. PATTERSON: Off the record. (Discussion off the record.)

MR. RITER: I say so far as the present studies are concerned, the studies that have been outlined for us, it will make no difference how the Commission decides to allocate the water or allocate the obligation.

COM. STONE: Mr. Chairman, I don't desire to ask a question because I probably wouldn't get an answer to it but I should like to make this observation: It is very obvious that this is a question which must ultimately be decided by the Commission. It occurs to me to be quite obvious that if we reach some tentative conclusions--I don't mean final conclusions but tentative conclusions--which the Engineering Advisory Committee has in mind, it may not as to the present studies but as to future studies expedite our proceedings here. There is no reason why such questions as this can't be discussed and some tentative conclusions arrived at which ought to be something at least of a guide to the engineers in reporting back to us rather than wait until all of their studies are in and then say, "Now here is another question. Give us the answer on this one."

It may, as Mr. Riter explains, mean a little additional work at this time but it might save time to proceed in this manner. I make that merely as a personal observation.

THE CHAIRMAN: Well as a personal observation on the part of the Chairman I am of the opinion that it will save a lot of work eventually and that it will obviate the necessity of having the much sought for accuracy we have talked so much about because if the water isn't there, why no undue burden will fall on any state.

Now, gentlemen, we have talked about this a great deal and are you ready now to dispose of this question by a motion or resolution indicating the action on the part of the Commission?

COM. STONE: May I confer with Mr. Breitenstein?

THE CHAIRMAN: Yes. (Com. Stone confers.)

COM. STONE: Mr. Chairman, to get this matter before the Commission I move that the Commission tentatively agree that the apportionment of the benefits and the apportionment of the obligations to make deliveries at Lee Ferry under the Upper Colorado River Basin Compact be determined on a percentage basis.

COM. BISHOP: You mean by that the obligations would be the same percent as the allocations?

COM. STONE: No, I am not talking about the percent; I am talking about the basis.

THE CHAIRMAN: Do I hear a second?

COM. WATSON: I second the motion.

THE CHAIRMAN: It has been moved and seconded. Now the motion is open for discussion.

COM. BISHOP: Mr. Chairman, it seems to me our division should be on a percentage basis of the amount of water available to the Upper Basin States. It couldn't be more than that.

COM. STONE: It might be less than that.

MR. BREITENSTEIN: I won't agree with Mr. Bishop. There isn't any agreement on behalf of the Upper Basin States giving up the rights of those states to any surplus water.

COM. BISHOP: That has to be negotiated after 1963 after such time as the one basin or the other has reached the total of its allocation.

MR. BREITENSTEIN: Mr. Chairman, so far as the apportionment of the benefits is concerned it is a percentage of the available water supply. So far as the apportionment of the obligations is concerned, it is a percentage of whatever water is necessary to satisfy the deficiency in flows at Lee Ferry.

COM. STONE: It seems to me that Mr. Breitenstein's interpretation of the meaning of that motion is correct and as the one who made the motion I would suggest my motion carries that interpretation.

It occurs to me that there can be no other interpretation. We all know what the joint and several obligations of the States of the Upper Division are at Lee Ferry under the terms of the Colorado River Compact. No one can question but what that is explicitly provided by the Compact and is fixed at an average delivery of 7,500,000 acre feet a year.

On the other hand, the basis, or at least one of the reasons for a percentage apportionment, is that no one knows what from year to year will be available for use in the Upper Basin and this provides a flexible means whereby you would make an apportionment of the water which Mother Nature will make available in the Upper Basin.

I hasten to explain again that this is only tentative. Further studies by the Engineering Advisory Committee may indicate that we would want to deviate from that percentage basis.

COM. WATSON: Judge Stone, may I ask a question?

COM. STONE: Yes.

COM. WATSON: Would the difference between your proposal and Mr. Bishop's proposal be this: that Mr. Bishop refers only to the apportionment under the Colorado River Compact of the 7,500,000 acre feet, whereas you would apportion all of the waters, surplus or otherwise, and when the year for dividing surplus came, viz. 1963, the formula for the division of that surplus among the states of the Upper Basin would have been made?

COM. STONE: You have brought in an element I wasn't particularly thinking about but I think you have correctly stated how that would work. It is the amount of water available to the Upper Basin. It is entirely conceivable, although in my judgment not likely, that after 1963 more water may become available to the Upper Basin. It is also conceivable that because of the vagaries of Nature we may have long periods when a full 7,500,000 acre feet is not available even with main stream regulation for use in the Upper Basin, and we should have a flexible method whereby those conditions which are unknown at the present time can be taken care of and not just fix it on the basis of the percentage of so many acre feet. If the 7,500,000 acre feet apportioned to the Upper Basin is available and no more is made available it will work out the same in any event.

COM. BISHOP: My point is, Judge, that you can't allocate or divide any water over and above 7,500,000 acre feet and be within the terms of the Colorado River Compact. The division has to be taken care of after 1963 as provided by the Colorado River Compact; and any implication we are trying to divide that water certainly wouldn't be in accordance with the terms of the Compact.

COM. STONE: All right then let that motion read, "available under the terms of the Colorado River Compact."

COM. BISHOP: That is as I think it should be.

THE CHAIRMAN: Off the record. (Discussion off the record.)

COM. BISHOP: My thought is Wyoming might need a lot more than the four or six percent you might want to give us at this time. After 1963 we might have another 3,000,000 acres we would want to irrigate and we might want a much larger percent than what this Compact Commission might be willing to give us at this time.

COM. STONE: I apprehend, Mr. Bishop, to use the words "available under the Colorado River Compact," if you get more than that, will take care of you.

COM. BISHOP: We will go with you on that.

THE CHAIRMAN: Now are there any further comments on this motion?

COM. STONE: As interpreted.

MR. BLISS: Mr. Chairman, I may be a little slow in understanding what is meant here. I hardly see how the states could endeavor to appropriate more than is allocated under the terms of the Compact. That has been modified by the Judge's latest amendment to his own motion. But I don't see that irrigation projects could be flexible enough to take much advantage of water over and above what might be allocated at the present time.

COM. STONE: It seems to me, Mr. Bliss, that we should keep in mind another provision of the Colorado River Compact. It just occurs to me now--and I may be wrong in this thinking--but there is a provision in the Colorado River Compact that the Upper Basin shall not withhold water nor be required to deliver water which cannot be put to beneficial consumptive use. And you get into trouble when you attempt to confine a motion of this kind to the 7,500,000 acre foot item. That item under the terms of the Colorado River Compact is surrounded with a lot of conditions. It is quite obvious that being parties to the Colorado River Compact there cannot be available to us any water in excess of what is made available to the Upper Basin under the terms of the Colorado River Compact.

MR. BLISS: If you are speaking of channel and reservoir losses, for example, which might be allocated to the various states and considered as beneficial consumptive use, I see part of your argument.

COM. WATSON: Mr. Chairman, could we have the motion read as amended?

COM. STONE: Mr. Watson, I don't believe the suggestion, this last addition, was added to the motion. It was stated by Mr. Breitenstein and I accepted that as an interpretation of the motion. So to get at what you want I think we should have to read both the motion and the interpretation.

COM. WATSON: May we have the motion and the interpretation read?

(Record read.)

THE CHAIRMAN: Are you ready for the question?

COM. BISHOP: Question.

(Thereupon a vote was taken and Com. Stone's motion as amended carried unanimously.)

THE CHAIRMAN: Off the record. (Discussion off the record.)

COM. WATSON: I would like to have the record show that upon the suggestion of one Commissioner this question may be opened up again.

COM. BISHOP: That is all right.

THE CHAIRMAN: Off the record. (Discussion off the record.)

COM. STONE: Mr. Chairman, this morning we were proceeding on the basis of Colorado bringing up for consideration the questions and factors which were submitted by the statement by Mr. Breitenstein. Do you desire now that we bring up another one of those or do you wish to call upon these other states for any statements as to factors of the nature made by Colorado? We do not wish as a state to shut off other states if they want to submit them now, but

if they don't we are ready to bring up another one of the factors or questions raised by the Breitenstein statement.

THE CHAIRMAN: It is the recollection of your Chairman, Judge Stone, that the states were called upon this morning. Utah and New Mexico will not be ready until Thursday, and Arizona will be ready then, to make their statement in regard to factors; but that Wyoming stated that state would be prepared to submit its statement of factors at this meeting. Com. Bishop, are you now ready to make that statement?

COM. BISHOP: Mr. Chairman, I have a statement of the factors we suggest to be considered. We may have additional factors later that we will wish to submit.

THE CHAIRMAN: Will you read those, Mr. Bishop?

COM. BISHOP: I numbered them for identification.

1. Method of making good any future obligation at Lee Ferry.

2. Shall transmountain diversions be made secondary to uses of water in the natural basin.

3. Determination of method of allocations, percent or mass acre-foot allocations.

4. Provision for administration of the compact if and when necessary.

5. Shall the waters of Blacks Fork and tributaries, Henrys Fork and tributaries between Utah and Wyoming, and Little Snake River and tributaries between Colorado and Wyoming, all interstate streams, be allocated by this compact.

6. Determine priorities of domestic, irrigation, and power uses of the water.

7. Determine if the compact is to be in perpetuity or shall it be renegotiated after thirty or more years.

Now what I have to say is not to be considered as a factor, I suppose, but our people want the Commission to know that we feel that unless a compact is negotiated no projects should be allowed or appropriations made for a continuation of any projects until there is a compact between the States of the Upper Basin.

COM. WATSON: Will you state that again please?

THE CHAIRMAN: Com. Watson is asking you to state that last portion again.

COM. BISHOP: I would like to have the secretary read it because I didn't state it like I had it set down.

(Record read.)

COM. STONE: May I ask a question on that last remark or statement by you, Mr. Bishop?

COM. BISHOP: Yes.

COM. STONE: Do you mean by your reference to appropriations for the continuance of a project that a project in Colorado or a project in Utah that is now under construction shall be discontinued and no appropriations made until the compact is consummated?

COM. BISHOP: No, what I mean, Judge, is that when this appropriation that has been made is exhausted there will be plenty of time between now and then for this compact to be completed, in my opinion, and if it isn't completed I don't think we should go any further with anything. As far as Wyoming is concerned we aren't in favor of it.

COM. STONE: You appreciate of course that ordinarily appropriations for projects are fully utilized by the end of a fiscal year. Then do I understand that if by June 30th, 1949, a compact has not been negotiated any project within the basin now under construction should not seek or be awarded an appropriation until a compact is made? Is that the meaning of your statement?

COM. BISHOP: Yes, sir. I might add that my reason is that I consider that to be adequate time for the Engineering Advisory Committee to complete their studies and for this group to get together on a division of this water.

COM. STONE: That is quite a penalty to place on present development which everybody desires and which provides the greatest basis for utilization of our water.

COM. BISHOP: I would say not in view of the fact that Wyoming has nothing to lose, and if we continue to go along under that plan, we won't be losing any more than we are losing now as we go along.

COM. STONE: That may be true as to Wyoming but after all as a group of states isn't it necessary for us to work in a mutually helpful manner rather than placing penalities on each other?

COM. BISHOP: We want to help you, Judge, but we want you to help us. We need your help much more than you need ours, as we have only one representative in the Congress of the United States and you have several.

COM. WATSON: Mr. Chairman, I would like to observe we have got to go together on this thing and if we are going to ask for a project in Utah, we would like Wyoming and Colorado to have their projects. I am sure we wouldn't feel like blocking the development of any project that has been authorized in Colorado.

COM. BISHOP: In view of the fact that we don't know just how much water you might need for that project, we wouldn't like to see you take more than your share of the water and we believe we should have a compact to settle that question.

MR. RITER: Mr. Chairman, may I indulge in an observation?

THE CHAIRMAN: Yes, sir.

MR. RITER: Gentlemen, let's not lose sight of the fact that we are only using now less than a third of the Colorado River Water that has been allocated to the Upper Basin. It seems to me there ought to be adequate cushion for any project, any reasonable project that is now on the books. It just seems--I am going to repeat to you again the warning I gave yesterday--while we squabble over the water somebody else is going to use it. That is just an observation.

COM. STONE: I would like to make another observation too, that such a policy as that is not only of concern to the states but it is of vital concern to the taxpayers of the Nation. You take a large project as the Colorado-Big Thompson and you stop all construction and all contracts that are now awarded, either the water users that will be served by that construction or the taxpayers of the United States are going to pay a penalty which will run into the millions of dollars.

COM. BISHOP: Judge Stone, if the representatives of Colorado realized that was going to happen they might be more interested in getting a compact.

COM. STONE: Mr. Bishop, I want to correct a statement that you have repeatedly made. I want to ask you by what rhyme or reason should Colorado not be interested in getting a compact and getting it at the very earliest moment? This state is just as much interested in the development as any state and we know that no substantial additional project authorizations can go forward until there is an apportionment of this water. If you can assign any reason why Colorado shouldn't be interested in getting a compact at the earliest moment possible I would like to hear it.

COM. BISHOP: I believe I can answer that, Judge. If we just go along the way we are going another ten to twenty years, Colorado will have used every drop of water that is possible for them to use; Wyoming won't have used any water.

COM. STONE: Your argument might be good if you will tell me how Colorado can get any substantial new project authorization without an apportionment of Upper Colorado River Basin water.

COM. BISHOP: That is the point.

COM. STONE: And I want to say to you that we are not interested in using any other state's water. Colorado recognizes an equitable interest in these other states and we can't see how we can ever encroach upon any water which is beyond our equitable and just share and we can't see any way whereby we could obtain new projects which will encroach upon other states of the Upper Basin. We recognize it is in the interest of all of the states to attempt to expedite the making of a compact. I apprehend that if Utah or Colorado or New Mexico or any other state in view of the report of the Bureau of Reclamation were to ask for a project which encroached upon or which exceeded or might exceed the state's assured share of water we would meet effective opposition, and unquestionably justly so.

COM. BISHOP: Judge Stone, I don't see how we are going to know what the assured percentage or allocation of the state is until we get together on a compact.

COM. STONE: That is what I have been saying.

THE CHAIRMAN: Now the Commissioner from Wyoming has submitted his factors and the other Commissioners will report Thursday morning, and I believe we are now ready to consider one by one the factors presented by Mr. Breitenstein before lunch, and Colorado may present those in any order she wishes.

COM. STONE: In view of the suggestion by the Chair, Colorado submits for consideration another factor suggested by the statement submitted by Mr. Breitenstein this morning, the question of the inclusion of an administration clause in an Upper Colorado River Basin Compact. We recognize

that it is not entirely logical to take up that item next. We further know that it cannot be disposed of except through considerable discussion because many matters are involved in administration, and we apprehend that all of the states will want to give that matter further study. However, it seems to us that we should at least discuss the question of whether such an administration clause should be included in an Upper Colorado River Basin Compact.

I am moved to suggest consideration of the next item due to a statement made at Salt Lake City by Mr. Wallace. Mr. Wallace stated he would be interested in connection with a resolution which he submitted, to know what the views of the Commission were on that subject before it was further considered by the Colorado River Basin States Committee. Is that not correct, Mr. Wallace?

MR. WALLACE: Yes.

COM. STONE: If that is correct, it would seem to me in the interest of making progress to suggest this subject for consideration at least partially at this time and I shall ask Mr. Breitenstein to open the discussion.

THE CHAIRMAN: Mr. Breitenstein, you have the floor.

MR. BREITENSTEIN: Well, Mr. Commissioner, in order to have any compact really effective it would seem that the compact itself should contain some administrative provisions. By that I mean that some agency should be set up which will have certain responsibilities and obligations towards making the compact effective.

Here in Colorado we have several compacts. In connection with some the matters involved in the compact are handled by the respective engineers of the states involved. In one compact, the Rio Grande, there is set up a compact commission consisting of representatives of each of three states and of the Federal Government. Mr. Bliss perhaps can tell more about the operation of the Rio Grande Compact Commission than any other person here in the room. While like any agency it has at times been the subject of criticism by one state or another, it is my observation that the Rio Grande Compact Commission has been an effective means of maintaining harmonious relations between the individual states and between those states and the Federal Government in effectuating the provisions of the Rio Grande Compact. In the Upper Basin of the Colorado River there are many problems more complex than those occurring in the Upper Rio Grande.

As to the form which such an agency should take, I have no fixed ideas. It would seem reasonable that there should be a representative of each state who might be a particular state official or the appointee of a particular state individual to serve for a term which might be for a definite period or might be at the will of some state official; and also that there should perhaps be one or more Federal Representatives on the agency, whatever it might be called. There are five states here and in view of the interest which the Federal Government has in the development of the River it might be appropriate to consider having more than one official. Also in that regard it might be well to consider the fact that there are several problems involved. One is the gaging of streams, a function which has been traditionally carried on by the United States Geological Survey in cooperation with the states. The other involves the use of large reservoirs which in all probability will be constructed by the Bureau of Reclamation and it seems only reasonable that the Bureau of Reclamation should have some representative on whatever agency is set up. Perhaps others should be; I don't know.

The next question is undoubtedly the powers which should be given to the agency and that involves the subquestion as to what powers if any should be given such agency to adopt rules and regulations to make the compact effective.

As I mentioned this morning another question is involved and that is, how are you going to take care of the expenses of such an agency? It might be found that the agency itself should have a staff of employees who would work for the agency and not for any particular state and not for the Federal Government. If you have such employees of course some method of paying them has to be resolved.

It seems to me that the question as to the general, overall powers of the agency should not be considered at this time but rather now we should consider whether or not such an agency should be set up and what its general character should be, leaving the question of powers perhaps to subsequent discussion. That is all I have to say right now.

THE CHAIRMAN: Thank you, Mr. Breitenstein. You have put the matter before the Commission very clearly in the opinion of the Chairman. The Chair would like to hear from members of the Commission and their advisers on this question. We will now have a recess of about five minutes.

(3:15 p.m. Recess.)

(3:30 p.m. Meeting resumed.)

THE CHAIRMAN: The meeting will come to order. The Chairman is rather pleased with the developments which have taken place today. I wish first to compliment Colorado in submitting a list of factors, also Wyoming, and we will reserve our comments after we have heard from the other states.

As I understand this situation the states are not insisting that these factors which they have presented be disposed of in a compact but they do present them for the earnest consideration of the Commission and action by the Commission as to whether or not these factors are to be disposed of in a compact which we have been talking about and if so in what manner. It occurs to your Chairman that as we proceed in the consideration of these factors it will likely become necessary to refer the "how" of disposing of some of these questions to the Legal Advisory Committee, who will undoubtedly examine existing compacts in order to have a guide in handling matters which this Commission may wish to have decided in the compact which we are trying to negotiate. Gentlemen, please bear that in mind in our progress on this matter. We should take definite action. Now off the record. (Discussion off the record.)

The Chairman would now like to hear from the Commissioners or their advisers relative to the matter which has been outlined by Mr. Breitenstein.

COM. BISHOP: Mr. Chairman, I believe Mr. Breitenstein is right that there should be an administrative body set up to administer the compact if and when necessary. It will probably be a great many years before there will be a shortage of water at Lee Ferry, and until that time there will be very little need for a compact commission. It seems to me that if the Bureau of Reclamation would be set up as the administrative agency they could well look after the necessary records and prepare for the administration of the compact at such time as a shortage of water at Lee Ferry would be obvious from the gaging records.

Mr. Breitenstein mentioned the fact that there should probably be on this commission a representative from each state and possibly two from the agencies. I will go along with him as far as one from each state is concerned, but it is twice too many from the Federal agencies. I think

one from the Federal agencies is all there should be and he could possibly be chairman of the commission. I don't believe the Federal Government should have two votes to the states' one. I believe in states rights and I believe we should maintain our position as states.

COM. STONE: May I refer to Mr. Breitenstein a question raised by Mr. Bishop? Mr. Breitenstein.

MR. BREITENSTEIN: Well, just one thing: I can't in my own mind get Mr. Bishop's statement to jibe. He says in the first place we have the Bureau of Reclamation run the River for a while and then at the end he says he believes in states rights. Well now to me the matters are utterly contradictory.

We in Colorado for years have gone on the theory that we will look after the affairs in our state and I apprehend there might be some difficulty in Colorado if the Colorado Legislature was given to understand that the Bureau was going to run this thing without regard to state agencies for any particular period of time. Now the latter part of Mr. Bishop's statement is right along with my personal thinking. I am a states right man; I admit that. It seems to me we have got to cooperate with the Federal Government because the Federal Government is putting up some of the money that is being used on these projects. I didn't mean to make a firm suggestion that this commission be composed of any particular number of men or anything like that. I thought that was something for discussion as to whether we have one Federal representative or two or a dozen. I didn't intend to cover that.

But it seems to me that if you are going to have an administrative agency you want to have it set up right away and not wait until you run into a wreck. Your administrative agency should be one to keep you out of trouble. You shouldn't wait to set the thing up until you get into trouble. So I think if you are going to have one at all it is important to have it set up and operating just as soon as you get your compact in effect.

COM. WATSON: Mr. Chairman, I think Mr. Breitenstein's analysis is sound and the principle is right. I suggest the matter be referred to the Legal Advisory Committee.

COM. STONE: For submission to the Commission, you mean?

COM. WATSON: Yes, and report back to the Commission.

COM. BISHOP: Mr. Chairman, what I had in mind was a commission to be composed of one representative from each state and one from the Bureau of Reclamation with the Bureau of Reclamation in charge of the administration under the supervision of the representatives from the states. That is what I had in mind.

THE CHAIRMAN: It would seem to the Chairman that this matter is subject to several divisions. In the first place, do you want to set up an administrative agency in the compact? That is the first question it seems to me which the Commission should decide. And if you decide that in the affirmative, the question then presents itself as to what is the character of this administrative agency? Will you use existing state officials and existing Federal officials to some extent or to any extent? I mention that for this reason, that you must remember these compacts will come before the legislatures of the states and they will probably be concerned about how much expense is involved in setting up an agency which may be the cause of greater taxation.

COM. BISHOP: My thought is, Mr. Chairman, that the Commission should consist of members of agencies already existing within the states and not set

up a new Commission that would amount to a new Bureau.

COM. STONE: Mr. Chairman, Mr. Frank Merriell, who is one of the advisers to the Colorado Commissioner, has indicated to me that he had an observation to make.

THE CHAIRMAN: Mr. Merriell.

MR. MERRIELL: For the benefit of those who give consideration to this question of administering this compact I would like to point out this: Your Engineering Advisory Committee today faces some problems for which the answers are going to be very difficult because there is a great lack of records in certain neighborhoods. It will not be too long a time between the formation of this commission and the time when it will have to exercise its powers for that commission to get the necessary records in those parts of the Upper Basin where there is today no record. And I feel very strongly that in selecting those places where records should be obtained and in the business of obtaining them, all the states have an interest, as does the United States, and that the administrative body should be set up to go to work at once upon the ratification of this compact. They will have a job of getting records for future use, the value of which most of us who are now working with the present records fully recognize.

THE CHAIRMAN: Mr. Merriell, would it be your thought that this administrative agency would be involved in the matter of finances or would the financial arrangements be made by existing state and federal agencies as they are today? It would seem to the Chairman that possibly it might be simplified if the administrative agency were composed of members from existing state and federal agencies and that the administrative agency would concern itself with the collection of records in the deficient spots and make its wants known to existing agencies.

MR. MERRIELL: Surely. It would cooperate I take it in every possible way with existing agencies and each of the states would make such provision for use of its present officials if possible, or a new official if necessary, to carry its share of the operation.

COM. BISHOP: Off the record. (Discussion off the record.)

MR. MERRIELL: There is one thing in my estimation which is essential: Before the middle river reservoirs are built which are contemplated for the regulation of the River, we ought to know a great deal more about what takes place in the middle river than we now know; and that administrative body can direct that work in cooperation with all the present agencies and the states of course will furnish their members and presumably implement those members and implement the work if they can't get it done any other way. I am very strongly impressed with the necessity for getting all this information.

COM. STONE: In line with the Chair's suggestion may I make this observation: First, I have no fixed ideas as to how this agency should be set up nor as to what powers should be given to it. I also know from a study of the question that there is imposed by law in various ways certain limitations on an administration commission. But I would like to make this observation, that the details ought to be referred to the Legal Advisory Committee since the makeup of such a commission and its powers has legal significance.

Also I think we should keep in mind in setting up such a Commission

that it should be so constituted that it does not represent any one state because here we have a group which will be performing a function not for one state but for five states, and you could not expect existing agencies within a state and officials employed by a state in all reason to assume that impartial position that the Commission ought to assume. I think that is a consideration which ought to be given to the setting up of an agency to administer the compact.

I can see in this a question which has to be settled after some rather careful study. It is a research job which the Legal Advisory Committee could well do. It seems to me as remarked by the Chairman that our present consideration should be confined to the question of whether or not the compact should have incorporated within it an article creating an administrative agency, and then refer the details to the Legal Advisory Committee for report back as suggested by Mr. Watson.

THE CHAIRMAN: The Chair would suggest just one thing on the assumption that this matter will be referred to the Legal Advisory Committee and that is that the legislators of the country, federal and state, are becoming concerned about the cost of administration of contracts and compacts; and I think everybody should bear in mind the necessity of being able to present to the respective legislatures an estimate of the cost of administration of whatever administrative agency may be set up.

Now, gentlemen, do you wish to take formal action on the question of setting up an administrative agency in the compact? If so, the Chair will entertain a motion to that effect.

COM. WATSON: Mr. Chairman, I move that the principle of creating an administrative agency be accepted by this Commission, that a clause be incorporated in the compact adopting the principle, and that we refer the matter to the Legal Advisory Committee to work out the details and report back to this Commission.

COM. BISHOP: I will second the motion.

THE CHAIRMAN: The motion has been made and seconded. Is there any discussion of the motion?

COM. STONE: Question.

THE CHAIRMAN: The question has been called for. (Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

COM. CARSON: Now, Mr. Chairman, so that this Committee will have an idea of what the Commission desires, I take it from the discussion that has here been had, they would like a clause worked out that would create a commission with at least one representative from each state and then define the powers of the body and the limits of its authority.

COM. STONE: It seems to me that so far as Colorado is concerned--and I would assume that would be true of the other states, I know Mr. Bliss mentioned it to me--he indicated very wisely I think that that was a question of research and study, and Mr. Watson's motion didn't go to any suggestion.

COM. CARSON: No, I know it didn't.

COM. STONE: It adopted it as principle and I don't believe we are prepared to make suggestions. We have confidence in this Legal Advisory Committee and if you come back with something we don't like I imagine it would be

thoroughly analyzed and changed or varied to meet the feelings and desires of the participating states.

COM. CARSON: Yes.

COM. STONE: I don't believe we ought to attempt to become committed on this.

COM. CARSON: This legal committee then would just undertake to work out a clause without any guide the best it can and then bring it back and recommend it or ask for further instructions?

COM. STONE: That is right. And you have got a representative on that committee from each of the states, haven't you?

COM. CARSON: From each state, yes.

THE CHAIRMAN: The Chairman offers this suggestion: that the Legal Advisory Committee work out this matter in alternatives. You can perhaps present it with a representation by each state and by the Federal Government using existing officials. Or you can throw that out the window and work up another scheme using an entirely new setup. I can see about three or four alternatives that are possible. Would that be too much of a task for the legal men to undertake?

COM. CARSON: If you are not going to say how they are to work it out, we will just do the best we can and report back. We won't try to anticipate somebody else's idea. We are on our own and we will do the best we can. If it will be changed later, it will be changed.

THE CHAIRMAN: The suggestion of the Chair was looking forward towards progress. If you come up with one proposition only and that is discarded then you go back again and study another month or two on something else. Well now why not undertake the matter with the idea of bringing forth several alternatives?

COM. CARSON: I think if it is put up to us just with the bare outline to work out an administrative clause, with all the members of this Legal Advisory Committee and their own views and mind, we will have to try to reach a meeting of the minds in that committee and report the result of the Committee's work the best we can and then we will have to be able to explain our reasons and why we did it and submit it for the approval or disapproval of the Commission and any further instructions. I don't think it would be practical to try to work out an agreement among the members of the Legal Advisory Committee on alternative proposals in advance of any instructions from this Commission.

MR. ROLLINS: Mr. Chairman, may I say a word here?

THE CHAIRMAN: Yes, Mr. Rollins.

MR. ROLLINS: Inasmuch as you asked for comments from advisers a while ago, may I say that we in Wyoming are very much concerned about this administrative commission because of the fact that the area covered in the Green River Basin in population is very small in comparison with the rest of the State of Wyoming, and these matters will have to be approved by our legislature. We feel quite confident that our legislature is not going to stand for any elaborate setup that is going to run into a lot of money that the State of Wyoming would have to pay for and that is the reason I think Mr. Bishop made the statement he did that perhaps for a number of

years it wouldn't require any great effort--what I mean is that there should be no great expense incurred due to the fact that the development of the Upper Basin will not have proceeded far enough. For that reason perhaps this commission could consist of someone who is already in an agency within the state or someone whom the Governor may appoint. But particularly are we a little bit worried about a setup which would include high-salaried people working under the commission at that time.

I thought as long as Mr. Carson has asked for something, that is one thing they could keep in mind in their deliberations and in preparing this statement for recommendation to the Commission.

THE CHAIRMAN: Off the record. (Discussion off the record.)

MR. PATTERSON: I would like to make one observation, Mr. Chairman.

THE CHAIRMAN: Sure, Mr. Patterson.

MR. PATTERSON: For the benefit principally of the Legal Advisory Committee. This same matter of an administrative agency to take over and administer the provisions of whatever compact is drafted, is a matter that has been discussed quite in detail and is right now under consideration to the extent that a draft of an article covering an administrative agency is before the Colorado-Kansas-Arkansas Compact Commission and in a period of a year and a half that matter keeps coming up in different forms ranging all the way from the minimum form in which the State of Colorado, the upper state in that case, might assume certain obligations in that compact to the lower state of Kansas and eliminate more or less entirely a separate administrative agency. It has gone from that minimum to a maximum of an independent agency with its own high-salaried employees, as some have discussed, patterned after the provisions of this Delaware River Compact in which that independent administrative agency would duplicate and to some extent supersede the functions of both state and Federal agencies in the same field, would be authorized to make independent investigations connected with determination of matters like stream depletion and consumptive use, reservoir losses and reservoir siltation rates, etc. Some place along the line there is going to have to be a happy medium and I am only directing my comments to this one point:

There is a relation between the powers assigned to this Commission, discretionary authority, and the language of the compact, the apportioning provisions of the compact you are proposing to write. You can say in general terms, "We will divide it equitably," and leave it up to the Commission to say what is equitable. Or you can say on the other hand, "This commission can do it thus and so, letter perfect, as written in this compact." That is another illustration.

So I hope this question, which has apparently been dodged in a discussion of the powers of this commission, isn't forgotten by the Legal Advisory Committee because it will have a bearing on what you assign to the commission, the language of your compact having to do with apportionment of uses and obligations.

COM. STONE: I thought we had passed this question and disposed of it. What comments are there further?

MR. PATTERSON: These were comments for the benefit of the Legal Advisory Committee.

COM. CARSON: Thank you, Mr. Patterson, for making them.

COM. STONE: I am not objecting to the comments made. The Chair said he would call on each of us.

COM. WATSON: Mr. Clyde would like to make a comment.

MR. CLYDE: It would appear to me, Mr. Chairman, that the Legal Advisory Committee could save considerable time for the Compact Commission by going to the various administrative plans which must exist over the United States for administering rivers under similar problems and report back by way of perhaps a written report what plan is used on the Rio Grande and the Delaware and on other rivers, our criticism of the Rio Grande plan as it might apply here, and then finally come forward with a written clause of a form which we would recommend. We could give to the Compact Commission the background of the study of the compacts over the nation at large, the methods by which other compact commissions and administrative agencies are functioning, perhaps by actually contacting the administrative officers to find out some of their administrative snarls, and that could then be reported back in a written report of the findings of the headaches that the administrative agencies are meeting over the country generally and then our recommendation by way of a clause we think would iron out some of those headaches and apply here.

THE CHAIRMAN: In answer to your question, Judge Stone, the reason why the Chair is asking for comments is on account of the perplexity apparently in the mind of the chairman of the Legal Advisory Committee, and it was with the idea of soliciting helpful suggestions to the chairman of that committee. The Chair now calls on Mr. Bliss.

MR. BLISS: Mr. Chairman, I can only point out this, which is probably obvious to the Legal Advisory Committee, that there are two functions presumably which will be administrative in nature. One would be the fact-finding group which would determine streamflows and reservoir losses and all the engineering data which are necessary to be kept in the administration of the compact. The other function is the actual executive or administrative function within the state. In other compacts of course--at least with which I have been concerned--those functions have been turned over to the state administrative official. Whether that could work in this case I don't know because there is the problem of administration of middle basin reservoirs, which is an overall problem with which each state is concerned. Whether that could be handled by the state administrative agency I don't know. That probably would have to be decided by the legal group.

THE CHAIRMAN: Thank you, Mr. Bliss. We haven't heard yet from another member of the Legal Advisory Committee, Attorney General Gray of Wyoming.

MR. GRAY: I don't believe, Mr. Chairman, that I have any contribution at this time.

THE CHAIRMAN: Well, I thought perhaps you might have some question you wanted to ask this Commission which might be of assistance to you in working out this task that has been assigned to the Committee.

MR. GRAY: Well, it would seem to me that if the Legal Advisory Committee can gather these provisions relating to administration that are contained in existing compacts, it would greatly simplify the problem of the Legal Advisory Committee. Adjustments perhaps might readily be made to arrive at the language we might wish to recommend to the Commission. And until I have an opportunity to review some of those compacts, I believe I will have no thoughts to present at this time.

MR. BREITENSTEIN: Mr. Chairman, may I say something?

THE CHAIRMAN: Yes.

MR. BREITENSTEIN: Sometime ago the Colorado Water Conservation Bo got out a compilation of interstate compacts. Now I know we did a devil of lot of work in getting that out and if the members of the Legal Advisory Com mittee would give some attention to that book I believe they would get some ideas out of it.

THE CHAIRMAN: I think that is an excellent suggestion, Mr. Breite stein. That is one of the best compilations I have had the opportunity to l at. It has a world of information in there and it is evident that a lot of research work was done. The Chairman most seriously recommends that to the earnest consideration of all members of the Legal Advisory Committee.

COM. STONE: I want to say, Mr. Commissioner, if there is anyone, either a member of the Legal Advisory Committee or a member of the Commissior who does not have a copy of it we shall be glad to make copies available. We have made an effort to send copies to all of these states. I believe I sent some to Mr. Bishop.

COM. BISHOP: I have one copy.

COM. STONE: And Mr. Watson and Mr. Bliss and Mr. Carson. But if you don't have enough copies for your attorney general's office and other of- ficials, if you will indicate to us how many additional copies you want we will attempt to supply them.

THE CHAIRMAN: Is the Commission now ready to pass from this item which was presented on the list by Colorado?

COM. BISHOP: If it is in order I would like to ask the Wyoming gro if they have anything to offer.

THE CHAIRMAN: Certainly it is in order, Mr. Bishop.

(Com. Bishop polls Wyoming group.)

COM. BISHOP: Okay.

THE CHAIRMAN: Is there any adviser from any state who wishes to make a further comment on this matter of the administrative agency? If not, is the Commission now ready to pass from this item to the next item on the li submitted by Colorado? I take it that the Commission is now ready and will Colorado please proceed.

COM. STONE: Mr. Chairman, in submitting these items we are not tak ing up at this time items which require considerable study. There is one ite presented by Colorado which it seems to us could be discussed at this time be cause it involves overall policy and is a question which may not require too much study.

Colorado proposes now the item with respect to the basis of the obl gation to make deliveries of water at Lee Ferry. There are several subdivisi of that item and I will ask Mr. Breitenstein to refer to his suggestions and itemize them and submit the first statement on that question.

THE CHAIRMAN: Judge Stone, will you inform us your wishes in the matter, as to whether you wish the Commission to take action on the matter a a whole or by subdivisions?

COM. STONE: It occurs to me, Mr. Chairman, that we are only submitting these for discussion and we are not going to ask any state to take action on something they are not ready to act upon.

THE CHAIRMAN: That is perfectly understood, Com. Stone, but this matter before you get through with it may involve some work by your Legal Advisory Committee again.

COM. STONE: That is entirely correct, and if the discussion discloses that fact, then I assume action in that direction will be taken. I don't know what the reaction of the Commission will be to it but I thought we might get it out on the table here and look at it. I don't know what it will require, whether it would be appropriate action to have further study or whether the states are ready to act upon it now. We are merely submitting it for consideration, Mr. Chairman.

THE CHAIRMAN: Very well. Mr. Breitenstein.

MR. BREITENSTEIN: Well, the question relates to the obligation to maintain the required flows at Lee Ferry. I have often heard Mr. Carson, whose state is interested as a Lower Basin State, say that that is a joint and several obligation. I am inclined to think that he is right from my own standpoint.

If it is a joint and several obligation, is it a joint obligation of the states as states, or may that obligation be divided up among tributary basins within states, or may the obligation be divided up between projects or groups of projects within a state?

The basic problem has been presented by the Commissioner from Wyoming in his suggested draft when he suggested that deficiencies at Lee Ferry be satisfied by shutting off all transmountain diversions. I can not talk as to the laws of any other states but Colorado, but in Colorado we have a priority system as you all know, and we have some transmountain diversions with very old rights, a number of which antedate the original Colorado River Compact, some of which do not. But as Judge Stone said the other day, our existing transmountain diversions export on an annual average something around 130,000 acre feet of water. In addition we have one major project, the Colorado-Big Thompson, under construction.

So far as Colorado is concerned it seems to me--and I am speaking personally now--that the only method which can be adopted is that of state obligations. After all, the states were the ones who signed the Colorado River Compact. They were the ones who agreed to deliver 75,000,000 acre feet every ten years. And that is a responsibility of each of the states of the Upper Division.

Now if a deficiency is caused by the diversions or storages of any project within a state it is up to the state to get that project straightened out. It is not up to any agency that might be created by this Commission or the Federal Government or anybody else it would seem to come up and tell John Smith he has to close down his headgate. That is a function it seems to me of the state.

I will concede that there may be some arguments pro or con on that and particularly there may be some arguments when you consider the fact that the lord may not bless the various tributary basins with the same amount of rainfall in each year. But regardless of those considerations it would seem to me that the obligation is definitely a state obligation and it is so

imposed upon the states by the Colorado River Compact and that the states cannot escape the obligation.

If it is a state obligation then the burden is on each state to satisfy the obligation of that state. And if it is such an obligation of the state, then the state has not only the right but also the duty of regulating the water uses within its own borders and no other state can come into one of the neighboring states and say to it, "You have to close down this diversion," or, "You have to stop this particular storage." That is a matter of concern for the states.

Of course, if that principle is correct then the theory advanced by Mr. Bishop as to shutting down transmountain diversions could not be accepted.

COM. BISHOP: Mr. Breitenstein didn't state it just as I did. Paragraph (b) of my statement, and I quote from what I stated yesterday, reads: "That the compact provide for closing of a portion of the transmountain diversions necessary to make good any obligation at Lee Ferry." And upon question from Judge Stone I explained I did not mean or intend to interfere with any existing rights in the Basin.

MR. BREITENSTEIN: The point I make would go to future rights as well as existing rights, Mr. Chairman. We think here in Colorado we have a right to use and dispose of as we see fit the water that is Colorado water. The limiting factor is that we have to comply with our state obligation and as long as we comply with that, it is not up to anybody to come into our state and say how we use our water.

COM. BISHOP: That same rule applies to Wyoming.

THE CHAIRMAN: In that connection, Mr. Breitenstein, it occurs to the Chairman that your argument, in which I see no flaw, is leading towards a simplification of the work of the Legal Advisory Committee on the work which was assigned to you previously because you are liable to have an agency set up which will run right into conflict with state agencies in the regulation of these old rights if you are not careful.

MR. BREITENSTEIN: May I make one further observation, Mr. Chairman?

THE CHAIRMAN: Certainly.

MR. BREITENSTEIN: There is a complicating factor which comes in when you consider projects constructed in one state for the use of another state or your main stream reservoirs which may be for the benefit of all states. Those are complicating factors which have to be considered of course.

THE CHAIRMAN: Of course, there are situations today, particularly on the North Platte, where reservoirs are built in Wyoming largely for the benefit in another state.

MR. BREITENSTEIN: That is right.

THE CHAIRMAN: But by cooperation between the Bureau of Reclamation and the state engineers the administration seems to work pretty well.

MR. BREITENSTEIN: That is a result, shall I say, of at least ten years' litigation. We ought to be able to avoid that here.

THE CHAIRMAN: I certainly agree with you we ought to avoid litigation and its tremendous cost. I am more or less reliably advised that it cost

about a million dollars. But the River was administered fairly equitably prior to the decision of the Supreme Court.

MR. BREITENSTEIN: I think it was too, Mr. Commissioner, but I have heard testimony from numerous witnesses who said that it wasn't. I disagreed with the witnesses but they raised their right hands and swore that it wasn't.

COM. BISHOP: I might remark in connection with that that under the decree of the Supreme Court in the Nebraska-Wyoming-Colorado litigation, it is being administered by the administrative officials of the states in a very harmonious and satisfactory manner.

THE CHAIRMAN: Off the record. (Discussion off the record.)

MR. PATTERSON: May I ask a lawyer a question for my own information about it?

THE CHAIRMAN: Yes, Mr. Patterson.

MR. PATTERSON: Does a joint and several obligation mean that if one state fails, the other has to make good?

MR. BREITENSTEIN: That is right, Charlie. It means that if you and I sign a note to Harry Bashore, either one of us can be sued for the amount of the note.

COM. STONE: Doesn't Mr. Patterson's question further indicate the necessity of apportioning the obligation because you have a separate note then to make a state comply with its agreed obligation under the Compact which we are considering.

COM. WATSON: Is this a partnership then, Mr. Chairman? Are we in a partnership of states in the Upper Basin?

THE CHAIRMAN: Well, the Chairman is not in the position of the Supreme Court of the United States and if there is any lawyer present who wishes to answer that question we will be very glad to hear from him.

MR. BREITENSTEIN: First, Mr. Will?

MR. WILL: Neither am I.

MR. RIVER: Mr. Chairman, Jean Breitenstein made a very pertinent remark when he says that this whole question is complicated by virtue of the operations of main stem replacement reservoirs. I have given quite a bit of thought myself to this particular problem of meeting the obligation at Lee Ferry and my own thinking has been that it is a joint problem in which all the states are interested. I haven't advanced my thinking to the point where I think it could be divided up among the states. Maybe I am way behind. Some of the other people have been thinking on this same problem.

As I envision the matter from an engineering viewpoint we have got this situation facing us: In the low ten-year period from 1931 to 1940, inclusive, the average recorded flow at Lee Ferry was about 10,200,000 acre feet. Now for the period of study the Engineering Advisory Committee has adopted from 1914 to 1945, inclusive, the recorded flow was in round numbers an average of 13,900,000 acre feet. If we write out of the picture any main stem reservoirs, then our future possibilities of development are limited to the difference between the average flow in the ten-year low period and our

obligation to deliver water at Lee Ferry.

That obligation we know will have two components. Mathematically we can't define them. We know one component will be an average of 7,500,000 acre feet to the Lower Basin. There will be another component which we can't define in mathematical terms which is our share of the obligation under the Mexican Treaty. That will leave a small quantity of water for future development, limiting ourselves to that particular condition.

However, if we develop in the Upper Basin beyond that quantity of water thus determined, thus defined by the low period, it will be necessary on the basis of records which we have in front of us to find ways and means of augmenting the flows available in the low period and that means holdover storage.

As I see the problem, as I have studied it and I have thought about it, it is difficult for me to get my mind in a position where we can get away from what Mr. Breitenstein calls the joint and several obligation. I realize there are a lot of ramifications but I feel in my own mind that that one qualification, that one complicating factor Mr. Breitenstein pointed out, is a very important one and I am at a loss, I am frank to admit, from the thinking I have done on it in the past--I haven't concocted or haven't thought up any schemes how that obligation could be allocated among the states. I still think it is a joint liability. That is my own thinking on the matter.

THE CHAIRMAN: Well, it would seem to the Chairman if this compact is ratified you have to assume that each state will comply with the law and the compact will be the law. If a certain percent of the obligation is assigned to a state it must meet it.

MR. RITER: The only trouble is that maybe we haven't thought quite far enough. Let's explore another possibility. If Mr. Breitenstein will recognize the possibility that holdover storage is needed--I am just asking questions now to find out--maybe you have been doing some thinking in advance of what I have been doing. Did you anticipate the possibility that each state would have an interest in these holdover reservoirs, a percentage ownership, to help meet the state's percentage obligation?

MR. BREITENSTEIN: Yes, that can be one thing. Of course, that brings in another question then, how are you going to control the releases of the water? If Colorado has 100,000 acre feet in a reservoir, do we get to say when we release it? That brings in another question it seems to me and here I am getting off my track because I am not an engineer.

You have your main stream reservoirs and the water coming into those reservoirs comes from certain defined sources, some of it, say, from Wyoming, some from Utah, and some from Colorado. Well now, if some scheme could be devised of measuring the contributions of the various states into those reservoirs it would seem to me like you ought to be able to figure out which state wasn't doing its share. Of course, no state should be called upon to shut down any of its uses to supply a deficiency unless the main stem reservoirs have failed in the test. So the first question is whether or not each state gets all the water it should down to the main stem reservoir. Then if they don't supply the deficiency, what do you do about getting enough water down there?

It is more than a double-barrelled question. It is a very serious question. It is one of the most serious ones the Commission will meet and I think it is something which we have got to start considering right away. I am sure each state wants to be fair in the matter. It wants to give its share of the water to satisfy the Colorado River Compact. Each one of our states signed

on the dotted line there. But as to how that obligation shall be met is a serious question which it seems to me the Compact Commission has to solve if the compact is going to be ratified by the state legislatures and approved by Congress. To me it is more than just saying that each state has so much water in a reservoir and that is released to satisfy the share of the state. The state has got to get the water down to the main stream reservoirs and if they fail, it has an obligation to reduce its uses so the deficiencies are met.

MR. BLISS: Mr. Chairman, I would like to ask if the problem that has been posed here doesn't involve the following principle: that in addition to our present consumption all states can develop to the amount which may be safely consumed in our ten-year low cycle period and an allotment made on that basis. Then the additional development can be made up to the 7,500,000 average use each year and the operation of the projects developed under that portion of the Upper Basin Compact will be obligated to deliver at Lee Ferry from the main stem reservoirs.

MR. PATTERSON: Your idea, John, is some method of finding out what proportions of the water of these reservoirs are contributed by the states and then giving them credit in that same proportion perhaps to releases and deliveries at Lee Ferry?

MR. BLISS: On an equitable basis, yes.

MR. PATTERSON: Would it also apply to a proportionate charge against each state for the evaporation losses from those reservoirs?

MR. BLISS: I presume that the contributions and the losses and the obligations to deliver would all be on some equitable basis, yes.

MR. PATTERSON: It would have to be some recognized or defined percentage or proportionate basis so you would understand what the obligation was.

MR. ROLLINS: Mr. Chairman, may I ask Mr. Riter a question?

THE CHAIRMAN: Yes.

MR. ROLLINS: I am wondering, Mr. Riter, if from the studies your agency has made you feel that sufficient water can be stored to take care of our obligation there so there would be no deficiency?

MR. RITER: Well, Mr. Rollins, as engineers we have to judge the future by the past. If we hold down our uses of water to the residual over and above the downstream obligations, yes. Now the question always comes up, what is the proper period of study? I recall in 1929 when I first became engaged in the study of the Colorado River, we went back and fabricated records through the drought centering around 1902 and 1904. We thought we had a pretty low period selected. So we went ahead and planned Hoover Dam on that basis. About the time we got it built and started operating, Nature demonstrated to us that there was a lower ten-year period, 1931 to 1940. I don't know what the future is going to hold; whether 1931 to 1940 is a proper basis I don't know.

MR. ROLLINS: What I am trying to get at is this: We will be developing during the next 15 or 20 or 25 years. Even if we use the measurements that were made during the ten-year low period there still will be considerable water that could be stored that could be accumulating provided these reservoirs could be put in within a reasonably short time, and if so

we would have a surplus there that would carry us over any dry period after we had developed to our maximum in the Upper Basin States.

MR. RITER: Mr. Rollins, my concept of holdover reservoirs is that they must be planned so they can be filled with the ultimate development you plan to make. In other words, I don't envision those holdover reservoirs as just emptying them once. I envision after they are emptied they have got to be refilled again to prepare for another drought cycle. So it wasn't my thought that they would be filled now during periods of incomplete development and then held full and subsequently emptied during a period of complete development. I have in mind a cyclic operation following complete development.

For instance, the Engineering Advisory Committee selected a period from 1914 to 1945, inclusive. If we should be so bold as to base our development on that period, that would mean that in calculating the amount of additional development that can be made in the Upper Basin--it isn't as simple as this, there are a lot of complications, of course--we would take the average flow in this long period 1914 to 1945, and subtract out the obligation. As I said before, the obligation is at least 7,500,000 acre feet for the Lower Basin plus an unevaluated amount, the Upper Basin's share of the Mexican Treaty obligation, which for the purpose of argument might be taken as 800,000 acre feet a year. The total obligation would then be 8,300,000 acre feet. Subtract that off from 13,800,000 and that will tell you how much average additional depletion can be made. I am just trying to simplify the problem to envision what the possibilities are.

Of course I realize there are complications. For instance, depletions are not constant year in and year out and there are a lot of other problems. Some of the engineers would want to be more conservative maybe and to make sure they were on the safe side, would probably want to make a smaller amount of development.

As I envision it, we have got to anticipate that these reservoirs will operate after we have made all the development we plan to make in the Upper Basin. They must fill during periods of good runoff and we must release storage from them during periods of low runoff. Of course, there are many other complications, for instance, of interbasin relations as to when we can store and when we cannot store in those reservoirs. There are many complications involved. I am merely trying to point out some of the problems.

COM. BISHOP: Mr. Riter, could you give us the 1914 to 1945 inclusive flow of the Colorado River at the Mexican border?

MR. RITER: I haven't calculated that, no, sir. I think we could compile the data. You want the historic flow?

COM. BISHOP: I would like to have it very much.

MR. RITER: I will compile the data. I don't happen to have the figures with me today but I believe the records are adequate to show what that was. Of course that will have to be calculated from records at Yuma station.

MR. PATTERSON: Mr. Chairman, may I ask the attorney an engineering question?

THE CHAIRMAN: Yes, sir.

MR. PATTERSON: As I understood Mr. Breitenstein's statement, he discussed the question of whether this obligation, by whatever legal language it

is called, is imposed upon the states or upon tributary basins or projects or groups of projects, and then I believe he gave the statement in his opinion it was an obligation imposed upon the states and had to be treated as such. I am wondering for the aid of the Engineering Advisory Committee if that question Mr. Riter keeps bringing up about the potential obligation of the Upper Basin to deliver more than 75,000,000 acre feet in ten years to the Lower Basin is one that we could have the benefit of further advice on.

You can see it makes a good deal of difference from the standpoint of the reservoir capacity required, and as an engineer it seems to me we ought to have some guidance rather than our own figuring on that question when we get to it. The first thing of course is to find out what water has been there and where it has come from before we can speculate too much on this but I am wondering about it now that you have mentioned this question of the delivery obligation. You considered it so far only from the standpoint of dividing it up among the Upper Basin States. Are there other questions under this compact involving additional obligations at Lee Ferry that we should take into account?

COM. BISHOP: Mr. Riter, I would like to ask you if you have any studies on the amount of water that is going to go to Mexico across the Mexican Border upon full development. Say we take all we can take; then the return flow below Imperial Dam would be about how much? Have you got the dope on that?

MR. RITER: During the Mexican Treaty hearings they presented testimony to the effect it would be in the neighborhood of 900,000 acre feet.

COM. BISHOP: That is about as I remember it.

MR. RITER: That testimony has been challenged by some people in Arizona and very strenuously by California to the effect that if such a large quantity of return flow should develop it would be intercepted within the United States and not be permitted to flow into Mexico, and there is a lot of force to their argument. I can't deny it.

COM. BISHOP: And then California admitted that 700,000 would be around the minimum that would go across there in the hearings in Washington.

MR. RITER: Well now, when I speak of return flow I didn't identify whose water that was. The Mexican obligation is 1,500,000 and that is on the River. In my mind it is a detail whether that gets to the Mexican border by return flow or whether it gets there by direct by-pass down the River. It is still 1,500,000 acre feet demand on the River.

COM. BISHOP: That is right. How could that make the obligation of the Upper Basin to deliver more to Mexico than the difference between what is going to get there anyhow and 1,500,000, which in my opinion would be around 800,000 of an obligation.

MR. RITER: Well, the people in the Lower Basin have testified that in their opinion that water will never get there anyhow. My own concept has been this, Mr. Bishop, of that return flow problem: The large share of this return flow would come from Arizona projects particularly. Of course bear in mind there are small contributions from California projects also. The large share of that return flow would come as return flow from Arizona projects.

Now with the Mexican Treaty in effect the question immediately comes up, what is the proper charge to Arizona? For example, if Arizona should divert 2,000,000 acre feet from the Colorado River and return through return flow 900,000 acre feet to Mexico, under the Colorado River Compact is the charge against Arizona the diversion minus the return flow or 1,100,000 acre feet? Or is the charge against Arizona the full amount of the diversion? In my opinion the charge against Arizona is the difference between the return flow and the diversion or 1,100,000 under the suppositions I have given.

That would mean then that Arizona has taken advantage of the fact that Mexico has a right to use water which would involve her return flow. That means then she is merely borrowing for the purpose of facilitating her own diversion some of Mexico's water and has by-passed it through the canals instead of letting it stay in the River. In other words, if it should finally be construed that my supposition is wrong and that Arizona is charged for the full amount of her diversion, I am confident that Arizona would arrange facilities so that there would be no return flow to Mexico, and that is my theory on the thing. I think I am right; otherwise I wouldn't be propounding it.

So in my opinion, getting back to your question then, in figuring the Upper Basin share of the obligation, assuming for the time being that there is no surplus water because in drought cycles there will be no surplus water--and I might say at this point that certain engineers have calculated that on a long-time period the surplus would be so insignificant that it would be impractical to use, but that is beside the point--but in drought cycles where we will all agree there is no surplus, then it seems to me the Upper Basin share is a half of 1,500,000 acre feet. That is my opinion. You suggest it might only be a half of the difference between a million and a half and this return flow of some 700,000 or some 900,000 acre feet, but I can't see it that way.

MR. BLISS: May I suggest, Mr. Riter, that the quality of the water might enter into your computations?

MR. RITER: That is true. There are many complications of this problem and by trying to simplify my explanation I hope I don't give the impression it is that simple to work out in practice.

(Discussion off the record.)

THE CHAIRMAN: Let it be understood that if the Colorado River Basin States Committee concludes its work before five o'clock tomorrow the Chairman will call the Commission together for consideration of the problems before it. I hope you all understand that. If less time is required tomorrow we will utilize that time in the work of the Commission.

Before we adjourn I wish to congratulate Colorado in having worked out a lot of factors or questions to come before this Commission. I think the State has done a good job and whether they are questions which the Commission may decide should be embodied in this compact or not remains to be determined but nevertheless they are questions properly to be considered and I hope the other states will do a good job in their presentation during the later sessions of this Commission. I don't know whether we will get around to them Thursday or not but the states have said they will be prepared.

Motion for adjournment is now in order.

(5:00 p.m., Tuesday, December 2, 1947, recess until completion of Colorado River Basin States Committee meeting on December 3, 1947.)

Denver, Colorado
December 3, 1947
1:30 o'clock p.m.

(All Commissioners present.)

THE CHAIRMAN: The Commission will come to order. Let it be understood that the Commission will recess or adjourn today at 3:30 in order that the minutes of the Cheyenne meeting may be corrected and placed in the hands of the Secretary and opportunity will be afforded for a meeting this afternoon of the committee appointed by the Colorado River Basin States Committee this morning to consider certain matters, and to permit an opportunity for a meeting of the Legal Advisory Committee during the remainder of the day.

The State of Colorado has made available to the members of this Commission and its advisers a compilation consisting of four volumes relating to the principles involved in a negotiation of interstate compacts. In this connection the Chairman is of the opinion the work which Colorado has done in this respect during the last four or five years will greatly facilitate the work of the Legal Advisory Committee and expedite such work because the information is all in one place. All of the treaties or compacts are there for anyone to read and I presume the citations should be a lawyer's paradise. Your Chairman has looked at them. Of course they mean nothing to an engineer but to a lawyer they should be of great value. I want to congratulate the State of Colorado for this excellent job.

MR. WALLACE: Off the record. (Discussion off the record.)

COM. CARSON: It is a very valuable work. I have studied it, too. It is a service to everybody that they have performed.

THE CHAIRMAN: Now the first order of business today is to complete the consideration of the matter before the Commission at our adjournment yesterday afternoon, which is the matter of the joint and several obligations of the states to deliver water at Lee Ferry. Off the record. (Discussion off the record.)

What further comment do we have on that item? (No response.) Well, gentlemen, there was considerable discussion of this question. What are the wishes of the Commission as to any action it may wish to take on the matter at this time in the way of reference to the Engineering Advisory Committee or to the Legal Advisory Committee?

COM. STONE: Mr. Chairman, the statement of Colorado in presenting that matter, which is a little bit beyond your explanation of it, was listed as: Shall the responsibility of maintaining the required Lee Ferry flows fall upon the states, certain tributary basins or individual projects or groups of projects?

MR. WALLACE: I wonder if Judge Stone wouldn't tell us what the thoughts of Colorado are.

COM. STONE: We shall be glad to do that and since Mr. Breitenstein made the explanation yesterday I will ask him to follow Mr. Wallace's suggestion when he asks, what are the thoughts of Colorado on that question.

MR. BREITENSTEIN: I tried to indicate that in the statement which I made yesterday. Perhaps I wasn't too clear. But as I understand it, the

water users here in the State who are interested in a Colorado River Compact and desire to see an Upper Basin Compact feel very strongly that that is an obligation of the individual states and that the states are the entities which are responsible for maintaining those flows. Of course that can be enlarged on to a considerable extent but it boils down to that, Mr. Wallace. The obligation is a state obligation.

It seems to me that that position is really the only one which can be taken. The states are the ones who made the Colorado River Compact. The obligation is created by the Colorado River Compact. We in the Upper Basin have to recognize it because of the Colorado River Compact. Of course I am always accused of being legalistic but if there ever was a case where you have to be legalistic, it is here. The states signed the Colorado River Compact and the states are bound by it and it is not any particular project and it is not any particular drainage basin. It is an obligation of the states so the states I say are the ones who are required to do this.

Now what each state wants to do within its borders in order to satisfy the total state obligation, that is the business of the state. Is that clear enough, Judge?

COM. STONE: Yes, and that latter statement by Mr. Breitenstein is the way it always appealed to me. You can only enforce a contract--and after all a compact is a contract among states with the consent of Congress--you can only enforce a contract upon the parties to that contract. You can only enforce a compact upon the states signatory to it.

And going further, it would be contrary it seems to me to the concept of the obligations and sovereignty of a state for any compact to wipe out state lines with respect to the meaning of the obligations under a compact. The state stands in the place of and represents its own water users, and the state must in the end enforce such laws, agreements and policies within its own borders as will insure the meeting of a state obligation. No state could enforce upon another state any arbitrary rule, either by compact or otherwise, which would be contrary to and interfere with the laws of that state, and that would be the effect if an effort was made to place this obligation upon any group aside from the state.

And after all it seems to me the die was cast when these states negotiating here today agreed to the Colorado River Compact and there was placed upon us a joint and several obligation. That several obligation was on a statewide basis. And it seems to me--and I am speaking only for Colorado--that we cannot avoid the legal conclusion--and here, Mr. Chairman, we must be somewhat as Jean says, legalistic--that the obligation is one of the states and not of the tributaries or individual projects.

MR. MERRIELL: I would like to make an observation, Mr. Chairman, and that is, as to Colorado at least the State is the only agency which has the power and the system to enforce any moves that might be necessary to enable Colorado to make its proportionate delivery. That would be a functional part of the duties of the State Engineer to administer the public water of Colorado. He is the only person that has that power in Colorado so that from the point of view of Colorado, that is the way it would have to be done.

MR. GILES: May I ask a question?

THE CHAIRMAN: Yes.

MR. GILES: I don't know whether this is proper at this stage of your discussion, Judge Stone, but would the state's obligation be based on a

percentage directly proportionate to the apportionment of the water itself?

MR. BREITENSTEIN: I didn't quite get your statement.

COM. STONE: That is a question which has been resolved.

MR. GILES: It has? I wasn't here.

COM. STONE: I think irrespective of what is agreed to as the several obligations at Lee Ferry, the same principle would apply.

MR. BLISS: Judge Stone, I think your records would be clear to the extent that the states are responsible not only at Lee Ferry but on tributaries to other states possibly.

COM. STONE: I think that follows. Mr. Breitenstein can supplement what I have to say or correct it if he thinks I am wrong. I think that follows. Whatever arrangement is made in the compact with respect to the apportionment of water or the determination of meeting the respective obligations at Lee Ferry--whatever that arrangement may be, the final obligation falls upon the state. Does that answer your question? Is that the way you view it, Jean?

MR. BREITENSTEIN: Yes. Whatever obligation there is on any entity to maintain any certain flows at state lines, that entity is unquestionably the state, just as in the Rio Grande Compact, Colorado is obligated to maintain certain deliveries at the state line. The same thing is true in the La Plata Compact. I mention those because they are between Colorado and New Mexico. So here if you have a tributary rising in one state and going into another state and there is an obligation in the compact for the upper state to maintain any particular stream flows, why that is a state obligation and not the obligation of any water user or group of water users.

COM. WATSON: Mr. Breitenstein, how would that apply to storage reservoirs along the main stem of the River where there is a community of ownership?

MR. BREITENSTEIN: Well, to me, Mr. Watson, that raises another question which I suggested the other day and which I apprehend we ought to discuss next. But to me that is a different matter.

COM. STONE: That is a matter which does not define state obligation. Isn't that the answer?

MR. WALLACE: Judge Stone says what it isn't. I take it what you mean is after an allocation is made to a state, the state shall minister in its own household and any priorities within the state are under state laws. Right?

MR. BREITENSTEIN: Yes, and may I add one point to it? The state has no extraterritorial jurisdiction unless there is some provision in the compact to that effect.

MR. WALLACE: Correct.

COM. WATSON: What would Colorado do to enforce its wishes in case of water being stored in a main stem reservoir in Utah?

MR. BREITENSTEIN: That brings up the question Mr. Riter brought

up yesterday. Is that water stored to the credit of Colorado? If it is stored to the credit of Colorado, Colorado should probably have some control over the release of it. If it is stored to the joint credit of everybody, that is different.

COM. STONE: And that is covered by another question raised by these factors submitted by Colorado.

MR. BREITENSTEIN: My thought was we had to take them up one by one. I didn't intend to foreclose any discussion of the other thing.

COM. BISHOP: Mr. Chairman, Mr. Rollins had an observation.

MR. ROLLINS: I was just wondering--Mr. Patterson and I have been talking a little here concerning the obligations of various states at Lee Ferry. Supposing it is determined here that the states individually must assume their obligations there and it is no concern of other states as to the obligation of an individual state; in case one state should default either voluntarily or for reasons beyond its control, would the responsibility be upon other states to make up that deficiency or would each state only be bound by the amount they were to furnish?

MR. BREITENSTEIN: Mr. Rollins, we have discussed that several times. No one yet has denied that the obligation under the Colorado River Compact is a joint and several obligation. So if there is a default they can go after all the states or one of the states to make up that default, and if we divide the obligations here on a percentage basis, shall I say, between the states, that state can go after its neighboring states and bring them into line. Under the Colorado River Compact the State of Wyoming can be sued all alone if the flows aren't maintained.

COM. WATSON: You speak of "they" going after them; who is "they"?

MR. BREITENSTEIN: The States of the Lower Division.

COM. STONE: After all, Mr. Rollins, to put it in another way: Under the Colorado River Compact it is a joint and several obligation which places upon the States of the Upper Division the obligation in their own self-interest of apportioning in an Upper Colorado River Basin compact this obligation; and if there is a violation of the Upper Colorado River Basin Compact, then there is recourse against a defaulting state under the Upper Colorado River Basin Compact. You must distinguish between the obligation under the Colorado River Compact, which is joint and several, and the obligation of each state under the Upper Colorado River Basin Compact.

MR. BREITENSTEIN: It is just like this, Mr. Rollins: Suppose five of us signed a note to Harry Bashore for a thousand dollars and then signed an agreement among ourselves we are each liable for a fifth of it. Now Harry Bashore can sue you for the full thousand dollars but you can come back after me for $200.

COM. BISHOP: Suppose you are broke and can't pay it? Does he have to pay it all or not?

COM. WATSON: Assume, Mr. Breitenstein, that there was an unprecedented drought in the State of Colorado and that the Colorado River flow and the Yampa flow was reduced to a minimum, and assume that Nature provided that there were good snows up in Wyoming and the Uintas and the Green flowed normal or above normal; that would mean then that Wyoming and Utah could deliver their

share of the obligation at Lee Ferry, Colorado could not, if we assume all reservoirs empty. What would be the recourse against Colorado?

MR. BREITENSTEIN: Just like Mr. Bishop said just now, if I didn't have the money Mr. Rollins couldn't collect from me.

COM. WATSON: But Utah would have to pay because we were joint partners in signing the note?

MR. BREITENSTEIN: That is right.

COM. BISHOP: That is why I contend we have to have a pool of these reservoirs and when the water gets in there once it is joint water, it belongs to all of us, and we can make any agreements we want. But what if a situation comes up with a thirty-year drought on the San Juan like the tree rings show there has been and they can't pay down there? The other fellows have got to pay and it is something we can't foresee, just what it is going to be, and that is the reason I think we have to have a pool of reservoirs as well as a power pool to take care of the situation.

COM. WATSON: And then at some later date we settle among ourselves the obligation.

COM. BISHOP: I think this administrative agency should have authority to handle it and if any one state doesn't like the way they handle it, they should have recourse to the court.

MR. GILES: Let's pursue Mr. Watson's question one step further, I don't know whether you are going to come to that sort of an arrangement or not in the compact that if in a drought year one state fails to produce its share, will that state ever have to make that up in future years--is that your idea?

COM. WATSON: I assume they would settle it among the States of the Upper Basin at a later date.

COM. STONE: Can we analyze that a little bit further? Mr. Watson has assumed a condition, an extreme condition, which from a practical point of view would never happen to that extent. You were considering Colorado, for instance, and you took the Green and the Yampa. Colorado has many tributaries, the Gunnison, the main stream, the San Juan, and many other streams. Now I imagine from a purely practical situation you couldn't have a drought that would just surround Colorado or Wyoming or any other state. It would never in my judgment come to that extreme situation, but suppose that--

COM. WATSON: It is surrounding an area of Arizona right now, Judge.

COM. STONE: I am thinking of the physical situation. That could be in the extreme, sure, but the area we are talking about, I don't see how a drought could stop at the Utah Line or the Wyoming Line. It is very apt to be a general situation. But aside from that, I would assume that the defense of drought would not be a complete defense. Each state would have to go as far as it can go to meet its obligations under a compact and after all we are talking about theoretical situations that we can't do anything about. We can't control Mother Nature. Neither can we go back and revamp the Colorado River Compact. The Colorado River Compact does make it a joint and several obligation. We can't avoid that. That is a factual matter that is before us and this other situation is to meet it the best we can.

MR. BREITENSTEIN: May I suggest one other thing? The thing that is bothering some of the people here is considered in the Rio Grande Compact. That stream is perhaps more fluctuating than the Colorado and there the problem was solved by setting up a system of debits and credits, that is allowing permissible departures within limits. Now perhaps the same thing might be done here, although it occurred to me if you set up a system of debits and credits on the Colorado River you would get too complicated. But that is how it was taken care of in a much simpler situation on the Rio Grande.

MR. PATERSON: Didn't it include a system of ten-year averages as well as a system of debits and credits on the agreed ten-year obligation? I think you would recognize it is a ten-year obligation but not a day to day or month to month obligation.

COM. STONE: Not even yearly.

COM. WATSON: May I ask Judge Howell to make a statement?

MR. HOWELL: So far it seems to me we have been discussing this matter from the point of liability. Perhaps that is not the right approach to this problem from the point of view of making this compact and it should be rather to approach it from the point of view of the method of fulfilling our duty rather than talking about the liability that will ensue on the failure on our part to perform our duty. Having that in mind, while I don't dispute anything that has been said here, the obligation upon the part of the Upper Basin is joint and several, which means of course that any one or more than one or all could be sued by whoever is damaged or injured as a result of the failure on the part of the Upper Basin to perform its duty. But there is no doubt, of course, that we can contract amongst ourselves as members of the Upper Basin as to what our liability as between ourselves shall be.

In order to get something constructive that we may do in order to effectuate that agreement it seems to me we ought to first of all establish it as a principle that this River should be so regulated that the obligation to make up any deficit will be minimized to the greatest extent. What I mean by that is that the long-term storage facilities and whatever else may be done from an engineering point of view, which I wouldn't want to enter into, should be undertaken as a part of the plan so that the possibility of any deficit will be minimized to the very greatest extent, understanding however, all that may be done there still may be the possibility of a deficit.

Then it would seem to me that we should agree on one of two things: Either that deficit shall then be made up by the states in proportion to the percentage of use of the water to which they are finally given the right under the compact; or an attempt should be made, which to my mind would perhaps be more logical although perhaps more difficult of ascertainment, that it should be related to the cause that produces the deficit. Now whether that could be done and still come within the limits of the suggestion made by Colorado that it is after all a state obligation, I do not know; but it does seem to me that this is the approach to this problem and these the possible solutions of it.

So it would seem to me that this matter should be referred perhaps jointly to the Engineering Advisory Committee and the Legal Advisory Committee to determine first of all, what is our obligation, because while it is fixed so far as the compact is concerned, as I understand it there may be some question as to the responsibility under the Mexican Treaty; and secondly, to establish it as a policy for the guidance of the Engineering Advisory Committee that in the development of this River it should be along the lines that will minimize any possibility of a deficit and then to make some recommendation back to this

Commission as to how the deficit should be handled if in spite of everything that is done there results a deficit.

THE CHAIRMAN: Thank you, Judge Howell.

COM. STONE: Mr. Chairman, I think Judge Howell has made some very wise observations on this question and speaking in support of Colorado's proposal here, I want it understood that we do not suggest any particular method but we concur in the principle that the obligations to make deliveries under the Colorado River Compact shall be minimized through appropriate provisions of the Compact and engineering operations. There is no question about that and we don't know yet, we haven't yet agreed upon those matters.

Our point is merely this: that whatever arrangement is made and whatever obligation is placed upon the states, and whatever method is devised to carry out this obligation under the Colorado River Compact, and when that is agreed upon, the obligation to carry it out is an obligation upon the respective states rather than an obligation upon a tributary or an obligation upon individual projects or groups of projects. And there again as suggested by Mr. Bliss from New Mexico, the tributary obligation is a matter of adjustment which will define or at least be considered in defining the obligation of a particular state. It goes to the rather simple matter of principle that when these obligations and these methods are finally agreed upon by this Commission, the obligation to carry them out is a state obligation because the states are signatory to the Colorado River Compact and will be signatory to this compact. That is all we are suggesting at this time is just that simple principle.

MR. HOWELL: I think I can go along with that all right. My only point is that the approach to it should be prevention of liability rather than determination of what shall be done when the liability occurs.

COM. BISHOP: Mr. Chairman, why couldn't the obligation in case of a shortage at Lee Ferry be met by each state in proportion to the available supply in the state for that year? I know from the records I have gone over in Wyoming that there are years when we have nearly twice as much water as we do other years. Maybe that same year we would have twice as much water the San Juan would only have a 50 percent supply. Why not work it out on a percentage basis of the available water in the state?

COM. STONE: I might say we are not proposing any method or do we believe that comes under this title. That is another matter to be taken up.

MR. HOWELL: My idea is that matter will have to be given further consideration as to what your method is going to be, determining what is the cause of the deficit or whether it is to be done by the arbitrary method by saying it shall be in proportion to the percentage of water allocated to the states. That is the reason I think it has got to be a matter of further study by the Engineering Advisory Committee and perhaps by the Legal Advisory Committee.

COM. STONE: I agree with you.

MR. WALLACE: May I make an observation?

THE CHAIRMAN: Mr. Wallace.

MR. WALLACE: In time of disaster the broader the field upon which the disaster falls the less is the concentrated disaster on a particular

area. Personally it seems to me it is wise for the entire Upper Basin to assume the obligation and in case of disaster permit the administrative body to so administer it so that as few people would be hurt as possible.

MR. PATTERSON: May I offer a thought?

THE CHAIRMAN: Mr. Patterson.

MR. PATTERSON: In line with Mr. Watson's hypothetical or illustrative case, speaking now for the Engineering Advisory Committee, it is very possible from the records, copies of which you have already been given, to calculate the relative amounts of water year by year if you want to, or month by month if you want to, that each of these principal tributaries historically has contributed to the total flow at Lee Ferry.

I have gone ahead of the official work of the Committee and have made some calculations along that line and without trying to explain them I will offer this one thought, that there is a very remarkable consistency when it is treated year by year and by ten-year averages as to the amounts of water furnished at Lee Ferry by the San Juan, the Colorado, and Green Rivers. It is really a parallel situation. They were all low in the drought; they were all high in the wet cycles.

MR. WALLACE: May I ask a question, Mr. Patterson? What was the condition during the current year as to the relationship between the Green and the Colorado?

MR. PATTERSON: I can't answer that, sir. I don't mean to say there are no departures but I am saying in general the average percentages of each of those streams are quite closely followed year after year.

MR. WALLACE: May I ask another question, Mr. Chairman, of Mr. Larson?

THE CHAIRMAN: Yes.

MR. WALLACE: What is the percentage of runoff on the Green and the runoff on the Colorado the current year?

MR. LARSON: I can't give you that answer.

COM. WATSON: Probably Mr. Wilson can.

MR. M. T. WILSON: Only in rough percentages. The Green River was about 120 percent of average and the Colorado at Cisco was about 100 percent of average.

MR. PATTERSON: You mean of its long-time average?

MR. WILSON: Yes.

MR. PATTERSON: That is true and yet it is also true that on a ten-year cycle in the '20's they were all about as high as each other based on ten-year averages. The drought cycle of 1931 to 1940, the same thing held true. The departures in 1931-1940 to the study period average showed a very remarkable similarity on all streams.

I am offering that as a thought of this kind: Instead of using arbitrary, hypothetical situations, your Commission will have records of that kind before it in order to study this question you are talking about when that question does come up for decision and base it upon more factual information and

variations in releases.

Just one other thought while I am speaking on this question of deliveries: It can't be entirely disassociated from the companion question of apportionment of uses. Amounts of water in a stream basin that are going to leave that basin--unconsumed outflows--to head towards Lee Ferry, are going to be modified by the amounts of water that are used or consumptively used in that stream basin. So that there is another control to deliveries and that is the control of or a limitation on uses. The two must not be entirely disassociated from each other.

MR. WALLACE: Mr. Chairman.

THE CHAIRMAN: Mr. Wallace.

MR. WALLACE: The point I am trying to make is that the broader the base upon which the disaster rests the less it is--how do I want to say it?--it is easier to bear. And personally, I would spread the disaster over as many shoulders as I could.

COM. STONE: The principle is correct and that could be accomplished when we get into the details of the apportionment of the obligation, and whatever that obligation is finally rests on the states and that is the point we are making.

MR. WALLACE: That is right.

COM. CARSON: Mr. Chairman, Arizona is not a state of the Upper Division and therefore it might appear that I am sticking my nose in matters with which we are not directly concerned, but my thought on this is that the two are very closely related, uses and obligations at Lee Ferry. Sometimes people fall into the error--I will take it to be an error--of stating that the obligation of the Upper Basin to deliver water at Lee Ferry is discharged when 75,000,000 acre feet every ten years is delivered whereas actually the obligation is to deliver all over a depletion of 7,500,000 acre feet by virtue of the provisions of the Colorado River Compact, which provides that surplus water should first be used to discharge the obligation to Mexico, which is 1,500,000 acre feet. When the long-time average flows of the River are considered according to our engineers, and the Upper Basin has depleted the flow of the River at Lee Ferry by 7,500,000 acre feet a year, the Lower Basin has depleted the flow at the Mexican Boundary by its apportionment of 8,500,000 acre feet a year, and the Mexican obligation of 1,500,000 acre feet is discharged, there remains in the River a surplus somewhere in the neighborhood of 220,000 acre feet and no more.

On this Upper Division obligation, I agree that it is joint and several. It seems to me for the Upper Basin to be able to reach a use of water which will deplete the flow at Lee Ferry by 7,500,000 acre feet a year, which is their right, that it will be necessary to have main stem storage reservoirs and that until they are provided it wouldn't be possible for the States of the Upper Division to so deplete the River. When they are provided on the lower reaches of the River within the Upper Division, then I think it could be worked out to where that storage would be accumulated there in wet years to carry over to deliver to the Lower Basin in dry years, which would prevent the onerousness of the effect of a drought in the Upper Basin; and that it will have to be worked out in some way so that they would come into and affect this question of what obligation is on each state.

I think Mr. Ollie Larson has an idea on that, of the possible effect of operation which I would like for him to explain now so people

can be thinking about it after the adjournment of this meeting.

MR. WALLACE: May I make an observation, Mr. Chairman? Of course I am not a lawyer and I have listened with a good deal of interest to the statement of Mr. Carson, and in that statement he has ignored two provisions of the Treaty. One is that it gives to all of the states ownership in the surplus and the other is that the Lower Basin may not call for the delivery of water that cannot be used for--

COM. CARSON: I haven't ignored them. I am assuming the Lower Basin will use up to its apportionment and the Upper Basin up to its apportionment and the surplus we have all agreed in the Compact should first be used to discharge the burden to Mexico.

MR. WALLACE: But there may be a surplus greatly above the amount necessary for use in Mexico. In other words, I would like to have some lawyers understand this, I would like the records to show that I cannot agree with the statement made by Mr. Carson at this time.

COM. CARSON: That is all right.

COM. STONE: May I concur in the statement by Mr. Wallace that leaving out any assumptions which Mr. Carson makes, is it not true that your theory, Mr. Carson, and your explanation is subject to the provision of the Colorado River Compact--

COM. CARSON: Yes.

COM. STONE: --that the Lower Basin cannot require the delivery of water and the Upper Basin cannot withhold water which cannot be used in beneficial consumptive use under the terms of the Compact?

COM. CARSON: Oh certainly.

COM. STONE: Then isn't it also true that all of the states of the Colorado River Basin under the terms of the Compact after 1963 may acquire an interest in the surplus--

COM. CARSON: Yes.

COM. STONE: --after deducting the amount which is required to be delivered to meet the obligations under the United States-Mexican Treaty?

COM. CARSON: Yes. I think I have taken all those into consideration too, Judge Stone.

COM. STONE: So that the Upper Basin does have an interest possibly in more than 7,500,000 acre feet of water.

COM. CARSON: Well, the balance, the surplus over and above the apportionment of 7,500,000 to the Upper Basin, of 8,500,000 to the Lower Basin, and 1,500,000 acre feet to Mexico, according to our engineers, is 220,000 acre feet based on long-time average flow. Now after 1963 if it develops that there is more water than that, why of course the Upper Basin as well as the Lower Basin States could share in it by the further apportionment of the water in the River.

But in figuring now on the obligation at Lee Ferry, until that apportionment is made it seems to me that the obligation is on the Upper Division to deliver the surplus at Lee Ferry for supplying to Mexico with that small

difference of 220,000 acre feet; and until that time of 1963 arrives so that the presence or absence of surplus could be further studied and understood, then on considering this question of the obligation at Lee Ferry and how it could be met, I think it can be met and the Upper Division can utilize that 7,500,000 acre feet of depletion at Lee Ferry by the construction and operation of reservoirs that would accumulate water over and above that 7,500,000 acre-foot depletion in wet years for delivery to the Lower Basin and Mexico in dry years.

And I think Mr. Larson, as I say, has an idea about the operation of those reservoirs and their necessity, which while it is probably not germane to the exact question you have raised as to the state obligation and the character of the obligation--and I agree it is a state obligation--I would like for him to make a statement in the record so you could be thinking about it by the next time we meet.

COM. STONE: May I ask Mr. Carson this question: Restricting the matter to the factor and question raised by Colorado, and irrespective of the matters which you now mention, whatever that obligation of the Upper Basin is, you agree it is an obligation of the individual states?

COM. CARSON: Yes.

THE CHAIRMAN: Mr. Larson, do you care to make a statement at this time?

MR. LARSON: I believe I can make a statement that might help this Commission in visualizing how a pool of reservoirs might be operated.

In the main stem studies that we are conducting in the Regional Office, which I have mentioned in several previous meetings, we are trying to explore the various methods of operating the River to get the largest irrigation yield out of the stream and to meet the obligation at Lee Ferry, whatever they might be, thinking that if we work out some basic data it would be helpful to not only your Commission direct but to your engineering advisers who may not go into all the details that we are going into. It is simply to be helpful and in making this explanation I will try to stay away from the legal entanglements and I also do not wish to be in the position of influencing the Commission in any way.

In the recent studies we have made in the past few weeks we have centered on three general plans of operating a pool of main stem reservoirs, those reservoirs starting at the lower end of the River beginning with Glen Canyon and going upstream as far as the Kendall on the Green and the reservoir on the Gunnison River in Colorado. We are sticking to reservoirs with a fairly good size. We are also trying to pick out a combination of reservoirs with the lowest evaporation and the greatest power head and that fits in best with stream regulation to equate the stream, to equate the Colorado and the Green so far as we can.

The first general principle would be to have a large holdover capacity, maybe 30 or 35 million acre feet, but anyway a capacity sufficient to store the entire flow of the Colorado River above Lee Ferry over and above releases made to meet the Compact, Mexican Treaty, or other requirements.

That would mean that to see what those plans might do in the future, we must go back and take the historic flow that the Engineering Advisory Committee has arrived at tentatively at least and then work through with an assumed yield in the Upper Basin, an assumed delivery at Lee Ferry--don't ask me what that is--and work it on through, subtracting

the evaporation depending on the stage in the reservoir in the combination we use. After you come forward from the year 1914 and you get into the wet cycle of 1922 to 1929, that is where you would have to have considerable capacity to store every drop that would not have to be released below Lee Ferry. That is the maximum holdover and also the maximum evaporation rate per year.

Now that is one general scheme.

THE CHAIRMAN: Pardon me just a moment, Mr. Larson. What irrigation development are you assuming in connection with that chain of reservoirs, that is what I am getting at, what consumptive use? Is that the maximum development?

MR. LARSON: Yes, it is a consumptive use that would just leave enough water to supply evaporation at those reservoir stages plus deliveries to below.

THE CHAIRMAN: In other words, that is the maximum?

MR. LARSON: You can't try to get what that maximum irrigation use is. Forget that. Go back to virgin flow.

THE CHAIRMAN: In other words, that is the maximum development possible with the Colorado River water supply for irrigation and meeting the obligation to the Lower Basin States and to Mexico?

MR. LARSON: Yes. We are trying to get an idea what that maximum is.

MR. WALLACE: What about delivery at Lee Ferry?

MR. LARSON: We must assume a rough figure for that. It may be right or wrong, but we have got to assume something. The second plan we would operate too like the first plan except that we would reduce maybe the number of reservoirs but at least the maximum holdover storage so that we would have lower evaporation rates, slightly smaller holdover possibly, and we would spill water in the high years from 1922 to 1929--we would spill some water. Then we would in that scheme immediately after the wet period ending in 1929--you get into the dry years of 1931 to 1934--we would then reduce the flow below 7,500,000 acre feet or eight or some other figure at Lee Ferry, to average up that spill that we made to deliver an average of 75,000,000 acre feet in any ten-year period plus any other deliveries that we might have to make. That is the second way.

The third way is to cut down reservoir holdover still more to save cost, save evaporation, and spill more in the wet cycle than we can recover, which doesn't appear to be good for the Upper Basin.

Under all three plans the amount of water that would be available for irrigation after we subtract releases to the Lower Basin and take out evaporation losses--the yield will change depending on how safe you operate that plan during that period 1914 to 1947. It appears--now this is my own opinion--it is my own opinion that it would only be good judgment to operate this pool of reservoirs safely and not scrape the bottom of the barrel, which in this period of operation from 1914 to 1947 does not come in the dry years of 1931 and 1934, it comes later, 1941 to 1946. We keep going down.

The reason we are running that operation through all three plans and some in between with a large margin of holdover is for these reasons--I tried to write them down as quickly as I could think of them:

The first reason is that all the projects for which there is water are not going to be built immediately so you will not get up to that full

amount right away. You can afford to carry over a large amount of water.

Second, you must keep, it seems to me, a large holdover in most of these reservoirs, say 10,000 acre feet or some other such figure, in order that you can keep up your power production while you don't need all the water, to pay for your projects, that part of the projects that irrigation won't pay unless of course Congress enacts some other law.

The third reason is that it would only be good judgment to operate the reservoirs very conservatively with the large holdover because we have so many unknowns. We talk about salvage, making an estimate of salvage. We won't know exactly what that will be. We may figure that vegetation along a stream is going to dry up by a less quantity of water, that is true; and be less evaporation, that may be true. But in building reservoirs we are also changing the grade into the stream and by lessening the velocity we might build up some places because the River does overflow and have more evaporation than we have now, I don't know. That may be isolated spots. At any rate we are talking about something that is going to be hard to determine exactly.

It is going to be hard to know what return flows are from projects. I have listened to that for two days with very much interest, how you are going to determine how much each state delivers to the stream and how much each state depletes the River. I am thinking about the San Juan. If the South San Juan, the Shiprock, the Hammond and the Animas-La Plata are built, we don't know what the return flow is exactly and some of the projects will be built surely before we have a long-time recording. Who will ever know whether the return flow is coming from this side of the River or that side or where it is coming from? We have the same thing on the Snake and a dozen other streams that are in more than one state, and even where it is within a state it will be hard to determine.

I can only see two ways, thinking out loud, of determining depletions, losses, and gains; that is by agreeing on a depletion rate for all the way from the headwaters downstream and go on that basis as fast as anyone puts land under irrigation; or try to measure the loss from the stream.

Now to me some of those questions might be answered in this holdover, that if you happen to arrive at a percentage of the water or your liabilities, then the pool should be operated on a percentage basis; and if those percentages, of course, are agreed upon, then a drought would appear one place or another and you went on the depletion rates, that would be absorbed in the whole operation and would not I suppose prove to be an isolation.

THE CHAIRMAN: Mr. Larson, isn't there another factor that enters into this maximum holdover storage which is the uncertainty of the exact inflow in the future in any period that you take as compared to the past?

MR. LARSON: That is what I tried to bring in there as one of my reasons that you wouldn't know the gains and losses and therefore you would want a large amount of holdover and for that similar reason you would want a large holdover against a possible dry cycle worse than any we have had.

THE CHAIRMAN: You might have a fluctuation in that ten-year period that you adopt which would be different than what you have experienced in the past.

MR. LARSON: Yes, but operating conservatively for a long period

with a large holdover would give you one other thing too: If you operate close to your belt, so to speak, and you have two dry years coming along, then you would be up against the proposition of making states turn water down. That would be difficult. This way, if you have a large holdover, dry years come along, you dip into that holdover and then you replenish in subsequent years when your runoff is better or adjust your whole operation. Of course that is going along when most of the lands are under irrigation a long time hence.

THE CHAIRMAN: My point, Mr. Larson, is this: that while you make up these theoretical reservoir operation studies, when it comes to the future when they are built and in operation, they will be operated on the basis of the best judgment you can get during that period of operation.

MR. LARSON: That is right.

THE CHAIRMAN: It may vary quite widely from your theoretical studies, which is in my opinion a very strong reason for maximum holdover.

MR. LARSON: That is right, take care of all the things we can't determine and don't know now.

MR. RITER: Along that same line that Mr. Bashore mentioned, we have already gone through that experience in the Bureau. In planning Lake Mead we considered the drought cycle to be the cycle ending in 1904 and we went to great ends and a great deal of effort to determine what the flows were prior to 1904. Then the 1931 to 1940 drought came along and that was more severe than the drought ending in 1904. The 1931 to 1940 is still the most severe drought that happened in the Colorado River Basin; however it isn't true other places. I think what you are apprehending, Mr. Chairman, is that there might be a drought more severe than the one we now have record of, 1931-1940; is that what you are apprehending?

THE CHAIRMAN: Not necessarily that but a variation in that period of flow. Of course what you mentioned may happen but there also may be a variation of two or three years in there which is quite dissimilar to your adopted period for reservoir operation study. As you have mentioned in the operation of Lake Mead, it then had to be operated on the basis of the predictions that could be made by man.

MR. LARSON: I would like to make one other observation along with the comments of Mr. Patterson that to guide our thinking over there we have made some quick estimates--or not using the work of the Engineering Advisory Committee--and I think if you take the estimates of the contribution by states and averaged them for the ten-year dry period, the seventeen-year period from 1931 to 1947, and the period from 1914 on, you will find that for each state they differ less than two or three percent I believe.

THE CHAIRMAN: Mr. Larson, the Chair would like to ask you a question at this point: Do you think it is practicable to assume that you can set up a system of debits and credits in these main stem reservoirs and really operate on that basis? In other words, if a state contributes its allotment this year and twice that next year that it should be set up in the books so that later the state may not be called upon for a deficiency? Do you think a system of that character would be practicable?

MR. LARSON: Yes, it will if you can arrive at some formula as to use, either on the basis of the depletions or measurements, to get at the depletion and return flow. On that very point I would like to mention a small reservoir, the Deer Creek Reservoir in Utah, where we had a similar problem. We did not

have states but we had interests that were quite different. We had five metropolitan water districts, one irrigation district, and several canal companies. They were not only interested in purchasing a certain number of acre feet in the Deer Creek Reservoir but they were interested in holdover collectively and individually.

That reservoir is worked out so that collectively as a general rule it will have a reserve holdover of 64,000 acre feet a year. Whatever evaporation is charged by the Water Commissioner is charged to the project supply as a whole. That is a collective water supply that belongs to the Provo Water Users Association. Now each subscriber of stock in that association then has the right to hold over water in the Deer Creek Reservoir each year that the capacity is available and his right is not in direct proportion to the stock he owns but it is in proportion to the relation of the percentage of his stock to every other stockholder that is holding water over in that reservoir that particular year.

Now if we have runoff that comes along and crowds these individual stockholders out, the spill comes first from the stockholder having the most holdover in the proportion his stock bears to every other stockholder holding over water, and then comes the next fellow and then it spills from both of them until they reach the third fellow, and it goes on down to the last one and then they all spill equally in proportion to their percentage. We have worked it for five years and it works swell. We keep books every day and it works out very well. The evaporation is charged to each one according to his acre feet per month.

THE CHAIRMAN: Mr. Larson, while you no doubt have used that method successfully on the Deer Creek Reservoir, you must remember we are talking about a chain of reservoirs and this bookkeeping account of that character would seem to be quite complicated, at least to the Chairman.

MR. LARSON: Well, there won't be over half a dozen main stem reservoirs I don't think, Mr. Chairman.

THE CHAIRMAN: Well, it seems to me this water would have to be chased through each reservoir and an account set up for that water and the Chairman is at least at this time of the opinion that such a system of debits and credits would introduce complications galore.

MR. LARSON: You asked me if it could be done.

THE CHAIRMAN: And you gave me a good answer also; and it is the hope of the Chairman that some way of putting this water that reaches the main stem reservoirs into a pool will be worked out eventually.

MR. ROLLINS: Mr. Chairman, may I ask Mr. Larson whether or not there will be one or more reservoirs on the main stem or tributaries sufficiently high up so that we in Wyoming could be taken care of in case of dry years not only on our obligation at Lee Ferry--and I think that could be taken care of through a pool of reservoirs lower down--but if we didn't have one of those reservoirs high enough so that in case of severe drought we couldn't be taken care of so far as our actual operations are concerned?

MR. LARSON: Mr. Rollins, the Kendall Reservoir is the largest reservoir of any consequence high on the Green River in Wyoming, the highest point. We have been working on the operations of that reservoir to take care of any needs, including carryover for drought years, on any potential projects in Wyoming. As far as meeting obligations at Lee Ferry, certainly the obligation of Wyoming can be met just as well in a reservoir lower down than one

way up at the head of the stream.

MR. ROLLINS: If the Kendall Reservoir, of course, is in your thinking at this time so that you are making sure we are protected, that is all I want to know.

MR. LARSON: It is not just in our thinking; we did about $10,000 worth of drilling a couple of months ago.

COM. WATSON: May I ask what the evaporation rate is at the Kendall?

MR. LARSON: I have listed the evaporation rates of all reservoirs at previous meetings. I would like the Commission to know our estimations are very, very rough. The reservoir sites should be carefully inspected and that is what we intend to do, to arrive at a more exact figure. But a rough figure I have arrived at up to now is about 26 acre feet per thousand acre feet of capacity per year at Kendall.

THE CHAIRMAN: Thank you, Mr. Larson.

COM. STONE: Mr. Chairman, on this question which is before us and the factor which was suggested by Colorado for consideration, the discussion has gone into details of matters which must be finally decided by the Commission. In order to get the specific question before the Commission I should like to make this motion:

It is moved that recognizing the necessity of working out a method for meeting deliveries at Lee Ferry under the terms of the Colorado River Compact, spread over the Upper Basin on an equitable basis so as to minimize the effects of such an obligation, that whatever the several obligations of the States of the Upper Division may be under the final determination of this Commission shall be and constitute a State obligation.

THE CHAIRMAN: Is there a second to the motion?

COM. STONE: I attempted to incorporate the principle suggested by Judge Howell and to confine this motion to the simple question of it being a state obligation as distinguished from the obligation of certain tributaries or individual projects or groups of projects. And if you want to make that motion read "it is tentatively", I will be glad to incorporate that.

THE CHAIRMAN: Is there a second to the motion?

COM. WATSON: Second the motion.

MR. WALLACE: The only comment I repeat is, the broader the base the less suffering.

COM. STONE: I included that, Mr. Wallace. I included that principle here by these words--

COM. WATSON: Read it all over again, Judge; then we will get it clearly.

COM. STONE: I would suggest that the reporter strike out my other motion and I will read it again and incoporate the word "tentatively."

I move that recognizing the necessity of working out a method for meeting deliveries at Lee Ferry under the terms of the Colorado River Compact--then Mr. Wallace--spread over the Upper Basin on an equitable basis so as to

minimize the effects of such an obligation, it is tentatively agreed by the Commission that whatever the several obligations of the States of the Upper Division may be under the final determinations of this Commission, these obligations shall be and constitute a State obligation.

THE CHAIRMAN: Does the Chair hear a second to the motion?

COM. WATSON: I second the motion. I understand the word "tentatively" is in there.

COM. STONE: That is incorporated, Mr. Watson, yes.

THE CHAIRMAN: The Chair would like to ask a question: Is it or is it not a fact that this motion is disposed of by the respective state laws and what effect would a motion or a resolution by this Commission have on the matter?

COM. STONE: Well, Mr. Chairman, there have been proposals made here which transcend state laws and it simply brings out the proposition that it is in the end, whatever the obligations are, an obligation of the respective states. You could argue that is the law anyway but some may disagree. It is simply a matter of principle.

THE CHAIRMAN: Off the record. (Discussion off the record.) You have heard the motion and the second. Is there any discussion of the motion?

MR. BLISS: Judge Stone, there seems to be some question. Simply stated your motion means that whatever the states' obligations, they administer their own affairs within their own state?

COM. STONE: Has that effect, yes. It is a state obligation rather than the obligation of anyone else or any group of persons. In my judgment it is a clear question of law because the states are signatory to the compact.

MR. WALLACE: Mr. Chairman, I am asking Mr. Watson if I may say a word or two. I feel very strongly that the obligation at Lee Ferry is an obligation on the Upper Basin States, and that the 7,500,000 acre feet allocated to the Upper Basin is on the same priority excepting that people who actually built and constructed and used a project prior to the ratification of the treaty have a priority; all the other water is on the same basis. I must allow that being so any state can arrange its own priorities within its own allocation, but I think it would be a very desirable thing indeed that in case of extreme drought, the administrative body could say to everyone within the Basin, "You plant three-quarters of a crop this year in place of a full crop." In other words, I think some of these things could be left safely to an administrative body that is constituted fairly and on which we can depend to act equitably. I don't like the idea of lessening the area that bears the burden of a catastrophe.

COM. WATSON: Mr. Chairman, the Colorado River Compact as I read it did not provide for an extreme emergency such as extreme drought, which was incorporated in the Mexican Treaty. It was therefore the thought of the framers of the Mexican Treaty that contingencies might arise that had not been thought of by the framers of the Colorado River Compact for which we must provide. Would it not be well for this Compact Commission to provide for that contingency in a manner similar to the way the Mexican Treaty provided for it and along the line Mr. Wallace has just spoken?

MR. BREITENSTEIN: May I say something, Mr. Chairman?

THE CHAIRMAN: Mr. Breitenstein.

MR. BREITENSTEIN: I recognize the point that Mr. Watson just raised in the list of factors I gave yesterday, I raised that very point, but I consider that is a separate and distinct point from the one we are preparing for here. Recognizing what Mr. Wallace says, nevertheless I think you cannot escape the fact that the states as states are signatories to the Colorado River Compact and that the obligations are state obligations.

Now Mr. Wallace suggests that it might be well in times of extremity to tell everybody, "You plant a half or three-quarters crop." Perhaps that is the equitable thing to do but so far as the states of which I have any knowledge are concerned you are going to have to change your state constitution and the Constitution of the United States before you are going to do that.

MR. WALLACE: I can't agree with that.

MR. BREITENSTEIN: How can you tell No. 1 to plant only half a crop? No. 1 has a vested water right.

MR. WALLACE: There are a lot of things where you are managing a situation in case of extreme drought or catastrophe where by agreement the strict interpretation of the law is set aside and voluntarily all the people agree that under the catastrophe circumstances, certain other rules apply.

MR. BREITENSTEIN: Yes, but, Mr. Wallace, you are talking there about a voluntary agreement. We are talking here about a compact which will have the effect of a law. That must comply with our various state constitutions. Certainly in times of extremity we may all want to be good neighbors and we may voluntarily agree to do this and I say that is fine and dandy. But we can't write that into a compact unless you are going to change some state constitutions and also the Constitution of the United States.

MR. WALLACE: I only refer to the one thing that sticks in my mind that I want to broaden the base of the area that has to pay for a catastrophe that is local in its character.

COM. STONE: In answering the suggestion of Mr. Wallace, assuming for the sake of principle we are attempting to set out in this motion that that could be accomplished, but recognizing that there are probably constitutional questions involved, and if we did work out a broad base or whatever base we work out, the obligation to effectuate carrying out that base of deliveries finally becomes a state obligation. In other words, one state can't exercise extraterritorial jurisdiction over another and the states are signatory to this Compact and whatever we do agree to, without commenting upon what arrangements we will make to spread this obligation, that is a detail which we haven't discussed--but whatever we agree to becomes the obligation of a state to carry it out. That is on my motion.

MR. WALLACE: May I say, sir, with the allocation of a given amount of water there goes a concurrent obligation.

COM. STONE: That is unquestionably correct.

THE CHAIRMAN: Is there further discussion of the motion?

COM. BISHOP: Mr. Chairman, it seems to me it is a joint obligation regardless of any agreement we make here for the simple reason that there will

be times evidently when some state doesn't have the water to pay and then the others have got to pay. It is just like this joint note Mr. Breitenstein talked about a moment ago. It has got to be paid. It looks like it is a joint obligation regardless of any agreement we make.

COM. STONE: Let's distinguish between the Colorado River Compact and the compact we are negotiating. It is a joint and several obligation under the Colorado River Compact. We can agree here as to the manner in which we shall carry out the several obligations and that is what we are dealing with. In other words, if we make an agreement, whatever it may be, for the meeting of this obligation at Lee Ferry and if a state violates that agreement, that violation is a violation of the state and the state is responsible for it. That is all this goes to.

COM. BISHOP: Let me give you a concrete example of what I have in mind: We will say we get 20 percent of this water and we are assessed 20 percent of the obligation at Lee Ferry but we have a drought in the Green River Basin and we don't have but 10 percent. Certainly we aren't violating anything if we can't produce that water and Colorado has got maybe 20 or 30 percent more than their obligation and they are on that note with us and as I said it is their obligation to pay and there is nothing we can write into an agreement or a compact that would keep the Lower Basin from compelling them to pay.

MR. BREITENSTEIN: May I say something in answer to what Mr. Bishop said?

THE CHAIRMAN: Yes.

MR. BREITENSTEIN: Say we don't have a drought, Mr. Bishop; say instead of having a drought we in Colorado take 5,000,000 acre feet over the mountains and that is the reason you have your deficit down at Lee Ferry. Now what would you say on that? There you have the reverse.

COM. BISHOP: I would say cut off the transmountain diversions right now.

MR. BREITENSTEIN: Say we use 5,000,000 acre feet in the Basin which is more than our share and your water is going to make up a delivery down at Lee Ferry; don't you think you would have some recourse against us to compel us to do the right thing?

COM. BISHOP: That is a different situation.

COM. STONE: That is the situation we are talking about. Who is your recourse against? Is it against the state or is it against some individual?

COM. BISHOP: I agree with you that each state should live up to their obligation within their ability to do so, Judge.

COM. STONE: You can't get any recourse unless you rely on the state and that is all this means. It has been suggested that this might be clarified by inserting these words: "That recognizing the necessity of working out a method for meeting"---I have---"deliveries"---"meeting the joint and several obligations to make deliveries at Lee Ferry." And I will add those words to my motion to clarify the intent.

COM. WATSON: I will second the motion under those conditions.

COM. WILSON: May I ask Mr. Breitenstein a question?

THE CHAIRMAN: Yes.

COM. WILSON: Under those assumptions you gave a moment ago about Colorado and Wyoming you said there ought to be a liability which Wyoming could pursue against Colorado if Colorado did what you suggested. Now what is your idea as to the nature of that right Wyoming would have against Colorado? Would it be a suit for damages or a suit for specific performance in the future? What is the nature of the obligation that Wyoming would have a right to look to Colorado to make good?

MR. BREITENSTEIN: Well very unfortunately, Judge Wilson, Colorado and Wyoming have been just in that situation once before; and the Wyoming authorities no doubt after very serious consideration of what they might do, brought an action in the United States Supreme Court to have Colorado cited for contempt of that Court. Here it would be for breach of a contract rather than a violation of a Supreme Court decree.

In that connection I am sure that both the attorneys for Wyoming and Colorado did consider what the Supreme Court might do and if you look in the law books there is one decision of the United States Supreme Court which indicates possible methods of approach to that problem including the use of force. But that is a matter on which there are decisions, at least one rather pertinent, and an action against the state for breach of a contract probably in the first instance would take the form of an injunction to prevent further violations of the contract and perhaps requiring some remedial action to alleviate whatever damages had been incurred.

I will just conclude by saying in that case brought by Wyoming very fortunately Colorado was found to be not in contempt.

COM. WILSON: Then the purpose of this motion is to make it clear that there is a liability on the part of one state to another state in the Upper Basin--

COM. STONE: That is right.

COM. WILSON: --rather than just to declare the plain law from the Colorado River Compact angle, it is a state obligation. In other words, the Lower Basin looks to the states to carry out their contract. But the purpose of this is to create a liability in favor of one state in the Upper Basin as against another if the states do not carry out their obligation.

MR. BREITENSTEIN: You know, Judge Wilson, the more I have listened to this discussion the more I have come to the conclusion that Colorado was wrong in raising this point because thus far we have been producing most of the water. We are sticking our necks out on it. I think we made a mistake in raising the point frankly.

MR. GILES: I don't think so. I think your motion is good. As far as I am concerned I see absolutely no harm in it. I think it is necessary in the considerations that are before this body right now.

COM. WILSON: I wasn't arguing against your motion; I was just trying to understand it.

MR. HOWELL: Can't it be simply stated this way: It is simply a contract for contribution of those who are jointly obligated.

MR. BREITENSTEIN: That is right and that is all it is, Judge Howell.

COM. STONE: And the parties to the contract are to meet the obligation.

MR. HOWELL: Yes.

MR. WALLACE: Off the record. (Discussion off the record.)

THE CHAIRMAN: It has been suggested that in view of the rather sharp discussion which this item has provoked that the matter be laid over until tomorrow morning and that the Chairman keep his promise to adjourn this meeting at 3:30. Is that satisfactory to the Commission or do you wish action on the motion at this time?

COM. STONE: Colorado wouldn't press action at this time but if there is no objection to it we might as well dispose of it.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

(Com. Stone's motion as amended was as follows: I move that recognizing the necessity of working out a method for meeting the joint and several obligations to make deliveries at Lee Ferry under the terms of the Colorado River Compact spread over the Upper Basin on an equitable basis so as to minimize the effects of such an obligation, it is tentatively agreed by the Commission that whatever the several obligations of the States of the Upper Division may be under the final determinations of this Commission, these obligations shall be and constitute a State obligation.)

(Thereupon a vote was taken and Com. Stone's motion as amended carried unanimously.)

THE CHAIRMAN: We will convene here tomorrow morning at nine o'clock.

(3:30 p.m., Wednesday, December 3, 1947, recess until 9:00 a.m., Thursday, December 4, 1947.)

Denver, Colorado
December 4, 1947
9:00 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order.

COM. STONE: If you are on the record may I take up a preliminary matter which this Commission should consider before we adjourn? I do it now for fear I will forget it after we get into discussion of other matters. It is this matter:

It was indicated to the Commission I believe on the first day of this session that the Engineering Advisory Committee had sought the advice of Mr. Blaney on the question of beneficial consumptive use of water. It was explained to the Commission and many of us know of our own knowledge that Mr. Blaney is perhaps the outstanding expert in this field in the United States. The thinking of the Engineering Advisory Committee as I understand it--and if I am wrong Mr. Riter can correct me--is that they would like to have their conclusions on this subject reviewed by an outside impartial person, and fortunately there is such a person available who is recognized as an expert in the field.

Some discussions have been had with Mr. Blaney regarding his services. He is a Federal man. What is the Agency that employs him, Randy?

MR. RITER: Soil Conservation Service.

COM. STONE: His boss, Mr. Clyde, has agreed that Mr. Blaney's services may be made available without any cost to the states or this Commission, but due to limited appropriations nothing is available for the travel expense of Mr. Blaney. It would be necessary for him to meet with the Engineering Advisory Committee, and as I am advised, to make a field trip over the area involved. At least the field trip has been recommended by the Engineering Advisory Committee and deemed advisable by Mr. Blaney. If this Commission is to have the advantage of his consulting service free of charge we must make available the travel expense, and it would seem to me we ought to take advantage of it, particularly since it is recommended by the Engineering Advisory Committee, that we ought to find ways and means of providing the travel expense.

I am informed that the field trip and for attending meetings of the Engineering Advisory Committe, that such travel expense would not exceed in all a thousand dollars. I would apprehend that no portion of the expense should be charged to Arizona because of its limited interest in the work that Mr. Blaney would do.

I would like to suggest--I am not going to put it in the form of a motion until there has been some discussion of it--that we arrange to provide that travel expense. I want to say for Colorado, my State is willing and thinks it advisable to provide our share of that travel expense.

COM. BISHOP: Judge Stone, I think that is a mighty good idea. Wyoming will go along and gladly pay our share. We want the field trip to include Wyoming's part of the Basin and Wyoming will go along in furnishing transportation for the party to go over our Basin. We would like to know ahead of time when he is coming. We will go along with you 100 percent on that.

COM. WATSON: Utah will carry its burden and its proportionate share of the total expense.

THE CHAIRMAN: What about New Mexico?

COM. WILSON: I think this expense can be handled just as the other ordinary expenses of this Commission like stenographic expense and things of that kind, and New Mexico is willing to pay its proportionate share just as we have on the other expenses. Is that your idea, Judge Stone?

COM. STONE: Yes, that was my idea. And there is another detail which ought to be considered by the Commission in connection with this matter. These states all have different rules and regulations about state travel, and obviously a man working in this capacity as an outsider cannot comply with the rules and regulations of all of the states. It seems to me that the money to cover this expense ought to be paid into a common fund in the hands of the Secretary of this Commission so that when Mr. Blaney submits his travel expense, it could be paid by the Secretary.

COM. BISHOP: The Attorney General can speak for himself but I believe according to the rules that have been made by our Attorney General and his predecessor, they would have to submit a bill for the expense after it had been incurred. I will pass that on to you, Mr. Gray.

MR. GRAY: Well, I think if a statement were submitted from the Commission itself, Mr. Bishop, we could handle it all right. I have some funds available for that purpose if you can't get them.

COM. BISHOP: That is all right. That is what I wanted to know.

THE CHAIRMAN: Gentlemen, I wonder if you have explored this question of travel expense thoroughly. In the beginning of this work your Chairman took matters up with the various Federal Departments and it is my recollection there were no strings attached to the help which the Department of Agriculture was willing to furnish in working out the problems of this Commission.

COM. STONE: I can answer that question, Mr. Chairman. The Department of Agriculture does not have any strings in furnishing the services but Mr. Clyde says emphatically that he has no money to even carry on travel expense which he deems necessary for his own purposes and that he has no money to pay these travel expenses for Mr. Blaney. He said he would do it if he had it but he recognizes this work has to be done expeditiously and now, and he can't wait until another fiscal year. I saw him at Phoenix after some of the members of the Engineering Advisory Committee had talked to him and he said he regretted that that was the situation.

THE CHAIRMAN: Well in this connection I might say that Mr. Selby has been doing work in regard to the value of irrigation on these pasture lands. Apparently there was no difficulty in finding funds for that and of course my communications were with the Secretary of Agriculture. Mr. Brannen's letter to me didn't put any strings on it and I am wondering in this connection if the matter were taken up again with the Secretary of Agriculture that the matter might be disposed of.

COM. STONE: Mr. Brannan and Mr.Clyde and the big-shots were all in Phoenix and the matter was fully discussed within their own group and this offer of Mr. Blaney's services was made strictly contingent upon that condition that we would have to furnish the travel expense.

THE CHAIRMAN: Very well. All right. The Chairman is satisfied then.

MR. RITER: Off the record. (Discussion off the record.)

THE CHAIRMAN: Are you ready to make a motion?

COM. STONE: Yes. To get the matter before the Commission I move that the four participating states, Colorado, New Mexico, Utah, and Wyoming, share equally the travel expense incurred in obtaining the consulting services of Mr. H. F. Blaney for the Engineering Advisory Committee; and that Mr. Blaney's expense vouchers be submitted to the Secretary of this Commission, who will then call upon these states to contribute their share on an equal basis.

COM. WATSON: Second the motion.

THE CHAIRMAN: Is there further discussion of the motion? (No response.) Ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

THE CHAIRMAN: At this time we would like to hear from the State of Utah and its presentation of the factors which it thinks should be considered in the negotiation and formulation of the proposed compact.

COM. WATSON: Mr. Chairman, ladies and gentlemen, I realize that a statement of this kind is somewhat repetitious considering what has been said and that it may be imperfect; however, the group from Utah wishes to submit this statement in writing for your consideration and criticism. The statement involves both principles and factors.

"In negotiating the Upper Colorado River Basin Compact, the two primary problems are (1) to divide the water equitably, and (2) to allocate the obligation at Lee Ferry. Our objectives have already been well defined in Article I of the Colorado River Compact, wherein our major purposes are declared to be 'To provide for the equitable division and apportionment of the use of the waters of the Colorado River System; to establish the relative importance of different beneficial uses of water; to promote interstate comity; to remove causes of present and future controversies, and to secure the expeditious agricultural and industrial development of the Colorado River Basin . . .'

"To accomplish the objectives of an equitable division of the water, no one factor should control. In the light of the present data, consideration of the following factors appears to be essential:

"1. We recognize that the Colorado River Compact is the existing law of the River.

"2. We must protect existing rights; by existing rights we mean those rights acquired by appropriation, and having vested prior to the ratification of the Colorado River Compact. Any rights initiated to the use of Colorado River water thereafter must, as between the states, be recognized as having equal priority.

"3. Since we have declared it to be one of our major purposes to establish the relative importance of different beneficial uses, and since each state in the Upper Colorado River Basin adheres to the doctrine of prior appropriation, Utah believes that the fundamental precepts of that doctrine must be given considerable weight in any equitable apportionment of the water.

The cornerstone of that doctrine is, beneficial use. In states following the appropriation doctrine it is universally held that beneficial use is the basis, the measure and the limit of the right. In apportioning the water, regard must be had for potential beneficial uses.

"4. Because of wide fluctuations from year to year in stream flow, the maximum use of water available to the Upper Basin States is entirely dependent upon availability of storage facilities. Storage water subject to call is more valuable than direct flow. The total amount of water that can be consumptively used by the Upper Basin through direct diversions can be greatly increased by the efficient use of storage facilities. Utah asserts that the contribution of such facilities has an even higher use value to the Upper Basin than does the contribution of water. Therefore, an equitable apportionment of the River's water requires that contribution of storage facilities by any state be given substantial weight.

"5. The ultimate development of the States of the Upper Basin depends on the availability of cheap electric power. The fast-growing industries of the Upper Basin offer a ready market for this power, provided of course that at the same time water is made available for domestic and irrigation use. We, in Utah, believe that the availability of cheap hydroelectric power throughout the Basin lies at the foundation of our prosperity.

"6. For the ultimate benefit of these compacting states it is indispensible that storage facilities be selected on the basis of their greatest efficiency.

"In addition to the factors or principles set out above, Utah recognizes that there are various problems which should be resolved before a compact is written. In that regard we list the following for purposes of discussion:

"1. A Board of Control consisting of a representative from each state and from the United States should be created to administer the River in accordance with the terms of the compact.

"2. The question of whether this compact shall endure in perpetuity or for a fixed term should be resolved.

"3. The rights of the United States and its agencies should be determined and protected either independently, or as a part of the allocation to each state, or otherwise.

"4. It should be determined how comprehensively this compact should cover particular problems interstate in character affecting less than all of the states.

"5. The methods to be adopted to control operation of main stem reservoirs.

"6. Determine consumptive use.

"7. The priority of water uses should be fixed.

"8. The basis for allocation of the obligation at Lee Ferry should be determined.

"9. We should establish the basis for dividing the water

apportioned to the Upper Basin by the Colorado River Compact."

I realize there are several outstanding points that may not have been discussed although they were mentioned. I would like to spend a few moments in discussing some of these problems that Utah considers outstanding. What I say may apply to all of the Upper Basin States in some respects and I am not contending that Utah alone contributes all of these factors. Some of them I shall mention obtain in all the states, and certainly I do not wish to make an argument about it.

I believe that very few of us realize the great development that will take place in the next twenty-five years in the Upper Colorado Basin. I do not think any of us are conscious of that fact. I shall make mention of a few of the resources.

In the Upper Colorado River Basin, as you all know, we have one-third of the coal reserves of the United States. We know also that the petroleum reserves of the nation are dwindling very fast and that the creation of synthetic processes for the manufacture of liquid fuel from coal have advanced at a rapid rate. By 1965, it is believed by some that the daily consumption of oil in the United States will be seven million barrels. One-half of this amount, it has been estimated by experts, will have to be furnished by synthetic fuel and not from the underground as it is in our present economy. Therefore, the coal reserves of the Basin will be drawn on very rapidly, not only for the uses of coal itself, but for the synthetic manufacture of oil. Oil-bearing shale will also be utilized. The hydrogenization of coal will probably be adopted prior to the use of shale for oil.

This coal in the Basin will be used, in addition to the process of hydrogenization, for the establishment in the Basin or out of the Basin of very large chemical plants. That is best shown by the fact that at the present time in the United States organic chemical factories are twice in number to the inorganic factories. This presses the question to the utilization of coal for these organic processes. I call your attention to the fact that even the Denver & Rio Grande and Union Pacific railroads are using oil for transportation at the present time.

The development of this coal will be common to all the states; however, tied in with the industries using coal, there will be still other industries that will be affected which I shall mention briefly a little later.

The Basin also contains very large deposits of carnallite near Thompson, Utah. The carnallite deposits are valuable and contain magnesium and potassium chloride. They are similar in extent to the deposits that made pre-World War I Germany. We have them in large quantities near Thompson, Utah.

I wish to mention in passing the phosphates which occur in all three states in the Basin, Colorado, Wyoming and Utah, and also out of the Basin in Idaho. In the area around Vernal the phosphate deposits are readily accessible as they can be mined by a steam shovel. They dip slightly away from the south flank of the Uinta Mountains. They are those white beds just at the bottom of those brilliant red beds. They lie in large quantities near Echo Park damsite where electricity will be available for their exploitation.

Tied in with all of these resources is the availability of hydroelectric power around which the development of the main stem of the river will be largely built. The State of Utah has recently issued a power survey report in cooperation with the Federal Power Commission. That report is available to any of you if you will write to the office of the State Engineer. The report predicts that Utah's demand for hydroelectric power in 1970 will be 800,000

kilowatts and by 1990, 2,500,000 kilowatts.

We think in Utah that these great resources will react to the benefit of all of the Basin states. A large part of the industry will be concentrated on the Wasatch front due to the fact that power will be transmitted a lesser distance. And may I add that it will be necessary for the Government to control the transmission lines. It will transmit the electric power into all surrounding states. However I repeat that the United States Government must control the transmission lines of the power projects in order to get cheap electricity to the people.

Now, over on the Wasatch front, we think that inasmuch as a large population has grown up there and that a great steel plant has recently been built that will bring in many accessory industries, this hydroelectric power developed on the Colorado River will be marketed very largely in that area. In fact, authorities have stated that eighty percent of the power marketed will be on the Wasatch front.

If that should be the case, we must consider the question of beneficial use and the order of beneficial use would be very high indeed in that area. I do not contend that the beneficial use in the Colorado-Big Thompson area is not of a high order but I do contend that in the area along the Wasatch front it would probably be of the very highest order. Water will be demanded for municipal use, for the raising of high-priced crops and for the operation of large industrial units in connection with Geneva and Columbia Steel. We therefore think that a definition of beneficial use is primarily important.

Regarding the division of the water between the States of the Upper Basin I think that there should be no priorities built up between the states since the time of the consummation of the Colorado River Compact. We hope that the State of Colorado can get its transmountain diversions and likewise we believe that Wyoming, New Mexico and Utah can get certain projects. We think that there is water available for these projects, even if we consider the minimum flow of the River. Certainly there is enough to give all of us a good start, even though we are compelled to divide only part of the water.

COM. STONE: Mr. Chairman, Colorado wishes to commend Utah for a constructive statement of the factors and principles involved. We wish of course, in line with the ones submitted by Colorado, to consider all of those questions mentioned. They deserve serious study and consideration.

COM. BISHOP: Mr. Chairman, I wish to compliment Mr. Watson on a very excellent statement and while I don't agree with all the statements he made, I think he has outlined factors that must be considered and I think we should recognize that and go ahead and consider those factors.

COM. WATSON: May I add that regarding all these transmountain diversions which appear so costly at the present time, we believe that hydroelectric power generated on the Colorado River above Lee Ferry will pay for all of them and for all feasible irrigation projects whether they are located in Wyoming, Colorado, New Mexico or Utah. If the profits from that power can be pooled, we will all benefit.

THE CHAIRMAN: The Chair observes, Mr. Watson, that you don't say in what length of time these projects will be paid for by power and I think it is very well you didn't attempt to limit it.

COM. WATSON: I think that is a very moot question and of course I

realize, Mr. Chairman, there is a great controversy between public and private power but I wish to add this observation: If it hadn't been for the very great resources of public power in the Tennessee Valley and in the Columbia Basin and at Boulder, we never would have won this war because we never could have manufactured the aluminum to make the airplanes which put out the eyes of the enemy. Neither could we have manufactured an atomic bomb. Now if public power can win the war, which it did as the greatest single contributing factor, public power can also win the peace. Likewise it can develop the Colorado River.

THE CHAIRMAN: Does the Commissioner from Arizona wish to submit any statement as to factors which in his opinion should be considered?

COM. CARSON: No, I don't think I could bring in any new factors that haven't already been mentioned. I think I could say this: that in my judgment some factors have here been mentioned and the discussion has taken a wide range that cannot probably be imposed in any compact that may be worked out. It seems to me the compact we must work out and all want to work out is confined to an equitable apportionment of the water of the Upper Basin and to arrive at that we must have information, not only as to the flow of the River at Lee Ferry but as to the flow of tributaries which in themselves are interstate, and any compact written must provide what portion of any state's share will come out of one of those tributaries which are in themselves interstate.

Then when we have arrived at that, and on the percentage basis which has been tentatively adopted, I believe we will be down to where we can begin to formulate or negotiate a compact of the percentages allowable to each state, specifying what part of that percentage would come from an interstate tributary.

On the other, in the main we recognize of course that we in Arizona are very slightly interested in the Upper Basin water and the division of that water; so we want to go along and be as helpful as we can in working out a compact but are not directly involved in the percentages which should be allowed to each state.

THE CHAIRMAN: It is your idea, I suppose, Mr. Carson, that the information which you mention cannot be finally and definitely determined but that it can be approximated, and it is realized it is based on a moving average.

COM. CARSON: That is correct, and the percentage would probably balance out any changed conditions or error that might result now in any of the engineering studies as to estimated evaporation losses, depletions, and salvage, so that it would work equitably and fairly. I don't take it that the flow of the Colorado River or any of its tributaries is capable of exact ascertainment or prediction as to what it will be in the future, but we can come as close as we can and then try to be fair. Then if there is any change on the percentage method it would affect all equally that are involved in that particular interstate tributary or the main stream.

THE CHAIRMAN: The Chair thanks both Mr. Watson and Mr. Carson. Now the Commissioner from New Mexico, do you have any further factors to suggest for consideration of the Commission?

COM. WILSON: Mr.Chairman, I will say at this time I want to join with the others in complimenting Mr. Watson of Utah for his very excellent presentation of many factors that are important and which we must consider. I have nothing personally to add to what I said the other day in attempting to make a statement that avoided detail and tried to stay within what I regard as fundamentals. However Mr. Bliss I think has some factors he would like to mention and discuss at this time.

MR. BLISS: Mr. Chairman, I would like to second what Judge Wilson and Mr. Carson have said. I think we are taking up details at the present time which to some extent, perhaps in some cases to a large extent, will be dependent upon the main issue which apparently we are now avoiding, the issue of the division of the water. I have a few comments which have been mentioned in Colorado's excellent presentation and which have been mentioned to some extent by Utah and Wyoming, but which I want to repeat because they apply directly to the State of New Mexico. I think the other states have made an excellent presentation of factors which must be considered. The items I have to present are these:

1. An agreement between the states covering the allocation of water must of course include agreements as to the obligation of tributary stream flows. This is axiomatic perhaps and yet I think it should be mentioned at this time.

2. There is a question whether or not allocations to the various states can or should be final at this time; or whether tentative allocations can be made which could be increased or perhaps decreased at a later date.

3. The question of Indian rights. Should allocations to the Indians be a part of each state's obligation or should the allocations in the compact to the Indians be made separately, as though to a sixth state? This is a matter of vital importance to the State of New Mexico. The fact that perhaps 90 percent of the water which may be available to New Mexico could physically be used on Indian land to the exclusion of white lands emphasizes the importance of that problem. I don't say that such percentage could be economically used on Indian lands but physically it could be. I believe that the Indian Service should be required, in spite of the Winters decision or any other Supreme Court decisions, to come in at the time compact allocations are made and commit themselves once and finally to whatever their claims may be. I think it is essential to the complete allocation of the water of the River that they be required to do so. I don't see how a satisfactory agreement can be drawn if the question of Indian rights is forever unknown and variable.

4. The question of the function of these main stream reservoirs. As has been pointed out it is evident that in spite of the preeminence of irrigation rights the only way we are going to pay for many of these irrigation projects is by the sale of power. If we recognize that principle, then it seems to me we have got to so operate our power pools that they can at all times supply the firm power to pay these costs. That may be a detail of operation but I do think it is important.

Another factor to be considered concerns the rights and obligations of the states in the main stream reservoirs. In former interstate agreements the principle of the sovereignty of each state's rights within its own boundaries is recognized. Yesterday we adopted that principle by a motion unanimously passed. But I am wondering if in the operation of the main channel reservoirs some different arrangement may not have to be made. I don't know. If the states are to have individual ownerships or rights in the reservoirs, that is one matter. If they are to have joint or common pool rights in a reservoir, that is another matter. If the states exercise individual rights in the common reservoirs, the Commission must consider the matter of contributions, the liability of each state for reservoir losses and their liability for deliveries from the reservoir in case of shortages.

Finally, there is a matter which I want to bring to the attention of the Commission for its consideration. I don't know whether it has merit but it seems to me it has. There are three kinds of uses in the Basin, the

first of which is the present or approved uses, which of course are primary. Then there are a series of projects which engineering analysis shows can be developed without utilizing the large holdover storage in main stream reservoirs and still make required compact deliveries at Lee Ferry. The amount of such use has not been definitely determined. It has been variously estimated at from 1,500,000 to 2,500,000 acre feet. Probably around 2,000,000 acre feet of water can be utilized by projects within the states without the use of the basin or channel reservoirs which will provide large holdover storage.

The third block of water is that water which can be used only by virtue of the large main channel reservoirs.

It seems to me that a logical provision would be to allot among the states, as a first step, the block of water which can be used in state developments without the use of main channel reservoirs. That block could probably be used in making as a first or initial allotment of water. Later or perhaps currently, when large channel reservoirs are made available, new projects which are dependent upon such reservoirs could be developed which, it seems to me, would have a special status. They should be obligated to deliver water at Lee Ferry in case the main channel reservoirs cannot supply such water.

I just throw this idea out to you for whatever it may be worth, Mr. Chairman.

The other matters have been mentioned by Colorado and Wyoming and Utah and I don't think I will repeat them here at this time.

COM. STONE: Mr. Chairman, Colorado has on many occasions negotiated on interstate water matters with New Mexico, and this statement of New Mexico indicates their usual careful consideration of very important matters. I particularly feel that New Mexico does have a question relating to that state which deserves very serious consideration, that is the question of the Indian rights, and it is my judgment that matter should be very carefully considered in appraising the equitable rights and interests of all these states. This statement of the Indian Service indicates that New Mexico and to a certain extent, not as great an extent but a considerable extent, Utah has a question there which we cannot avoid, without very thoroughly and with an open mind appraising and considering in arriving at the equitable rights and interests of these states.

MR. WALLACE: Mr. Chairman, on that matter I am interested very much on behalf of the State of Utah. If this statement made by the Indian Service is correct, Arizona would have 22,000 acres, Colorado 20,350 acres, New Mexico 192,000 acres, and Utah 100,220 acres. The question of Indian rights I think is never very clearly defined or settled for all time but the claim on the part of the Indian Affairs Bureau of the United States is very great. Apparently it goes to the fact that the Indians may use the water now or at any future time.

Now some of us think that the Indians are entitled to the water when they can take it out of the natural flow of the stream and that if they go outside the natural flow of the stream for the purpose of reservoiring, then they must submit to the same regulations as the white man does.

Our Indians are pretty well taken care of in Utah so far as water supply is concerned and in that sense our interest isn't so great in the future development as that of New Mexico, but this does very strongly affect both Utah and New Mexico. I think the time has come when there should be a settlement of it even though it requires legislation on the part of Congress. The Indian

should have all the rights to which he is entitled but he should not be permitted to stand in the position where development must cease.

Therefore, Mr. Chairman, I think there should be a committee appointed upon which both Utah and New Mexico are represented to go to Washington and sit down with the Office of Indian Affairs and go to the Secretary of the Interior until finally an arrangement is made under which the Indians get a square deal and progress need not be stopped. We talk about these things, have been talking about them for two or three years, but we haven't taken hold of the nettle and it is time we did. I think it is entirely possible that those who represent the Indians are fair-minded men and I hope this group are fair-minded men, and a settlement should be made upon a permanent basis so we need not go forward with this worry. And certainly you can't agree upon a final development of this river until we know exactly what must be done as to the Indians. What do you think about it? Off the record a moment. (Discussion off the record.)

COM. WILSON: I want to say this: Of course the Legal Advisory Committee that has been appointed has discussed somewhat the Indian problem along with other problems, and whether it is necessary to do what Mr. Wallace said and form another committee--that might have some merit in it. I will say this at the present time--I can't state New Mexico's position as unalterable, it is just my opinion now--that as far as this Indian question is concerned, when it comes to an allocation of the water, New Mexico doesn't make any distinction between the Indians and the whites. They are all residents of New Mexico, they are all land owners in New Mexico, they are within the Basin, and they are entitled to their fair share of whatever apportionment is made.

I do feel of course it is nothing but right and fair and equitable that in making that allocation, that matter be considered as far as the needs of any state are considered when you look at its population as a whole. That has been my thinking up to the present point on this Indian problem, that New Mexico and Utah and any other state that has Indians in it are entitled to have it considered that they do have Indian uses and Indian rights and any allocations made to them should take that into consideration. When you have done that, gentlemen, I think that is all you can do.

I don't want to preclude any further investigations or any further studies by committees or any efforts to have Congress pass laws. Personally I don't believe you can get Congress to pass a law that will determine the ultimate rights of Indians. I think you will find, Commissioner, that is a political question and the Supreme Court can't determine their rights for all time to come. Their rights exist and it goes back to the old idea they are dependent people and they are wards of the Government and the Government as a political organization will have to take care of the Indians.

If it could be settled once and for all it might be a very happy situation but I think you will find after you have gone into it there is nothing a committee can do, there is nothing Congress can do, there is nothing the Supreme Court can do. The Indians are citizens, they are land owners, and if they own land within the Colorado River Basin they have certain rights and I doubt, Mr. Bliss, if those rights can be made any more certain than they are now. The future will have to take care of that. From any allocation made to New Mexico, we will have to take care of Indians and whites the best way we can. That is my idea on it.

MR. WALLACE: Mr. Chairman, we had a great president of the United States once upon a time, his name was Grover Cleveland, and he said, "It is a condition and not a theory that confronts us." In this

particular instance we have a group of citizens of the United States who seem to have a special interest that cannot apparently be determined. Is that the point you make? Is there no way upon which we can agree with the Indian Service or the proper officials in the United States that will say, "The Indians have so much land, so many acres can be irrigated, and therefore the amount of water they require is so much"? Is there anything different in that than dealing with the white man?

Apparently we have all sorts of claims. I have heard they want 20 acres of land developed for each Indian family and then I read in another place that New Mexico wants 155,500 acres of land developed for the Indians. Surely negotiations can be made with the proper authorities and an understanding that is fair to everybody agreed upon as to the Indian lands and the white lands. We can't make an allocation to New Mexico, if you insist on having the Indian lands allocated to New Mexico--we can't agree upon an allocation until we know how much land there is for which we have to furnish water.

The only point I am talking about is this: that certainly there is somewhere in the United States authority that will determine what is a square deal for the Indians and that is the only thing I wish. I would like to determine what that is.

COM. WILSON: Congress will determine that when they are asked for an appropriation to construct Indian works just as Congress determines no matter how much water we have. If we want a project that is entirely whites, Congress will look at it and make the appropriation or refuse to make it and they do the same thing with the Indians. And, Mr. Wallace, if you owned a tract of land in Utah which was granted to you and it had a water right with it, I don't think the Legislature of Utah or Congress would attempt to take that right away from you or determine its limits.

MR. WALLACE: We are not asking the Congress to do that but the thing we are asking is an understanding to be made through which the Indians got a square deal and no more, and that the understanding be of such a nature that we can go ahead and develop this River completely and efficiently. Without such an understanding apparently we can't do it.

COM. WILSON: When Congress and the people of the United States granted the Indians certain reservations they granted those reservations with the knowledge that these rivers and streams were running through them and with the ownership of the land went the right to use water. You take that right away from them, whatever it is.

MR. WALLACE: Let's have an understanding what that right to use the water means. Does it mean you can go on the white man's land and make a reservoir and use more water for the Indians than they could from the natural flow of the stream?

COM. WILSON: The Supreme Court said it is the right to use whatever water is necessary to an enjoyment of the grant of land to them.

MR. WALLACE: Does that mean they can go on white man's land and build reservoirs and double their use?

COM. WILSON: That is a question you can't resolve in advance. What is necessary is a matter that is always open and which the courts are always determining. I don't think we can determine that now.

THE CHAIRMAN: We will recess for five minutes.

(10:45 a.m. Recess.)

(10:55 a.m. Meeting resumed.)

ACTING CHAIRMAN GILES: Gentlemen, Chairman Bashore asked me to call the meeting to order in his absence. He had to be excused for a few minutes. When the recess was taken the question of what procedure if any would be taken with respect to the determination of the claims of the Office of Indian Affairs was under discussion.

MR. WALLACE: I would like to say further in view of the opinion expressed by New Mexico, I see there is nothing further to do at this time but I remark at this time that if negotiations are made and the agreement made on the size of the Indian works and arrangements made for their construction, that would settle the problem.

COM. STONE: Mr. Chairman, I should like to have Mr. Breitenstein make a statement. I suggest that because Colorado has given some study to that question from a legal point of view and that would be the basis for a motion I have in mind unless somebody else makes a motion first. I should like to call on Mr. Breitenstein.

ACTING CHAIRMAN GILES: Very well, Com. Stone.

MR. BREITENSTEIN: Several years ago Judge Stone, who has the ability to see rather distantly in the future, brought up this question of Indian rights and asked me to write an opinion on it. I didn't know anything about Indians then but I tried to learn something about them and did get out an opinion and some of my conclusions are at variance with the opinion stated by representatives of the Office of Indian Affairs as to the rights of Indians. Maybe my conclusions are right and maybe they are wrong.

After that some students up at the University of Colorado became interested in the problem and they prepared an article which was published in the ROCKY MOUNTAIN LAW REVIEW. Most of their conclusions were the same as mine.

MR. WALLACE: Pardon me. That was by whom?

MR. BREITENSTEIN: That was by the University of Colorado Law School in the ROCKY MOUNTAIN LAW REVIEW. While we cannot of course foretell what action Congress may take, we can at least come to our own conclusions as to what the rights of the Indians are and as to what the courts might be reasonably expected to hold those rights to be in the future. I think there is a very serious question that the United States Supreme Court or any other Federal courts will hold that the principles of the Winters decision apply to projects on Indian lands which are not now constructed and in operation; and if I am right in that, it seems to me that the problem here presented is minimized.

In other words, I think there is a definite legal problem here which the Commission is entitled to refer to its Legal Advisory Committee and then to be guided in its future actions by their recommendations. If the other states have not made similar studies on this I heartily recommend that they do it.

COM. STONE: Mr. Chairman, to expedite this matter, I move that the legal question of the rights and interests of the Indians in Colorado River water be referred to the Legal Advisory Committee set up by this

Commission, for study and recommendations to the Commission. That is my motion.

In support of it I refer to the statement made by Mr. Breitenstein and I should like to remark that after studying his brief, it seemed to me that the Commission should be better advised concerning this as a basis in taking any action which it may take in the future. As Mr. Breitenstein says, the other members of the Legal Advisory Committee may not agree with the conclusions he reached in this brief, but it is a question where whatever is available on the subject should be studied by the Legal Advisory Committee. The Commission would be better informed and could act more wisely if we have the recommendations of that Committee before us, so I submit the motion.

COM. WILSON: I second the motion.

MR. WALLACE: Pardon me. Can you reproduce that opinion?

COM. STONE: Copies of this opinion can be reproduced and of course will be made available to the Legal Advisory Committee or we are willing, as far as Colorado is concerned, to make them available to all members of the Committee.

MR. WALLACE: They could be made available from our state. I am not a lawyer but I would very much like to have a copy of it.

COM. STONE: We don't need to worry about the expense of it.

MR. WALLACE: Will you do that and see that we get copies?

COM. STONE: There is no objection to that. The Law Article, I apprehend I will be able to get copies of the ROCKY MOUNTAIN LAW REVIEW. I am not sure I can but I will attempt to.

MR. WALLACE: I would like to personally have copies of those two documents. Utah is very much interested.

COM. CARSON: We would too.

MR. WALLACE: May we have those then, Judge Stone, whatever the expense is, and arrange to send them to us or whatever you care to do?

COM. STONE: Yes, we will.

COM. BISHOP: Mr. Chairman, I would like to ask Judge Stone a question in that connection: Isn't it true, Judge Stone, that regardless of the findings of any committee it will be necessary for us to insert a paragraph in that compact to the effect that "nothing in this compact shall adversely affect the rights of the Indians"?

COM. STONE: I am not ready to answer that question, Mr. Bishop. I think that is a question we will have to determine after further study and consideration of this question. I would go this far and say that unquestionably the rights and interests of the Indians must be considered in the making of this compact. What clause shall be inserted and in what manner it shall be handled is a question where I am not in a position now to make any specific recommendation. That has to be considered by the Commission and these studies may indicate one form of approach or treatment and they may indicate another.

COM. BISHOP: Well perhaps you haven't had the same experience that we have. In all the compacts we have negotiated the Office of Indian Affairs has insisted upon this clause protecting the Indians and we were given to

understand that no compact could be passed by the Congress that didn't have that clause contained in it.

COM. WILSON: May I say, Mr. Bishop, in response to your question of Judge Stone and Judge Stone's reply--I will say that I agree with Judge Stone that that is a matter which this Commission should consider very carefully and whether this Commission can put a clause in the compact we may negotiate in reference to Indian rights attempting to define them or amend them is a matter we must determine. But in answer to your question, Mr. Bishop, it is well to remember that in the original Colorado River Compact from which we derive our 7,500,000 acre feet, the clause was in there.

COM. BISHOP: That is right.

COM. WILSON: Nothing in that compact was to in any way affect the rights of Indians or the obligation of the United States of America to the Indian tribes. Now if we obtain whatever rights we have in the water under such a limitation, why we will have to determine whether we can put that limitation on ourselves or not.

COM. STONE: I agree with Judge Wilson, we can't forget that clause, but it does require as he says further study to ascertain whether we can--

COM. WILSON: If you can work it out I will be glad to help you work it out.

COM. WATSON: Com. Bishop, I should like to ask you how many acres of Indian land in Wyoming there are in the Green River Basin?

COM. BISHOP: We don't have any Indian lands in the Green River Basin, Mr. Watson.

COM. WATSON: Off the record. (Discussion off the record.)

COM. STONE: Mr. Chairman, we are taking up time now discussing questions which are referred to the Legal Advisory Committee, and a motion is before the House. I don't wish to cut off the debate but the question is on whether or not this question shall be referred to the Legal Advisory Committee and not up for discussion of preconceived conclusions.

COM. BISHOP: Question.

THE CHAIRMAN: You have heard the motion. The question has been called for. (Thereupon a vote was taken and the motion of Com. Stone carried unanimously.)

COM. CARSON: Now, Mr. Chairman, off the record. (Discussion off the record.)

MR. WALLACE: If I understand the position of the Commissioner from New Mexico it is this, that he wants the Indians of New Mexico treated as citizens of New Mexico and the allocation to New Mexico to be upon the basis of the requirements of both whites and Indians, regarding them all as citizens of New Mexico, is that right?

COM. WILSON: I think I can answer that yes. There are several implications there; I don't know what you have in mind.

MR. WALLACE: In other words--I can say it in a very few words--

you would like to have the Indians regarded as citizens of New Mexico.

COM. WILSON: You can say, "citizens or land owners."

MR. WALLACE: Or land owners.

COM. WILSON: They are both.

MR. BLISS: May I suggest, Mr. Wallace, that the population to work the Indian lands proposed are not now in New Mexico. They would have to be imported.

MR. PATTERSON: May I offer a thought on this point, Mr. Chairman?

THE CHAIRMAN: What is the point? We voted on a motion. Apparently the discussion is not complete on the motion because we are still discussing the motion, is that right?

COM. STONE: The motion carried.

THE CHAIRMAN: Yes, but I would like to keep to our program if we can. Is this a further discussion of the motion you wish to offer?

MR. PATTERSON: It is a comment in line with Mr. Wallace's discussion and Mr. Bliss's statement.

THE CHAIRMAN: Very well.

MR. PATTERSON: As far as the Engineering Advisory Committee is concerned, we deal with lands that are irrigated lands, that are potentially possible of irrigation, no matter whether it is white men or red men living on them, owning them or using water. We cannot go into questions of who owns the land individually or what their rights may be with respect to their neighbors; but we are dealing with facts as to lands whether it is white land or red land, and facts as to water, rather than whether a white man or a red man uses it. I want it clear we are not as engineers concerned about the relative rights of the white man to the rights of the red man.

THE CHAIRMAN: Does Colorado have another factor to be discussed at this juncture?

COM. STONE: Will you excuse us just a moment and we will take that order up. (Confers.) Mr. Chairman, is your inquiry as to what other factor submitted by Colorado we wish to submit for discussion at this time?

THE CHAIRMAN: Yes, sir.

COM. STONE: And you wish to follow the Colorado list rather than going to any other list. Many of the matters mentioned by the other states are the same as those we have presented. If there is no objection and that is a request of the Chair, Colorado submits for discussion this question or factor contained in the Colorado statement heretofore presented:

What provisions shall be made with respect to the construction, operation and maintenance of facilities in one state for the benefit of another state? Attached to that are other implied questions. I shall not submit those now. But in line with the procedure which we have been following I will ask Mr. Breitenstein to open the discussion on behalf of Colorado.

MR. BREITENSTEIN: It seems to me that this is a pertinent question to

bring up. Yesterday morning in the Basin States Committee they adopted a resolution relative to the Split Mountain project and the Echo Park project. Of course it is hard to divorce this consideration or the consideration of this factor from a consideration of the main stream reservoirs. Nevertheless there is some line of distinction between the two.

It is my concept of the two projects which were mentioned yesterday, that they are valuable not only for the benefit of all states but also that they have a particular value perhaps for the State of Utah. The Echo Park project as I understand it involves a damsite in Colorado which will back up water on both the Green River and the Yampa River in Colorado. The Split Mountain project is one in Utah which will back up water in both Utah and Colorado.

Trying to differentiate any aspect of that problem from a main stream reservoir located further downstream which will operate both to generate power and to regulate the River, it seems to me that consideration has to be given to several items. First, how are the reservoirs to be operated? Who is going to make the determination as to the storage and release of storage of water? Is it going to be necessary to exercise the power of eminent domain under Colorado law to construct those projects? What provision if any is to be made for the tax loss to the county in Colorado in which the projects will be located?

I don't know what the evaporation loss from those reservoirs might be. As I read the Bureau's report they merely give a lump figure for evaporation losses in the Upper Basin without breaking that down as to evaporation losses from any particular reservoir, but there will of necessity be some evaporation losses. Now if you have a reservoir entirely in Colorado and the benefits from that reservoir accruing either to another state or to the joint account of the states, is it fair to charge all those evaporation losses to Colorado? Of course the same problem would be involved in main stream reservoirs downstream. Say one is located in Utah for the benefit of all the states; should all the evaporation losses be charged to Utah?

Another factor comes in there and that is on the power generated by these projects. Is the evaporation loss to be charged in any proportion based upon the uses of power?

Now if I am right in my thought--and I may be wrong--that the two projects mentioned will be of particular value to Utah in connection with its Central Utah project, should the beneficial consumptive use of water in the State of Utah made available, partly at least, as a result of the construction of these projects, be considered in prorating the losses?

In connection with other rivers we have had the problem in Colorado of the construction of facilities in Colorado for use in storing and diverting water for the benefit of another state. We have here in Colorado a statute passed many years ago when the thinking of the Colorado officials was different than it is now which forbad diversions in Colorado for use outside the state. That has in many instances been waived by compact and I think it should be here, but in connection with this Upper Basin situation, we in Colorado are on the other side of the fence in one instance at least. On the Little Snake River we have water users who divert water in Wyoming for use on lands in Colorado. Of course we would like to have their rights so to do recognized just as we feel that in proper instances we should recognize diversions in Colorado for use in the other states.

The problem is one which to some extent is complex but it is one which we feel must be given consideration if we are to avoid future controversy, and I am sure you will find Colorado fair and reasonable in the matter. The only point is we want something definitely decided on that so none of us will have any trouble in the future. If the members of the Commission have recently read the Republican River Compact they will find provisions which were inserted in that compact which take care of some of the matters.

MR. WALLACE: Elaborate on that.

MR. BREITENSTEIN: The best way to do that perhaps is to read it. If I can find it here hurriedly I will read it to you.

COM. STONE: It seems to me it would be a good idea to do it because it does submit the question.

MR. BREITENSTEIN: This doesn't take care of everything I mentioned but it takes care of some of them.

"ARTICLE VI: The right of any person, entity, or lower State to construct, or participate in the future construction and use of any storage reservoir or diversion works in an upper State for the purpose of regulating water herein allocated for beneficial consumptive use in such lower State, shall never be denied by an upper State; provided, that such right is subject to the rights of the upper State.

"ARTICLE VII: Any person, entity, or lower State shall have the right to acquire necessary property rights in an upper State by purchase, or through the exercise of the power of eminent domain, for the construction, operation and maintenance of storage reservoirs, and of appurtenant works, canals and conduits, required for the enjoyment of the privileges granted by Article VI; provided, however, that the grantees of such rights shall pay to the political subdivisions of the State in which such works are located, each and every year during which such rights are enjoyed for such purposes, a sum of money equivalent to the average annual amount of taxes assessed against the lands and improvements during the ten years preceding the use of such lands, in reimbursement for the loss of taxes to said political subdivisions of the State.

"ARTICLE VIII: Should any facility be constructed in an upper State under the provisions of Article VI, such construction and the operation of such facility shall be subject to the laws of such upper State.

"Any repairs to or replacements of such facility shall be made in accordance with the laws of such upper State."

Article IX brings in another point:

"It shall be the duty of the three States to administer this compact through the official in each State who is now or may hereafter be charged with the duty of administering the public water supplies. . ." and so on.

That does not consider of course the method of charging evaporation losses and things like that, but it does take care of many of the other problems which I mentioned.

MR. WALLACE: A question if you please. Granting that the tax on the property that will be used for the reservoir is $50,000 a year and the construction of the power plant cost $40,000,000, how much taxes would you pay?

MR. BREITENSTEIN: I apprehend the power plant wouldn't be taxable. Uncle Sam would probably own it and say it was off the tax rolls.

MR. WALLACE: What arrangements would be made to pay tax or would there be an arrangement made to pay taxes on that power plant?

MR. BREITENSTEIN: You can't tax the property of the United States and I have a feeling that--take Echo Park, for example, the dam and power plant would be built by Uncle Sam and would not be taxable.

MR. WALLACE: You know what arrangements were made on Boulder Dam?

MR. BREITENSTEIN: Yes. The scheme evolved here is a little different than the scheme on Boulder Dam. It just seems to me that perhaps there is some merit in this scheme rather than the Boulder Dam scheme. I don't know.

MR. WALLACE: Well, in this particular plan you are simply paying the taxes each year that you would have had on the properties there---

MR. BREITENSTEIN: --during the ten-year period before. That is not as much to our advantage as the Boulder Dam scheme.

MR. WALLACE: No, it isn't.

MR. BREITENSTEIN: Obviously. Of course the thing is also tied up, Mr. Wallace, with some of your reservoirs in Utah and whatever scheme is adopted should be of uniform application throughout the Basin.

MR. WALLACE: Of course looking at it from a state point of view and from the point of view of people who are interested privately in public utilities, the plant should pay taxes.

MR. BREITENSTEIN: We don't want to get into that argument.

MR. WALLACE: That is the point you have got to meet.

MR. BREITENSTEIN: But just take the situation of Moffat County now. I don't know how much taxable property there is which would be covered by the Echo Park reservoir but there will probably be some and there will be some loss to Moffat County in taxes. When we get before the Colorado Legislature, the representatives from Moffat County are going to say, "What about our loss of taxes?" We have got to have some answer for them.

COM. STONE: Even in Colorado in an intrastate matter, the Colorado-Big Thompson project, it was agreed that in that case $100,000 would be paid to Grand County because of losses of taxes.

MR. WALLACE: Isn't it more than the present loss in taxes?

COM. STONE: This specific agreement was to compensate for the estimated loss in taxes on the lands that would be submerged by reservoirs.

MR. BREITENSTEIN: That was a lump sum deal just to take care of it.

COM. STONE: That was a lump sum deal but I offer that just as a suggestion that there is a principle there that cannot be overlooked.

MR. WALLACE: The question is a simple one I asked you: Isn't

that $100,000 a larger sum than the County has heretofore received?

COM. STONE: No, it was based on an estimated loss of taxes.

MR. BLISS: Mr. Chairman, I would like to ask Mr. Breitenstein if h discussion included the possible allocation of power revenues which might go toward the repayment of irrigation costs.

MR. BREITENSTEIN: Well of course that is a factor which has to be considered. Take the Echo Park Reservoir. Now what benefits does the State of Colorado get out of the Echo Park Reservoir? I am not talking against it; I am just trying to follow the question. What benefit does the State of Colorado get out of Echo Park Reservoir except from the standpoint of regulation of the stream? We don't know whether we will get any power or not; maybe we will. But how are the evaporation losses to be charged there? From all that I can find out the Echo Park damsite is an admirable site and it is a project which is as desirable as any main stream reservoir. There is nothing against it at all but these questions come up.

If we go up to the Colorado Legislature and say, "Now they are going to have this Echo Park Reservoir and the evaporation loss from that reservoir will be 50,000 acre feet a year." Somebody will say, "Is that charged to the Colorado share?" We have got to have some answer to that.

MR. WALLACE: Theoretically this reservoir when built will--not theoretically but actually will benefit the entire group of the Upper Basin States by making more water immediately available by reason of equation of the flow.

MR. BREITENSTEIN: I am not denying that, Mr. Wallace. I think that is unquestionably right.

MR. ROLLINS: Is there anyone present here, the Bureau or anyone else, who has figures on the amount of land that may be submerged in the two states of Colorado and Wyoming by reason of construction of the Echo Park Reservoir?

COM. STONE: Of course, Mr. Rollins, there no doubt will be numerous reservoirs in any plan of development of the Colorado River where this principle will be involved. There would have to be a general principle.

MR. ROLLINS: I realize that but I am just wondering inasmuch as we had already talked of those two particular projects, the Echo Park and the Split Mountain, if there was sufficient data now available so that we would know about--

COM. STONE: --how the matter worked? You can ask Mr. Larson. No, Mr. Larson isn't here.

MR. UNTERMANN: May I say something on that? I would like to point out with reference to the value of the land inundated in these particular projects, it is principally canyon land and incidentally a good portion is Dinosaur National Monument Government land, just with reference to these two projects. So it is hard to arrive at an existing taxation value of that land for reimbursement.

COM. STONE: If there was no private land within the reservoir site, the principle we are talking about wouldn't apply.

MR. WALLACE: Except the State wants taxes on a project built withir

its borders. Even Hoover Dam pays taxes both to Arizona and Nevada.

COM. STONE: That was in lieu of potential taxes.

COM. BISHOP: Mr. Chairman, I agree that that is an important factor and that a clause on the order of the one read by Mr. Breitenstein should be incorporated and it seems to me this Committee that is going to make the tentative draft should give it careful consideration and present it. I can't see that we can settle it here, and until we have time to do that, I suggest we go on to some other subject.

COM. STONE: I would like to inquire of Mr. Bishop what committee do we have to make a tentative draft of a compact? I don't know of such committee. There was referred to the Legal Advisory Committee this administrative clause but I don't know of any one who is going to make a tentative draft. It occurs to me that this is a matter of such importance that there ought to be some discussion--maybe we can't arrive at any conclusions now--of the matters that are involved.

COM. BISHOP: Judge Stone, it would seem to me that the matter of submitting a tentative draft was given to the Legal Advisory Committee considerably more than a year ago and I consider they are still going ahead with it. The main reason the Legal Advisory Committee was set up was to submit a tentative draft.

THE CHAIRMAN: The Chair would like to make an observation at this point. After having listened very carefully to the comments which have been made, it would seem that we shouldn't lose sight of the fact--or at least it so appears a fact to the Chair--that these reservoirs and this development will be made by the United States, that it will be the business of the United States to acquire the right-of-way. Insofar as I know Congress has made no disposition for divesting the ownership of these reservoirs from the United States and what we should consider in the formulation of the compact is the restrictions that the states desire placed on that ownership and possibly operation for some time.

Then it seems further, to your Chairman at least, that there can be no development in the Colorado River Basin until this compact is formulated, developments for consumptive use particularly, and in the opinion of the Chairman no development in the way of using the energy of the water until the most efficient chain of reservoirs has been worked out, so that when you go to the Congress you can say that this reservoir you are now proposing to build is one of a chain of reservoirs, which chain has been determined to be the most efficient grouping possible on the Colorado River.

It also appears to your Chairman that at that time it will have to be stated that the power development from this particular reservoir is for the benefit of all the projects and that the water used is for the benefit of all the projects; and if the compact is eventually worked out and ratified, that the water entering this reservoir or other reservoirs is common property. The lawyers probably will criticize me for the term "common property". I don't know what else to call it. It is "joint and several property" maybe, whatever term you want to use. You know what I mean. And in that way you will have a proposition that's fairly understandable to people and capable of successful operation.

It occurs to your Chairman that the provisions which have been read in the Republican River Compact pertain more particularly to the construction of reservoirs in one state for the benefit of another by other than a Federal agency.

Now as to the question of payments in lieu of taxes, I don't know whether you can incorporate a provision like that in a compact or not. Perhaps you can. I don't know. But if you cannot, that can be specifically set forth in the authorization for the project.

COM. STONE: Mr. Chairman, commenting on some of your remarks I want to say most emphatically that the provisions in the Republican River Compact were not intended nor could they be intended to apply to solely projects constructed by a private agency.

THE CHAIRMAN: No, I understand that, Judge. But my thought was that they were really aimed in that direction.

COM. STONE: No, they were not. I participated in that compact and it was aimed in the other direction. It was anticipated and fully understood that the large projects which were envisioned by the Compact Commissioners would be constructed as projects Federally financed.

THE CHAIRMAN: And Federally owned?

COM. STONE: Well there is a question where there is a lot of law and a lot of disagreement. We don't conceive that the Federal Government owns all of these projects. We do know it is the policy of the Federal Government on projects constructed within a state to benefit lands within a state, to reserve the power; but we likewise envision these irrigation projects as storing water which must be stored in conformity with state law, and that the Federal Government acts as a trustee for the actual water users.

And we must recognize that these projects as we are developing the Colorado River are to be multiple use projects and if we are to be guided by the provision of the Colorado River Compact, domestic and irrigation uses come ahead of power uses. Whether we are guided in this compact by the Colorado River Compact or not in that matter is a question which we no doubt will discuss further. But I don't think we can ever lose sight of the proposition that the highest beneficial use of this water should be in this arid country for the irrigation of lands and to provide domestic supplies.

The Colorado law restricting the diversion of water in Colorado for the use and benefit of water users in another state can't be sidestepped by merely saying these are Government projects.

THE CHAIRMAN: No, Judge. Let me interrupt you just at this point. My suggestion is that in the final wording of this compact you will put the restrictions in on the operation of these reservoirs that the states so desire. Of course it is recognized that the Bureau of Reclamation has always operated under the provisions of the state laws and that domestic use comes first and irrigation use comes before power use. Those are things which you can very properly cover in a compact in my opinion.

COM. STONE: The point I am making is, Mr. Chairman, that if that is what you meant, those are the very restrictions we are talking about which, as Mr. Bishop says, obviously must be included in such a compact. There is involved, however, the question of loss of taxes in one state because of submerging land by a project which will serve another state. Mr. Wallace has called our attention to the fact that a principle was followed in the authorization of the Boulder Dam--I guess it is now the Hoover Dam. There was a payment in lieu of potential taxes based upon what taxes might have accrued to a state if that project had been built by private enterprise. That is another matter which so far as I know has not been followed with respect to any other project.

What we were particularly referring to, however, in our original presentation was largely confined to the taxes which would have been collected over a given period of time by a legal subdivision of the state through the taxing of lands which would be submerged by a project.

THE CHAIRMAN: Judge, it was my suggestion that the pooling of benefits would also go to the pooling of responsibilities and disposition of revenues.

COM. STONE: That might be true as to some of these projects. Unquestionably many of these projects will serve all of the states, and any principle should envision that situation. On the other hand, there probably will be projects built in one state which are largely, almost entirely, for the benefit of another.

THE CHAIRMAN: Yes, I think that is true.

COM. STONE: We have all classes of proposed developments involved in this situation.

THE CHAIRMAN: Any further remarks on this?

MR. RITER: Mr. Chairman, I think Mr. Rollins asked a question which has not been answered. He asked if we had information regarding the areas of the reservoir, referring specifically to the Echo Park Reservoir, located in both states. We have the information but I don't have it with me. We have a good map of that reservoir site and its factual information. It can be determined.

MR. ROLLINS: Are they available?

MR. RITER: I don't have it with me today but I am sure it can be made available.

COM. STONE: May I ask, do you know whether or not with respect to that particular reservoir site, are there any private lands within the site?

MR. RITER: I believe there are.

COM. WATSON: Judge Stone, I have been over most of the site and there are very few private lands. As this gentleman from Vernal said, the area is largely box canyon and the land is valueless. However on the Yampa there are some ranches that might be inundated.

COM. STONE: Of course that is a very fortunate situation when you find a reservoir like that because if there should be any imposition of repayment in lieu of taxes it would be very small in that case.

MR. ROLLINS: Would the Government have any particular interest in the Dinosaur deposits over there?

MR. RITER: Yes.

MR. ROLLINS: Wouldn't they want those protected?

COM. WATSON: The Dinosaur deposits are south of Split Mountain. These reservoirs are north of Split Mountain.

MR. WALLACE: Mr. Chairman, the point I am trying to get at, are

the states going to require revenues from the structures that are going to be built? Is Colorado going to tax the Echo Park for that?

COM. STONE: The only point we have raised, Mr. Wallace, is the loss of taxes which have theretofore been paid on submerged lands. That is as far as our point goes at the present time.

MR. WALLACE: Of course I have raised the additional question as to the possibility of one state taxing these great works for the benefit of the state itself.

THE CHAIRMAN: It is the opinion of the Chairman that that is a matter for the Congress to determine. A state could not tax property of the Federal Government as Mr. Breitenstein has pointed out. But if it is agreeable to all, it would seem that in the authorization of these projects payments can be made in lieu of taxes, and of course you must have a source of revenue for making the payments. It would seem to the Chairman that the payment would have to come out of the power profit.

COM. STONE: I might say on behalf of Colorado that as a general principle, the State would be inclined to recognize that the loss of potential taxes envisioned by Mr. Wallace in his question would be largely compensated by the benefits which would accrue in the development of the River; and if the payment in lieu of such taxes was imposed, that would probably be a matter which would be considered, as the Chairman says, in the authorization of the project. But on a general and broad principle, I don't believe we can grab off benefits of that kind and at the same time retain all of the benefits which this state as well as all other states will obtain through the development of the Colorado River. I don't believe we can be hoggish in that direction.

MR. WALLACE: Is the State of Colorado taxing the power producing parts of the Colorado-Big Thompson project?

COM. STONE: So far as I know it is not. As a matter of fact, as Mr. Breitenstein brought out, there is a question whether we could or not because the Government retained the ownership and control of those power facilities. We wouldn't have the power to do so and I don't believe we ever expect to raise that question because of the great benefits to the State.

THE CHAIRMAN: It is a further observation of the Chairman that this question of payment in lieu of taxes goes farther than the interest of a state. It affects the county governments and seriously affects their operation where they have a large body of land taken out of taxation, and it would seem fair to the Chairman that some arrangement should be made to take care of them because you have a big construction program going on in the county possibly where you are taking out a large body of land and there are children that have to go to school and you are expecting the county to finance that and it becomes a ver serious burden. So in the humble opinion of your Chairman it is a very important question and goes farther than the matter of whether a state wants to do it or not.

COM. STONE: Mr. Chairman, when we say the "State", we represent not just the State as a single entity but we represent the legal subdivisions of all the states and the point you bring out is just the question which we pose. We were thinking, as indicated by Mr. Breitenstein's statement, primarily of the legal subdivisions of the states, such as school districts and counties and taxing units within the state, that is the point, and not the point of potential taxes. It is the point of the replacement of the revenues which have heretofore accrued from lands which would be submerged within a legal subdivision such as a county by a reservoir. I think your remarks are very apropos

but I hasten to say that is just what we are thinking about.

THE CHAIRMAN: Off the record. (Discussion off the record.)

MR. RITER: Mr. Chairman, in his discussion yesterday Mr. Larson referred to project pools, and I think Mr. Watson intimated the same thing or if he didn't come out and say it directly he intimated the same thing in his statement this morning regarding the functions of the main stem power projects in producing revenues to finance project developments. You gentlemen remember in an earlier draft of the Bureau's report we even went so far as to suggest the pooling of all projects within the whole Colorado River Basin. That plan was not favorably received by the Basin so it was cut out of the final report, the report that was submitted a year ago.

Now when we start thinking seriously about promotion and building of projects, we are going to look around for sources of revenue because these projects--I am speaking now of the irrigation projects--are very expensive and under the present yardstick of the Reclamation Act they would have to be declared infeasible; but nevertheless they are good projects that develop vast acreages of land, land that is now idle and practically worthless from the standpoint of agricultural production.

Specifically in the case of Echo Park Reservoir, I notice from the map of Colorado there are a number of large projects in Moffat County, which is the same county in which Echo Park Reservoir is located. Perhaps appropriate arrangements could be made so that part of the income, the so-called net income, or power profits if you please from these projects, might be made available to help finance some of the projects in Moffat County.

I realize that is a matter which the Commission will not want to dabble with but it is certainly a problem the states are going to have to wrestle with. In other words, the states can jointly set up your own power pools. I hope this discussion has been contributing to the problem at hand and I am not too far off on a tangent.

MR. WALLACE: There are two items involved, Mr. Chairman. I think it is entirely right that the state, the county, or whatever community is involved, should be compensated for loss of taxes by reason of taking property off the tax rolls. The other question really goes to the matter of competitive sale of power and the question we probably are going to have to meet is: Are these great power producing plants to pay taxes for the benefit of the entire state, the county and so forth; Or are they going to be tax free by reason of the ownership by the United States? Or will something have to be done as in the case of Hoover Dam where compensation is made to the states?

THE CHAIRMAN: Gentlemen--

MR. WALLACE: It will eventually have to be solved relative to the water of the Colorado River. What happens in the case of Coulee or Bonneville I am not advised; are you, Judge Stone?

COM. STONE: Pardon me?

MR. WALLACE: Are you advised as to how the question of taxation for the benefit of the state is resolved in the case of the Bonneville and Grand Coulee projects?

COM. STONE: I am not. I don't know, Mr. Wallace.

MR. RITER: May I answer that off the record?

MR. WALLACE: Yes, you answer it.

(Discussion off the record.)

COM. WATSON: May I add, Mr. Riter, that the Bonneville Power Administration in the last ten years has paid back to the United States Government $104,000,000 which included 3 percent interest on money advanced for the project.

THE CHAIRMAN: Gentlemen, it is now twelve o'clock and we will recess until one-thirty.

COM. WILSON: I make a motion we adjourn this afternoon some time.

COM. WATSON: I will second the motion if we can work right up to the last minute.

THE CHAIRMAN: The motion is that we adjourn some time this afternoon.

MR. WALLACE: Mr. Chairman, just what can we accomplish by remaining here another day or so?

THE CHAIRMAN: Off the record. (Discussion off the record.)

COM. WILSON: Mr. Chairman, I make a motion we adjourn this afternoon at or before five o'clock and reconvene at Denver on the 17th day of February, 1948, at ten a.m.

THE CHAIRMAN: Do I hear a second to that motion?

COM. WATSON: Second.

(Thereupon a vote was taken and the motion of Com. Wilson carried unanimously.)

THE CHAIRMAN: We will now recess until one-thirty today.

(12:05 p.m. Noon recess.)

(1:30 p.m. Meeting resumed.)

THE CHAIRMAN: The Commission will come to order, please. It will be understood that the Commission will convene in Denver in the Shirley-Savoy Hotel at ten a.m. February 17th, 1948.

Gentlemen, I believe the next matter of business is a consideration of the next item presented by Colorado.

COM. STONE: I assume, Mr. Chairman, you refer to the item which was under discussion when we recessed at noon. To open the discussion this afternoon on that subject and in view of some of the discussion which took place this morning, I wish to again state that in the matter submitted by Colorado under this point, we do not contemplate nor do we believe there is involved under our suggestion the question of potential taxes. And in connection with the matter of payments in lieu of potential taxes of the nature recognized under the Boulder Canyon Project Act and of the nature mentioned by Mr. Wallace

this morning, we do not believe that matter can be covered by an interstate compact.

Furthermore we are of the opinion that if we attempted to cover it it would not be approved by the Congress and further, we doubt the policy of attempting to include such a matter. It is our judgment that when you contemplate making reimbursements in lieu of potential taxes you are getting into a field of project authorization adjustments which can only be handled by the Congress in authorizing a project. Therefore the question submitted by Colorado on the tax matter is pretty well covered by a clause similar to that read into the record from the Republican River Compact this morning. We do not even believe that you could go so far as to provide in a compact that such arrangements for the payment for taxes lost could be accomplished through charging such an item to the operation and maintenance of a project. That is a matter which would have to be adjusted in the authorization of the project.

In that connection I wish to reiterate what this clause in the Republican River Compact provides. This clause I recall in the Republican River Compact negotiations was quite thoroughly argued and was rather carefully written after considering many of the matters that were suggested this morning. I call your attention to the fact that the Republican River Compact merely states that the "grantees of such rights"--that is the easement rights through land which would be covered by a reservoir, the granting of those rights---

> ". . that the grantees of such rights shall pay to the political subdivisions of the State in which such works are located, each and every year during which such rights are enjoyed for such purposes, a sum of money equivalent to the average annual amount of taxes assessed against the lands and improvements during the ten years preceding the use of such lands, in reimbursement for the loss of taxes to said political subdivisions of the State."

You will notice that principle is based not upon potential taxes but upon reimbursement for the loss of taxes which had previously been paid to some political subdivision in which the reservoir is located. And we don't at this time submit for tentative approval that ten-year formula but merely submit for your consideration the principle.

Now that provision cannot be fully understood, as is evidenced by the discussion this morning, unless you also consider another provision of the Republican River Compact, and which unquestionably will be included in the Upper Colorado River Basin Compact, which says that:

> "Nothing in this compact shall be deemed:
>
> . . . . .
>
> "(b) To subject any property of the United States, its agencies or instrumentalities, to taxation by any State, or subdivision thereof, nor to create an obligation on the part of the United States, its agencies or instrumentalities, by reason of the acquisition, construction, or operation of any property or works of whatsoever kind, to make any payments to any State or political subdivision thereof, state agency, municipality, or entity whatsoever in reimbursement for the loss of taxes."

Those two sections must be considered together and some similar arrangement unquestionably would be incorporated in an Upper Colorado River Basin Compact.

So that if it should happen that the easement rights for a reservoir were acquired by the United States, then under the law we recognize that the political subdivision would have no right to ask for such reimbursement for loss of taxes; but it would set a principle so that in the authorization of a project and through the action of Congress, arrangements may be made in the authorization of a specific project for such reimbursement for taxes to be provided from operation and maintenance of a project. If we approach it from that point of view and handle it in a manner similar to that, I think we keep within the realm of reason and still protect the rights and interests of certain legal subdivisions within a state, a matter which our Chairman mentioned this morning, and we found in the Republican River Compact that was about the only way you can handle it.

That is a rather long explanation but I had a feeling that what Colorado had in mind was not fully understood. I certainly do not think we can include any provision in this compact for payments in lieu of potential taxes.

THE CHAIRMAN: It would occur to the Chairman also, Judge Stone, that those provisions which you have mentioned would be helpful in seeking authorization of a project in this manner: They would show to the committees of Congress that the states were in agreement on that principle. Are there any further comments? Does the Commission wish to take any formal action in the way of a motion in the disposition of that question or factor?

COM. WATSON: I know so little about it that I would suggest that it be referred to the Legal Advisory Committee.

COM. STONE: On Mr. Watson's suggestion, Mr. Chairman, that they be referred to the Legal Advisory Committee, the whole question that was submitted this morning involves a lot more than just these two questions, the right of exercise of eminent domain and the right for the storage in one state and diversion of water for use in another. That has to break down in a number of subdivisions. And did I understand that your suggestion would go merely to part of the questions raised by Colorado this morning?

COM. WATSON: Right.

COM. STONE: I would like to have Mr. Breitenstein comment upon that as to what part of this point or what questions that arise under this factor should be referred to the Legal Advisory Committee in view of the discussion which has been more or less limited to two or three items of the entire factor.

MR. BREITENSTEIN: Judge Stone, it would occur to me that the proper action to be taken at this time would be to refer to the Legal Advisory Committee consideration of compact provisions relative to the use of eminent domain and the provision for reimbursement of taxes, and provisions relative to diversions, storage and release of storage, and in relation to requirements as to the filing of maps and plans, all in connection with the construction of a project in one state for the benefit of another state or states--those matters should be referred to the Legal Advisory Committee for consideration and report back to the Commission. That leaves one matter which was mentioned this morning for further consideration. That is the question of the charging of evaporation losses and I would like to say something about that if I may after a bit.

COM. STONE: Mr. Chairman, it seems to me we could split this question up as suggested by Mr. Breitenstein and refer the matters which he mentions only at this time, to the Legal Advisory Committee. I would like to call attention to the fact that one of our commissioners is absent.

MR. ROLLINS: I will take his place.

COM. STONE: To get this matter before the Commission and in line with the suggestion of Mr. Watson, I move that the questions which have just previously to this motion been mentioned by Mr. Breitenstein be referred to the Legal Advisory Committee.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion has been made and seconded. Is there any further discussion of the motion? Are you ready for the question? (Question is called for. Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

MR. BREITENSTEIN: May I mention the other point I had in mind now?

THE CHAIRMAN: Yes.

MR. BREITENSTEIN: That refers to the question of charging reservoir evaporation losses. I have heard the engineers at this meeting talk about making reservoir operation studies. It has been my experience in dealing with engineers, particularly in making such types of studies, that one or more engineers will take some factual data which is agreed upon by all of them and then those engineers will make assumptions and upon the basis of those assumptions will operate the river, and of course unless the assumptions are the same, why the results will be vastly different. I know of one lawsuit in which four sets of engineers, all of them capable, took the same basic factual data and by making different assumptions came out with answers that were so different you couldn't understand they were discussing the same problem.

(Com. Bishop returns to hearing room.)

One of the factors which I am given to understand is considered in such a study, and it seems to me which is one which must be considered here, is the question of reservoir evaporation losses. As I read the Colorado River Report, the Bureau did not attempt to break down reservoir evaporation losses to individual reservoirs in the Upper Basin.

We know from what has been said that it is contemplated that reservoirs be built in several states. Referring again to Echo Park, that is a reservoir which will be in Colorado for the benefit of all the states and particularly for the benefit of Utah. That is a reservoir in one state for the benefit of another state or states and there is going to be some evaporation from it, and we would like to know how you are going to charge that evaporation loss. Is it to be deducted from Colorado's share of the water? That is putting it as bluntly as I can. And how are these engineers in making their studies going to handle assumptions like that? Maybe they can answer that better than I can.

COM. STONE: Off the record. (Discussion off the record.)

COM. WATSON: Mr. Chairman, isn't that a matter Mr. Breitenstein brought up to be referred to the Engineering Advisory Committee?

MR. RITER: Mr. Chairman, the Engineering Advisory Committee has as one of its assignments the study of reservoir operation that must of necessity include determination of reservoir losses. We are not attempting to say to whom those losses are going to be charged. We will gather the factual information on how much we estimate the annual stream depletion is by virtue of the reservoirs and place it in the hands of the Commission to

decide among themselves which if any of the states are to be charged with that evaporation loss. It has been my concept of the problem at present that main stem reservoir losses would be a several and joint loss to be shared by all of the states and that such losses would not be allocated to any particular state.

MR. BREITENSTEIN: Off the record. (Discussion off the record.)

MR. RITER: Mother Nature is going to evaporate water from the reservoir surface just the same as Mother Nature evaporates water from Lake Mead in the Lower Basin. I believe most people who have discussed the problem, however, do recognize that these main stem reservoir losses are part of the 7,500,000 acre feet allocated to each basin.

COM. STONE: Mr. Riter, did I understand your comments at this time to be confined to main stem reservoirs that are clearly for the benefit of all the states, or do your remarks apply to all reservoirs?

MR. RITER: No, my remarks are confined to reservoirs which are for the benefit of all states. Judge Stone, the engineers can give you factual information on what the reservoir losses are estimated to be for any particular reservoir but as I see it it is a problem for the Commission to decide among themselves, considering the facts as to the use of that particular reservoir, whether or not such reservoir losses should be allocated wholly or in part to one or more states, or whether they should be considered a joint account for all states.

MR. ROLLINS: Off the record. (Discussion off the record.)

MR. RITER: It is our intention where legal problems are involved not to attempt to make assumptions on them without consulting the lawyers. Now I can see in the case of Echo Park Reservoir how that might conceivably be a particular reservoir rather than a general reservoir although my thinking in the past has been that that is a general reservoir for the benefit of all states. I more or less size the situation up in this manner, speaking in terms of figures--we have 7,500,000 acre feet of stream depletion available in the Upper Basin. Before attempting to divide the 7,500,000 acre feet I would be inclined to subtract therefrom a figure, say 800,000 acre feet, to represent main stem evaporation losses. Then what is left, 6,700,000 acre feet in the example used, would be the water that would be divided among the states. That is my thinking on it, Jean.

MR. BREITENSTEIN: I have considered that myself. It seems to me that there may be a lot of merit in that on reservoirs of general use to all the states. I don't know enough about Echo Park to know whether that is entirely general use or whether there is some particular use for the benefit of the State of Utah. I don't know enough about that. While your formula might be fair on a general reservoir we doubt if it is on a reservoir that has a particular and peculiar benefit to one state.

MR. RITER: Mr. Breitenstein, with respect to Echo Park and from the facts in the case, which have not been clearly defined as to how it will be used, it appears as though there might be some justification for allocation of part of the evaporation losses of Echo Park to a particular project. That is something that will have to be studied out. I don't think we are prepared to say today. Mr. Larson has gone home. I do know, however, that Echo Park Reservoir is being considered as one of the units of the Central Utah project.

MR. BREITENSTEIN: That is the reason I said what I did but I don't know.

MR. RITER: As I mentioned this morning, Echo Park might also be considered as a holdover reservoir for the benefit of the whole basin; and furthermore it might also be considered as a revenue producer for the benefit of some of the Colorado projects in the Yampa River Basin.

MR. BREITENSTEIN: I grant all that. I am not saying anything against Echo Park. I don't want it to be considered that way. But my thought is, to be specific about the thing, if we go up to the Colorado Legislature to try to get this compact ratified and they see there is a reservoir going to be built in Moffat County and there will be 50,000 acre feet a year evaporation loss from that reservoir, they will ask: "Does that come off the Colorado share?" What are we going to say in answer to the question? That is just being practical about the thing.

MR. RITER: Today you can't answer the question but I do think by the time the compact is negotiated you will be in a position to answer it. Unless my thinking is changed between now and the time the compact is negotiated, you can answer it this way: Echo Park Reservoir operates for the benefit of all states so the evaporation loss from Echo Park Reservoir will not be charged against any particular state, it will not be charged against Colorado. However it is deducted from the 7,500,000 acre feet before Colorado has her share of the allocation defined.

MR. BREITENSTEIN: Let me present two other reservoirs and each of them are entirely in Colorado and already built, Vallecito and Taylor Park.

MR. RITER: I believe in those cases you will have to admit they are entirely for the benefit of lands in Colorado.

COM. STONE: That is the situation we are discussing.

MR. BREITENSTEIN: All right, they are entirely for Colorado lands so we are stuck for that. We have got to absorb that.

MR. RITER: Yes.

MR. BREITENSTEIN: Now if you have one for the benefit of lands in one state and it is located in another state. I am talking about benefits to particular lands in another state.

THE CHAIRMAN: Without any power development?

MR. BREITENSTEIN: Whether there is any power development or not.

THE CHAIRMAN: Your Chairman feels there might be a difference.

MR. BREITENSTEIN: You are bringing in another factor, Com. Bashore. When you consider power development you may have that power used 100 percent in one state or you might have it used 20 percent in each of the states. If the allocation of power to any particular state is a factor, then you have another variable brought in to complicate the allocation of such losses as evaporation.

COM. WATSON: Wouldn't the burden be in proportion to the benefit received?

MR. BREITENSTEIN: It seems to me that is a pretty fair way to do it, Com. Watson, but your benefit received is both in the irrigation of lands and in the use of hydroelectric power, and also perhaps in domestic uses too.

MR. MERRIELL: It isn't an impossible task for the Engineering Advisory Committee to work those things out.

MR. BREITENSTEIN: All right, let's let the Commission tell the Engineering Advisory Committee to work them out.

MR. RITER: We have already been told to work them out. I am sorry we didn't have the answer at this meeting but we will at some future meeting.

COM. STONE: I want to point this out: It may be the Engineering Advisory Committee will come up with some answers. What we are discussing now isn't an engineering question; it is a question of a principle which might be developed and discussed by this Commission for the guidance of the Engineering Committee in making their findings. It looks to me as if this is not entirely an engineering question unless Mr. Riter and his Committee want to consider the policy question and make recommendations on that as well as questions of engineering.

MR. WALLACE: May I say a word, Mr. Chairman? It seems to me the subject you are discussing goes right back to the question of whether the states are going to work together or going alone. Fortunately we in Utah are in a position so that we don't have to have Echo Park project. We have other projects there that would serve Utah and be entirely in the State of Utah. It seems to me you are going into the major proposition of whether the states are going alone or as a unit.

COM. WATSON: Mr. Breitenstein, wouldn't this be a breakdown of the statement I made that the assessment would be in proportion to the benefits received: If a certain portion went to power and say we used that power--say we used all the power from Echo Park; then we would pay that amount of the burden assessed against electric power. A certain portion would be used for irrigation and for domestic use. Colorado may get some of the power. Certainly Colorado would participate somewhat in the storage.

MR. BREITENSTEIN: I don't disagree with you at all, Com. Watson. I think the proposition that you state as a general principle is absolutely fair, but it is something I say we can't pass over. We have got to consider it. It isn't us fighting anybody else because it is a problem which involves all of us and if we settle it now we aren't going to have a lawsuit over it twenty years from now.

COM. STONE: Mr. Chairman, I am very much impressed by the suggestion made by the Commissioner of Utah. That is an example of a solution of the question which we are suggesting under this point.

COM. WATSON: Judge Stone, wouldn't that same principle be associated with any other reservoir on the river? Let's assume now there is a reservoir wholly in the State of Utah. Nature has provided that site through the work of the Colorado River in widening out the canyon and leaving it narrow at a certain point. This is the result of the process of erosion over a long period of time. Now, wouldn't that fact--and Utah contends this--that that site has been provided along the main stem of the River by the State of Utah due to the forces of Nature, be a factor in which Utah would receive benefits just the same as if it were Colorado that produced 1,000 acre feet of water from the snow of the mountains that ran through this channel? It would be rather difficult to evaluate these two factors but at the same time wouldn't the fact that the reservoir existed entirely in the State of Utah or entirely in the State of Colorado be a contribution for which the state should be credited?

MR. BREITENSTEIN: I don't deny that at all. You have a natural

resource; we have a natural resource; and by the joint use of them we are both benefited.

COM. WATSON: That is right, it would work both ways.

MR. BREITENSTEIN: Sure it does.

MR. RITER: Mr. Chairman, Judge Stone made a remark a while ago about the engineers dabbling in policies. Well, we are human beings; we can't help but have ideas. Our basic job, however, is to find facts and present them to this Commission, then the Commission will make the policies. I assume however that as human beings and as citizens of this State of Colorado or the United States, we are at liberty to express ourselves and if we have any suggestions, the Commission will either throw them out or accept them---

THE CHAIRMAN: Just a moment off the record. (Discussion off the record.)

COM. STONE: Mr. Chairman, I didn't want Mr. Riter to feel that I was implying the engineers should not make recommendations as to policies as they may see fit. It just occurred to me though that if we could arrive at some general conclusion at least tentatively on this question it might be some help to the engineers in completing their data with respect to evaporation losses. We know now that this question of reservoir evaporation losses was not adequately covered in the Colorado River Compact.

If we are to profit by the experience of the past, and in order to avoid trouble in the future, we ought to cover and in my opinion must cover in some general way in this compact, provisions relating to the question of evaporation losses and in this we must work as states recognizing our common interest. We can't dispose of the question though by saying we are all interested and we have a common interest and we must work together. I think by fair and equitable provisions on the evaporation loss question we will do more to insure working together than if we leave it for possible controversy in the future.

I want to say again that I am much impressed with the general principle which has been stated by Mr. Watson here.

COM. WATSON: Couldn't then, Judge, the Legal Advisory Committee draft something that contained the principle of the benefits and the burdens being proportionate?

MR. BREITENSTEIN: Why not let the lawyers try to work on that? Make a motion referring it to them.

COM. WATSON: I will make a motion that we refer this problem to the Legal Advisory Committee.

COM. STONE: The motion must be more specific than that.

THE CHAIRMAN: Gentlemen, just a minute. It is at least the hope of the Chairman that one of these committees will be able in the near future to present something in the way of information which apparently this Commission needs to determine whether or not the percentage basis which you have tentatively agreed upon should be considered the basis of allocation of benefits, and as I remember also of responsibilities, cannot be carried down into the matter of these general purpose reservoirs to include the item of evaporation and any other items of loss or gain.

MR. ROLLINS: Mr. Chairman, isn't it true that while specifically Utah may benefit more materially from the use of power in the Echo Park Reservoir, still all of the states will benefit from the revenues derived from the production of power. It seems to me it is going to be very difficult to ascertain definitely just what each state's interest in the power revenues will be.

THE CHAIRMAN: Well, of course, Mr. Rollins, I hope we don't get mixed up in our thinking that this compact might make an allocation of power to a certain state. I don't believe any of you are thinking of that. If so, I think it would be a hopeless task. That would come later after your compact is negotiated. But the principle of how the states are going to share in all these benefits, if it did not include evaporation on the general purpose reservoirs, I think should be cleared up.

MR. ROLLINS: When Mr. Watson referred to the benefits that Utah would derive or any state would derive, did he have in mind only the agricultural development or did you also have the power possibilities in mind?

COM. WATSON: I had in mind all benefits tied to that reservoir whether it was storage, irrigation, power or whatever those benefits might be.

MR. ROLLINS: That is what I thought. If that is true, Mr. Chairman, then the question of power cannot be eliminated from this discussion it seems to me.

THE CHAIRMAN: As I understand the situation, Mr. Watson, isn't it this that you are setting forth before the Commission: That in the development of these resources and bringing them together, Utah is counting on recognition of the fact that she has available reservoir sites. You are not getting into the question of whether you should have more or less power or more or less land irrigated. It is one of the important contributions to the whole pool, that you have the sites in the State of Utah, and I don't believe there was any attempt to confuse that.

COM. WILSON: It is a question of somebody formulating a motion. I think everybody is in agreement on the principle. Mr. Carson and Mr. Breitenstein are formulating a motion.

COM. STONE: We are formulating a motion in an effort to outline the principle which was mentioned by Mr. Watson which will get it down to something specific.

THE CHAIRMAN: You have a motion to propose, Mr. Watson?

COM. WATSON: I move that the Legal Advisory Committee be requested to draft a provision to effectuate the principle that losses of water incidental to reservoir operations be proportioned between the states upon the basis of the benefits received from such reservoir operations.

COM. STONE: Second the motion.

THE CHAIRMAN: Is there discussion of the motion?

MR. RITER: I would like to raise a question if you don't mind. Maybe we should defer it until you get something specific before the Commission, but I would like to refer to the fact that if you are going to take power as one of your benefits and it is understood by everybody that is what one of the benefits is and that goes into this compact and this compact comes before the Congress, you are going to open up the old fight again with California because California will say it is going to be a bad precedent to apportioning the

evaporation losses at Lake Mead, which has not yet been done.

COM. WATSON: Isn't it possible that Mr. Carson may have an idea on that? Will you talk to that point, Mr. Carson?

COM. CARSON: Mr. Chairman, it seems to me that the concept of an evaporation loss being due to a power operation and therefore the evaporation loss being charged to power operation as distinguished from any state is a misconception in this, that power as such has no right to consume water. If any water is lost by evaporation from a reservoir that should be used solely for power production, the effect of it is to cut down the quantity of water that can be apportioned among these states.

I think for the purpose of this proposal here it would work out fairly to say, subject to the study by this Committee, that the evaporation losses on any reservoir should be borne ratably by the persons who are benefited from the storage in the reservoir which makes the evaporation loss possible, either between states or between users in one state and users in another state. And I think that would work out fairly and equally concerning a reservoir in an upstream state for the benefit of a lower state and also a reservoir in a lower state for the benefit of an upstream state if some matter could be worked out as Mr. Ollie Larson said yesterday concerning debits and credits in the bank in the lower reservoir. That would be my idea of how it could be worked out.

I don't think it aids us to say we charge so much to the power because power has no separate apportioned right to use water and whatever evaporation it causes reduces the amount of water that can be apportioned to the states.

THE CHAIRMAN: It is the opinion of the Chairman that Mr. Riter's suggestions are pertinent but as the matter is referred to the committee of lawyers they will no doubt give that matter consideration, and if we attempt to go much further on it here we will be attempting to do the work that has been assigned to the committee.

COM. CARSON: I would just like to say one other thing in connection with Mr. Riter's reference to Lake Mead. As Mr. Riter states, we for Arizona agree that we who benefit from the storage in Lake Mead must bear the evaporation loss ratably in proportion to the benefit we receive from that storage, and that California denies. But I believe that equity would require that persons who do benefit by that storage share ratably any evaporation loss caused by that storage; and also that any storage of water of the stream either in an on-stream reservoir or in an off-stream reservoir is in equity considered as diverted from that stream, any interference with its natural flow.

(Discussion off the record.)

COM. WATSON: Mr. Chairman, may I for the benefit of the record state that in considering the Glen Canyon Reservoir we ought to figure whether or not the Rainbow National Monument would be submerged because we certainly wouldn't want to lose that arch for the benefit of California.

COM. STONE: I move the question, Mr. Chairman.

(Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

THE CHAIRMAN: We will now proceed to the next item.

COM. STONE: Mr. Chairman, do you wish and is it agreeable to the Commission for Colorado to submit the next factor or point?

THE CHAIRMAN: That was the intention of the Chairman that Colorado would continue with its presentation of the various points on its agenda.

COM. STONE: Colorado submits this factor or question for the consideration of the Commission: Shall beneficial uses, whether consumptive or not, be given any order of preference? And in line with our procedure of the past I will ask Mr. Breitenstein to open the discussion.

MR. BREITENSTEIN: Well, by "order of preference" we mean, shall a particular type of use, that is domestic, irrigation, industrial, hydroelectric power generation, navigation, or many others, be given any preference? Shall there be a list of preferences? Here in our State under our Constitution and statutes, we have such a list of preferences and I assume the other states do. As you all know, under the Colorado River Compact, domestic and irrigation are given the first preference. Now that subordinates the use of water for the generation of hydroelectric power to domestic and irrigation uses.

Is it desirable or necessary to have such a preference list in an Upper Basin Compact? It probably can be argued with considerable force that since the Colorado River Compact does establish a list of preferences for the entire Basin, it is necessary in an Upper Basin compact to include a provision of the same type as that in the Lower Basin Compact.

You also recall the provision of the Colorado River Compact relative to navigation and I suppose you all know that there is a decision of the United States Supreme Court declaring certain sections of the Green and Colorado Rivers in Utah navigable. So is it necessary to place in the Upper Basin compact any reference to navigation?

While the problem perhaps sounds rather simple to state, I apprehend that it carries with it more source of future trouble than anything else. In all probability in the future after your main stem reservoirs are constructed and in operation, you are going to have a competition, unless by some means it is avoided, between those who would release large amounts of water for the generation of power and those who would hold the maximum amount of water back so it will be available to meet delivery obligations at Lee Ferry.

I think that states the principal factors which are involved in the question presented by Judge Stone.

COM. WATSON: What is Judge Stone's thinking on the matter?

COM. STONE: I want to remain open-minded and I am always impressed to find that my thinking is not always straight when I listen to some of the other Commissioners. But for the moment and to be more or less in the position of the Devil's Advocate, I am persuaded that these states as signatories to the Colorado River Compact are bound by that preference which is specified by the Colorado River Compact. Unless I can be shown to the contrary I believe that preference will have to be recognized by the Upper Colorado River Basin Compact.

I do not see how these states can become signatories to one compact expressing an order of preference and vary that preference with respect to a portion of the Basin, that portion which is the concern of these states. I think if we did there might be serious objection urged in Congress against any compact which we might submit for the approval of Congress. I don't believe it

is good policy or wise to deviate from that principle which we at one time agreed to so far as the whole Basin is concerned.

I also am and for years have been an adherent to that principle. It is my concept that the West has been adherent to that principle. We in the West in the arid section must rely on water for our agricultural development and for our domestic uses--everyone relies on it for domestic uses. We have great supplies as pointed out by Mr. Watson this morning of fuels for the production of electric energy. In my opinion we can never satisfy these states nor support the principle which we have always followed in these states if we do not adhere firmly to the principle of domestic and irrigation uses coming first.

I believe it is not only a principle wisely covered by the Colorado River Compact but it is a principle which has been adhered to in the West, and I refer particularly to Section 1 of the 1944 Flood Control Act where we imposed that principle upon states east of the 98th Meridian and specified that any uses of water arising west of the 98th Meridian for navigation and in the Arkansas River for power production, shall not adversely affect the use of water west of the 98th Meridian for beneficial consumptive use purposes including domesitc, irrigation, mining, and other beneficial consumptive uses.

I strongly urge for the moment, subject to changing my mind if I can see something to the contrary, that we maintain that principle by recognizing the same principle which is adopted in the Colorado River Compact in an Upper Colorado River Basin Compact.

COM. BISHOP: Mr. Chairman, we agree with that principle fully. Under our laws irrigation and domestic use is superior to power. And we hope this compact will be so worded that if a system of power dams is built on the River, it will operate so that as agricultural use becomes more until there isn't sufficient water to operate the power plants, they will be abandoned if you please as the water becomes needed for agricultural purposes. As I see it, the power projects will be built principally as far as we are concerned to take care, of course, of the power needs in the Basin and would pay for the irrigation benefits. After 40 or 60 years or a long time in the future, those benefits will have been paid and the power projects can well be abandoned to be replaced by electric energy from other sources.

COM. WATSON: I just wish to ask Mr. Bishop if he didn't think this string of reservoirs which will be selected as the most efficient in order to deliver the obligation at Lee Ferry, wouldn't that very operation entail the development of electric energy? Would there be any necessity for an abandonment in that case?

COM. BISHOP: I would hope not, Mr. Watson. But the point I was trying to bring out was that I wouldn't want to see the power hold up agricultural development even though it had to be abandoned. I think the engineers in making the plans should try to have it so planned that it isn't necessary to abandon the power.

COM. STONE: Mr. Chairman, I should like to point out this one other matter which occurs to me: We can't very well enforce this conception of preferential use for agriculture and domestic uses as supported by the Colorado River Compact if we are going to vary that rule in the Upper Basin.

MR. ROLLINS: Don't you think, Judge Stone, that the very fact that Congress has gone on record both in the Flood Control Act and the Navigation

Act, they would scrutinize very carefully any future laws or compacts which would in any way modify or abrogate that declaration of policy in Congress?

COM. STONE: I think so, Mr. Rollins. And so far as I am personally concerned I have taken such a strong position on it I would have difficulty supporting an Upper Colorado River Basin Compact that deviated from that rule.

COM. WILSON: Mr. Chairman, just to get in the record I would like to say I am entirely in agreement with everything Judge Stone said speaking on this motion. I think we can't do anything except to follow the language of the Colorado River Compact in reference to preferential uses. Now the motion read by Mr. Breitenstein, I don't know whether it mentioned navigation or not; did it?

COM. STONE: He didn't make the motion, Fred, but he did in his presentation of the question mention navigation and referred to the fact that the court had held that certain sections of the Green River and I believe the Colorado River had been held to be navigable.

COM. WILSON: Suppose we also incorporate in the compact language that is intended to make these uses you have mentioned superior to navigation? I would like to ask Mr. Breitenstein and the other gentlemen here if even assuming the Congress approved the compact, would that take precedence over the regulation of commerce under the Constitution of the United States?

MR. BREITENSTEIN: The Constitution of the United States says Congress has power to regulate commerce. If in the regulation of commerce Congress wishes to make navigation subservient to something else, it certainly has the power to do it.

COM. STONE: Mr. Wilson, we had a lot of experience on that question in connection with the Republican River Compact. That very question which you raise was presented. In the consideration of that compact we had the advice as legal adviser to the Federal Representative of Mr. Stinson, formerly of the Chief Counsel's office of the Bureau of Reclamation.

In the first Colorado River Compact the states attempted to make navigation subservient to these beneficial consumptive uses. That question raised a question in Congress when the Republican River Compact was presented to Congress. The action of the Congress, however, in approving the compact was vetoed by the President.

We recognized then that the states in making a compact had no power to compact on that particular question due to the fact that the Government of the United States is not a party to a compact, and the approval of a compact by the Congress does not make the United States a party nor make it a party to the extent that by approval it agrees to provisions in the compact.

Now we circumscribed that situation in the Republican River Compact by a special provision which stated that the states ratified the compact subject to concurrent legislation by the Congress which would make navigation subservient to the beneficial consumptive uses of water.

Now apparently when the Colorado River Compact was written that question was very much in the minds of those who wrote the compact because it says:

"Inasmuch as the Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the developments of its basin, the use of its waters for purposes of

navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes."

Then there is included this most significant statement--

COM. WILSON: That is the Colorado River Compact?

COM. STONE: Yes. It says:

"If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding."

Undoubtedly that language implies that the Commissioners had serious question as to whether they could make effective that provision and here in later years we have gone into that matter further and came to the definite conclusion that the Compact Commissioners did not have the power to make such a provision effective unless in making the compact the states say they ratify only if the Congress will pass concurrent legislation on that subject.

Someone might say that the '44 Flood Control Act may handle this situation. It does not because the entire Colorado River is west of the 98th Meridian, so we gain no help from that legislation. That legislation dealt with this same question and if we were a river covered by the 1944 Flood Control Act we would be in good position, but unfortunately we were not.

COM. WILSON: In other words, you think it would take not only the consent of Congress to this compact but specific legislation?

COM. STONE: My answer to that is "yes".

COM. WATSON: Mr. Chairman, I make this observation just to show that there will be some discordance thrown into this argument: The Colorado River Compact says, "Inasmuch as the Colorado River has ceased to be navigable for commerce. . ." In the operation of this River we are going to have a great string of reservoirs. We are going to do all we can in developing this River to make it navigable.

The River was considered navigable in certain sections by the Supreme Court when it held that the states owned the beds of streams because the river at that point was navigable. That was due to the fact that certain oil leases were in question and the question arose as to whether or not the land on the bed of the river belonged to the state or the nation. If it belonged to the state you went to the Land Board for the lease. If it belonged to the nation you went to the Land Office for the lease.

After all that has been done we turn around and make this river a navigable river. It doesn't make any difference what the assertion of the Compact is. The Compact is acting on the river as it was. As the river will be, it will be a navigable stream and there will be all kinds of sailing craft and fishing craft and boats navigating the river from one end to the other, and it seems to me the act of man is going to make it a navigable river regardless of the Colorado River Compact.

COM. STONE: Do you make the river navigable or do you create new navigation on bodies of water?

COM. WATSON: A lake is merely a wide place in the river.

COM. WILSON: Mr. Watson, don't you think the answer to that is

this: The declaration in the Colorado River Compact that the Colorado River had ceased to be navigable didn't have any effect one way or the other as to its navigability or non-navigability. It was a statement made but it didn't affect the question of whether it is or not.

COM. STONE: I think Judge Wilson is entirely right about it.

COM. WILSON: No matter what we say, unless the Congress exercises its powers and waives its right to treat it as a navigable stream there is nothing we can do.

COM. CARSON: That is the Economy Light and Power case on the Des Plaines River in Illinois.

COM. WATSON: Off the record. (Discussion off the record.)

MR. BREITENSTEIN: The point is that Congress has the power to regulate commerce between the states and if in the regulation of commerce between the states it says a certain river is not navigable, why it isn't under its control.

COM. CARSON: Well, Mr. Chairman, I don't think that we in a compact could bind the Congress but I don't think this is necessarily limited to the control of Congress as to the navigability of rivers. But they do have the control under the Constitution and the Supreme Court has said in that Economy Light and Power case that a river that isn't navigable in effect continues to be navigable until Congress declares otherwise although there hasn't been a boat on it in a hundred years or the memory of any living man. So that continues to be the law of the case.

But even though Congress should still claim that the Colorado River is navigable I believe a clause similar to that which was in the Colorado River Compact originally does have some effect so far as the interests of states in navigable rivers is concerned. I think it would be well to have such a clause following that of the Colorado River Compact in any compact that would be here written.

COM. STONE: Mr. Carson, you mean that we should have that loose clause? Under the Colorado River Compact you certainly didn't make navigation subservient.

COM. CARSON: You did so far as the states are concerned.

MR. BREITENSTEIN: In the Republican River Compact we did as far as Congress is concerned.

COM. STONE: You didn't make navigation subservient in the Colorado River Compact because Congress by merely approving the compact did not accede to that and navigation is a matter for Congress and not a matter for the states.

COM. CARSON: I know, but so far as the states' interest in navigation or resulting from Congress declaring a stream to be navigable, we did subserve all of the interests of the states to this priority system, which I think is as far as we can go here.

COM. STONE: May I submit, Mr. Carson, we can go farther and I think we ought to give serious consideration as to whether we should go farther by adopting the approach which was made in the Republican River Compact because there it became very effective.

COM. CARSON: My present thought is no, that we should not go beyond

this but I am open to discussion or argument on it. The reason is that here is a compact that is made by all these states, seven states; two of them are not here. This compact has got to be based upon the Colorado River Compact, so I think as clearly as we could we should follow the definitions and the language of the Colorado River Compact to avoid giving to the other states that are not here represented any possible claim that we had by this Upper Basin Compact put ourselves in a position to violate the main Colorado River Compact or raised any question as to its validity. With that kind of a clause in there there would be nothing to prevent our undertaking to join together to get an Act of Congress declaring it ceased to be navigable but I think it should be outside and apart from the Upper Basin Compact.

MR. ROLLINS: Mr. Chairman, if the Colorado River had been a navigable river before the ratification of the Colorado River Compact and before the building of the Bouder Dam, certainly when the Boulder Dam was built it ceased to be a navigable river in its entirety. How are you going to get around it?

MR. BREITENSTEIN: Your law isn't good on that, Mr. Rollins, unfortunately.

COM. CARSON: It is still a navigable river under the decision of the Supreme Court of the United States in the action brought by Arizona challenging the constitutionality of the Boulder Canyon Project Act.

COM. STONE: I am inclined to think that Mr. Carson has something there from a practical effect leaving out all legal considerations. I don't think we have got very much to worry about because there will be dams across the river and such navigation as occurs will be that navigation described by Mr. Watson. It will be navigation on man-made lakes and reservoirs and won't be continuous navigation up and down the stream, and if we followed the provision of the Colorado River Compact we would be in keeping with the present compact but we would be accomplishing one very definite thing and that is except for navigation the use of the water---

"Subject to the provisions of this compact, water of the Colorado River system may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes."

That is the thing we are getting at and the navigation business to my mind so far as this situation is concerned is largely academic.

COM. CARSON: There is another phase of that, Mr. Chairman, that we should be bearing in mind as to whether we should consider any resolution of Congress declaring that it has ceased to be navigable.

THE CHAIRMAN: Gentlemen, we will recess for five minutes.

(3:55 p.m. Recess.)

(4:00 p.m. Meeting resumed.)

THE CHAIRMAN: Gentlemen, let's get to work again. We are going to get through now in about half an hour. The meeting will come to order. Judge Stone, do you wish to make any announcement in regard to the meeting of the Colorado River Basin States Committee in connection with the next meeting of this Commission?

COM. STONE: Yes, I wish to announce in compliance with the action taken at Salt Lake City on November 20th and 21st, I shall expect to call a meeting of the Basin States Committee to convene here at the same time that the Compact Commission meets on February 17th so that we can fit in a meeting of that committee at the time all of these men are here.

THE CHAIRMAN: Off the record. (Discussion off the record.) Then in view of the fact, Com. Stone, that you expect to call a Colorado River Basin States Committee meeting, beginning with February 17, 1948 the Chairman of the Upper Colorado River Basin Compact Commission will arrange at that time for an intermission to fit in with the work of the Colorado River Basin States Committee.

COM. STONE: Thank you, Mr. Chairman.

THE CHAIRMAN: We shall now resume consideration of the matter before the Commission.

COM. CARSON: Mr. Chairman, I was just about to make another observation on this question of navigation, that I think it should be carefully considered before any attempt would be made to get any resolution through Congress abandoning the Colorado River as a navigable stream, its possible effect on future appropriations for dams and improvements on the river. I want everybody to be thinking about that before we meet again.

COM. STONE: Mr. Chairman, I would like to prepare a motion on that subject to submit to close this matter and in preparing it I want to say that Colorado believes that this navigation matter is academic and all that we are interested in in submitting this point is the priority of beneficial consumptive uses and we believe largely we are bound by the present Colorado River Compact. There is some reason too to leave the subject alone because of authorization questions.

Mr. Chairman, I make this motion, that this Commission tentatively agree that the Upper Colorado River Basin Compact contain provisions relative to the preferential use of water in substantially the same form as now contained in the Colorado River Compact and that the Legal Advisory Committee be requested to draft the necessary language to effectuate this matter.

COM. WILSON: Second the motion.

THE CHAIRMAN: The motion is made and seconded. It is now open for discussion.

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

THE CHAIRMAN: Gentlemen, the Chairman is rather pleased with the work which you have done at this meeting here in Denver. I think we are making progress. This group certainly has it in it to handle this question, and you have some of the best brains in the country from a legal, engineering, and common sense standpoint.

Now there have been many questions submitted here by the states for consideration. You have all done a good job on that, and it is the hope of the Chairman that by the time we have the next meeting you will do some thinking on these questions so that we can begin to gather up the loose ends and bring this thing together.

Is there a motion for adjournment?

COM. WATSON: Move we adjourn.

COM. BISHOP: Second the motion.

THE CHAIRMAN: We now stand adjourned until February 17, 1948.

(4:15 p.m., Thursday, December 4, 1947, Commission adjourned until 10:00 a.m., Tuesday, February 17, 1948, at Denver, Colorado.)

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GOLD SUITS PONDERED

Actions Under Advisement

Cummings, Worried, Says Adverse Decision Would Result in Chaos

WASHINGTON, Jan. 11. (UP)—The Supreme Court tonight had under advisement the five suits brought against the government in an effort to force it to pay its gold obligations in old standard gold dollars rather than the present devalued paper dollars.

After desperate final pleas today Atty.-Gen. Cummings plainly was worried over the outcome of the actions which may wreck the administration's entire monetary policy.

An adverse decision by the court, Cummings said, would result in "chaos."

POSSIBLE EFFECTS

While observers discounted this statement, it was believed overthrow of this New Deal measure would:

Increase the funded debt of every corporation with gold clause bonds by 69 cents on the dollar;

Give gold clause bonds a premium rating on exchanges;

Depress the stocks of gold clause bond corporations because of the diminished value of asset value behind them;

Add to the expense of railroads and utilities with gold clause bonds, and thus make necessary higher rates;

Cancel the differential exportable goods enjoy in foreign markets.

FINAL APPEARANCES

The Attorney-General and Assistant Solicitor-General Angus MacLean made dramatic last-minute appearances in an attempt to answer sharp and significant questions which have been asked the government at previous hearings.

They stretched a scheduled half-hour of argument to almost an hour, then filed soberly from the courtroom as Chief Justice Hughes called the next case.

With that action, the five gold cases, involving more than $100,000,000, became locked in the internal deliberations of the court whence no secrets ever leak.

NEXT DECISION DAY

The decision may be announced February 4, the next decision day after the coming recess.

Cummings, in his closing appeal, dwelt on the serious thought which the administration and Congress had given the monetary program and the decision to give every dollar an equal parity with every other dollar. He emphasized the crisis which confronted the administration on taking office.

PURPOSE EXPLAINED

Cummings emphasized that, in invalidating the gold-payment clauses in private and public obligations, the government had not sought to hurt a given class, as had been contended, but that it sought to avoid creating a special class.

Money itself, he argued, is inextricably intermingled with the life of the people and of greatest importance in foreign relations and international commerce. This was a major factor in determining the government's policy.

CONCLUDING SUGGESTION

Cummings's apprehension perhaps was best typified by this concluding suggestion that, if the court wanted to hear further argument by the government later, it would be available.

MacLean was the last to dwell on the legal aspects of the cases. He sought to meet a question asked by Chief Justice Hughes at the close of yesterday's session, who demanded where the Constitution gave any authority for the government to refuse to honor war-time Liberty Bonds bearing the gold clause, in gold or its equivalent.

COMPARISON OFFERED

The assistant solicitor answered that the government could not be bound by any contract which might hamper the exercise in the future of its sovereign power. He compared the present case with a situation in which it might be agreed by the government that a person or piece of property should be forever exempt from taxation. Nothing could be construed as preventing the government from changing its mind at some future date and imposing taxes.

"Could not the validity of international loans stand on the right of a sovereign to make contracts?" Hughes asked the attorney. "Is it not of the essence of sovereignty to be able to contract because it might be necessary to its welfare to contract?"

DISTINCTION IN CONTRACTS

MacLean asserted there would be a distinction in contracts between nations, where the sovereignty of the other nations also would play a part and would create a question of international law.

Justice Pierce Butler asked about assertions that other nations have done to gold what this government did. He noted that English law on taking property for public use is different from American.

MacLean answered that while this might bear on the question of taking property without just compensation, the government does not admit that just compensation has not been made in paying the bonds dollar for dollar in currency.

"PERFECT BRIDE" PARTS FROM MARRYING JUSTICE

Emma won by elimination after he had interviewed several hundred applicants.

But Harrison's faith in matrimony is still unshaken.

"Whenever any of the children or grandchildren of the couples I have married want to get married themselves, I'll perform the ceremony free," he said.

EVANSTON (Ill.), Jan. 11. (UP)—Evanston's marrying justice and his "mail order" bride have separated.

Samuel Harrison, 82 years of age, who has performed 1500 marriage ceremonies, revealed today that he and his "perfect bride," Emma, 41, are living apart.

Harrison sought out Emma through a newspaper advertisement after his first wife died in 1936.

Scientist Compares Ransom Notes and Hauptmann Writing



J. H. Trendley, East St. Louis manuscript expert, studying specimens of Lindbergh ransom notes and phrases admittedly jotted down by Hauptmann after arrest. Writing nearest camera on chart was taken from kidnap letters. (A. P. Wirephoto)

NOTES LAID TO GERMAN

(Continued from First Page)

has made his living in the profession of what he calls "an authority of disputed script." His work has taken him to thirty-nine States, to Canada, to Europe and every other place where lives or fortunes swing on a question of hand-writing. In litigation involving a will his fee is $100 a day.

TECHNICAL ANALYSIS

No one was prepared, though, to see an elderly man who needed a mechanical device tucked under his coat to enable him to hear questions. There has been a parade to this witness chair of elderly men and all of them have testified against Hauptmann. They have been curiously alike, all of them having gray mustaches, ruddy faces and glasses. First there was Hochmuth and then Dr. John F. Condon.

Today there was Osborn.

He got his pointer and charts, turned his back on the jury and delivered a lecture on handwriting.

EXPLAINS SYMBOLS

"And what were your conclusions after you studied the handwriting in the ransom notes and the script that Hauptmann wrote in jail?" he was asked.

"I firmly believe Hauptmann wrote the ransom notes and wrote all of them. The same symbol is on all the notes. A red spot with interlocking blue circles. They were made, apparently, with some crude instrument that did not absorb ink well, probably the bottom of a cup or china dish.

"Three holes were punched at the bottom of all the notes. By holding all those notes up to the light, you can see through them, and they are so uniform that they must have been made by some mechanical device."

PECULIAR SPELLING

Osborn began to demonstrate the peculiar spelling in the ransom notes and told how the same spelling occurred in things Hauptmann admittedly had written, such as his application for an automobile license.

Here are some of the words:

"Signature" is spelled "singnature."

"Right" is spelled "riht."

"Light" is spelled "liht."

"House" is spelled "haus."

"Our" is spelled "aure."

And, furthermore, Osborn said "that spelling shows that the writer of these notes is of German extraction."

SCHWARZKOPF TESTIFIES

It was a technical discussion, barren of the stark tragedy and drama that has been dwelling in the courtroom, and the persons it interested most were those whose mind has a technical turn. Two of those today were Hauptmann and Lindbergh, who sat six chairs apart, and hung on every word of Osborn's lecture.

Col. Norman Schwarzkopf, chief of New Jersey State Police, went to the witness chair briefly to clear up another point about which the world has been wondering ever since Hauptmann was arrested. Did the police give him a third degree in an attempt to force a confession out of him? Schwarzkopf, in his capacity as head of the New Jersey State Police, was in Greenwich Village police station the day Hauptmann was arrested.

WROTE VOLUNTARILY

"Were any threats made against Hauptmann when police asked him for samples of his handwriting?" asked defense counsel.

"No," Schwarzkopf replied.

"Was he ill-treated?"

"No, he gave us the handwriting voluntarily."

Although there was $14,600 of Lindbergh's ransom money in court today, the envelope which contained it never was unsealed. The defense did bring in a $5 bill, which was part of the ransom money. Across the back of it in ink was written "Loew's," indicating it had been handed into a theater box office.

Frank J. Wilson, intelligence officer for the Internal Revenue Bureau, was on the witness stand. He identified the $5 and the $14,600 in the red envelope as being part of the $50,000 that Jafsie handed across a cemetery hedge.

NONE AFTER ARREST

Then he began to clear up some more things about which everybody who knows about the Lindbergh case has speculated for months:

"Was there any of this ransom money passed after Hauptmann was arrested?"

"Not to my knowledge."

"Was any of it passed outside the United States?"

"No."

"Where was most of it passed?"

"In or around New York City."

NEW NAME IN CASE

"Was there $2980 of this ransom money turned in to the Federal Reserve Bank in New York on the day President Roosevelt ordered in all gold certificates?"

"Yes."

"Whose name was on the deposit slip?"

"J. J. Faulkner."

"Did you check up on J. J. Faulkner?"

"Yes, and found out a man by that name had just died."

"He had committed suicide by leaping from the Chrysler Tower in New York?"

"Yes."

"Was the handwriting on his deposit slip that of Bruno Richard Hauptmann?"

"I was told it was not."

STRESSED BY DEFENSE

The defense regarded this as an important point, indicating that some one other than Hauptmann had handled the ransom bills. Defense counsel have intimated they will seek to link the kidnaping to a gang of four persons—as yet unidentified.

So now—almost three years after Jafsie handed $50,000 over the cemetery hedge—it is possible to strike a balance sheet on what became of the money. Here it is:

Paid by Jafsie—$50,000.

Recovered at intervals, chiefly in New York City and in small amounts—$3980.

Recovered from the Hauptmann premises in the Bronx—$14,600.

Total recovered—$18,580.

Still unaccounted for—$31,420.

Court adjourned tonight until Monday.

RANSOM BILL APPEARS IN PENNSYLVANIA

GETTYSBURG (Pa.) Jan. 11. (UP) A Lindbergh ransom note turned up in Gettysburg today.

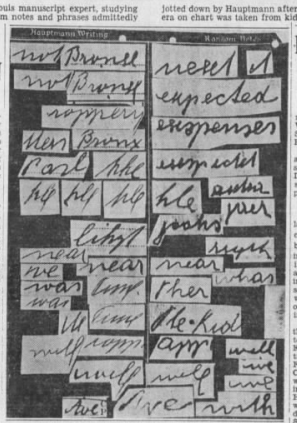
When Mervin E. Tipton, who conducts a shoe repair shop, handed Charles W. Myers, his landlord, a $10 bill in part payment of rent, both men noticed that the bill was drawn on the Hunterdon county National Bank at Flemington, N. J.

Suspecting that the note might be one used in paying the Lindbergh ransom, both men went to a bank where the serial number was checked. The number, A001005, tallied with the number of one of the ransom notes. Tipton is unable to trace the ransom note. Department of Justice officials were notified.

TANKER BLAST BRINGS FIRE

NEWARK (N. J.) Jan. 11. (UP)—Fire which followed upon an explosion aboard a tanker being loaded with gasoline destroyed the barge, a pier and a warehouse today, threatened near-by storage tanks filled with thousands of gallons of oil and gasoline and caused damage unofficially estimated at $150,000.





Handwriting chart at baby murder trial. Samples at left are those of Hauptmann's penmanship. Those at right are from ransom notes. (A. P. Wirephoto)

HAYS OUSTER FIGHT SEEN

(Continued from First Page)

mount sales; Abel Cary Thomas, Warner general counsel; Gradwell Sears, Warner sales executive, and Herman Starr.

Charges of conspiracy, coercion and intimidation were fired at the sixteen defendants as the Justice Department prepared to initiate similar action in Los Angeles and possibly several other leading cities.

THREE NAMES MENTIONED

Although there was no direct relationship between Hays and the companies and individuals accused by the St. Louis grand jury, well-informed circles tonight were hearing that the monopoly drive is aimed indirectly at the head of the industry's most prominent trade association. The administration also was reported to be attempting to outlaw the practice of block booking in a similar roundabout fashion.

According to Washington reports, the Roosevelt administration desires to see Hays replaced by Joseph P. Kennedy, former Paramount executive and present chairman of the Federal Securities and Exchange Commission; Herbert Bayard Swope, well-known writer, editor and prominent Democratic leader, or Frank H. Walker, who at one time connected with Paramount and one of President Roosevelt's closest friends. Swope at present is a director of the Radio Corporation of America and of Keith-Albee-Orpheum.

HAYS VISIT REPORTED

The capital gossip also reported that Hays, whose contract with the organization has two or more years to run, has been practically shorn of all authority as the result of disagreements with members of his board of directors. Industry representatives maintained, however, that relations between the association president and leading executives of the 9000 producers are harmonious and agreeable.

This contention, however, was doubted by persons who understood that Hays recently paid a quiet visit to the White House to find out personally the Roosevelt attitude toward the industry in general and himself in particular. While friends of the former Republican Postmaster-General asserted that Hays and President Roosevelt are on good terms, Democratic sources indicated clearly that the White House desires a major housecleaning of the entire industry.

ASK CODES ABOLISHED

The filing of the indictments at St. Louis also stirred up new demands for the abolition of N.R.A. codes and an ending of the suspension of anti-trust laws under the Industrial Recovery Act. Administration critics in Congress, particularly Senate progressives, were highly elated at the news of the charges against the oil industry and called for a continuation of the campaign.

Black and red chows reasonable. Poke pups. Chows at stud. For information see Class. 295, Times Classified Ads.

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DEATH CALLS TO SEMBRICH

Former Opera Soprano Had Been Ill Since November 15 of Heart Ailment

NEW YORK, Jan. 11. (AP)—Mme. Marcella Sembrich, 76 years of age, internationally known opera singer, died today at her home here, after an illness of nearly two months.

Death was due to heart complications, from which the former Austrian operatic soprano had been ill since November 15, last. Her home was with her son, Marcel William Stengel, and his wife. They are the only relatives she had in this country.

Mme. Sembrich was internationally famous for her interpretation of Italian operatic roles.

RETIRED IN 1916

Although she suffered illnesses in 1930 and 1931, she was active some months ago, and in 1933 actively aided in a campaign for funds to keep the Metropolitan Operahouse open.

She made her first appearance in America in "Lucia di Lammermoor" at the Metropolitan Operahouse October 24, 1883, and afterward sang in the leading cities of the United States for many seasons. She retired from the operatic stage in 1909 and from the concert stage in 1916.

TRIUMPH IN EUROPE

Her great international triumph came in June, 1880, when she sang "Lucia" in Covent Garden, London. Before that she had appeared at the Dresden opera and within a short time had the city at her feet. She next went to Berlin, where no opera singer except Lilli Lehmann had scored such success as was hers.

From Berlin as a center she undertook tours all over Europe. Every year she went to Russia, and invariably returned laden with costly gifts showered upon her by royalty and nobility.

PRICE-FIXING DOOM SEEN

N.R.A. Board Member Says Policy Will Fall of Its Own Weight

WASHINGTON, Jan. 11. (UP)—A. D. Whiteside, N.R.A. Administrative Board member, told business men today that price-fixing eventually will fail "of its own weight."

"There is no Federal law that can compel supply and demand," Whiteside said at a hearing on the board's proposal to remove price control provisions from most codes.

MIGHT BRING ORDER

A law, he said, however, might "supply and demand into some order in times of stress."

Opposition to the board's proposal gathered force as the hearing on the business men assembled for the meeting.

William A. Hollingsworth, Code Authority chairman for the retail trade, said price fixing has benefitted the little business man in his line.

COMPLETE COMPLIANCE

Representing more than 100,000 retail tobacco stores, Hollingsworth said assertions that price fixing is impractical and unenforceable do not apply to the tobacco trade. He said almost complete compliance with code provisions has been obtained.

W. A. Harriman, N.R.A. administrative officer, said he expected the hearing to be finished tomorrow.

Gain in Drunk Cases Reported

SAN FRANCISCO, Jan. 11. (AP) Prohibition repeal increased the number of persons treated for drunkenness in this district here almost 22 per cent during 1934, Dr. J. C. Geiger, City Health Officer, reported today.

He said there were 7468 treatments in 1934 against 9539 last year. The latter number was 14.2 per cent of all treatments.

NOW IT'S "LILAC TIME" EVERY SATURDAY AT 3 P.M.
Revel in romantic melodies, sung by Earl Oxford!
Learn the latest dance steps, taught by Arthur Murray!
Practice at home favorite dance tunes, played by the Pinaud Orchestra!
Thrill to stirring songs, by the Chevaliers' Octette!
Lilac Time is the gay musical show sponsored by PINAUD—the show that is taking the East by storm! You've been asking for it—here it is! Brought to you every Saturday, 3 P. M., Columbia, by
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on behalf of their fine famous specialties, Eau De Quinine Hair Conditioner, Lilac De France, perfumed skin lotion, and Six-Twelve, Eyelash and Eyebrow Beautifier.

Diva Succumbs



Mme. Marcella Sembrich, former opera star, who died in New York yesterday.

MANCHUKUO EMPEROR ILL

Kang Teh Reported to Be in Grave Condition With Little Hope for Recovery

LONDON, Jan. 11. (AP)—The Singapore correspondent of the Exchange Telegraph Agency reported today that Emperor Kang Teh of Manchukuo is gravely ill, there was little hope for his recovery, and that a regency council has been appointed to govern the Japanese-created empire.



Emperor Kang-Teh

Colorado Flow for 1934 Sets All-Time Low

LAS VEGAS (Nev.) Jan. 11. (UP) Last year's severe drought was reflected in a 75 per cent drop in the annual flow of the Colorado River, establishing an all-time low.

The run-off during 1934 was 4,372,200 acre feet, compared to normal of approximately 16,000,000. The maximum flow last year was 24,350 cubic feet per second, occurring May 18; the minimum was 1780 cubic feet August 14.

The highest flow on record was in 1884 when 300,000 cubic feet per second roared down the stream bed. The nearest recent approach to that figure was 200,000 feet per second in 1921.

LAND BUYING PLAN URGED

Resources Board Proposes $675,000,000 Outlay to Retire Poor Acreage

WASHINGTON, Jan. 11. (AP)—A huge program to spend $675,000,000 in buying up poor land and retiring it from farm production was recommended to President Roosevelt today by the National Resources Board.

The purchasing would be extended over fifteen years, 9,000,000 acres being bought each year at an annual cost of $45,000,000.

CONSERVATION MOVE

This farm land, comprising 450,000 farms, should be withdrawn from agriculture, the board said "in order that both the natural and human resources of the nation may be conserved."

The report, drawn by the board's land planning committee, is supplementary to the board's earlier study—which President Roosevelt told Congress would guide the expenditure of $4,000,000,000 in his new work-making program.

FURTHER SUGGESTION

It urged that the Federal government and the States take steps to prevent further settlement of lands so poor the occupancy is "clearly contrary to the public interest." It turned thumbs down on any "substantial movement of unemployed people from urban areas into commercial agriculture."

Land to be retired, the committee suggests, may be added to the national forests, or leased to States for wild life refuges, parks and the like.

ICKES OPENS 'LITTLE MAN' OIL INQUIRY

Special Committee Ordered to Study Effects of Code and Recovery Law Clause

WASHINGTON, Jan. 11. (AP)—Secretary Ickes, the oil administrator, today named a special committee not connected with the oil administration to make a survey of the effects on independent and small enterprises of the oil code and Section 9C of the recovery law.

This was the section empowering the President to regulate interstate oil shipments, which was ruled invalid by the Supreme Court.

TO STUDY COMPLAINTS

Ickes said the committee will investigate complaints from some of the smaller operators and companies that they are being handicapped to some extent by the effects of the code. It will confer with him tomorrow before beginning its inquiry.

COMMITTEE MEMBERS

Members of the committee: Paul Blazer, Ashland (Ky.) independent refiner, chairman; Mason Houghland, Nashville (Tenn.) independent marketer; Sidney Swensrud, oil economist with the Standard Oil Company of Ohio; H. B. Fell of Ardmore, Okla., executive vice-president of the Independent Petroleum Association of America; R. E. Allen, secretary of the Committee of California Oil Producers.

MAROONED RUSSIANS SAVED

ASTRAKHAN (U.S.S.R.) Jan. 11. (AP)—After being marooned for ten days on an ice floe in the Caspian Sea, eight-nine fishermen escaped today over an ice bridge pointed out to them by airplanes.

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Bar Gold—London ..... 141s 4½d (United States equivalent $34.80)
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New York 54¾c
Quicksilver—New York 73.50-75.50
Copper—Electrolytic Blue Eagle.. 9
Lead—N. Y. 3.70; E. St. Louis.. 3.55
Zinc—E. St. Louis 3.75

Nevada State Journal

Established November 28, 1870
Client of the United Press Associations

THE WEATHER
Nevada—Cloudy Friday. Saturday unsettled with snow and rain. No change in temperature.
TEMPERATURE YESTERDAY.
Highest 33 Lowest 19

VOL. LXIV. NO. 60. Entered as Second-Class Matter at Postoffice, Reno, Nevada RENO, NEVADA, FRIDAY, JANUARY 11, 1935 PRICE FIVE CENTS

'WOMAN IN GREEN' IN HAUPTMANN TRIAL

Mary Pickford Divorces Doug In 3 Minutes

Hollywood's 'Perfect Marriage' Ends in Judge Ben Lindsey's Court; Only 4 Questions Asked

LOS ANGELES, Jan. 10.—(U.P.)—The "royal family of Hollywood" was finally divorced late today when Mary Pickford obtained a divorce from Douglas Fairbanks, Sr.

In a quiet, three-minute proceeding that was terminated almost before she knew it, the slight blonde complainant placed the final stamp of failure on Hollywood's one-time "perfect marriage."

The decree was granted on the ground of mental cruelty, a consequence of Fairbanks' protracted absences from California.

She answered only four questions to dissolve a marriage about which had been written and spoken many thousands of words. Her attorney, Loyd Wright, asked:

"Have you lived in this county for more than three years prior to filing of this complaint?"

No Community Property

"Yes, I have," Miss Pickford replied.

"You allege herein that there is no community property and that a property agreement has been made to the full satisfaction of both your husband and yourself. Is that true?"

"That is true; there is no community property."

"Have you read carefully all the allegations which are contained in your complaint?"

"Yes, I have."

Before Judge Lindsey

"And you are familiar with all the allegations?"

"Yes, I am, and they are all true."

"That is all; you may step down."

Apparently surprised by the brevity of the proceedings Miss Pickford hesitated, and Superior Judge Ben B. Lindsey, before whom the case was tried, prompted her to leave the stand.

No Contest

She was succeeded on the stand by Mrs. Elizabeth Lewis, her secretary, who corroborated the fact of final residence said to her knowledge the allegations in the complaint were true.

Judge Lindsey then announced that there was no necessity of going into details in the absence of Fairbanks, who had disclosed several months ago his intention not to contest the suit, and the decree was entered, three minutes after Miss Pickford had stepped into the courtroom.

Miss Pickford's demeanor as she entered the courtroom was calm. She was almost gally dressed in a huge gray broadtail coat, gray frock, gray straw-and-cloth hat with a red feather and red scarf.

London Case Ignored

As was expected, the complaint made no mention of the recent divorce in London of Lord Ashley from Lady Ashley, the former Sylvia Hawkes, London actress, a suit in which Lord Ashley charged infidelity and named Fairbanks corespondent.

The couple's marriage, a secret from Sunday morning in March, 1920, was hailed by fans the romantic world over as a perfect union, a shining tale from the story books.

DOUG SILENT

ST. MORITZ, Switzerland, Jan. 10.—(U.P.)—"I have nothing to say."

That was all reporters could get from Douglas Fairbanks, Sr., late tonight, when they told him Mary Pickford had divorced him in Los Angeles.

Lady Sylvia Ashley also is a guest in the hotel.

SILVER QUEEN CLAIMS SOLD

New York Hears of Important Mojave Transaction

NEW YORK, Jan. 11.—(U.P.)—The Silver Queen claims near Mojave, Cal., reported to be one of the most important gold strikes on the west coast in 30 years, changed hands today, according to Dow-Jones & Co.

A group organized by the Gold Fields American Development Co., subsidiary of the United Gold Fields of South Africa and including several British and American mining corporations, according to Dow-Jones, have exercised in the name of the Golden Queen Mining Co. of Delaware their option to purchase the Silver Queen properties. United Press inquiries at the New York office of the Gold Fields American Development Co. elicited the information that "the company had nothing to say."

Discovery of the Silver Queen claims by George Holmes more than a year ago was followed more recently by concentrated efforts by various mining interests to acquire the properties.

Senate Committee Backs World Court

WASHINGTON, Jan. 10.—(U.P.)—The senate today received a favorable report from the foreign relations committee on United States adherence to the world court.

The report, which was presented by Majority Leader Joseph T. Robinson, author of the ratification resolution, said:

"The United States should delay no longer in giving its adherence to the world court, which promises much for the future development of the American policy of judicial settlement of international disputes."

Modern Cribbing Revealed in N. Y.

NEW YORK, Jan. 10.—(U.P.)—Modern methods in examination cribbing today were outlined by a New York university undergraduate quarterly:

1—Examinee has palm-sized note pad with rubber band to snap it up his sleeve if teacher comes.

2—Write notes on spectacles in grape fruit juice and breathe on the glasses when in a pinch.

3—Stick notes in back of watch and if teacher inquires, tell him it's a picture of grandma.

MILLION SILVER DOLLARS DAILY PUT IN SERVICE

WASHINGTON, Jan. 10.—(U.P.)—The treasury pushed $35,607,743 more in silver certificates and coin into circulation during December, bringing total silver money in the hands of the public to a record high of $917,535,466.

Issuance of silver money at a rate of more than a million dollars a day reflected the administration's silver rehabilitation program.

While silver money increased in December, total money in circulation fell from $5,546,533,937 to $5,535,713,269, the treasury reported today.

During December silver certificates in circulation rose from $636,357,140 to $691,622,417, subsidiary silver from $291,127,881 to $294,345,995; and standard silver dollars from $31797,694 to $32,046,106.

SEN. BORAH WARS UPON MONOPOLY

U. S. Licenses for Corporations Are Proposed

WASHINGTON, Jan. 10.—(U.P.)—Sen. William E. Borah, R., Idaho, bitter foe of monopoly, today opened his fight to protect the little business man in the shifting economic picture guided by the New Deal.

He introduced in the senate a bill to license all corporations engaged in interstate commerce and warned that this measure would be followed by a federal incorporation act.

Federal Control

Thus, Borah reasoned, business and industry will have their choice of reorganizing their capital structure to meet stiff federal incorporation requirements or to comply with demands of a federal license.

"The aim and purpose of the act," he explained, "is to bring commercial corporations engaged in interstate commerce under practically the same supervision and control as now obtains with reference to common carriers."

Some Exempt

Banks, common carriers, radio broadcasting companies and other organizations already subject to federal control or regulation would be exempt under the proposed legislation. Licenses would be refused to any corporation "which shall be found to be an unlawful trust or combination or a monopoly."

The federal trade commission would be authorized to administer the new project. It would be given almost dictatorial powers over industry with authority to revoke licenses of any corporation found guilty of violating anti-trust laws.

Inquiry Asked

Borah's measure followed within two days a resolution offered by Sen. William King, D., Utah, authorizing a congressional inquiry to determine whether suspension of anti-trust laws under the NIRA had encouraged monopoly and, if so, to what extent.

Both proposals denoted an increasing sensitiveness on Capitol Hill to widespread complaints from many sections of the nation that the little man slowly was being driven out of business by powerful combinations which have sprung up under New Deal plans for industrial self-rule.

Asks Fingerprints To Prevent Crime

CHICAGO, Jan. 10.—(U.P.)—Chicago headquarters of the department of justice was glad to comply when Richard Hennessy wanted his fingerprints taken but it did want to know the reason. "If ever I'm tempted to commit a crime, having my fingerprints on record may deter me," he explained.

Fan Dancer Is Too Much for France

PARIS, Jan. 10.—(U.P.)—The police purity squad today forbade the American fan dancer, Jean Warner, to dance in the nude in the ultra smart restaurant, Bagdad.

"Nakedness is all right in the theater," said the police, "but it is too close to the customers in the restaurant."

Cops Saved From Cowbells; Fog Lifts

MOUNT KISCO, N. Y., Jan. 10.—(U.P.)—Lifting of the fog today took a great weight from shoulders of police. Weather cleared just in time to prevent Police Chief Edwin B. McCall putting cowbells around the necks of his officers to save them from being hit by automobiles.

'PERCENTAGE GIRLS' HIT

Mrs. Mary Franzman Asks New Law to Forbid Barmaids

Women entertainers in barrooms were criticized last night by Mrs. Mary C. Franzman at an open meeting called by the Washoe county legislative delegation.

Mrs. Franzman asked the delegation to work for a bill which would prohibit women working behind bars or in front on a percentage basis. Beer parlors, she said, should have no barmaids.

Mrs. Franzman represented the W. C. T. U. at last night's meeting.

She also spoke in behalf of the national child labor amendment and urged the Washoe county delegation to support such a measure in this state.

Mrs. A. J. Buell, representing the Women's Forum, also spoke in behalf of the child labor law.

'Spill Blood If We Must,' Cry of Huey Long Foes

"Square Dealers" in Demand Laws Be Repealed

NEW ORLEANS, La., Jan. 10.—(U.P.)—Louisiana's newest political eruption boded trouble tonight for Senator Huey Long, who converted the state into a dictatorship and left it in charge of servile officials while he went to congress to save the country from the capitalists.

New leaders were springing up among the people. Old anti-Long forces rushed to their banners.

Recruits by the hundreds joined the "Square Deal Association," under the leadership of Ernest Bourgeois, 29, unemployed refinery worker.

Backed by prominent anti-Long business men, Bourgeois served an ultimatum on Governor O. K. Allen, Long's puppet, giving him until next Wednesday to call a special session of the legislature to repeal the dictatorship laws by which Long seized the state.

Bourgeois said it was "fight to the end and spill blood if we must."

The sixth congressional district, anti-Long hotbed, was in a frenzy. Dr. F. D. Travis, Hammond physician, organized the "Fair Fist and Skull club" and promised to have 1000 members in a month to help the square dealers. Membership cards cost a dollar and carry skulls and bones in red ink.

G. B. Campbell, publisher of the anti-Long Hammond Vindicator, told the United Press: "It looks like considerable hell is to be raised in this parish before many moons."

Excited square dealers suggested an "immediate revolution," with lynching parties for recalcitrant legislators.

Inquiry Asked

NEW YORK, Jan. 10.—(U.P.)—Senator Huey Long announced tonight he would make his cousin, Lieutenant-Governor Paul C. Cowingle, governor of Louisiana if Governor O. K. Allen would resign.

"But Oscar wouldn't resign unless he got a better job," said Long.

Decision Drafted In Tahoe Dispute

WASHINGTON, Jan. 10.—(U.P.)—Secretary of the Interior Harold L. Ickes said today his decision on the controversy between Nevada and California irrigation and power interests and Lake Tahoe property owners would be handed down within a few days.

He said the ruling had been written and given to Nathan R. Margold, departmental solicitor, before being made public.

Price Fixing Will End, Davis Asserts

LINCOLN, Neb., Jan. 10.—(U.P.)—Chester C. Davis, AAA administrator, told an organized agriculture meeting today that the administration will abandon price fixing through codes as a recovery measure except possibly in the field of natural resources.

"Price fixing through codes is on its way out," he said, "except perhaps in the field of the natural resources industries, particularly coal and oil."

Colorado's Flow Is 75% Below Normal

LAS VEGAS, Nev., Jan. 10.—(U.P.)—Last year's severe drought was reflected in a 75 per cent drop in the normal flow of the Colorado river, establishing an all-time low.

The run-off during 1934 was 4,272,000 acre feet compared to normal of approximately 16,000,000. The maximum flow last year was 34,250 cubic feet per second, occurring May 18; the minimum was 1780 cubic feet on August 14.

Booze Tax Exceeds A Million a Day

NEW YORK, Jan. 10.—(U.P.)—The nation's drinkers paid more than a million dollars a day into the treasury during 1934, Wright Matthews, acting commissioner of internal revenue, revealed today.

Total internal revenue receipts for 1934 were $374,506,232, he said.

7 Die in Fire

SOMERSET, Ky., Jan. 10.—(U.P.)—Five children and their parents burne dto death today when fire destroyed their mountain log cabin at Public, 16 miles east of here.

NEW BANK LAWS TO BE ISSUE

Administration Is in Favor of Strict Control

WASHINGTON, Jan. 10.—(U.P.)—Banking legislation, a subject President Roosevelt did not touch in his message to congress, gave promise tonight of becoming a subject of major conflict in congress this session.

An undercover movement on Capitol Hill to eliminate direct federal control from the federal reserve system by removing the secretary of the treasury as an ex-officio member of the board seemed likely to force the administration to reveal its hand as it runs directly counter to plans for increasing government control of banking.

Reply to Bankers

Proponents of the movement are drafting a bill which is regarded as the reply of banking and industrial interests to agitation for a central bank. The history of previous attempts along this line indicated the measure has a good chance to pass. During consideration of the Glass banking bill in January, 1932, the senate voted 62 to 14 to remove the secretary of the treasury from his federal reserve board membership. The house blocked the bill.

The measure was revived in the banking act of 1933 but removed at the personal solicitation of William H. Woodin, then treasury secretary.

Stricter Control Hinted

Repeatedly in recent months the administration has given hints of stricter federal banking control. Today it was learned the plans to give the federal deposit insurance corporation a read powers over all phases of banking.

A bill now being drafted at the request of Chairman Leo T. Crowley of the FDIC, proposes FDIC control over mergers and expansion, character of bank management, their economic position and capital structure. It also would write the FDIC more closely with the treasury. At present the FDIC insures individual deposits up to $5000 in 14,200 of the country's 15,900 operating banks.

SEC Head Complains

Meanwhile Chairman Joseph P. Kennedy of the securities and exchange commission claimed that efforts to regulate that field has been hampered by the action of the house appropriations committee in slicing some $720,000 from the budget of the securities and exchange commission.

Probably the most important congressional action of the day lay behind the announcement of Chairman James P. Buchanan, democrat, Texas, of the house appropriations committee, that President Roosevelt's request for a $4,880,000,000 "blank check" for relief would be honored. Only an additional $200,000,000 would be "earmarked" for specific purposes.

Jobless Actors to Tour CCC Camps

NEW YORK, Jan. 10.—(U.P.)—CCC boys can't go to Broadway so the government is bringing Broadway to them. Twenty troops of professional actors, many unemployed players from the Great White Way, have been organized by the emergency relief bureau to tour conservation corps camps presenting such stage favorites as "Turn to the Right," "Uncle Tom's Cabin" and "The Whole Town's Talking."

Tourist Trade in L. A. Is Up 30%

LOS ANGELES, Jan. 10.—(U.P.)—Importation of tourist—a major California industry—enjoyed a 31.8 increase during the past year, according to figures released today by the All-Year club, a tourist bureau.

Visitors to California numbering 1,103,994 brought an average of approximately $140 apiece with them—and spent it, the figures showed. Revenue figures increased 32.1 per cent to a tota of $148,229,361.

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Calles, Seriously Ill, Flies to U. S.

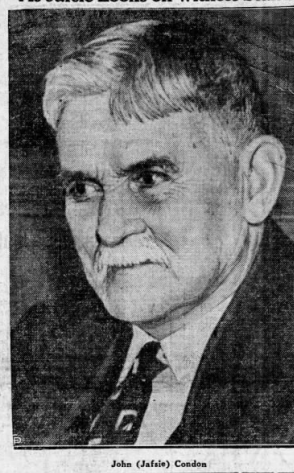
GLENDALE, Cal., Jan. 10.—(U.P.)—Gen. Plutarco Elias Calles, former president of Mexico, was brought here today by airplane from Mazatlan, Mexico, to undergo treatment for a serious abdominal disorder.

CHICAGO FOG LIFTS

CHICAGO, Jan. 10.—(U.P.)—A fog blanket which has covered the middle west since Sunday lifted today and was replaced by light snow.

Mysterious Figure is Injected Into Case By Attorneys for Prisoner

As Jafsie Looks on Witness Stand



John (Jafsie) Condon

6 TOTS KILLED; TRUCKER HELD

School Bus Is Upset When Hit by Heavy Vehicle

STURGIS, S. D., Jan. 10.—(U.P.)—A warrant charging first and second degree manslaughter for each of the six children killed in the school bus-truck accident near Dalcite was issued late today for Tad Roberts.

Roberts, who was first believed to have been a passenger in the molasses laden truck which struck the school bus at one end of a narrow bridge late yesterday, was driving the truck at the time of the accident, according to Coroner George Tisdale of Meade county.

The accident occurred, according to Coroner Tisdale, when the truck swerved to the wrong side of the road. A. F. Lindahl, driver of the bus, said he also swerved across the road, hoping to pass the truck on the wrong side. The two heavy machines crashed head-on. The bus was overturned, its top ripped open.

Boy Twists Head, Can't Straighten It

DETROIT, Jan. 10. — (UP) — Charles Vess, 12, was in the midst of working an arithmetic problem at school today. He twisted his head sideways. Five hours later Charles' head was still twisted sideways and physicians were attempting to right a dislocated vertebra.

SAAR CAVALRY BATTLES MOBS

Rioting Starts When South Americans Arrive

(Copyright, 1935, by United Press)

SAARBRUCKEN, The Saar, Jan. 10.—(U.P.)—Cavalry and mounted police battled with mobs in the streets of Saarbrucken today in one of the worst riots of the dangerous prebisicite period.

The Nazi German front organization had its usual cordon around the railway station. Suddenly opposition groups appeared. They jeered the Nazis and sought to break through their lines in an effort to reach the platform. They charged the Nazis were seeking to show the arrivals that all was unified and calm in The Saar, and all in favor of voting for rejoining the Reich under Nazi rule.

Mounted police charged the massed ranks of Nazi sympathizers. They were joined by the landjager, the native Saar cavalry.

The Nazis retreated in formation, but attempted another demonstration in front of city hall.

Name Postmaster

WASHINGTON, D. C., Jan. 10.—(UP)—President Roosevelt today sent to the senate the nomination of Delevan P. Defenbaugh to be postmaster of Winnemucca, Nev.

NEW STEAM ENGINE

Sheathed in Steel, Minus Stack and Bell, It Goes 120 M. P. H.

CHICAGO, Jan. 10.—(UP)—The steam engine, relegated to the junk yard by proponents of the Diesel stream lined trains, came up from a nine count today to reassert its supremacy.

Within 60 days, disguised as something that looks much like a prehistoric monster, it will be pulling the New York Central lines crack Twentieth Century between Chicago and New York at a maximum speed of 120 miles an hour.

The new engine, first to use the aero-dynamics design, is sheathed in gleaming steel and lacks most of the traditional equipage of the Casey Jones type. Belching smokestack and clanging bell are eliminated.

Its blunt front end will reduce air resistance 36 per cent at 90 miles per hour and its driving power is equivalent to 4075 horse-

DR. CONDON CLEARS UP TESTIMONY

Breckenridge Helps Jafsie When He Takes Stand

CLINTON, N. J., Jan. 10.—(UP)—Albert S. Osborne, partly deaf, internationally known handwriting expert, will take the witness stand tomorrow as the first of six state witnesses who will testify that Bruno Richard Hauptmann was the author of the Lindbergh ransom notes.

The state announced tonight that the handwriting phase of its case against Hauptmann will be explored exhaustively tomorrow and probably on the following session.

By HARRY FERGUSON
(Copyright 1935 by United Press)

HUNTERDON COUNTY COURTHOUSE, Flemington, N. J., Jan. 10.—(UP)—Jafsie walked out of the trial of Bruno Richard Hauptmann today and a mysterious "woman in green" took his place.

She has come to stay, too, for defense lawyers said, that some day soon they would put her on the witness stand as a final fling in their attempt to prove that Dr. John F. Condon was involved in the kidnaping.

Issues Cleared Up

Were it not for this woman in green, Jafsie would have an unbroken record of victories over Edward J. Reilly, chief defense counsel, with whom he fenced for almost two days over details of payment of $50,000 ransom. There were many vague and contradictory statements hanging in the steamy air of the courtroom when yesterday's session adjourned with Jafsie still on the stand.

But today he came in like a fresh breeze and blew them all out the window.

Suspicion Removed

Then Col. Henry Breckenridge, former assistant secretary of war and adviser to Col. Charles A. Lindbergh, got on the witness stand and helped blow away any fog of suspicion that yesterday's session may have left over Jafsie. He verified all important details of the old man's story, and ended by giving him a character testimonial.

The defense promises that the "woman in green" would return some day, before Hauptmann's right to live or die is written on a slip of paper and put into the hands of the jury foreman, and drag something from the past that Jafsie will need to explain.

Tells Same Story Again

No one had noticed her seated back in the throng of witnesses. Jafsie was on the stand, droning away on testimony that already was a twice-told tale in this courtroom —the story of how he drove up to St. Raymond's cemetery and paid $50,000 ransom.

It was a sleepy courtroom, for Jafsie's sallies and interruptions did not have the snap and sparkle that they had yesterday. About that time of day thermometers in the courtroom, which stood at 65 when the session begins, crawl up to 88 from the warmth of human bodies packed tightly into it.

Calls for Mrs. Keoran

Edward J. Reilly, defense counsel, hasn't been a crack criminal lawyer for 20 years for nothing. When it comes to play out a courtroom drama, he opens all the stops and lets the spectators have it. He was talking to Jafsie when suddenly he whirled and bellowed:

"Is Mrs. Keoran in the courtroom?"

Nothing happened at first. Then she came pushing through the crowd.

Led to Jafsie

She had on a green suit and a green felt hat. Forty-five might be her age. She is slender and short. Fifteen years ago her hair must have been red, but now it is shot through with gray and some of it

(Continued on Page 6)

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The Los Angeles Times (Los Angeles, California) · Sun, Jul 15, 1934 · Page 60
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Finding of Oil Fields by "Man-Made Quakes" Looms in New Caltech Tests

Along El Camino Real

With Ed Ainsworth

A BLAZING SKIES DAY after day refuse to yield any promise of needed rain, the thoughts of mortals turn more and more to water.

All over Southern California men are toiling to assure a supply of the precious fluid.

Under a red-hot sun in the desert, pygmies wrestle with steels and alone, concrete and coils of wire. They are building power lines to carry from far distant Hoover Dam the surging electrical energy that the great sheet of water there will generate.

•

Down in the bowels of a 10,000-foot mountain other gnome-peck and batter at solid rock. They are digging tunnels to slack the thirst of millions. Through these immense bores in the San Jacinto Mountains will rush smooth floods of water to come forth and make the Southland blossom.

In Imperial's cauldron sweating humans tear at earth and rock. A great canal is being fashioned to carry water to endless fields of alfalfa and lettuce. Melons and dates, tomatoes and peas will get their share. Moisture will bring forth the wonders of Eden for the tables of the world.

•

Dirt and concrete mount higher and higher in a growing hulk that is known as El Capitan dam in San Diego county. Behind it will pile up a great expanse of water to be used as parching lands demand it.

Water glistens now behind the solid mass of Pasadena's dam in San Gabriel Canyon.

Already, though, the little dams are suffering.

Lush grass grows now in the bottom of the lake as the water behind San Dimas dam dwindles. Six weeks ago the creek there began to go dry. Soon the lake may be gone entirely.

Devil's Gate reservoir is and has been for months only a dry and uninviting waste.

•

All this spurs the quest.

In stuffy offices men bend over maps and blueprints—in Ventura, in Santa Ana, in Sacramento, in Washington.

They are tracing water courses, planning dams, studying rain charts, pondering over the sinking water levels in California wells.

Ventura expects to have in six months a complete plan worked out for the county. Somewhere in the Ventura River watershed will be a storage dam.

This county is wise. It knows that it must prepare for the future. Its manifold attractions assure continued growth. It must overcome the dangers of run-off loss of water as the result of forest fires, both past and future.

Orange county also is hard at work on plans for water saving and flood control. Various interests are trying to compose their differences and pave the way for a unified appeal for Federal assistance. Already its project is on the "favored" list in the national capital.

•

On the brown, baked ranges, too, where lean cattle sniff hopelessly at the bare grass roots in hope of finding a cooling drink, the search for water relief goes on.

In the meantime the famishing cattle must be slain, victims of drought and a new era. Their flesh will go to fill the stomachs of hungry men and women on Federal relief rolls.

•

Until the skies relent or man finds a quick sure way to bring water to arid parched regions, the age-old cry still will go up to ring against the burning sky. "Water! Water!"

It is a cry that is spurring the minds and muscles of engineers and builders. Surely history will record no greater benefaction to the race than the sweating toiling men who bring water in plenty to arid towns and baking countryside.

•

Many motion-picture theaters in Berlin, Germany, are installing sound equipment.

PICTURE PLAYER WILL BE BRIDE

Claudia Cummings, Daughter of Actor Ralph Morgan, to Wed Photographer

PASADENA, July 14.—Claudia Cummings, motion picture actress and daughter of Ralph Morgan, character actor, will marry Robert Shippee, 24-year-old aerial photographer, it was revealed here today when the couple filed notice of intention to wed.

Miss Cummings, in filing the notice, stated she is a divorcee and that she resides at 920 North Roxbury Drive. Beverly Hills. Shippee gave his address as Red Bank, N. J.

Mr. Morgan accompanied his daughter to the marriage license bureau and paced up and down the corridor while the notice blanks were being filled in.

RED MENACE CHECK URGED

Warning Given School Group

Instructors of Trades Hear Dr. Gordon S. Watkins at Santa Barbara

Los Angeles Makes Clean Sweep of Prizes Given for Work Exhibits

SANTA BARBARA, July 14.—Several hundred California instructors of industrial subjects listened this morning to solemn warning that a Communistic element in the ranks of labor is striving to bring about wholesale unrest and unless sternly checked will inflict a social and industrial revolution upon the United States.

The speaker was Dr. Gordon S. Watkins, dean of the University of California summer session in Los Angeles. The occasion was the closing session of the California Industrial Education Association's convention at the Santa Barbara State Teachers' College.

FUTURE UNDER TRIAL

"We are beginning a new day and a new era," said Dr. Watkins after announcing his subject, "Industrial Relations and the New Deal." "We are looking into the future under trial and tribulation. Since the New Deal was promulgated we have had 2400 labor disputes. These really affected 4,000,000 individuals within the past year.

"Present discontent is largely due to difference of opinion on the question of collective bargaining and to an incoming feeling of unrest for which the Communistic element in labor is responsible. This element is a minority factor and we must keep it so if the new or any other deal is to restore normalcy.

LEADERSHIP ESSENTIAL

"Experienced leadership in labor organizations is essential to any effective improvement in the industrial situation. This many unions do not have. For instance, a young leader in Los Angeles recently called out the men of his trade over a matter of 25 cents a week. The workmen were getting $30 a week.

"We should work for a law making compulsory the arbitration of all labor disputes. The interest of the nations must be considered above that of the individuals. At the same time labor organizations should be guaranteed the safeguarding of such activities as their pension, insurance and hospitalization funds."

At the annual election of the C.I.E.A. A. R. Nichols, San Jose, dean of the San Jose Teachers' College, was named president; Roy L. Soules, supervisor of industrial education in the Santa Barbara city schools, vice-president, and H. S. Stewart, city schools industrialist at San Jose, secretary.

CLEAN SWEEP OF PRIZES

Los Angeles schools made a clean sweep of the prizes awarded for the best industrial schools exhibits. Miss Viola Swan, Fremont High School, won first prize with a doll project in cosmetology; Edward Barkoff, Frank Wiggins Evening Trade School, second with a model cost from his dressmaking and tailoring class. Miss Jaunita C. Darwin, Polytechnic special day and evening school, was third with a home art exhibit of flowers.

The judges were Miss Charlotte Ebbits and Miss Winnifred Frye of the home economics and domestic art departments of Santa Barbara State College.

CUPID FOILS JINX AFTER BAD "13TH"

Daughter of ex-Mayor of San Bernardino Married in Riverside Court

RIVERSIDE, July 14.—A belated Friday, the 13th, hard-luck story came to light today when William Bolton, 22 years of age, and Patricia Ann Catick, 18, both of San Bernardino, presented themselves at the marriage license bureau in County Clerk Clayton's office.

Bolton explained that on last May 2 the pair had obtained a Riverside marriage license. Yesterday they decided to use it and drove over here to be married. But when they arrived here the bridegroom-to-be discovered that in the interim he had lost his license.

In the meantime the clerk's office had closed for the day and the disappointed young couple was compelled to return home unmarried.

They came back early today, however, and Clerk Clayton issued them a duplicate license. Without further delay they went to the office of Justice of the Peace Moore and took the vows.

The bride is the daughter of J. W. Catick, once famous as San Bernardino's wealthiest Mayor," and now head of the Board of Water Commissioners.

SAN DIEGO TO OBSERVE ANNIVERSARY TOMORROW

SAN DIEGO, July 14. (AP)—Monday is the one hundred and sixty-fifth anniversary of Father Junipero Serra's founding of San Diego and the event will be commemorated appropriately on the site of that initial ceremony—Presidio Hill, at the northern edge of the city.

The San Diego Historical Society is sponsoring a program there. From the hill one can see Derby Dike, which was built by America's first great humorist, George Horatio Derby, many years ago.

O. W. Shepard, 92-year-old Civil War veteran and San Diego pioneer, will play violin solos, and Leroy A. Wright, former State Senator and pioneer San Diegan, will trace the city's history.

The program is expected to attract people from all parts of California and many Arizonans plan to attend, according to word received by the historical society.

Who Said Jack and Beanstalk!



Just a Sunflower

Left to right, Rena Saunders, Billy Saunders, Doug and Patty Wygand and in the front, Boogie Wygand with plant 21 feet, 8 inches high.

VAN NUYS, July 14.—Last April Rena and Billy Saunders, nieces and nephew of Mrs. John A. Bragg, read the story about Jack and the Beanstalk.

"It's all hooey," said Billy. "Nothing can grow so big."

"Let's try it, anyway," said Rena. She found a seed of some sort in her aunt's back yard and planted it. It became Billy's job to keep it watered.

Pretty soon out popped a sunflower plant. Billy kept on the job with his watering can. The plant is now twenty-one feet and eight inches high.

"Even if it isn't as high as the beanstalk," Rena said today, "it's about the tallest sunflower that ever grew around there parts."

DRY COLORADO RIVER LOOMING

Tanks to Water Stock Will Be Built in Imperial

EL CENTRO, July 14.—Irrigation district and county officials expressed today their belief that the Colorado River will be completely dry within ten days if it continues to drop at its present alarming rate. The flow at the Grand Canyon today was 2220 second feet, ninety second feet under yesterday.

A telegram received today by the irrigation district, from the Reclamation Bureau at Denver, reported the San Juan River dry for the first time on record. Hot, dry weather continues over the watershed and there is little hope for rain over Sunday.

Work will be given 350 men from the county relief rolls Monday on a new S.E.R.A. stock water relief project, the erection of corrugated iron tanks wherever stock water is needed in the valley. These will be filled by means of trucks. Fifty tank trucks have been requested by Charles Schotland head of the S.E.R.A. in Southern California who left for Los Angeles this morning to bring pressure for obtaining them.

Schotland said "The S.E.R.A. will spare no expense for the relief of humans and live stock suffering from lack of water in Imperial Valley."

BURGLARS GET PRISON TERM

SAN DIEGO, July 14.—William C. Butler, James Larson and Clifford Messter pleaded guilty this morning before Superior Judge Griffin to robbing the home of Herman Heisel. San Diego sportsman, after beating Heisel's Chinese servant, and this afternoon were on their way to San Quentin Prison.

OFFICIALS SEEK COLLEGE BUYER

Santa Barbara Buildings and Site on Market

Erection of New Structure on Mesa Held Up

Plan for Purchase by City Under Discussion

SANTA BARBARA, July 14.—Before the new State College can be built on the Mesa site overlooking Plaza Del Mar and the Santa Barbara channel, someone will need to buy the present college buildings and site on the Riveria, declared college officials today after a conference with Vierling Kersey, State Superintendent of Public Instruction. One possibility under discussion is for the city to bond and purchase the present plant for a price ranging upward from $300,000.

"We must face the proposition of local participation in the Santa Barbara College project," said Clarence Pheips, president of the college, today. "An ideal solution would be that of selling the present plant to some denominational college, but there is none in the offing.

"Another possibility lies in the local Board of Education's interest in the property as expressed by formal resolution last March. The plan would be ideal for polytechnic school work and such a course would draw population into the Santa Barbara High School district."

Supt. Kersey approved informally the plan of reinterating the local school board. The matter is one that requires quick handling if a possible $600,000 Federal loan is obtained, it is stated.

TWO SEIZED IN ORCHARD RAID DRIVE

Sheriff's Officers in Norwalk Area Declare War on Fruit Thieves

NORWALK, July 14.—Orange and lemon thieves in the Norwalk area are risking capture by Capt. Marty and his deputies, who declare they're going to stop the huge-scale operators who have nightly been raiding groves in the Sheriff's substation No. 4 area.

Capture of two men in a lemon grove of the McNally ranch at La Mirada by Deputy Sheriffs Lipscott and Andrews last night following three arrests made the night before of men found in the Tweedy grove indicate that the officers are making a determined stand.

Joseph Pergoni of Los Angeles and Lorenzo Catain of Alhambra are being held on suspicion of grand theft. A car filled with sacks of lemons and with license near the place where officers say the men were discovered picking the fruit.

San Diego Plans Exhibit of Gems

SAN DIEGO, July 14.—An exhibition of gems, illustrating San Diego county as the "gem casket of America," is being arranged for the California Pacific Exposition which is to open here next April, it became known today when George Kunz, dean of Rancho Santa Fe, veteran geologist and authority on semi-precious gems, reserved exhibition space for his collection of gems which have been found in San Diego county. The Dodds collection of semi-precious gems is one of the largest in the world.

He said six other collectors and geologists have already signified their intention of joining him in the exhibit.

CONCLAVE HEARS BISHOP TODAY

Brethren Will Climax Glendale Session



Bishop Laurin Burton Baldwin

GLENDALE, July 14.—Climaxing the seventieth annual session of the California Conference, United Brethren in Christ, Bishop Laurin Burton Baldwin of Corvallis, Or., head of the Pacific Coast district of the church, will deliver the annual conference sermon tomorrow morning. He will take as his subject, "Looking Into God's Word with Clarified Vision."

Bishop Baldwin also will give the concluding sermon of the five-day session tomorrow night, when he will address the delegates informally on "My Church."

The conference, which is being held in the United Brethren Church, Justin avenue and Fifth street, has attracted delegates from every county in the State, according to Rev. Lewis A. Regnier, pastor.

A special service was conducted tonight, at which Dr. W. B. Hogg of the Country Church of Hollywood was guest speaker.

BALCHEN TRIES OUT TRANS-ANTARCTIC PLANE

Pontoons Rushed From New York Used at Lake Elsinore



Bernt Balchen Preparing to Take Off in Polar Star

ELSINORE, July 14.—Equipped with pontoons rushed from Long Island, N. Y., the Polar Star that will carry Bernt Balchen and Lincoln Ellsworth on their trans-Antarctic flight was put today through final rigid tests on Lake Elsinore. The plane left for Mines Field, Los Angeles at 5:30 p.m. after completing its tests.

A squadron of United States Army planes from March Field dipped down over the lake both yesterday and today. Balchen as he took off from the water in the specially constructed all-metal airship.

Mrs. Balchen arrived yesterday from Norway to spend a few days with her husband, before he departs on the expedition to the South Pole. Mrs. Balchen will remain in Southern California until the latter part of the month when she will return to Norway via New York to rejoin their 3-year-old son, Bernt Balchen, Jr.

"WINGS" OF BALCHEN PLACED ON FLYERS' WALL

RIVERSIDE, July 14.—"Wings" of another famous aviator today graced the "famous flyers' wall" in the atrium of the Mission Inn.

Bernt Balchen was the airman thus honored. Balchen, who in 1929 flew over the South Pole and who will soon return to the Antarctic, placed his "wings" on the "flyers' wall" at an impressive ceremony. Preceding the rite, Mr. and Mrs. Balchen, Miss Molly Stillem, Avis Bresthen and Martin Borgord, a Norwegian artist, were guests of Mr. and Mrs. DeWitt Hutchins at dinner. Mr. Hutchins is assistant manager of the Inn. Balchen will sail from Los Angeles Harbor July 28 for New Zealand.

KERSEY ASSAILS BUILDING CODE

School Structure Law Held to Be Unreasonable

SANTA BARBARA, July 14.—The new school building code adopted by the California Legislature after the wrecking of several school structures in Southern California by the earthquake last year was denounced here today by Vierling Kersey, State Superintendent of Public Instruction. The criticism was voiced at a meeting of the Santa Barbara chapter of the American Institute of Architects hurriedly called at the Chamber of Commerce that they might take advantage of the official's visit to the city in connection with the conference of industrial educators at State College.

"The building code adopted under the Don Fields bill is unreasonable in its requirements," said Mr. Kersey. "The architects' fees, the costs imposed and unworkable unless its text is generously revised or given liberal interpretation by the courts. There will be no appreciable amount of school building in California until the interpretations requesting figuring on stress and strain and holding power of every nail in the structure are liberated."

Gun Club Trial Jury Dismissed

HUNTINGTON BEACH, July 14. A deadlocked jury was dismissed late last night by Judge C. P. Pann when it failed to reach a verdict in the trial of the Blue Bill Gun Club, charged by the county with the waste of water from pumping wells, emptied into duck ponds used for hunting purposes.

There are five more gun clubs to be tried. The Westminster Gun Club was convicted and fined, but the jury failed to agree in the Los Patos Gun Club trial.

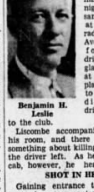
The Casadora Gun Club will be tried on similar charges July 19. Lick is president and David F. Smith, secretary.

SUICIDE THREAT EFFECTED

Pasadena Salesman Shoots Self to Deathbed Club After Late Taxi Ride to Eating Place

PASADENA, July 14.—Carrying out a threat he had voiced to several of his friends recently, Benjamin H. Leslie, 49 years of age, well known as an automobile salesman in this city for a number of years, shot and killed himself early this morning in his room at the Overland Club, 44 South Euclid avenue.

Shortly before midnight he had telephoned for a taxicab, and on its arrival had directed the driver, A. L. Lincombe, to take him to an all-night drive-in sandwich place at West Colorado street and Avenue Sixty-four. After drinking several glasses of beer at the sandwich place, according to police, he directed the driver to return to the club.



Benjamin H. Leslie

Lincombe accompanied Leslie to his room, and there Leslie said something about killing himself, but the driver left. As he reached his cab, however, he heard a shot.

SHOT IN HEAD

Gaining entrance to the house again, he accompanied Fred Langstaff, house man, to Leslie's room and found the salesman stretched out on his bed with a bullet hole through his head and a heavy revolver grasped in his right hand. Recently Leslie had been discharged from a position and his friend said worry over financial affairs was probably responsible for his act.

OIL MAN'S WIFE SAVED IN SURF

Notes Found in Auto of Matron Start Inquiry

HUNTINGTON BEACH, July 14. Rescued from the surf this morning about halfway between this city and Bolsa Chica Gun Club by a passing motorist who had seen her floundering about, Mrs. Helen Dunlap, wife of D. D. Dunlap, prominent Long Beach oil operator, was first thought to have been the victim of an accident while in bathing, but notes discovered shortly afterward by the local police caused further investigation to be instituted.

The motorist, C. B. Thorpe, placed the woman in his machine and rushed her to the Community Hospital in Long Beach, where Dr. W. P. Garrison, her family physician, who was called to treat her, said she undoubtedly will recover.

DISCOVER AUTO

Meanwhile, the local police went to the spot where Thorpe reported he pulled Mrs. Dunlap from the ocean, and there found a car registered to D. D. Dunlap, 2469 Cervitos avenue, Long Beach, parked at the roadside. Inside the car were found a scarf, a bath towel and a book, entitled "The Gypsy," with almost every large blank space at the end of a chapter filled with notes written in pencil. The first note read:

"I have asked God to show me the right thing to do and it seems to be this. I cannot live without you. Ask Mr. Swafield, it is not money I want but you, Dan, you cannot realize how much you have meant to me. Please, please forgive me for all the unhappiness I have caused you. Your wife, Helen."

ATTORNEY FOR HUSBAND

When apprised of the reference to "Swafield" in this note, Roland O. Swafield, Long Beach Attorney, said he is probably the person meant, as he has represented Dunlap in legal matters, but he added that none of the latter's affairs are concerned with any possible domestic difficulties.

Another of the notes read: "It was just a case of too much devotion. How do you like me in bathing suit? Helen or Elmita."

"WAVED TO DRIVER"

On the last page was the note: "PC 82971—a truck with the above number waved to me and I waved to driver—the last person I expect to see on this earth."

On the fly leaf of the book was written "Helen Dunlap" and then a name and address of a doctor, and giving three Long Beach numbers at which he could be reached, one of them being the number of the Dunlap residence.

NEWPORT BEACH FETES EDITORIAL DELEGATIONS

NEWPORT BEACH, July 14.—The keys to the city today were handed over by Mayor Hermann Hilmer to newspapermen and women from all over the Southland as a prelude to the annual Tournament of Lights set for July 28. Two hundred representatives of dailies, weeklies, magazines and other periodicals invaded the harbor district and partook of the feast provided.

City officials and members of the Chamber of Commerce were hosts. Yarns were swapped throughout the day by veterans and others in the press world. A trip over the bay to view the harbor on which a $2,000,000 development program will soon begin was one of the features. Speed boats carried the visitors skimming across the bay and channel to the ocean beyond. Other visitors enjoyed deep-sea fishing, bathing or jumping the breakers.

Sam Meyer, editor of the Newport Harbor Publishing Company, presided at both the luncheon at the Peacock Tavern and at the banquet served in the Balboa Inn restaurant. Mayor Hilmer and President A. B. Rousselle of the chamber extended the welcomes.

P. H. Owen, past 80 years of age, from the Barstow Review, with sixty years of newspaper work, was both the oldest person and the oldest from the point of service.

Harry Hammond of the Riverside Enterprise has served for forty years.

John King of the Hemet News, candidate for Congress, has fifty-three years of service to his credit.

EARTH CRUST UNDER STUDY

Rockies' Origin Being Sought

Savants Measure Explosion Waves to Learn Structure Three Miles Down

Drill and Dynamite Used in Research at Big Horn Basin, Wyoming

PASADENA, July 14.—Echoes from artificially created earthquakes are being used by California Institute of Technology geologists to determine the origin of the Rocky Mountains, it was learned today.

A Caltech announcement reveals that this new technique for investigating the nature of the earth's crust to a depth of three miles probably will revolutionize methods for discovering oil and mineral deposits heretofore unsuspected because of their great depths.

Reports received today by Caltech officials contain news of the successful research conducted for more than a month in Wyoming by a party of eleven local scientists headed by Dr. John P. Buwalda and Dr. Beno Gutenberg.

TESTS IN WYOMING

The party, equipped with a portable drilling rig given Caltech by the Fullerton Oil Company, and carrying enough explosive to sink a battleship, has been concentrating its efforts in an investigation of the structure of Bighorn Basin and the Beartooth Range in Wyoming.

Artificial earthquake waves are generated by exploding thirty pounds of dynamite at the bottom of a fifty-foot hole. The wave shoots downward through the rock, it is asserted, at a speed of two miles a second, part of the wave being reflected back to the surface wherever it strikes the upper layer of a different kind of rock.

WAVES MEASURED

Measuring with an accuracy of one one-thousandth of a second the time interval between the instant of the explosion and the return of the reflected wave," recites the Caltech announcement, "it is possible to calculate how deep the reflecting body lies. And knowing the depth of the reflecting body at a great many points it is then possible to tell the form of the body and thus visualize the structure of the country at great depths."

Excellent reflections, it is asserted, have been obtained from the granite floor of Bighorn Basin at depths of more than 15,000 feet, and the form of the bedrock has been sketched over the entire distance from Cody, Wyo., to the Big horn Mountains, nine miles to the east.

The research indicates that the east front of this part of the Rocky Mountains was formed by the thrusting of great slabs of old hard rocks, miles long and wide, eastward over the soft rocks of the plains for distances of thirty miles, the slabs gliding forward on horizontal layers.

POSTOFFICE DEDICATED IN REDLANDS

New Structure Erected at Cost of $150,000 Opened With Ceremonies

REDLANDS, July 14.—Redlands' newest and most beautiful public building, its postoffice, pure white Mediterranean-type structure at Redlands avenue with the red roof and the blue and white mosaic tower, was formally dedicated this afternoon.

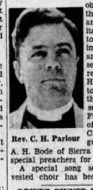
The building, which cost more than $105,000 is, according to B. H. Graf, government engineer, one of the soundest in the city. It is of reinforced concrete, with white plaster finish, a beautiful dome and an interior feature is the great central work room through which all the mail is handled.

Lyman M. King presided at the dedication, which started when Dick Hardy, taking the part of a pony express rider, dashed up with the first "mail" telling of the completion of the building.

A. E. Isham told of the work of the Chamber of Commerce to get the building. Mr. King read a history of the Redlands postoffice prepared by Postmaster Stone and L. O. Hamong, one of the early carriers, and Representative Collins spoke briefly.

Hermosa Beach Church Marking Silver Jubilee

HERMOSA BEACH, July 14.—St. Cross Episcopal Church, known as the "church in the garden," will close a week's observation of the twenty-fifth anniversary of its consecration tomorrow when impressive silver anniversary services will be held. Rev. C. H. Parlour, rector, will deliver the anniversary sermon and Father Spencer of St. Matthias Church, Los Angeles, and Dean A. H. Bode of Sierra Madre will be assisting preachers for the occasion.



Rev. C. H. Parlour

A special song service by the vested choir has been arranged.

DRIVER PINNED UNDER CAR

REDONDO BEACH, July 14.—Albert Montanas, 43 years of age, of 125 South Elena avenue, incurred injuries which are expected to prove fatal when he was pinned beneath his automobile which turned over on Camino Real today. He is at the General Hospital suffering from a skull fracture and internal injuries.

HONEY MAKERS CRY FOR SUGAR

Beekeepers in Meeting in Riverside Discuss Loan from Farm Bank

RIVERSIDE, July 14.—Apiary owners must speedily obtain sugar as food for their winged charges or starvation will destroy the honey-producing insects, speakers said here today at a meeting of beekeepers in Fairmount Park.

Riverside, Los Angeles, San Diego and San Bernardino counties were represented at the largely attended session.

Loans from the Federal Farm Loan Bank at Berkeley were discussed as one means of tiding the beekeepers through Southern California's most disastrous honey-producing season. The only food available for the bees at present, it was stated, are pepper berries, off-bloom oranges and a little alfalfa.

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The Los Angeles Times (Los Angeles, California) · Wed, Jul 11, 1934 · Page 4
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Along El Camino Real

With Ed Ainsworth

IF THESE WEATHER EXperts keep on at the rate they are going we soon shall be able to tell, in advance, the temperature of almost any hour of the day.

Caltech is taking the lead in putting forecasting on the most scientific basis in its history.

The latest development is the establishment of an aerological and oceanographical observatory at Long Beach. That sounds very imposing.

All it really means, though, is that studies of the air and the ocean are going to be carried on simultaneously in one convenient location.

*

The new weather station is a boon to the balloon business.

Each day and night the trial balloons will go up—almost as fast as they go in certain political quarters.

As they mount toward the stratosphere they will be watched through telescopic equipment to chart their antics at various altitudes. The weather sharps then can deduce certain conditions for accurate forecasting.

The balloons are not retrieved. They cost only a few cents each anyway. And it would take a flock of balloon-chasers equipped with butterfly nets and outfitted with speedy airplanes to run them down—or up.

*

It will be particularly interesting to note the progressive and correlated study of air and ocean conditions.

It may be discovered that there is more of a connection than is now believed between sea temperatures and sky phenomena.

The observatory no doubt will pray. Moreover, that it doesn't get a chance to study ocean and sky too closely linked—in a waterspout, for instance.

*

Progressive little Oceanside, snuggled amid its brilliant flowers on the San Diego county coast is feeling even more sophisticated today.

It already was proud of the fact that it has an afternoon daily—something unusual in a town of only 3500 population. Now it is even prouder that its young publishers, Harold and Paul Back, have added an augmented wire service to make the paper better and brighter.

The Becks are exceedingly young and exceedingly enthusiastic. So are many other would-be publishers. But this young pair have made a success for several years.

Oceanside has a right to be proud of them.

*

Every fishermen in Fullerton and the surrounding territory stands a good chance of getting a black eye tonight.

Federal Rule G-20-A is going to be discussed.

That doesn't sound like anything to fight over. But it is.

Specifically, the Izaak Walton League is going to hear a debate over the new rule which is intended to give the Federal government extensive control over State fish and game.

*

Many fishermen are violently opposed to the project. On the other hand there are numerous supporters of the plan.

With them, well-known enthusiasm for anything piscatorial, the Fullerton Waltonites have every prospect of a warm evening in more ways than one.

It is to be hoped, though, that the battle doesn't progress to the point where the combatants will start slinging fishing hooks in one another. They should just stick to barbed words.

*

Today's Ultimate Ignominy: For some visitor at the fishermen's meeting in Fullerton to forget all his best lies when it his time to speak.

IRWIN RITES TO BE TODAY

ONTARIO, July 10.—Mrs. Laura Combs Irwin, wife of Rev. David F. Irwin, will be laid to rest in Bellevue Cemetery tomorrow following services at 10:30 a.m. at Draper's chapel.

Long Beach Faces Unique Situation as Recall of Entire Council Indicated

'SFCESSION' PLANS HIT

San Diego County Idea Scouted

Deputy Attorney-General Says Annexation to Arizona Illegal

Leaders in South Move to Join Neighbor State to "Get Fair Deal"

Reports from San Diego yesterday that a movement is being launched to have San Diego and Imperial counties join the State of Arizona caused State officials in Los Angeles to express doubt whether such a thing can be done legally.

Inquiries at the Attorney-General's office elicited the opinion that neither San Diego nor Imperial counties can "secede."

Gov. Merriam declined to comment on the proposal.

"Such a move is tantamount to secession from the sovereign power of the State of California," said Dep. Atty.-Gen. John L. Flynn.

"It is as though a State would join Mexico or Canada, seceding from the Union. First of all, every public official is bound by oath to support the constitution of the State of California and of the United States."

Flynn declared he never before had heard such a proposal and that there is no precedent and that a study will have to be made before further opinion can be given on the subject.

SAN DIEGO SUPERVISOR HEADS SECESSION PLAN

SAN DIEGO, July 10.—A move to annex San Diego and Imperial counties to Arizona in the building of a new southwestern empire was launched here today by a group of San Diegans headed by Edgar Hastings, San Diego County Supervisor.

"We have launched this move because San Diego county is getting the short end of almost every deal in California," Hastings said. "The proposal to unite California's fifty-eight counties into five or fifteen will make San Diego county and Imperial county each a bigger cost than ever. Both counties will be in better position as part of the State of Arizona.

PLAN OUTLINED

"We, working with the San Diego County Planning Commission which will consider the move next week, will recommend the boundary changes to the National Planning Board. If this board approves it the two counties will be annexed to Arizona on the new map.

"These advantages to San Diego county are certain: San Diego and Imperial Valley would have two United States Senators instead of one from Los Angeles and one from San Francisco."

He also said San Diego would be closer to the State capital, which would be at Phoenix.

NAME PROPOSED

"Naturally, Arizona is enthusiastic; it would give that State a seaport," added Hastings.

"A survey of San Diego and Imperial officials and civic leaders shows the only opposition is one of sentiment: you can't eat sentiment. But for them, we propose to name the new State Arizonia.

"If the Yandergrift plan is adopted we will be merely a part of Los Angeles. If we are a part of Arizona, we will get our share of Federal moneys and cease to be the forgotten county.

"Of course, the ultimate annexation would require Congressional action, but we anticipate no difficulty on that score, since we are almost assured of the support of the National Planning Board."

OTHERS BACK PROPOSAL

The Board of Supervisors, it declared unofficially to be for it. Fred Hansen, La Mesa, member of the Planning Commission, says it may be this section's salvation.

Mal. Ford McCauley, executive secretary of the Chamber of Commerce and chairman of the Planning Commission, says the proposal has some phases which would materially benefit these two southern counties.

MASONS PAY FINAL HONORS TO JACKSON

HUNTINGTON PARK, July 10. Members of the Huntington Park Masonic lodge conducted graveside rites at Inglewood Park Cemetery this afternoon for John Foster Jackson, 70 years of age, retired lo al business man and civic leader who died Sunday at Lake Elsinore. Mr. Jackson had resided in Huntington Park for more than twenty years.

He leaves his widow, Mrs. Nell Jackson, and a daughter, Mrs. Terence Lynch.

DEATH PURSUES 50,000 SARDINES

Mackerel Placed by Joker in Live Bait Tank Elude Efforts of Anglers

SAN DIEGO, July 10.—Fifty thousand sardines have gone into the second day of a losing race with death off San Diego.

A practical joker yesterday dropped two hungry mackerel into the live-bait tank of the sport fishing barge Point Loma. The tank is twenty feet square and ten feet deep. While the thousands of sardines become fewer, the mackerel elude every device conceived to capture them.

Capt. Oakley J. Hall and Ralph J. Chandler, president of the Lassco Line, spent the day in a futile attempt to lure the mackerel onto their hooks with dead bait. No bite! And live sardines on hooks are just two others among 50,000.

WATER SHIPPED INTO IMPERIAL

Tank Cars Carry Relief to Valley Residents

EL CENTRO, July 10. (UP)—They brought water to Imperial Valley today by freight car, since the mighty Colorado River cannot supply the domestic demands of the drought-stricken area.

Six tank cars, bearing 70,000 gallons of water, were spotted at six rural points, and the residents carried the precious fluid in buckets and canteens to their homes.

There has been little rain in the Colorado River Basin, which takes in the States of Colorado, Utah, Nevada, Arizona and California. The government gauge at Yuma today showed only 262 second feet of water in the stream, when the normal flow at this time of year is close to 3000 second feet.

It is planned to increase water shipments until 700,000 gallons daily are brought to the valley from Mecca, 120 miles to the north. The Federal Drought Relief Administration has provided funds for the water.

There still is water in the irrigation canals, diverted from the Colorado River, but ranchers are using it on a pro rata basis.

GLENDALE LIBRARIES MUST CLOSE

Budget Slash Leads to Order Shutting Branches for Two-Week Period

GLENDALE, July 10.—The three branch libraries here will each be closed for a two-week period this summer, in an effort to meet the slashed library budget passed by the City Council. The library board of trustees decided this late last night following a hectic session.

The decision was made after Librarian Bess B. Yates explained that the budget for these branches was cut by the City Council after the board had granted vacations to employes.

A. H. Haak, City Comptroller, today pointed out that the reduction from estimated expenditures during 1933-34 of $67,521.06 amounts to approximately 9 per cent. He also stated that the allocation set by the City Council of $61,368.82 is less than 17½ per cent below the $73,647.94 total asked by the library board in the first place.

Whittier Pair Hailed at Fete

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Hundreds of guests called to felicitate them.

Dr. Newlin has been president of three colleges. He organized Pacific College at Newberg, Or., and was its president for nine years. He was president of Whittier College from 1907 until 1915, and president of Guilford College in North Carolina two years.

He was a member of the faculty of Fullerton Junior College for thirteen years, having retired last year.

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JURY'S REPORT RAPS BRANION

Santa Barbara Body Declines to Vote Indictments

Relief Regime Declared to Have Been Lax, However

Full Control by Supervisors Declared Imperative

SANTA BARBARA, July 10.—Grand jury investigation into charges of a $20,000 shortage in the Santa Barbara county commissary, has closed with no criminal indictments voted. The jury, however, signed charges of inefficiency, negligence and lack of co-operation with the county government against H. C. Branion, State Relief Administrator, now under Los Angeles Federal grand jury indictment for similar asserted offenses.

Included in the charges, is Miss Aleta Brownlee, assistant State relief administrator under Branion.

The jury report declares that the relief department when under Branion-Brownlee direction, was allowed to be come hopelessly muddled, to a point where certified accountants could not interpret the accounts. This gave rise to the charge of "shortage," but the jurors believe from the evidence put before them that the fault was "inefficiency in keeping the proper records, and failure to properly record the goods that were distributed to unemployed persons."

The jury found that the County Supervisors "should be in absolute control of the affairs of the county welfare department, and of the unemployment relief department, and should be accountable to the people of the county of Santa Barbara for the proper expenditure of all moneys by them in their official capacity."

ATTORNEY ACCUSED IN STOCK DEAL

Asserted Manipulation Brings San Diego Charge Aimed at Chester Ames

SAN DIEGO, July 10.—Complaint charging grand theft growing out the defunct stock manipulations in the defunct Hollywood Dry Corporation was issued against Chester C. Ames, San Francisco attorney, by the District Attorney's office here today.

According to the complaint, Ames offered to collect $8000 worth of stock owned by George N. Harris of San Ysidro. He told Harris, according to the complaint, that he knew of an official in the company who had absconded with $500,000.

When Ames gave Harris a check for $4000, Harris paid him only $1156.55 as commission and expenses, he told the District Attorney. The check Ames assertedly was returned marked "no funds."

Term Given to Youth Seized on Honeymoon

OCEANSIDE, July 10.—Howard Anderson, 21 years of age, of Oceanside, who disappeared from this city July 4 with Ruth Hare, 16, from a local dance pavilion, and was caught in Escondido Saturday after spending the night in a cabin on a honeymoon in Yuma, was sentenced to 250 days in the County Jail by Judge Harris today, after he had entered a plea of guilty to petty theft charges.

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The cattlemen returned to their homes to supervise the round-up, a great one if not the last one.

WHY SHOULDN'T ARCADIA CELEBRATE!

Pretty Girls to Assist at Municipal Birthday Party



They Seek Title of Queen

Left to right, front row, Grace Ward, Maxine Reardon, Lorraine Cooper; back row, Margaret Dorsey and Dorothy Ebert.

ARCADIA, July 10. Extensive plans for the celebration of the thirty-first birthday anniversary of this city, August 4, with a carnival of progress sponsored by the Women's Club and aided by the Chamber of Commerce, are rapidly taking shape, according to Mrs. Charles Willey, chairman of the ways and means committee.

A carnival queen contest now is in progress, with five girls entered. The winner will be featured in a coronation pageant, and the other four will be termed ladies in waiting.

A parade with business, civic and fraternal entries will move through the town to Santa Anita Park, where prizes will be awarded.

Proceeds will be used by members of the Women's Club for furnishing of the new Santa Anita clubhouse, which is being built. Members of the P.-T.A. will use their carnival profits for welfare work.

FIRE PERILS AUTO CAMP

Two Hundred Men Fight Forest Blaze Fanned by Stiff Wind in San Diego Area

SAN DIEGO, July 10.—Fanned by stiff high winds, a fire which broke out in the dry brush and grasses on the mesa near the foot of Palomar mountain early yesterday and swept three miles up the slope by dusk tonight despite the combined efforts of approximately 200 men and three tank trucks.

AUTO CAMP DOOMED

The Crestline Auto Camp has been deserted as doomed to go within two hours.

Before midafternoon sixty men from the Fallbrook C.C.C. camp, with their tank truck had joined 110 men from the Escondido and Palomar camps with their tank trucks. Working with them were approximately forty ranchers, miners and townsmen.

Direction of the men was assumed by E. C. Carlson, deputy ranger, and Luther Gordon, county fire warden.

STARTS ON RANCH

The fire, sighted by lookouts on five neighboring peak., started on the Monument ranch and spread through the oak and brush country into the pine regions.

No other habitations are threatened unless there is a change of wind, it was reported at Gordon's office.

VANISHED AUTO TOURIST FOUND

Compton Citizen Discovered in Bay Hospital

COMPTON, July 10. — W. G. Wright, 38 years of age, of 708 North Rose street, object of a widespread search following his disappearance while on a motor trip to Portland, Or., on which he left here July 3, was located by Compton police tonight in a Santa Monica hospital, where it was said he was suffering from a nervous breakdown.

Assistance of the police was enlisted by Mrs. Wright, who asserted she had received, through her husband's father, E. S. Wright, a barber at 648 American avenue, in Long Beach, a package containing some of her husband's clothing, including a blood-stained shirt.

NOT HUSBAND'S WRITING

The package also contained the business card of a San Fernando liquor distributing concern on which was scribbled a man's name and the address, "Schales, Wash.," she told police. The writing was not in her husband's hand, she declared.

The clothes were expressed from Bellflower, she said, and police there disclosed that her husband and a man named "Neal" assertedly had checked out last Wednesday and the following day the hotel received telegraphic instructions to ship the clothing. The message came from Ocean Park, the hotel proprietors stated.

FROM OCEAN PARK

Further complicating the situation, Mrs. Wright today received a telegram from Ocean Park, stating: "Having car trouble. Be home as soon as parts arrive. W. P. Wright."

The wife was further mystified by the initials "W. P." not her husband's.

FAIR ENVOY TO SEEK EXHIBIT FROM ITALY

SAN DIEGO, July 10.—A. Conti, owner of the Southern California Chamber of Commerce, and also of the executive committee of San Diego's California Pacific Exposition, which is scheduled to open in Balboa Park April 1, 1935, left today for New York, where he will sail for Italy to arrange for an exhibit of Italian marble statuary. Decision to make the trip followed inquiry regarding the exposition from the famous Carrarra marble quarries.

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The company, in permitting the city the use of the water, agrees to go so without in any way obligating itself to continue so doing.

Efforts will be made to obtain S.E.R.A. labor for the project.

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Salvation Army Dinner at Beach Pays Honor to Mrs. Joseph B. Dabney

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Broker Group's President Dies

SAN DIEGO, July 10.—Lewis Murray Hutchinson, 64 years of age, president of the American Customs Brokers Association, died today at his home here.

"MAJORITY" VOTED DOWN

City Attorney Appears Loser

Four "Minority" Members of Group Have Chance to Retain Office

City Clerk Will Call for Vote by Districts If Ouster Complete

LONG BEACH, July 10.—Long Beach faced an unique situation in city government tonight as early returns from today's recall election indicated the ouster of all nine City Councilmen and the City Attorney.

Thirty-seven out of 137 incomplete precincts tonight showed a majority for recall of all ten incumbents.

DIVISION SHOWN

The voting showed a division which indicated practically a certainty the recall of the "majority five," and the City Attorney. The majority group comprises Councilmen Walter D. Singleton, Timothy Stephens, John J. Oswald, Mayor M. E. Paddock and Claude A. Winslead.

The other four Councilmen, running behind sixteen to thirteen, were conceded a mathematical possibility of remaining in office. The minority, or holdover group, comprises Councilmen J. J. Barton, Frank H. Church, J. W. V. Steele and Oscar H. Wortle.

Nowland H. Reid is the City Attorney upon whose proposed recall voters balloted today.

It was estimated approximately 34,000 votes had been cast.

CLERK WOULD ACT

If the Council is recalled, Harold Akers, City Clerk, will call an election by proclamation for the voters in each district to select their new Councilman and the new Council would then name a new City Attorney, it was stated tonight.

Terms as Councilman for those recalled would cease with announcement of the vote canvass, legal authorities declared.

Councilman Winstead seemed destined to be the wood beater, his opposition vote being four to one.

VENTURA'S WATER PLAN TAKES FORM

City Asks Extension of Six Months in Which to Round Out Program

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This was revealed when the City Council voted to request the Division of Water Resources of the State Department of Public Works for an extension of that length of time before flood water rights on the land involved are established.

City Manager Stockburger said today that the survey of the Hoffman Dam site on Coyote Creek will be completed next week, after which the survey crews will begin working on the Dunshee site on Santa Ana Creek.

South Pasadena Headquarters of P.T.A. Now

SOUTH PASADENA, July 10. — Mrs. Mark F. Jones, president of first district, California Congress of Parents and Teachers, announces the removal of district headquarters from Glendale, where they have been for the last two years, to the City Hall of South Pasadena.

Official office hours will be from 9 to 12 each Monday and Friday, inclusive.

The district executive board will hold a meeting July 19 at the home of Mrs. C. W. Luther, 220 Twentieth street, Santa Monica, at which time Mrs. Jones's appointments will be ratified.

RENO DIVORCE FILING

RENO (Nev.) July 10.—Divorce suits filed today include that of Georgia Patterson vs. Louis F. Patterson of Los Angeles county. They were married at Long Beach, September 9, 1904. Cruelty is charged.

NAVAL BASE SITE OFFERED

LONG BEACH, July 10.—A site of 16,000 acres between Long Beach and the Bolsa Chica Gun Club has been offered to the government for the establishment of a complete naval base with dry-dock, naval and aircraft facilities, according to F. L. Bixby, who has unified the offer by which property in the Hellman, Bryant and Bolsa Chica Gun Club has been made available to the government. The offer is reported to be under consideration by officials at Washington.

NAVY FLYER SETS RECORD IN CROSS-COUNTRY FLIGHT

SAN DIEGO, July 10.—What was described by Capt. John Towers, commandant of the North Island Naval Air Station, as the fastest cross-country flight ever made anywhere in the world by a fully equipped military or naval plane ended at 6:55 p.m., when Lieutenant-Commander W. G. Trimillioon arrived at the North Island field in a new model Vought Corsair scout plane in which he had set out from Anacostia, D. C., early this morning.

Lieutenant-Commander Tomlinson, who gained fame several years ago as the leader of the group of navy stunt flyers who were known as the "Sea Hawks," had taken off from Anacostia at 3:30 a.m., eastern standard time, which made his elapsed time for the slightly more than 2800-mile flight fourteen hours, twenty-five minutes.

He had made four stops en route for refueling purposes, and this brought his actual flying time to less than fourteen hours, which meant he had made an average speed of more than 200 miles an hour.

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El Monte Lions Will Indulge in 'Cannibal Feast'

EL MONTE, July 10.—Barbecued lion will be served at the annual banquet of the El Monte Lions Club Friday evening, July 27 in Guy's Lion Farm.

Heading the entertainment will be a jungle beauty contest, each entrant wearing a costume similar to that she would wear if cast upon a desert island.

Edgar Rice Burroughs, author of Tarzan stories, will judge of the contest, according to club officials.

The setting for the banquet will be one of the arenas of the lion farm, with scores of the beasts furnishing the background.

Bee Gets Blame for Auto Crash

BELL, July 10.—The victims were Mr. and Mrs. Steve Chantos of Los Angeles. The couple was in an automobile which struck, head-on, a telephone pole on Clara street, just east of here. The accused is one lone bee.

This, according to police reports, tells the story of a near-tragic accident here. While driving on Clara street Chantos was stung by a bee. While endeavoring to kill the insect he lost control of the car and crashed into a telephone pole. Both he and Mrs. Chantos were treated for minor cuts and bruises.

Run of Grunion Due Tomorrow

HUNTINGTON BEACH, July 10. Glittering grunion will scoot on the beaches here Thursday night and hundreds of grunion-hunters are expected to chase them.

The fun are scheduled to run from 9:30 until 10:30 p.m. They will come to spawn again Friday between 10 and 11 p.m. and again on July 15 from 11 p.m. to midnight.

All of this information is from admitted grunion experts.

Body of Youth Washed Ashore

SEAL BEACH, July 10.—The body of Joseph Baerzen, 17-year-old high school youth who was drowned in the channel here when his boat capsized, was washed ashore here today. It had been in the water three days.

The mother identified the body and collapsed. Joseph was the oldest of four children.

David Thompson, a companion in the boat swam to shore.

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PACT ON MELONS SOUGHT

RESEDA, July 10.—Nearly 500,000 crates of cantaloupes will be shipped to Los Angeles from San Fernando Valley territory during the harvest, it was stated today by a group of independent growers who met here to consider the feasibility of a protective agreement in marketing the crop. There are about 2200 acres in melons in the valley area this year.

It is proposed to form a voluntary group of growers using a prorate system in marketing until all shipping is over. When arrivals begin to be ready for marketing at the same time allotments will be made of the amounts to be sold each day.

GUN INJECTS MYSTERY INTO AUTO CRASH DEATH

PASADENA, July 10.—A cocked and loaded revolver found on the ground beside the vehicle has injected some mystery in the death today from traffic injuries of George Miller, 45-year-old Annandale Golf Club chef, who was injured last night when struck down by an automobile driven by M. E. Johnson of 1962 Worcester avenue, Los Angeles.

The accident occurred as Miller walked across the Colorado street and Club road intersection near the golf club. The force of the impact caused the victim's head to crash through the automobile's shatterproof windshield. He was rushed to the Pasadena Hospital in the city ambulance.

Motorcycle Officers Boyd and Goble reported they found a cocked and loaded .45-caliber revolver lying on the pavement where the pedestrian was struck. The police believe Miller may have had the weapon in his pocket as a protection against possible bandits. Mr. Johnson, driver of the automobile, was cited to appear in Police Court on a charge of operating a car with faulty brakes. Miller's body is at the Reynolds and Eberle mortuary.

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NEWS ABOUT PEOPLE YOU KNOW

Dan Hunter was a weekend visitor in Reno.

Mr. and Mrs. Pete Atkins, Stockton, are visiting here.

G. J. Kenney, Los Angeles, is back in Reno.

Mr. and Mrs. J. H. Wooten, Washington, D. C., are visiting here.

John Petrovich and Pete Beko, Tonopah, were in Reno yesterday.

T. M. Harris, jr., Salinas, Calif., is visiting in Reno.

Perry L. Jones and E. Davies, forest service men, are in town for a few days.

Constable Henry Hughes of Gerlach is in Reno for several days receiving medical treatment.

W. D. Hay, Winnemucca, visited here Sunday. He is taking the state bar examinations here this week.

Mary Brackett, clerk of the assembly, went to Winnemucca last weekend.

Mrs. Herbert Tait, 325 Clay street, will be hostess at a meeting of the Nevada State Nurses' Association tonight.

The music section of the American Association of University Women will meet at the home of Miss Irene Peterson tonight.

Mrs. L. Gentry yesterday was taken from St. Mary's hospital to her home, 59 Bell street, by the Reno Ambulance service.

D. Fogelquist, R. Colbourn, W. N. Davis, Luck Strike cigarette representatives from Oakland, are stopping at the Overland.

John Steponovich of the Palace Cafe has returned from Los Angeles where he has been visiting relatives.

Ray Killian, office manager of the state superintendent of schools at Carson City, was here over the weekend.

Fred Henderson is back in Nevada after looking over several mining properties in the California mother lode country.

Mr. and Mrs. Harry Ish now take their Nevada State Journal at their new home, 11 Bret Hart avenue. Ish is general agent of the Southern Pacific.

Mrs. R. H. Rowland, Lovelock; J. E. Rickenbach, Tonopah; Rudolph Herz, Reno; E. E. Christian, Mr. and Mrs. F. O. Broili, John Sugadi and Henry Gendaguetta, Reno; and Lester C. Munk, Lovelock, stopped at the Fielding hotel in San Francisco recently.

Mrs. Ione Chase, executive secretary; Mrs. M. J. Webster, junior Red Cross chairman, and Mrs. Nelson Mekeel, recording secretary of the Washoe county Red Cross chapter, left yesterday to attend a division meeting of the organization at San Francisco. General Red Cross activities will be taken up at the conference.

J. Grant Crumley, C. F. Wittenberg, Allan Rives, John Connolly, Lowell Daniels, R. Montague and Ray Germain of Tonopah were in Reno yesterday and conferred with Engineer R. A. Allen relative to PWA projects in Nye county.

AT THE HOTELS

Golden — J. G. Crumley, Lowell Daniels, Mrs. M. Vuich, Virginia Vuich, Mae Vuich, Helen Clendenning, John E. Nay, C. F. Wittenberg, John Conolly, Tonopah; George Russell, H. J. Breen, Elko; Thomas O. Craven, F. D. Cooley, Carson City; Mr. and Mrs. W. C. Hancock, Battle Mountain; Mr. and Mrs. A. C. Grant, Las Vegas.

W. C. Fagert, Irene Taltini, Fallon; S. L. Quayle, Ely; J. T. Boyd, Placerville; Mr. and Mrs. Carl Orobio, Lovelock; Frances Filipcic, Truckee, Cal.; Bill Smith, Jason Jones, Nevada City, Calif.; W. D. Hay, Winnemucca.

Overland—Mr. and Mrs. Pisi, Fallon; Bill Siri, Mrs. W. F. Siri, Truckee; Raymond Killan, H. M. Payne, Carson City; Mr. and Mrs. J. Curtis, Gold Hill; Elizabeth Baker, Yerington; Mr. and Mrs. W. V. Timmons, Elko; A. Reilly, Fred Tom, Ely; J. C. Tyler, Beowawe; W. H. Gibson, Wells; L. Apperson, Martinez.

VALUES IN THE ROUGH

Brewster Adams' book, "Values in the Rough," may be bought at Armanko's, the J. C. Penney store, Gray, Reid, Wright; George Southworth's or at Stafford's Mark Twain shop in Carson City. j12tf

QUIVERING NERVES

When you are just on edge . . . when you can't stand the children's noise . . . when everything you do is a burden . . . when you are irritable and blue . . . try Lydia E. Pinkham's Vegetable Compound. 98 out of 100 women report benefit.

It will give you just the extra energy you need. Life will seem worth living again.

Don't endure another day without the help this medicine can give. Get a bottle from your druggist today.

Lydia E. Pinkham's VEGETABLE COMPOUND

Reno Lions Start Drive to Bring Convention Here

Reno Lions, in the current issue of the "Sierra Nevada Lion," weekly bulletin of the club published yesterday, fired the opening gun in the campaign to bring the 1936 district convention of Lions to Reno.

This conclave would bring to this city more than 2000 delegates and visitors, and in the bulletin the invitation to bring the big gathering to Nevada is pressed. Copies will be sent to each of the 104 clubs in the district.

The 1935 district convention will be held at San Diego, Calif., June 20 to 22, and Nevada headquarters will be established in that city to carry forward plans for landing the big meeting in Reno next year. Alys Stanley has been appointed to have charge of headquarters as Nevada hostess and will be assisted by a committee of six or eight women from other sections of the Sierra Nevada district.

The Sierra Nevada Council of Lions is sponsoring the movement to bring the 1936 convention to Reno, and it is planned, the bulletin states, to make the reception and entertainment at Nevada headquarters during the coming June convention one to be long remembered.

The bulletin explains the plans for establishing headquarters at the San Diego convention and for bringing the 1936 meet to Reno as follows:

"Ten rooms have been reserved at the U. S. Grant hotel for the Nevada delegation, and will serve as the Nevada headquarters. The rooms will be decorated in true Nevada style, a number of paintings, photographs and pictures from historic places of interest, views from our lakes, historic Virginia City, fishing scenes from the more than a dozen mountain streams near Reno, where real rainbow trout are the pleasure of fishing. No pamphlets or folders of any kind will be hurled around in the convention hall as usually is the case. Souvenir booklets and other pamphlets will be in the Nevada headquarters for all visitors, and every member and visitor to the San Diego convention is extended a cordial invitation to visit the Nevada headquarters during the convention days.

"The Reno city council passed resolution that when the convention came to Reno in 1936 the entire business section of the city would be decorated in the Lions colors, and Mayor Sam Frank announced that the Reno municipal band (30 pieces) would be placed at the disposal of the Lions to welcome the delegates and visitors to Reno. There is no question that the welcome you will receive in Reno will far exceed that of any other convention city ever held in the fourth district. If you want to have a convention that will be different you must come to Nevada, you must come to Reno.

"Through the courtesy of the Reno Lions club this bulletin is being sent to every Lions club secretary in the fourth district, in the hope that each one will read this invitation to the members, to be our guests during the convention days in San Diego.

With the slogan, "Bring the 1936 District Convention to Reno," the local Lions club has appointed the following convention committee to serve at the 1934 convention at San Diego: Carle B. Stanley, chairman; Frank Campbell, A. J. Dieringer, Harry S. Foote, John B. Foy, Mayor Sam Frank, C. B. Hanson, Jack H. Kehoe, William M. Kennedy, S. W. Longabaugh, Dr. S. K. Morrison, Jay Noviach, Clarence H. Patten, L. D. Summerfield, Dr. J. LaRue Robinson, Abe Zetoony.

Each club in the Sierra Nevada council will appoint members to supplement the Reno committee.

U. S. Grand Jury Sessions Called

Judge Frank H. Norcross yesterday called a federal grand jury to meet at Carson City February 11, and a federal trial jury for February 11.

About 60 cases involving infractions of the narcotic law and sale of whisky to Indian charges will be laid before the jury. In addition a Mann act charge against John Chastian, arrested in Phoenix, Ariz., will be brought before the jury. Chastian allegedly took Anabelle Dills from Earp, Cal., to Las Vegas Nev.

It was not disclosed whether any indictments involving the harboring of Baby Face Nelson will come before the jury.

For Your VALENTINE Whitman's Chocolates from SKEELS DRUG STORE
Heart Boxes 50c Up
Free Delivery — Phone 3139

Nevada Hostess



Alys Stanley, of Reno, who will act as hostess at Nevada headquarters at the district convention of Lions club in June at San Diego. At this time Nevadans will invite the Lions to hold their 1936 convention in Reno.

Attorney Urges Small Legislature

The advantages of a small, one-house legislature wer,i discussed by Robert M. Price at yesterday's meeting of the Rotary club in the Golden hotel.

Legislatures, meeting briefly each two years, hurry through a bewildering mass of business and are unable to give proper consideration to each item. A legislature of five meh, adequately paid, devoting practically all their times to state business, asserted Price, would be able to enact better laws.

Price's plan would provide a four-month interval between the introduction and passage of a measure, giving the people time to study and protest or approve. He would also make it an offense for anyone to solicit the vote of a legislator.

Upstream storage and the passage of legislation which would permit Washoe county to bond itself to pay part of the cost were endorsed by the Rotarians yesterday.

Harry Heidman was program chairman and Earl Ross presided. Fran Wald, soloist, provided the music for the program.

Bar Applicants Commence Exams

Six applicants to the Nevada bar began their examinations before the state Bar association committee yesterday.

The examination held yesterday at the county library building under the direction of Mrs. Una Dickerson, librarian, was on research work. The bar association's committee on membership will conduct the written examination of the applicants today, tomorrow, Thursday and Friday. The same committee will give oral examinations Saturday to the six.

The bar committee consists of Albert D. Ayers, chairman; Milton Badt of Elko, Howard Browne of Austin, Robert Z. Hawkins of Reno, A. L. Haight of Fallon, William Forman of Reno and Douglas Busey of Reno.

American Legion To Meet Tonight

Darrell Dunkle Post No. 1 of the American Legion will meet tonight at Veterans' hall in the Washoe county library building, with only routine business scheduled. Col. Thomas W. Miller of Caliente post will speak to the post at the February 19 meeting instead of tonight as had been planned. He is department chairman of the foreign relations committee.

Following the post meeting this evening there will be a session of the Forty and Eight.

Local Residents Seeking Divorces

Suits for divorce were filed by two local residents n the district court yesterday.

Mrs. Bertha M. Michel charged William E. Michel with cruelty. They were married at Sparks April 4, 1926. Platt & Sinai represented Mrs. Michel.

R. E. Shaffer sued Mrs. Riola Shaffer, charging cruelty. They were married here June 15, 1930. Sam Rosenthal acted for Shaffer.

FOR SALE
Brand New '34 Willys 77 Coupe
Substantial Reduction in Price
H. C. HEIDTMAN
320 South Virginia Street

Darrell Dunkle Drum and Bugle Corps Is Winner

The Darrell Dunkle post's drum and bugle corps of Reno won first honors at the contest staged at Truckee Sunday in connection with the annual convention and snow frolic of the sixth California district of the American Legion, which was attended by more than 75 legionnaires from this city and members of the auxiliary.

There were three drum corps in the contest, Reno, Roseville and Sacramento, and the local organization won first place in the scoring. The award consisted of a $35 cash prize. Twenty-nine members of the local corps made up the competing unit and the trip to the mountain city was made in a Greyhound bus. Darrell Dunkle corps also took part in the street parade.

Among the Nevada legionnaires at the district convention were Department Commander Lew Moder of Carson City and Lieutenant Governor Fred S. Alward, a member of Las Vegas post. Both officials addressed the delegates.

The Darrell Dunkle cirps has several activities planned for this month. February 6 and 7 and February 11 and 12 they will play on the radio Boy Scout programs and on February 28 will give a dance at Tonys Spanish ballroom to raise funds to purchase new uniforms.

Last night the drum corps played at Sparks in connection with the celebration put on by Duby Reid post of the railroad city.

Mrs. Ellithorpe Is Laid to Rest

With many friends of Reno and Sparks gathered in tribute to her memory, the funeral of Mrs. Mary E. Ellithorpe, who died at her Reno home Saturday, was held yesterday afternoon at the Ross-Burke Company chapel.

There was a Christian Science service, and included vocal selections by Lawrence Layman. Mrs. Lola Grimmer was the organist.

The committal was in Mountain View cemetery. Acting as pallbearers were E. H. Benner, Ed Wolfan, sparger, B. F. Curler, O. E. LeCray, John Marshall and Walter Palmer.

Verdi Resident Is Laid to Rest

Services were held yesterday for Mrs. Mary A. Connell, old time resident of Verdi, who passed away Saturday at her Reno home.

There was a Christian Science service at the Ross-Burke Company home chapel, and Mrs. Lola Grimmer was the organist.

Acting as pallbearers were A. L. Dibble, Gaylord T. Wilder, Carl L. Bela, E. B. Coffin, A. C. Beecher and C. J. Anderson. Interment was in the family plot at Hillside cemetery.

McCarran Calls Western Caucus

WASHINGTON, Feb. 4.—(UP)—Sen. Pat McCarran (D. Nev., today called a caucus for tomorrow of senators and representatives from mining states to consider action regarding the tariff cut of 50 per cent on manganese accorded by the United States to Brazil in the reciprocity agreement signed Saturday.

Forty-one senators and 145 congressmen from 33 states signed a petition to President Roosevelt on June 28, 1934, appealing "for all just and proper actions that may be necessary to insure the maintenance and further development of the manganese mining industry in the United States."

Reno Couple Wed At Gardnerville

Announcement of the marriage of Miss Tima Silsby, daughter of Mr. and Mrs. E. H. Silsby of Reno, to Leslie Barnes in Gardnerville January 26 was made here yesterday. The ceremony was performed at the home of Rev. A. A. Chapman, pastor of the Methodist church at Gardnerville. Following a honeymoon the couple will reside in Reno, where the bridegroom is employed.

City News In Brief

The Weather

Highest temperature yesterday 52 degrees; one year ago, 61.

Lowest temperature yesterday, 37 degrees; one year ago, 39.

Normal temperature yesterday, 35 degrees.

Mean temperature yesterday, 44 degrees, which is 9 degrees above normal.

Temperature yesterday at 5 a.m., 40 degrees; humidity, 74 per cent.

Temperature yesterday at noon, 48 degrees; humidity, 56 per cent.

Temperature yesterday at 5 p.m., 50 degrees; humidity, 52 per cent.

Precipitation for 24 hours ended at 5 p. m. yesterday, none.

Normal precipitation from September 1 to date, 3.94 inches.

Total precipitation from September 1 to date, 2.97 inches.

Deficiency compared with normal, .97 inch.

Vital News

MARRIAGE LICENSES

Ervil Scott Fry, 29, and Evelyn Elisabeth Culver, 20, both Salinas; Charles G. Edwards, Westwood, and Izabelle Rose Owens, Healdsberg; Evert H. Sandelin, 45, and Esther C. Swanson, 35, both San Francisco; Robert A. Waters, 21, Oakland, and Edith Berg, 20, Alameda; Harry H. Smith, 31, and Martha J. Gosling, 28, both Redding.

Roy J. Miller, 39, and Harriet Mendel, 30, both San Francisco; Theodore Knudsen, 29, and Cora Thomas, 27, both San Francisco; Floyd O. Kenison, 42, and Pearl Marcont, 32, both Reno; Lloyd Apperson, Martinez, and Bernice L. Coffey, Reno; Alfred L. Drake, 39, Reno, and Helen Case, 38, Los Angeles; Paul Lewis, 27, Napa, and Grace Olivera, 18, Oakland; Manuel C. Ferreira, 22, and Carmel M. Arevedo, 18, both Reno; John Vacs, jr., 21, and Ruth Kuster, 18, both Reno; George W. Nielsen, 27, and Beatrice M. Wise, 26, both Ely.

DEATHS AND FUNERALS

BACHOVICH—In Tonopah, February 1, 1935, Akim T., husband of Angie Bachovich and father of Gus, Helen and Anna Bachovich of Gragle, Calif.; brother of Mrs. Anna Vuich of Tonopah. A native of Jugoslavia, aged 46 years, 11 months and 15 days. Friends are invited to attend funeral services at the home chapel of the Ross-Burke Company on Tuesday morning at 10 o'clock. Rev. Brewster Adams, clergyman. Interment in Mt. View cemetery.

GILLORY—Friends are invited to attend the funeral services for Mrs. Bertha Gillory Thursday afternoon at 2 o'clock at the African Methodist-Episcopal church. O'Brien and Nugent in charge.

In District Court

IN THE DISTRICT COURT

In the matter of the estate of Carl E. Corbitre, deceased, petition filed; in the matter of the estate of John S. Lind, deceased, petition filed.

DIVORCE SUITS FILED

Alfred Negro vs. Bella Jacaruso; Ida Hoge vs. Sidney Lee Hoge; R. E. Shaffer vs. Riola Shaffer; Bertha M. Michel vs. William E. Michel; Bernice L. Coffey vs. William H. Coffey; George G. Rapp vs. Hazel Mae Rapp.

Real Estate

REAL ESTATE TRANSFERS

Deed, John W. Mathews and wife to Kathryn H. Johnson; deed, Jack Ambrose and wife to Francisco J. Pimental; deed, William E. Michel to Bertha M. Michel.

BUILDING PERMITS

John Cerveri, 355 Wheeler avenue, remodeling, $200.

Certificates for Nevada Teachers Issued at Carson

Seven teaching certificates were granted to Nevada teachers by the state board of education at a recent meeting. Attending the meeting were President F. N. Fletcher, Otto P. Heiner, Governor Richard Kirman and Chauncey W. Smith, state superintendent of public instruction.

Certificates were presented to Mrs. Natalie Arigoni, Reno, elementary life diploma; Miss Dorothy L. Jensen, Carlin, elementary life diploma; Raymond Kilian, Carson City, high school certificate; Mrs. Florence E. Peterson, Yerington, high school certificate; Mrs. Ola F. Triplett, Wells, second grade elementary certificate; Mrs. Nella G. Harbaugh, Tonopah, special music certificate, and Mrs. Dorothy Higgins Bell, Reno, substitute teacher's certificate.

A change in the state board regulations, suggested by B. D. Billinghurst of Reno, regarding certification of substitute teachers, was adopted as a part of the state board regulations and is as follows:

"Effective on and after September 1, 1934, certificates for substitute teaching may be granted, on payment of $2 each, to Nevada teachers whose Nevada certificates have expired: (1) For high school or junior high school teaching valid for two years when the teacher is a graduate of the four-year teachers' course of the University of Nevada (or an institution of equal rank), and (2) for elementary school teaching valid for two years when the teacher is a mal school two years' course (or graduate of the Nevada state normal institution of equal rank). In case of illness or other necessary absence of a regular teacher the substitute teacher shall serve no longer than until the end of the current semester. The certificates for substitute teachers are valid in Nevada schools only for actual substitute work and are not renewable. Before their expiration the teacher shguld do the three credits required for the renewal either of the high school or the elementary school certificate."

A new plan covering the deputy system was proposed by Superintendent Smith. Such a plan would require four field deputies and would necessitate the enlargement of the present supervision districts, thus dividing the five districts into four supervision districts. Under this plan the deputies would not be required to regularly visit schools with more than four teachers, since such schools have a superintendent or principal to supervise the work.

Superintendent Smith proposed some changes to remedy the present discrepancies in the present law regarding the textbook commission. He proposed that the law be amended so that the members of the textbook commission shall be appointed and take their oath of office in January and that no adoption be made until the year following the appointments, adopting only part of the books at that time and the rest over a period of four years. Also, since the members of the state board of education are ex-officio members of the state textbook commission, and very much not have the time to study texts for adoption, Smith suggested that two delegates be appointed from among the state board members who have the time and are willing to take up the extra duties, and let them be the members of the state textbook commission representing the state board members.

DR. J. W. GEROW
Has moved from room 32 to room 15 in the Hilp building over Hilp's Drug store. Hours 11 to 12 a.m., to 4 and 7 to 8 p.m. adv j11 tf

ATTENTION PAINTERS
Local Union 567. Special Meeting and Entertainment, Wednesday, February 6. —Adv. f5

ELECTRIC APPLIANCES
All Standard Makes and Fully Guaranteed
See Our Complete Line of Appliances Before You Purchase
Universal Electric Heating Pads ..$ 3.00
Electric Irons ..$ 2.75
Mix Masters ..$19.50
Hammond Electric Clocks. The finest made. Special purchase enables us to give you such low prices.
Hammond Electric Alarm ..$2.75
Hammond Mantle Clocks with Bichronos motor; continues to run through all over interruptions. Regular $27.50 ..$12.50
APEX CLEANERS ..$19.50
ROYAL CLEANERS ..$24.50
SPECIAL PRICE ROYAL with Light ..$44.50
$5.00 allowance on your old cleaner
Zenith Radios
Nevada Machinery & Electic Co.
"Nevada's Pioneer Refrigeration and Radio Dealer"
121 North Virginia Street Phone 3601

BOULDER LAKE NOW REALITY; WATER STORED

BOULDER CITY, Nev., Feb. 4.—(UP)—Boulder Lake was a reality today, the backed-up waters of the Colorado river forming a lake 10 miles long and 30 feet deep behind the vast concrete rampart of Boulder dam.

The control tunnel through which the river was diverted Friday was closed for 12 hours last night.

Today the big valves were opened, but the lake failed to diminish and engineers believed storage of water had begun. The flow of the river, slight at this season, had been believed insufficient to accomplish storage immediately and still care for the needs of irrigation areas downstream.

Sixteen thousand acre feet of water were stored during the night. When full the reservoir will contain 30,000,000 acre feet.

Bachovich Rites Will Be Today

Funeral services for Akim T. Bachovich, who died Friday at Tonopah, will be held today at 10 a. m. in Reno at the Ross-Burke Company home chapel. Rev. Brewster Adams will officiate, with interment in Mountain View cemetery.

Bachovich had been a resident of Tonopah for many years. A native of Jugoslavia, he went to Alaska in 1905, and later to southern Nevada. He then went to San Jose, where he engaged in the lumber business. Retiring from business in California a few years ago, he returned to Tonopah. He was a member of the Young Men's Serbian Society.

Surviving are his widow and three children, Gus, Helen and Anna Bachovich, of Graeagle, Cal.; a sister, Mrs. Anna Vuich, of Tonopah; two nieces, Miss Mae Vuich of Hawthorne and Miss Virginia Vuich of Tonopah; a nephew, Mitchell Vuich, a student at the University of Nevada.

Rites Are Held For Mining Man

With many old time Nevada friends in attendance, final rites were held yesterday afternoon for Harry Harris, veteran Nevada, mining man and state highway department employe, who died at his home here last week.

Services of the Episcopal church were conducted by Rev. Bayard H. Jones at the Ross-Burke Company home chapel and there were selections by Vernon Armstrong, accompanied by Mrs. Grimmer.

Acting as pallbearers were Jack Rawson, Harry Hawkins, I. Schultz, Charles Blaker, Jack Sullivan and W. Klaus. Interment was in Mountain View cemetery.

Trees for Spring Planting Ready For Local Farms

Local farmers desiring to purchase forest trees for spring planting this year should get in touch with the offices of the Washoe county extension service, officials said yesterday.

Trees may be secured the same as in past year at nominal prices from the school of forestry at the Utah state agricultural college, which is cooperating with the U. S. department of agriculture.

Several different varieties are available this year in both soft and hardwoods.

Trees for planting can be secured for planting under the following conditions:

All trees secure from the college must be planted on farm land in Nevada for windbreak or windbreak or shelterbelt purposes.

All trees must be protected from fire, grazing, trespass and other injurious agencies, in so far as reasonably possible. This may necessitate fencing in numerous cases.

All trees must be cultivated and irrigated for the first four years after planting.

When requested, the applicant must furnish a report to the extension forester, showing the condition of all trees received and planted by him.

All plantations must be held open to inspection by representatives of the United States department of agriculture and of the University of Nevada at all times.

No trees secured from the college may be sold.

Nurse Association Meeting Tonight

The February meeting of the Nevada State Nurses' Association will be held today at 8 p. m. at the home of Mrs. Herbert Tait, 325 Clay street, officers announced yesterday.

There will be a business session of the association, followed by a social hour.

Cheap Oil Burner Invented Sweeping the Country

Cooks a Meal for 1c — Does Away With Coal or Wood in Stoves, Ranges, Furnaces; Half the Cost.

A simple oil burner, which 15,000 users say beats anything ever gotten out for low cost, perfect performance, burns cheap oil in a new way and does not clog up or carbon. Slips in any old stove, range or furnace, by generating; gives intense heat instantly by turn of valve. Is sent on 30 days' free trial at manufacturer's risk to anyone wishing to end the drudgery of coal or wood and cut fuel bills. United Factories, B-3603 Exchange Bldg., Kansas City, Mo. want energetic men to demonstrate and take orders for this amazing burner and are making a no-cost sample offer to one person in each locality to introduce. Drop them a 1c postcard today and learn how to make big money, spare or full time. (Advertisement)

The 10th of the Month is Their Pay Day---



You may be an employer—or an employee. In either case you know the meaning of "pay day"!

RUNNING a business is like running a household: Current income must be depended upon to meet current expenses. Help must be paid regularly. Materials purchased must be paid for according to terms. Rent, light and other bills must be paid when due.

The merchant, the physician, the dentist—all credit granters—in order to meet their obligations, must insist on prompt payment of their accounts in accordance with standard terms.

Each month's charges are due on the first of the following month and payable not later than the 10th. The 10th, by courtesy, is the final date for payment—after that, bills are considered delinquent.

You are their paymaster! Prompt payment of their accounts will enable them [illegible] their creditors in turn to pay their bills promptly. Everyone will benefit, including yourself—for on prompt payment of their accounts in accordance with standard terms.

Use your credit freely and pay all bills by the 10th or promptly as agreed

Nevada Credit Rating Bureau
Incorporated
304-305 Byington Building

Swing and Easel Frame
WINTER SPECIAL
Now is the time to have your pictures framed. All frames displayed in our windows ⅓ off, including glass and fitting.
Bring Your Photos in Now to
The Nevada Photo Service
253-255 Sierra St.—Reno

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JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
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2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	**Q, R**	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

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UNITED STATES DEPARTMENT OF THE INTERIOR
J. A. KRUG, Secretary

Bureau of Reclamation
Project
Number

BUREAU OF RECLAMATION
MICHAEL W. STRAUS, Commissioner
E. O. LARSON, Regional Director

INTERIM REPORT

COLORADO RIVER STORAGE PROJECT

AND

PARTICIPATING PROJECTS

States of the Upper Division
Upper Colorado River Basin

PRELIMINARY DRAFT
OF PROPOSED REPORT
FOR REVIEW ONLY
NOT FOR PUBLIC RELEASE

Region 4
Salt Lake City, Utah

March 1949

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UNITED STATES DEPARTMENT OF THE INTERIOR
J. A. Krug, Secretary

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March 1949

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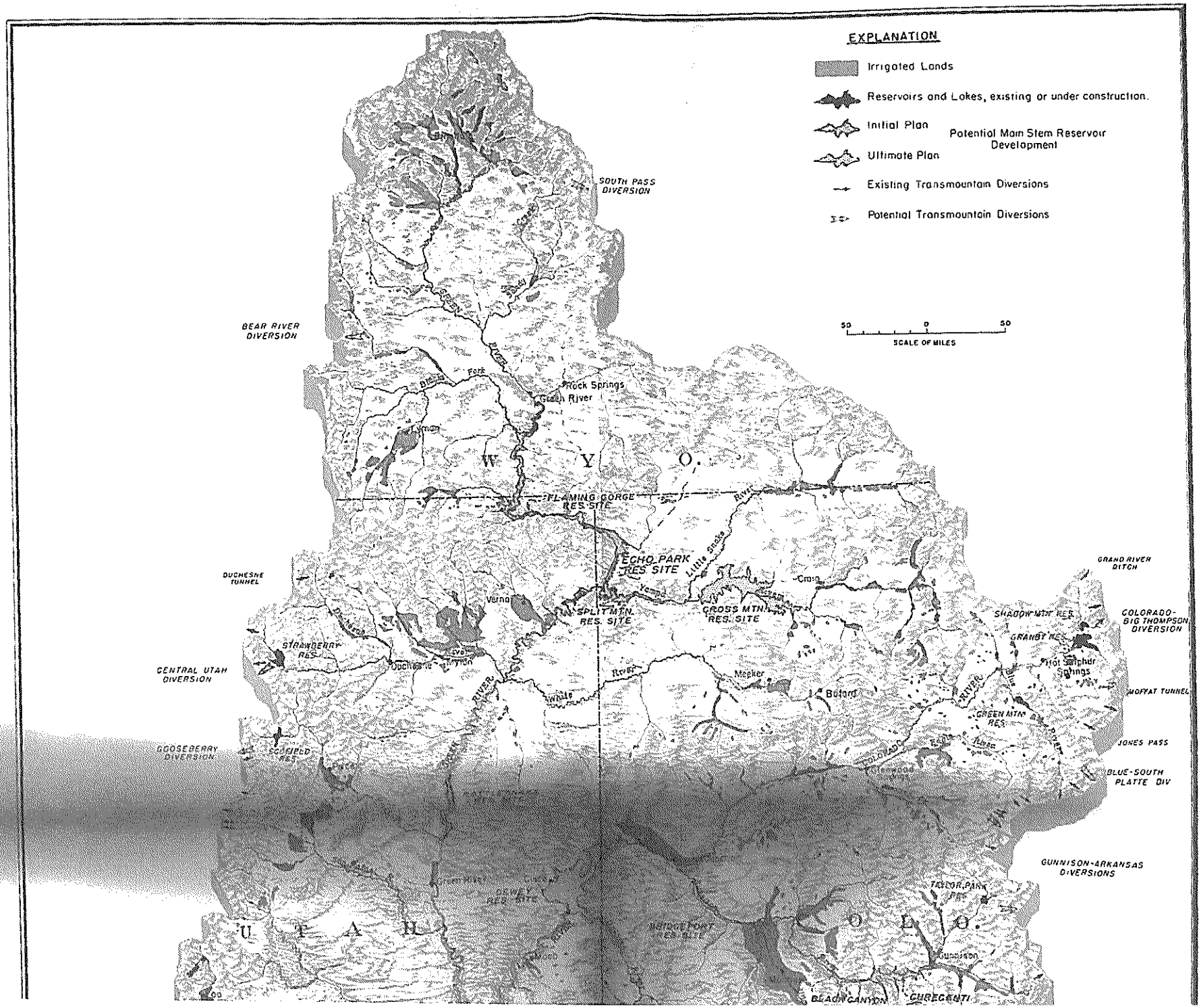
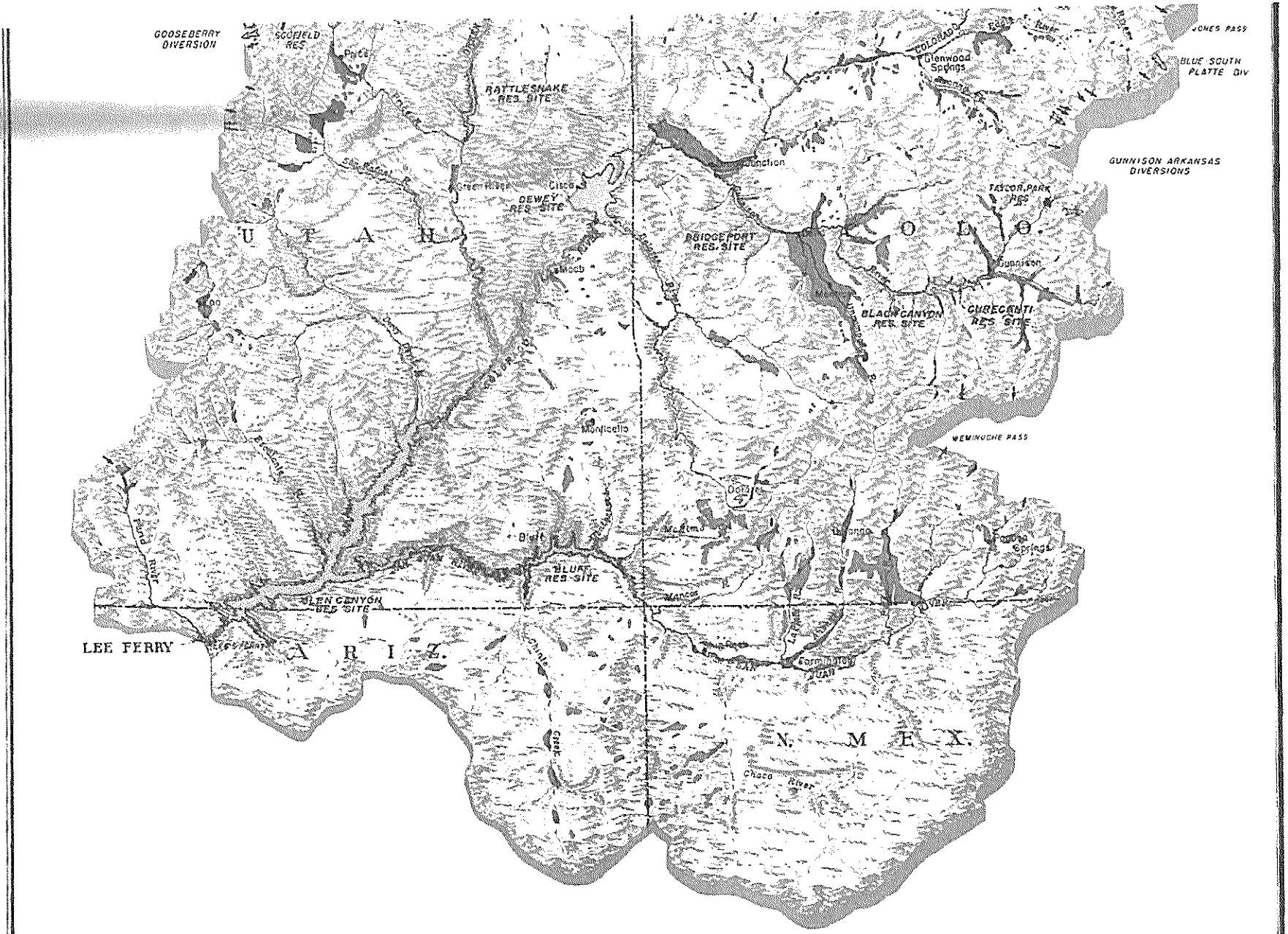

EXPLANATION
Irrigated Lands
Reservoirs and Lakes, existing or under construction.
Initial Plan
Ultimate Plan
Potential Main Stem Reservoir Development
Existing Transmountain Diversions
Potential Transmountain Diversions
50 0 50
SCALE OF MILES
SOUTH PASS DIVERSION
BEAR RIVER DIVERSION
Rock Springs
Green River
Lyman
W Y O.
FLAMING GORGE RES. SITE
ECHO PARK RES. SITE
Little Snake River
Craig
DUCHESNE TUNNEL
Vernal
SPLIT MTN. RES. SITE
CROSS MTN. RES. SITE
STRAWBERRY RES.
CENTRAL UTAH DIVERSION
Duchesne
Meeker
Buford
White River
GRAND RIVER DITCH
SHADOW MTN. RES.
GRANBY RES.
COLORADO-BIG THOMPSON DIVERSION
Hot Sulphur Springs
MOFFAT TUNNEL
GREEN MTN. RES.
JONES PASS
BLUE-SOUTH PLATTE DIV
GOOSEBERRY DIVERSION
SCOFIELD RES.
GUNNISON-ARKANSAS DIVERSIONS
TAYLOR PARK RES.
DEWEY RES. SITE
BRIDGEPORT RES. SITE
U T A H
O L O.
Gunnison
BLACK CANYON
CURECANTI



UPPER COLORADO RIVER BASIN

PRELIMINARY DRAFT

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Region 4
Post Office Box 360
Salt Lake City 8, Utah

March 31, 1949

To: Commissioner

From: Regional Director

Subject: Interim Report on Colorado River Storage Project and Participating Projects in the States of the Upper Division--Upper Colorado River Basin.

1. This letter is submitted as my interim report on the potential Colorado River Storage project and on a group of Federal reclamation projects selected for initial participation in the benefits and revenues of the storage project. The various multiple-purpose facilities of these projects are needed as part of a comprehensive Colorado River development program. Substantiating materials on which the report is based are appended.

2. Authority to make this report and supporting investigations is provided in the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto, particularly the Boulder Canyon Project Act and the Boulder Canyon Project Adjustment Act).

Scope and Purpose

3. Consummation of the apportioned uses of Colorado River water in the States of the upper division (Colorado, New Mexico, Utah, and Wyoming, comprising most of the Upper Colorado River Basin) in a manner consistent with the rights and obligations established by interstate

compacts and the international treaty governing the operation of the Colorado River will require construction of major regulatory reservoirs on the Colorado River and its tributaries in the Upper Colorado River Basin. For this purpose the Colorado River Storage project plan contemplates the development of six major regulatory reservoir sites. The dams, reservoirs, and appurtenant power facilities at these sites, and also power facilities at three sites below potential regulatory reservoirs, are tentatively included in the Colorado River Storage project plan.

4. In a broad sense all water-use projects in the States of the upper division initiated subsequent to the signing of the Colorado River Compact in 1922 would participate indirectly in the regulatory benefits afforded by the Colorado River Storage project. Since the signing of that compact a few self-supporting projects have been constructed and others authorized. As a rule, however, earlier projects utilized the least expensive sites and the most convenient water supplies. Most future irrigation projects in the States of the upper division, although highly desirable from a National standpoint, will require financial assistance. It is intended that Colorado River Storage project power revenues offer this assistance. Qualifying criteria have been suggested herein in an attempt to assure orderly development and equitable participation of projects of all States of the upper division. Projects thus qualifying for assistance have been designated participating projects.

REPORT OF THE REGIONAL DIRECTOR

The plan discussed herein provides a practicable means for [illegible] the utilization of the natural resources of the States of the upper division. Recognition is given to inherent benefits, such as [illegible] retention and river regulation for power and flood control, [illegible] accrue as a result of the project storage facilities to the [illegible] of the lower division (Arizona, California, and Nevada, comprising [illegible] of the Lower Colorado River Basin). Discussions, however, are [illegible] confined to activities directly affecting the States of the upper division.

6. The necessity for stream flow regulation, although a typical requirement for development of most river basins in the western United States, is pronounced in the Upper Colorado River Basin. Here the requirement for storage of the erratic flow extends beyond usual project needs. State and international obligations dictate that development in the basin be accompanied by maintenance of an almost uniform flow of Colorado River water passing Lee Ferry from the upper to the lower basin. Analysis of available stream flow records of the Colorado River shows that this can be accomplished only through extensive river regulation. With recent ratification and approval of the Upper Colorado River Basin Compact, use of Colorado River water for resource development in the upper basin is expected to increase rapidly. Without extensive river regulation the limit of development will be attained in the very near future.

Promotion

REPORT OF THE REGIONAL DIRECTOR

Compact and Treaty Obligations

A history of the division of the water on the river between the upper and lower basins is given in the Department of the Interior report entitled The Colorado River, dated March 1946 and printed as House Document 419, Eighties Congress. Since that report a compact has been ratified by the States of the upper basin and approved by the Congress. In the compact, signed on October 11, 1948, the States of the upper basin agreed, subject to the provisions of the Colorado River Compact, to the rights and obligations of each signatory State respecting the uses and deliveries of the water of the upper basin.

8. By the Upper Colorado River Basin Compact (Article III (a)) Arizona was apportioned a use, not to exceed 50,000 acre-feet annually, of the 7,500,000 acre-feet apportioned the upper basin under the terms of the Colorado River Compact. The remaining use apportioned the upper basin was divided among the States in the following percentages:

State of Colorado	51.75 percent
State of New Mexico	11.25 percent
State of Utah	23.00 percent
State of Wyoming	14.00 percent

9. Other important provisions of the Upper Colorado River Basin Compact relate to uses of water in States of the upper division, particularly as they may affect uses in other States of the upper division. Provisions also are made for the sharing of the joint obligations of the States of the upper division, particularly the Lee Ferry flow obligations provided in the Colorado River Compact and the Mexican Treaty.

10. The Upper Colorado River Basin Compact (Article VIII) created an interstate administrative agency to be known as the Upper Colorado River Commission to determine, among other things, the quantity of consumptive use of water for the upper basin and for each State of the upper basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry. This form of determination reflects the policy adopted by the States of the upper basin as to the method of determining consumptive use and relating such use to Colorado River system operations.

11. In its studies the Bureau of Reclamation has allowed for all related provisions of the Colorado River Compact, Mexican Treaty, and the Upper Colorado River Basin Compact. Where interpretations were necessary, policies of the upper basin States were used.

The Colorado River Report

12. The Colorado River Report includes a description of the basin's resources, its needs and problems, and its present and potential development.

13. The report outlines 134 irrigation and multiple-purpose projects within the natural boundaries of the Colorado River Basin, 100 of which are located in the upper basin. It also describes several projects involving the exportation of Colorado River water beyond the basin's natural boundaries. Information inventoried in the Colorado River Report has been used in the preparation of this report and will continue to supply valuable information and background for many future investigations.

REPORT OF THE REGIONAL DIRECTOR

Investigation Subsequent to the Colorado River Report

The 1946 Colorado River Report concluded that the development of water resources, particularly in the upper basin, was severely handicapped by the fact that water apportioned the upper and lower basins had not been allocated among the various States. This resulted in immediate upon formation of the upper basin compact and intensive investigation in the upper basin then possible through recession of war activities. Unusually rapid progress was made in completing the compact, and the States have pressed the Bureau of Reclamation for investigations and reports on projects which can now be undertaken.

Need for Immediate Development

15. Over the past 75 years irrigation developments in the upper basin have been confined to numerous small private enterprises and 13 projects of various sizes undertaken by the Bureau of Reclamation. According to the Engineering Advisory Committee's final report to the Upper Colorado River Basin Compact Commission, dated November 29, 1948, about 1,385,000 acres are being irrigated at the present time in the upper basin. Based on the committee's data, present man-made depletions in the upper basin reflected in the flow at Lee Ferry average about 2,000,000 acre-feet annually. With projects under construction or authorized for construction, man-made depletions at Lee Ferry would average about 2,550,000 acre-feet annually. Recurrence of unregulated flow conditions of the critical 10-year drouth period 1931-1940 would permit in the States of the upper division total man-made depletions

exceeded [illegible] 4,750,000 acre-feet annually as measured at Lee Ferry. [illegible] would be reduced as necessary when the States of the [illegible] were required to assist in meeting deficiencies in [illegible] in order that the States of the upper division might consummate [illegible] consumptive use allocated to them under terms of the upper [illegible] compact, regulatory reservoirs with an active aggregate capacity of about 23,000,000 acre-feet would be required for long-time hold-over [illegible] in the Upper Colorado River system. The regulation provided by [illegible] reservoirs would be required in addition to the regulatory [illegible] of upstream storage constructed for water-use projects.

With water resources developed at a reasonable rate, the regulatory reservoirs would be required for long-time hold-over purposes in about 21 years. Immediate construction of the regulatory reservoirs is needed, however, in order that electric energy demands of power market areas might be supplied. Some of the revenues from the power produced could apply against the cost of the joint use facilities before these facilities were actually used for regulatory purposes. Some power revenues could also apply against the costs of economically justified and urgently needed irrigation projects in the States of the upper division which are beyond the repayment ability of the users of irrigation water. With early construction unused water would be available for rapid filling of the reservoirs. The regulatory reservoirs would incidentally result in immediate benefits to major Federal facilities in the States of the lower division whose functions are being limited by

the lack of upstream sediment control. With construction of the [illegible] several important potential power developments in the lower [illegible] upstream from Hoover Dam could receive early favorable considera-[illegible]. The reservoirs would also be of immediate benefit to recreation, fish and wildlife conservation, and flood control.

Plan of Development

17. In addition to the 100 potential in-basin projects and several major water exportation projects outlined in the Colorado River Report, other potential uses of Upper Colorado River Basin water no doubt remain to be discovered. The consumptive use requirements of all possibilities far exceed the uses apportioned to the upper basin. From the many potentialities projects must be segregated that have consumptive use requirements compatible with the uses apportioned the respective States of the upper division. This, however, will require considerable investigation and detailed study. Thus, to designate features and projects constituting the ultimate plan of development is not practical at this time.

18. Existing and authorized projects are considered as the first stage of basin development. Construction could now proceed on private undertakings and Federal reclamation projects in a second stage of development. Most of the Federal projects would require special financial assistance. Revenues from the Echo Park unit of the Colorado River Storage project would provide this assistance for an initial group of projects. Other units of the Colorado River Storage project and the river regulation afforded

by their operation would permit subsequent stages leading to the ultimate development of Colorado River resources in the States of the upper division. The plan suggested herein does not restrict future development to Federal reclamation projects requiring special financial assistance. Construction could proceed independently of, and concurrently with, this plan on private undertakings and on self-supporting Federal reclamation projects.

Colorado River Storage Project

19. Under the Colorado River Storage project reservoirs would be constructed on the Colorado River system above Lee Ferry. These would have a total capacity of 48,065,000 acre-feet and would maintain against sediment encroachment an active storage capacity of 23,000,000 acre-feet. It is imperative that these reservoirs be located at sites collectively capable of permitting, through storage water replacements, the greatest possible yield from the waters of the Upper Colorado River Basin within the consumptive use apportioned annually to the States of the upper division consistent with the production of electric energy in the substantial amount necessary for the economic development of the water and other related natural resources of the States of the upper division. Some of the reservoirs would be used jointly for regulation by the Colorado River Storage project and for water development by the individual States. Such reservoirs would be the Flaming Gorge from which a gravity diversion could be made to the Central Utah project and the Bridgeport from which a replacement diversion could be made to western Colorado lands. The construction schedule for the dams and appurtenant facilities would meet the increasing need for electric

energy. The primary function of the project, however, aside from [illegible] possible individual water-use projects, would be to provide the long-time hold-over necessary to meet Lee Ferry flow obligations.

20. To protect the exclusive use of storage for hold-over purposes, the plan provides reservoir capacity for the storage of encroaching sediment. Regulatory reservoir evaporation, recognized in the Upper Colorado River Basin Compact as a legitimate charge against the apportioned consumptive use of the States of the upper division, limits the extent to which such protection might be justified. For the purpose of this report complete sediment retention was planned for a period of 200 years. During this period an estimated 18 million acre-feet of sediment would be retained in project reservoirs. An estimated 12 million acre-feet would be retained in the active storage sections. Succeeding generations could maintain the protection by controlling some sediment at its source and by developing remaining upstream sediment storage sites.

21. The release of water from the regulatory reservoirs would provide an excellent opportunity for the production of firm electric energy. Inactive storage pools with an aggregate capacity of about 12 million acre-feet would be necessary, however, to provide the minimum heads required for operation of the various hydroelectric plants. These pools would also retain, in 200 years, about 6 million acre-feet of the sediment entering the reservoirs. In addition to the losses incurred during the initial filling of the inactive storage pools, there would be a consumptive use directly attributable to inactive storage. This use

would amount only to the incremental evaporation losses entailed by superimposing the active storage capacities upon the inactive storage pools. The States of the upper division could well afford to include these inactive storage losses in their apportioned use in view of the necessity for sediment provisions and the tremendous benefits which would be derived from the generation and sale of electric energy.

22. Under average stream flow conditions, sufficient water would be available for filling of all project storage facilities. The reservoirs would remain nearly full as long as the river flow was sufficient to meet the 10-year 75,000,000 acre-foot Lee Ferry flow obligation and to supply any flow required from the States of the upper division to meet deficiencies in Mexico. During periods of critically low flow, the States of the upper division, in order to consume their apportioned water (7,500,000 acre-feet minus 50,000 acre-feet to Arizona), would release water from their hold-over storage reserves to meet the Lee Ferry flow obligations. Following such a release the States of the upper division would replenish their reserves during years of favorable water supply.

23. The Colorado River Storage project would include the units shown in the following table.

Projects included in Colorado River Storage Project

...ect unit	River	Total reservoir capacity (a.f.)	Capacity reserve for hold-over storage (a.f.)
...k Canyon	Gunnison	510,000	0
... Mountain	Yampa	5,200,000	4,200,000
...canti (Cottonwood ...m)	Gunnison	2,500,000	2,000,000
... Park	Green	6,460,000	4,400,000
...ring Gorge (Red ...anyon Dam)	Green	4,180,000*	1,965,000
... Canyon	Colorado	26,000,000	10,306,000
...lesnake	Green	2,000,000	641,000
...lt Mountain	Green	335,000	0
...tewater (Bridgeport ...m)	Gunnison	880,000**	0
Total		48,065,000	23,512,000

*1,300,000 acre-feet of storage would be required for gravity diversion to Central Utah project.

**500,000 acre-feet of storage would be required for replacement irrigation in western Colorado.

24. Construction program. A construction schedule has been planned to meet the electric energy requirements of areas which could reasonably be serviced by the power system of the Colorado River Storage project. The schedule allows for energy requirements to be supplied first from potential local power developments not included in the project system. Power load areas within the States of the upper division would be given preference to the use of project energy. Early relief would also be furnished power-deficient areas in the lower basin. A substantial portion of the energy supplied the lower basin would be withdrawn, however, as demands in the States of the upper division required. Potential power developments in the lower basin, such as the Bridge Canyon, Kanab Creek, and Marble Canyon, could replace these withdrawals.

5. The cost of the Colorado River Storage project is estimated [illegible] million dollars as shown in the table below. This cost is [illegible] on prices prevailing on July 1, 1948. It includes [illegible] cost of dams, power plants, transmission facilities, access [illegible]ities, construction camps, rights-of-way, relocations of transportation and communication facilities, investigations, engineering, and [illegible]ead. Operation, maintenance, and replacement costs are estimated [illegible]t 10 million dollars annually for the total project.

Project unit	Height of dam above river (feet)	Power installation (kilowatts)	Estimated construction costs (millions of dollars)
Green River			
Flaming Gorge (Red Canyon Dam)	475	75,000	91*
Echo Park	525	200,000	139
Split Mountain	245	120,000	68
Rattlesnake	445	200,000	156
Yampa River			
Cross Mountain	295	60,000	49
Gunnison River			
Curecanti (Cottonwood Dam)	475	75,000	112
Black Canyon	600	210,000	158
Whitewater (Bridgeport Dam)	250	40,000	35**
Colorado River			
Glen Canyon	565	800,000	347
Subtotal		1,780,000	1,155
Investigations			5
Total		1,780,000	1,160

*Includes 15 million dollars for facilities allocated to Central Utah project.

**Includes 14 million dollars for facilities allocated to replacement irrigation in western Colorado.

26. The Echo Park unit would be little affected by sediment control and is ideally situated with respect to supplying the immediate upper basin power market needs. It has been selected for construction as the first unit of the Colorado River Storage project. This unit would involve the construction of a concrete, curved, gravity type dam at the Echo Park site on the Green River about 3 miles downstream from the mouth of the Yampa River. The dam would rise 525 feet above the river bed and would have a crest length of about 900 feet. The reservoir impounded by the dam would extend up the Green River 63 miles and up the Yampa River 44 miles. It would provide 6,460,000 acre-feet of storage capacity. The power plant at the base of the dam would contain five units with a total installed capacity of 200,000 kilowatts. A transmission system would extend from a substation near the dam to important power load centers in Colorado, Utah, and Wyoming. Interconnections would be made with existing Bureau of Reclamation facilities and with existing utility systems. Access to the dam site would be provided by means of a heavy-duty highway from U. S. Highway 40 near Vernal, Utah.

27. The Glen Canyon unit is also of substantial initial importance, being located at the lowest possible point for control of sediment and river discharge in the upper basin and within reach of the present critical power-deficient areas in the lower basin and lower part of the upper basin. Construction of this unit will be recommended as soon as tentative conclusions have been confirmed by investigations currently in progress. The Glen Canyon unit is so urgently needed that these

investigations will be expedited to the full extent of available funds and personnel. With early construction of the Echo Park and Glen Canyon units, considerable flexibility would be permitted in the planning of future units of the Colorado River Storage project.

28. Annual Benefits and Costs. The tangible benefits resulting from the Colorado River Storage project, exclusive of those from the Central Utah project and replacement water in western Colorado, are associated with river regulation (for irrigation, municipal, and industrial water supplies), power generation, fish and wildlife conservation, recreation, flood control, and sediment storage. While all of these benefits are measurable in monetary terms, only the benefits derived from power generation have been evaluated at this time.

29. Power benefits would be the major tangible benefits and would result both directly and indirectly from the project. These have been estimated over a 100-year period of analysis. The direct power benefits are measured by the annual gross revenues expected from the sale of energy produced under project operation. These are expected to have an average value of nearly 35 million dollars annually. Allowance is made in the estimate for expected stream depletion and transmission losses. The value of indirect power benefits resulting from the sale of electric energy generated by the project would approximate 36 million dollars annually. Thus annual direct and indirect benefits would amount to about 71 million dollars annually. Direct and indirect benefits from increased power production in the lower basin attributable to the facilities of the project have not been determined.

30. Tangible benefits from irrigation and from use of water for municipal and industrial purposes, although possible only through river regulation, are being analyzed and claimed largely by individual projects. Substantial benefits of an intangible nature would accrue to the region and the Nation as a result of river regulation.

31. Only limited information is now available on other project uses, such as fish and wildlife conservation, recreation, flood control, and sediment storage. Thus the monetary evaluation of benefits from these uses is precluded at this time. Further investigation will allow a fuller appraisal of all benefits.

32. In order to permit comparison of costs and benefits the entire investment of the Colorado River Storage project has been expressed as an annual economic cost. This annual cost is estimated to be about 41 million dollars. It was determined by amortization of the estimated construction cost (1,131 million dollars, exclusive of costs allocated to Central Utah project and to irrigation of western Colorado lands) over a 100-year period at 2½ percent interest. Appropriate allowances were made for interest costs during construction and salvage values of the project works. The annual cost also includes annual operation, maintenance, and replacement costs estimated to average 10 million dollars.

33. The evaluated annual benefits from power alone (71 million dollars) compare with the annual costs of the entire project (41 million dollars) in a ratio of 1.73 to 1.00. Thus the Nation would realize an

gain of $1.73 from power alone for each dollar spent for
tion of the entire project.

Repayment. The total cost of the Colorado River Storage
(1,131 million dollars, exclusive of costs allocated to the
Utah project and to irrigation of western Colorado lands) would
paid from power revenues. At this time no part of the cost is
ated in a nonreimbursable basis to fish and wildlife conservation
creation. An average firm power rate of 5.2 mills per kilowatt-
t load centers within the natural boundaries of the upper basin
t nearby points of interconnection with power systems in adjacent
has been used in the payout studies. This rate is based on amor-
tion of project costs allocable to power at 3 percent interest. The
allocable to power (860 million dollars) include the cost of power
and appurtenant facilities, plus 59 percent of the costs of joint
lities such as dams and reservoirs. The remaining 41 percent of
costs of joint facilities would be allocated to river regulation
percent), sediment storage (10 percent), and the Central Utah proj-
and irrigation of western Colorado lands (4 percent). The last
vestment in power facilities would be incurred 19 years after the
stallation of the first power unit, and the power allocation would be
paid 46 years after the installation of the last power unit. Invest-
nts allocated to river regulation, sediment storage, and investigations
271 million dollars) would be repaid from power revenues on the basis
60 annual payments for each investment. The allocation to the Central

project and the irrigation of western Colorado lands would be from the revenues of the projects benefiting from the joint facilities of the Colorado River Storage project.

Upper Division Development Account

35. Because of the river regulation it would afford, the Colorado River Storage project would possess many of the attributes of simpler reclamation projects now utilizing project power revenues to assist users of irrigation water in paying project irrigation costs. If a complete appraisal had been possible at this time of all potential uses of the water of the Colorado River system in the upper basin within the States of the upper division, a single project plan encompassing all such uses may have been appropriate. Extensive investigations over many years, however, will be necessary to assure a complete and systematic development of the system's water. Progressive future development concepts a slight departure from usual reclamation financial concepts. In the States of the upper division a need will exist for substantial assistance to Federal reclamation projects utilizing Upper Colorado River Basin waters. This assistance could be provided by establishment of an account known as the Upper Division Development Account.

36. To the Upper Division Development Account would be credited all revenues from the sale of electric energy generated or to be generated by the Colorado River Storage project in excess of revenues required to pay project operation, maintenance, and replacement costs.

37. All construction costs of the Colorado River Storage project which are assigned for repayment from power revenues would be charged

...t the Upper Division Development Account in accordance with an ...ished project payout schedule.

38. Net credits, being the difference between aggregate credits ...regate charges in the account, would be used for the purpose ...wing complete reimbursement of the reimbursable costs of irriga- ...rojects or units thereof utilizing Upper Colorado River Basin water ... States of the upper division which would not produce sufficient ...nues to repay construction costs allocated to irrigation. The net ...its which would accrue at the end of 10-year intervals under the ...olorado River Storage project development plan are shown in the follow- ...g tabulation.

Year	Accumulated net credits (million dollars)
0	0
10	74
20	239
30	396
40	512
50	582
60	599
70	722
80	941
90	1,165
100	1,390

39. Participation of projects or units thereof in the privileges ... the Upper Division Development Account would be brought about by ...tion of the Congress. The Secretary would recommend to the Congress ... project or unit thereof to participate in the privileges of the ...ccount when all sources of estimated revenues available to such project

unit thereof over a period of 60 years were insufficient to return reimbursable costs of the proposed project or unit thereof.

40. A project could participate in the account if it had a benefit-cost ratio of at least unity and could pay its own operation, maintenance, and replacement costs and a part of its construction cost.

Participating Projects

41. In 60 years net credits of approximately 70 million dollars would accrue to the Upper Division Development Account from the Echo Park unit of the Colorado River Storage project. These credits would allow initial participation of a substantial group of Federal reclamation projects utilizing Upper Colorado River Basin water in the States of the upper division. These participating projects would constitute a part of the second stage of basin development. Construction of other units of the storage project would allow participation of additional Federal reclamation projects in the privileges of the account to the extent of accrued net credits. In this connection the Upper Division Development Account would offer an opportunity for complete development of Upper Colorado River Basin water in the States of the upper division.

42. The group of projects selected in cooperation with the States of the upper division for initial participation in the development account are as follows:

(tabulation)

43. All the projects selected for initial participation are in Region 4 except _____ which are in Regions ___ and ____. The latter projects are covered by project reports entitled _____.

44. The projects selected for initial participation are briefly described as follows:

Need for Further Investigations

45. To keep pace with the rapidly expanding power demands and to assure the best possible utilization of the river resource, extensive investigations must be pressed on all possible units of the Colorado River Storage project. The units presented in paragraph 23 do not include all possibilities for development on the middle river. Other developments, including those listed below, may possess equal or better potentialities and must receive ample consideration in the course of future investigations.

Green River
- Riview
- Desolation

San Juan River
- Martinez
- Bluff
- Goosenecks
- Slickhorn
- Great Bend

Yampa River
- Juniper
- Lily Park

Colorado River
- Dewey
- Moab
- Junction
- Dark Canyon

46. Investigations should be accelerated on all potential projects using Colorado River water in the upper basin in order that unnecessary delays might be avoided in the comprehensive development program. Only through intensive investigations and adequate study can proper projects be selected for development in time to meet the needs and demands of local, regional, and National interests.

Conclusions

47. Upper Colorado River Basin water is available for development in the States of the upper division up to their apportioned consumptive use.

48. Consummation of the average annual use of 7,450,000 acre-feet of Upper Colorado River Basin water apportioned the States of the upper division by the Upper Colorado River Basin Compact is possible only through long-term river regulation in hold-over reservoirs above Lee Ferry with an aggregate live capacity of approximately 23,000,000 acre-feet.

49. The required regulatory storage as well as long-time protection from encroaching sediment could be provided under the Colorado River Storage project.

50. The Colorado River Storage project has engineering feasibility and is economically justified.

51. Releases from project reservoirs would permit the extensive production of hydroelectric energy. The market demands for hydroelectric energy would fully absorb the output of all the project units under an orderly construction program.

52. Net operating revenues from the sale of electric energy would be sufficient (1) to pay project operation, maintenance, and replacement costs; (2) to repay within a period of 50 years, with 3 percent interest, the costs of power facilities and the portion of joint facilities allocated to power; (3) to repay within a period of 60 years the cost of joint facilities allocated to purposes other than power; and (4) to assist in the repayment of economically justified and urgently needed Federal reclamation projects utilizing Upper Colorado River Basin water in the States of the upper division.

53. Financial assistance could best be rendered Federal reclamation projects through establishment of an Upper Division Development Account.

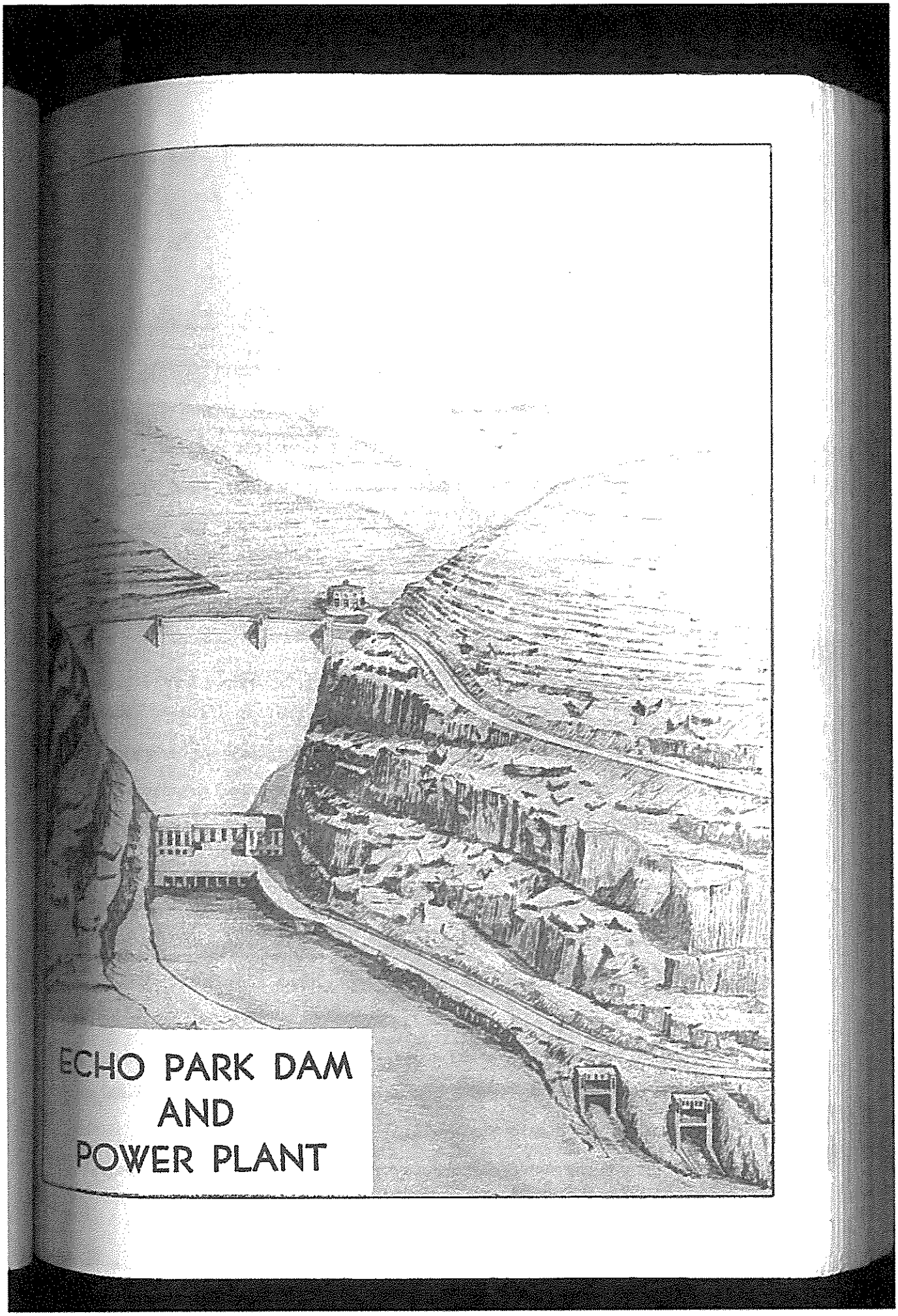
54. The Echo Park unit is so situated that it could meet the most urgent needs of the upper basin and therefore is the logical unit for first construction. As an initial unit, it would permit participation in the privileges of the development account to the extent of 70 million dollars.

55. A group of projects for initial participation in the privileges of the development account could be selected from potential developments on which the Bureau of Reclamation now has detailed information.

56. Further investigation and construction of other units of the Colorado River Storage project would permit appropriate participation of additional projects in the privileges of the development account.

57. The plan suggested herein would fit in with comprehensive basin development. Construction could proceed concurrently with, and independently of, this plan on private undertakings and on self-supporting Federal reclamation projects.

SUBSTANTIATING REPORT


ECHO PARK DAM
AND
POWER PLANT

CHAPTER I

G E N E R A L D I S C U S S I O N S

Extensive agricultural and industrial expansion in the Upper Colorado River Basin requires coordinated development of all natural resources. In this vast semiarid section of the United States the availability of water is of prime importance. Geographic and economic barriers have retarded the use of this precious resource. Keeping pace with the demand for more homes, food, and other consumer goods, and with new technological advances, water resources of this area must be developed to permit agricultural and industrial growth.

This report shows how the proposed Colorado River Storage project would make possible the maximum practicable use of Upper Colorado River Basin water in the States of the Upper Division (Colorado, New Mexico, Utah, and Wyoming) comprising most of the Upper Colorado River Basin. Consummation of the apportioned uses of Colorado River water in the States of the upper division in a manner consistent with the rights and obligations established by interstate compacts and the international treaty governing the present and future operation of the Colorado River will require construction of major regulatory reservoirs on the Colorado River and its tributaries in the Upper Colorado River Basin above Lee Ferry (a point in the main stream of the Colorado River 1 mile below the mouth of the Paria River). For this purpose the Colorado River Storage project plan contemplates the development of six major regulatory reservoir sites. The dams,

...rirs, and appurtenant power facilities at these sites, and also ...facilities at three sites below potential regulatory reservoirs, ...tatively included in the Colorado River Storage project plan. ...in a broad sense all water-use projects in the States of the ...division initiated subsequent to the signing of the Colorado ...Compact would participate indirectly in the regulatory benefits ...ted by the Colorado River Storage project. Since the signing of ...compact a few self-supporting projects have been constructed and ...authorized. As a rule, however, earlier projects have utilized ...least expensive sites and the most convenient water supplies. ...efore, most future irrigation projects in the States of the upper ...sion, although highly desirable from a National standpoint, will ...financial assistance. It is intended that Colorado River Storage ...ject power revenues offer this assistance. Qualifying criteria have ...suggested herein in an attempt to assure orderly development and ...able participation of projects of all States of the upper division. ...cts thus qualifying for assistance have been designated partici- ...ng projects.

The Colorado River Report

A comprehensive report, entitled The Colorado River, dated ...1946 and printed as House Document 419, Eighty-first Congress, ...been prepared by the Department of Interior under the sponsor- ...p of the Bureau of Reclamation. This report discusses the development ...the water resources of the Colorado River Basin for irrigation, river

...tion, power production, flood and sediment control, and other ...ficial uses in the States of Arizona, California, Colorado, Nevada, ...exico, Utah, and Wyoming. The report includes a description of ...asin, its natural resources, needs, and problems. The report ...inventories present and potential developments in the basin.

Some 134 projects are listed as possibilities for future development of the water resources within the natural drainage area of the Colorado River. One hundred of these projects are located in the upper basin. Potential projects for the export of water from the Colorado River Basin are also discussed. The water supply available, however, is not sufficient for development of all the potential projects listed. The report points out the need for future detailed investigations to obtain adequate information required by the Department of the Interior to formulate, in cooperation with interested States, a comprehensive plan for use of the water resources of the Colorado River system.

Information contained in the Colorado River Report has been used freely in the preparation of this interim report on the Colorado River Storage project and participating projects. Basic data contained in the Colorado River Report have not been repeated here. General descriptive information regarding the upper basin may be found in that report.

Compact and Treaty Obligations

Use of water in the Colorado River system is governed by interstate compacts and an international treaty. Provisions of these documents have been fully considered in the plans for development of the waters of the river system.

GENERAL DISCUSSIONS

Colorado River Compact

The Colorado River Compact, signed November 24, 1922, and subsequently ratified by all signatory States and approved by Congress, has often been referred to as the "law of the river." Article II of the compact, the upper basin and the lower basin are defined as follows:

"(f) The term 'Upper Basin' means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River system above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry.

"(g) The term 'Lower Basin' means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry."

Article III of the compact provides, among other things, for the apportionment of the use of water to the two basins.

"(a) There is hereby apportioned from the Colorado River system in perpetuity to the upper basin and to the lower basin, respectively, the exclusive beneficial consumptive

use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist.

"(b) In addition to the apportionment in paragraph (a), the lower basin is hereby given the right to increase its beneficial consumptive use of such waters by one million acre-feet per annum.

. . . . .

"(d) The States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact."

The plan for storage and use of water herein proposed is strictly in accordance with the Colorado River Compact.

Mexican Water Treaty

The treaty between the United States of America and the United States of Mexico, effective November 8, 1945, allots to Mexico a guaranteed annual quantity of 1,500,000 acre-feet of water to be delivered in accordance with a schedule specifically set out in the treaty. When the United States Section of the International Boundary Commission decides that there is a surplus of water in the Colorado River in excess of the amount necessary to supply uses in the United

GENERAL DISCUSSIONS

States and the guaranteed quantity of 1,500,000 acre-feet allotted to Mexico, the United States, by the express terms of the treaty, would undertake to provide a total quantity of 1,700,000 acre-feet to Mexico. Provision is made in the treaty for reduction of the guaranteed quantity to be delivered to Mexico in the event of extraordinary drought or serious accident to the irrigation system in the United States.

The obligation to allot water to Mexico was anticipated in the Colorado River Compact which was executed some 23 years before the treaty was ratified. In Article III (c) of the compact, it is provided that if, as a matter of international comity, the United States shall recognize in Mexico any right to the use of Colorado River water, such water shall be supplied first from surplus water and if that is insufficient the ". . . deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency. . . ."

Upper Colorado River Basin Compact

On October 11, 1948, commissioners representing the Upper Basin States—Arizona, Colorado, New Mexico, Utah, and Wyoming—entered into a compact for the apportionment of the consumptive use of water". . . apportioned in perpetuity to and available for use each year by the Upper Basin under the Colorado River Compact. . . ." The compact has been approved by the Federal representative,

Harry W. Bashore, ratified by the legislature of each State, and approved by the Congress. Article III provides for apportionment of the consumptive use of water as follows:

"(a) Subject to the provisions and limitations contained in the Colorado River Compact and in this Compact, there is hereby apportioned from the Upper Colorado River System in perpetuity to the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, respectively, the consumptive use of water as follows:

(1) To the State of Arizona the consumptive use of 50,000 acre-feet of water per annum.

(2) To the States of Colorado, New Mexico, Utah, and Wyoming, respectively, the consumptive use per annum of the quantities resulting from the application of the following percentages to the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by Upper Basin under the Colorado River Compact and remaining after the deduction of the use, not to exceed 50,000 acre-feet per annum, made to the State of Arizona.

State of Colorado.....51.75 percent,

State of New Mexico.....11.25 percent,

State of Utah.....23.00 percent,

State of Wyoming.....14.00 percent."

GENERAL DISCUSSIONS

In anticipation of projects which require diversion and storage of water in one State for use in another State, Article IX was included in the Compact:

"(a) No State shall deny the right of the United States of America and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity of any signatory State to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one State for the purpose of diverting, conveying, storing, regulating, and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the States of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper signatory State for consumptive use in a lower signatory State, when such use is within the apportionment to such lower State made by this Compact. Such rights shall be subject to the rights of water users, in a State in which such reservoir or works are located, to receive and use water, the use of which is within the apportionment to such State by this Compact."

Paragraph (b) of Article IX provides for acquisition of out-of-State property by donation, purchase, or through the exercise of the power of eminent domain. Paragraph (c) provides for administration of water conservation facilities in one State for use of water in another State.

GENERAL DISCUSSIONS

Article IX is of special significance to the project under consideration [illegible], as to the appropriation of water of the Colorado River, it [illegible] existing statutory law in some of the upper basin States which [illegible] the right to divert water in one State for use in another State. [illegible] compact provides for curtailment of use of water by the upper [illegible] States in the event of shortage, for the charging of storage [illegible], and for the administration of the river by a commission to be [illegible] as the Upper Colorado River Commission. Paragraph (c) of [illegible] V is of great importance in the development of the States of [illegible] division.

"(c) In the event the Commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the Upper Division, the storage of water for consumptive use shall be given preference. Any reservoir or reservoir capacity hereafter used to assure deliveries at Lee Ferry shall by order of the Commission be used to store water for consumptive use in a State, provided the Commission finds that such storage is reasonably necessary to permit such State to make the use of the water apportioned to it by this Compact."

Scope of Present Investigations

Studies leading to the publication of the Colorado River Report indicated that considerable long-term hold-over storage above Lee Ferry would be required for the upper division States to utilize

GENERAL DISCUSSIONS

fully their apportioned use of water from the Colorado River Basin and fulfill their obligations under the Colorado River Compact.

The present investigations, initiated in 1946, have been conducted to determine the most attractive plan for providing river regulation, sediment retention, and power production at potential storage reservoirs on the Colorado River above Lee Ferry. The investigations have been carried on in sufficient detail to establish an over-all plan and to determine its engineering and economic feasibility.

In its investigations the Bureau of Reclamation worked closely with the Upper Colorado River Compact Commission, an organization consisting of representatives of the upper basin States, which was established for the purpose of agreeing to the States' rights and obligations respecting the uses and deliveries of the water of the upper basin. The Bureau recognized the importance of the factual data assembled by the commission and used the data extensively in the preparation of this interim report.

During the early stages of the present investigations, stream flow data and related information required in a thorough analysis of the area's potentialities were assembled. All available field data on potential hold-over storage sites were assembled and studied. As the compact commission was nearing an agreement during 1948, the studies were extended and expedited for completion of this interim report at the earliest possible date. A preliminary plan of development for the Colorado River Storage project was determined for the purpose of the

...port. Also sufficient information permitted the selection ... unit of the project for immediate construction.

...field data used in the investigations have been obtained ...graphic and profile surveys of dam sites; location surveys for ...conduits, power plants, access roads, and camp sites; and geo... examination or exploration of dam sites. The surveys were con... before and during these investigations. Other work included ... water supply, stream flow depletion, sediment, power pro... power markets, and power rates; economic analyses and repay... preparation of preliminary designs and estimates; and ...ation of an interim report.

...orts have been prepared on several projects in Region 4 ... the use of Upper Colorado River Basin water. The States of ... division might select from these water-use projects a group ...al participation in the benefits and revenues of the Colorado ...orage project. Information is being obtained on projects in ...gions of the Bureau which would be eligible for participation ...nefits and revenues of the storage project. The plan would ...with comprehensive basin development. Construction could proceed ...ently with, and independently of, the plan on private undertakings ...elf-supporting Federal reclamation projects.

Acknowledgements

...s report has been prepared in Salt Lake City by personnel of ...4, Bureau of Reclamation. During the course of the investi... the various States of the upper basin have provided valuable ...ance and information, particularly the factual data accumulated

GENERAL DISCUSSIONS

[illegible] by the Upper Colorado River Basin Compact Commission. [illegible] regions of the Bureau of Reclamation have also supplied use- [illegible]. Published data of Federal agencies, particularly the [illegible] Survey and Federal Power Commission, have also been used.

CHAPTER II

COLORADO RIVER STORAGE PROJECT

PLAN OF DEVELOPMENT

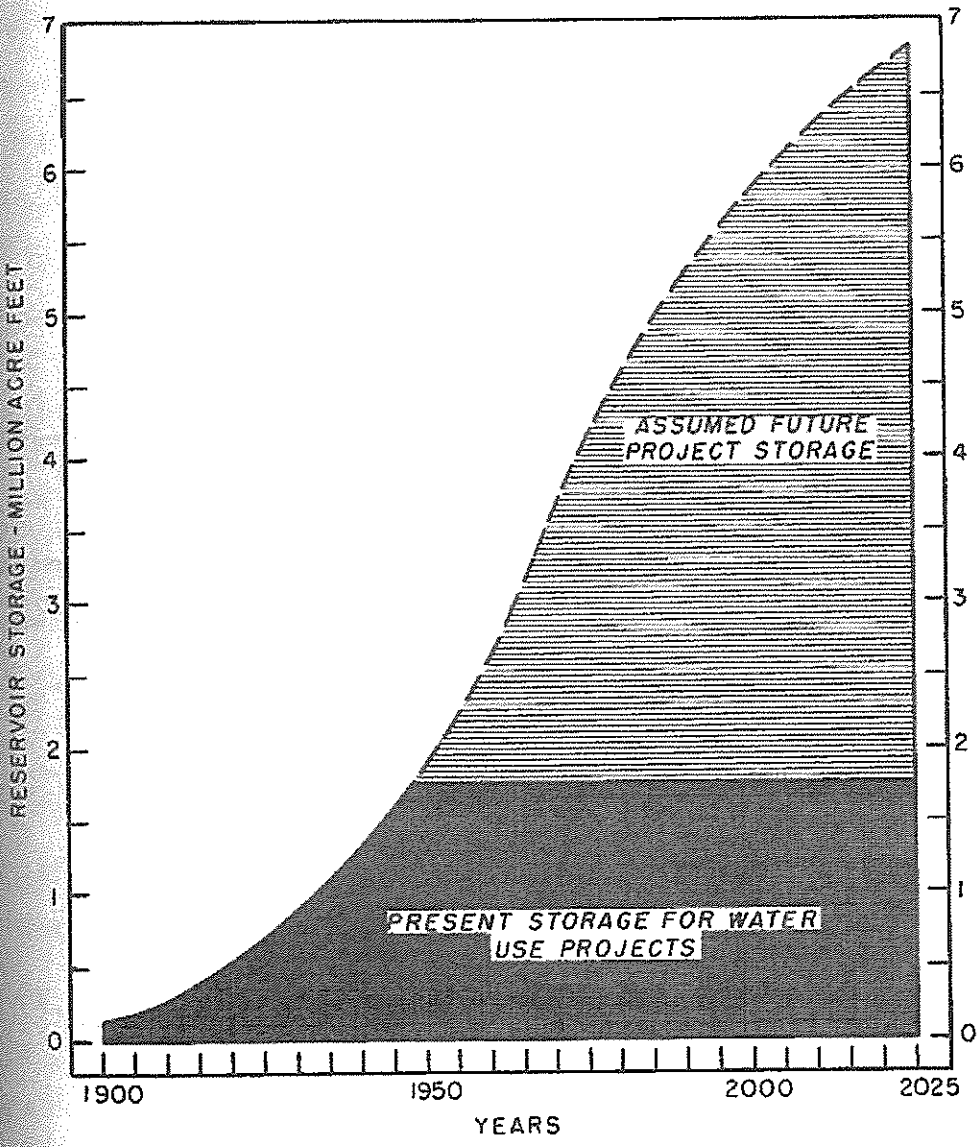
In addition to 100 potential in-basin projects and several major water exportation projects outlined in the Colorado River Report (H.D. 419, 80th Congress), other potential projects using upper basin water no doubt remain to be discovered. The water requirements of all possibilities far exceed the consumptive use apportioned to the upper basin. From the many potentialities, projects must be segregated that have consumptive use requirements compatible with the uses apportioned the respective States of the upper division. Since this selection must be preceded by extensive investigation and detailed study, it is not practical at this time to designate features and projects for inclusion in the ultimate plan of basin development.

The presently constructed and authorized projects are considered the first stage of basin development. Sufficient information is available to permit the selection of a small group of projects to be included in a second stage of basin development. The group would consist of a number of individual irrigation and multiple-use projects and one unit of the Colorado River Storage project. Included in the second stage of basin development, but independent of the plan proposed herein, would be private projects and Federal reclamation projects not requiring financial assistance of the plan. Initiation of the Colorado River Storage project and the river regulation afforded by its operation would permit subsequent stages in the ultimate development of Colorado River resources in the States of the upper division.

Under the Colorado River Storage project large regulatory reservoirs would be constructed along the Colorado River and its principal tributaries above Lee Ferry, Arizona. The hold-over storage thus provided would be a necessary addition to more than 5 million acre-feet of new storage, as shown in the chart on the following page, which would be required on tributary streams for individual water-use projects in the States of the upper division.

The necessity for hold-over storage arises from the provision of the Colorado River Compact apportioning in perpetuity to each the upper basin and the lower basin the consumptive use of 7,500,000 acre-feet of water annually and from the provision specifying that States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive water years.

After the signing of the Colorado River Compact, the upper basin suffered a protracted drouth far more severe than experienced during the periods of previous water supply records. During the 10-year period from October 1931 through September 1940 the flow at Lee Ferry averaged only 10,151,000 acre-feet. This would be equivalent to an estimated virgin or undepleted average annual 10-year flow of about 11,832,000 acre-feet. Without a reservoir system with sufficient capacity to carry over into the drouth period excess flows from years of high run-off, recurrence of such drouth conditions would permit in the States of the upper division man-made depletions averaging only about 4,332,000 acre-feet annually as measured at Lee Ferry. Reductions would be made in the permissible depletions as necessary for the States



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

UPPER BASIN RESERVOIR STORAGE
FOR WATER USE PROJECTS

DRAWN. . . . H.R.S. . . . SUBMITTED F. M. Warnick
TRACED. . HRS. . . RECOMMENDED Reed Jerman
CHECKED WBH . . APPROVED E. O. Larson

289-P-1	SALT LAKE AREA OFFICE FEB. 1949	

the upper division, under provisions of the Colorado River Compact, assist in meeting deficiencies in Mexico. During protracted dry periods under the Colorado River Storage project, sufficient water would be released to the States of the lower division from hold-over storage to permit upstream flows to be utilized in the States of the upper division up to their apportioned beneficial consumptive use.

Use of water on upstream tributaries would affect the operation of Colorado River Storage project facilities. As more complete information on upstream water uses becomes available, further analysis of residual flows may dictate changes in the capacities and locations of some regulatory reservoirs now being considered. Some potential units of the Colorado River Storage project must be further investigated before their relative water conservation efficiencies and economic limitations may be determined. More careful consideration must be given to the storage capacity needed to fulfill other beneficial functions of multiple-purpose developments such as sediment retention, power production, recreation, flood control, and conservation of fish and wildlife.

It is imperative that the reservoirs providing storage capacity be located at sites collectively capable of permitting, through storage water replacements, the greatest possible yield from the waters of the Upper Colorado River Basin within the consumptive use apportioned annually to the States of the upper division consistent with the production of electric energy in the substantial amount necessary for the economic development of the water and other related natural resources of the States of the upper division.

Reservoir Sites

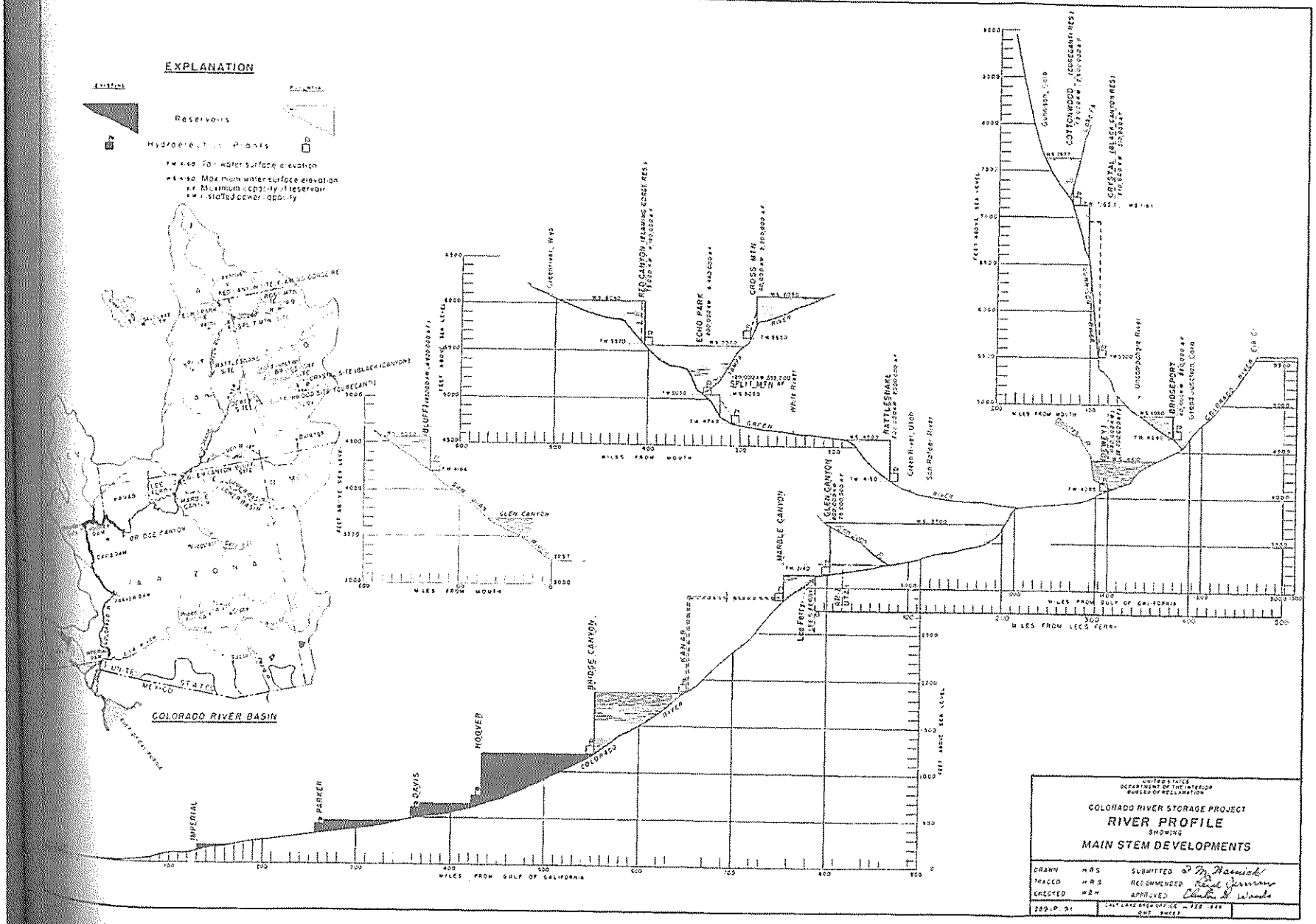
Comparative water supply and economic studies have been made for ght potential storage sites within the upper basin, six of which, es- ially adaptable for hold-over purposes, have been included in the n. Three other sites in the upper basin, where power facilities uld benefit from upstream hold-over storage, have also been included. racteristics of the sites considered are summarized in the table on following page.

Studies to date indicate that compliance with Lee Ferry flow obli- ions during future drouth periods equal in severity to the 1931-1940 iod would require at least 23 million acre-feet of active hold-over rage capacity if maximum utilization of the water apportioned the es of the upper division were to be attained.

To protect the exclusive use of storage for hold-over purposes, space be provided in the regulatory reservoirs for the storage of encroach- sediment. Regulatory reservoir evaporation, recognized in the Upper orado River Basin Compact as a legitimate charge against the apportioned sumptive use of the States of the upper division, limits the extent to such protection might be justified. The mean annual sediment load ported by the Colorado River past Lees Ferry has been estimated at ,000 acre-feet. For the purpose of this report, complete sediment tion was planned for a period of 200 years. Over this period roximately 18 million acre-feet of sediment would be retained, of an estimated 12 million acre-feet would be retained in the active

Reservoir site	Location of dam	Present river el.(ft)	Dam height (ft)	Total reservoir cap. (af)	Inactive storage (af)	Max.water surf.area (acres)	Pow.plant installed cap. (kw)	Purposes to be served
Echo Park	On Green R. 3 mi. downstream from Yampa R.	5,050	525	6,460,000	1,500,000	43,100	200,000	H,P,S,R,F
Flaming Gorge (Red Canyon Dam)	On Green R. 36 mi. downstream from Utah-Wyo. State line	5,570	475	4,180,000	1,300,000	42,000	75,000	H,I,P,R,F
Split Mountain	On Green R. 21 mi.downstream from Echo Park Dam site	4,810	245	335,000	300,000	4,220	120,000	I,P,R
Cross Mountain	On Yampa R. 7 mi. upstream from Little Snake River	5,800	295	5,200,000	1,000,000	52,200	60,000	H,I,P,R,F
Rattlesnake	On Green R. 22 mi. upstream from Gr.Riv.Utah	4,150	445	2,000,000	500,000	10,750	200,000	H,S,P,R.F
Curecanti (Cottonwood Dam)	On Gunnison R. 3½ mi. downstream from Sapinero, Colorado	7,165	475	2,500,000	500,000	18,200	75,000	H,P,R,F
Black Canyon (Crystal Dam)	On Gunnison R. about 1 mi. downstream from Crystal Creek	6,570	600	510,000	300,000	3,200	210,000	P,R,F
Bridgeport	On Gunnison R.about 15 mi. upstream from mouth	4,640	250	880,000	500,000	10,250	40,000	I,P,S,R
Glen Canyon	On Colo.R. 15 mi. upstream from Lees Ferry	3,140	565	26,000,000	6,000,000	154,000	800,000	H,P,S,R,F
Dewey	On Colo.R. 3 mi. below the Dolores confluence	4,085	335	8,200,000	2,000,000	73,000	180,000	H,P,S,R,F
Bluff	On San Juan R. 15 mi.downstream from Bluff, Utah	4,196	359	6,920,000	3,000,000	'0,000	85,000	H,P,S,R,F

Symbols used: I--Irrigation; H--Hold-over storage for river regulation; P--Power; S--Sediment retention; R--Recreation; F--Fish and wildlife conservation.


EXPLANATION
Reservoirs
Hydroelectric Plants
Tail water surface elevation
Maximum water surface elevation
Maximum capacity of reservoir
Installed power capacity
COLORADO RIVER BASIN
UNITED STATES
MEXICO
IMPERIAL
PARKER
DAVIS
HOOVER
BRIDGE CANYON
KANAB
MARBLE CANYON
GLEN CANYON
NATTLESNAKE
SPLIT MTN
ECHO PARK
CROSS MTN
RED CANYON
BLUFF
COTTONWOOD
CRYSTAL
BRIDGEPORT
COLORADO RIVER
GREEN RIVER
SAN JUAN RIVER
WILES FROM GULF OF CALIFORNIA
WILES FROM LEES FERRY
FEET ABOVE SEA LEVEL
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
RIVER PROFILE
SHOWING
MAIN STEM DEVELOPMENTS
DRAWN
TRACED
CHECKED
SUBMITTED
RECOMMENDED
APPROVED

storage sections of the reservoirs above Lee Ferry. Succeeding generations could maintain the protection by controlling some sediment at its source and by developing remaining upstream sediment storage sites. Little, if any, reduction in the sediment volume entering the main channels of the river is anticipated for future years because of the great extent of the sediment-contributing areas and their physical characteristics.

The release of water from the regulatory reservoirs would provide an excellent opportunity for the production of firm electric energy. Active storage pools containing about 12 million acre-feet would be necessary, however, to provide the minimum heads required for operation of the various hydroelectric plants. These pools would also retain, in 50 years, about 6 million acre-feet of the sediment entering the reservoirs. In addition to the losses incurred during the initial filling of the inactive storage pools, there would be a consumptive use directly attributable to inactive storage. This use would amount only to the incremental evaporation losses entailed by superimposing the active storage capacities upon the inactive storage pools. The States of the upper division could well afford to include these inactive storages in their apportioned use in view of the necessity for sediprovisions and the tremendous benefits which would be derived from generation and sale of electric energy.

Under average stream flow conditions, sufficient unused water would be available for rapid filling of all project storage facilities. The

reservoirs would remain nearly full as long as the river flow was sufficient to meet the 10-year 75,000,000 acre-foot Lee Ferry flow obligation and to supply any flow required from the States of the upper division to meet deficiencies in Mexico. During periods of critically low flow the States of the upper division, in order to utilize their full apportionment of consumptive use (7,500,000 acre-feet annually minus 50,000 acre-feet to Arizona), would release water from hold-over storage reserves to meet their Lee Ferry obligation. Following such a release of regulatory storage water in exchange for upstream uses within the apportioned amount of 7,450,000 acre-feet annually, the States of the upper division would replenish their reserves during years of favorable water supply.

Of the eight reservoirs considered, the Bluff and Dewey would be the least desirable from the standpoint of reservoir evaporation losses and are not included in the plan. Both reservoirs would have large exposed water surface areas at appropriate capacities. Despite the disadvantage of excessive evaporation, storage at either or both sites may eventually become desirable inasmuch as these reservoirs would intercept sediment originating upstream and thus protect active capacity at the strategic Glen Canyon site.

Reservoirs at the Echo Park, Flaming Gorge, Cross Mountain, Rattlesnake, and Curecanti sites, all of which are included in the proj- ect plan, would have low evaporation losses. These reservoirs would be principally confined within narrow canyon sections and thus would not

have large exposed water surfaces or would be located on the headwater reaches of the river where evaporation rates would be low. Besides providing river regulation, all of these developments would produce considerable quantities of electric power.

The Glen Canyon site, located about 15 miles upstream from Lees Ferry, is the lowest possible point for regulation in the upper basin. It is also the only site where both the physical features and the water supply justify storage of more than 10,000,000 acre-feet. Physically the site will permit construction of a dam to impound more than 30,000,000 acre-feet. Present detailed studies have shown an economic justification for a total capacity of at least 26,000,000 acre-feet under the Colorado River Storage project.

Large-scale storage in Glen Canyon would be comparatively efficient even though the reservoir would have a rather high water surface evaporation rate. The large flow at the site and the high dam would combine to produce more than 4 billion kilowatt-hours of firm energy annually. Existing and potential downstream developments would benefit materially from the stream flow regulation at Glen Canyon. The useful lives of these developments would be extended with sediment retention in the upper basin.

The Split Mountain, Black Canyon, and Bridgeport sites have limited storage possibilities. Development of the sites is included in the plan, however, as they are located below large potential regulatory reservoirs and thus offer opportunities for extensive power production. Releases from Curecanti Reservoir would pass

through the Black Canyon power plant, operating under an average head of nearly 1,600 feet, and then through the Bridgeport power plant, operating under an average head of nearly 250 feet. More than 300 feet of head at the Split Mountain Dam and power plant would utilize releases from Echo Park Reservoir.

Besides providing river regulation, storage reservoirs at Bridgeport and Flaming Gorge sites are expected to serve irrigation needs. A gravity diversion from Flaming Gorge Reservoir could supply replacement water to lands in the Uinta Basin under the Central Utah project. Water from Bridgeport Reservoir could be used to supply replacements for Grand Valley lands prior to maximum upstream depletions for future developments.

Possibilities also exist for irrigation developments in connection with project storage facilities at the Cross Mountain, Curecanti, and Split Mountain sites. Water from Cross Mountain Reservoir could be used for irrigation of new lands in Colorado and Utah north of the White River. Curecanti storage water could be used to provide replacement water for Uncompahgre Valley lands after ultimate development of projects diverting water from the Colorado River Basin into the drainage basins of the South Platte and Arkansas Rivers. Split Mountain Reservoir could supply lands near the mouths of White and Duchesne Rivers by gravity and thus avoid pumping of a supply direct from the Green River. These possibilities, however, must be further investigated before they can be incorporated as a part of the project plan.

To supply the anticipated power requirements, all of the power facilities at the sites tabulated in the table on page 17 should be in operation by 1980. Development of all the sites, except Bluff and Dewey, would be necessary to provide the 23,000,000 acre-feet of active hold-over storage necessary to assure maximum water utilization in the States of the upper division and to maintain this capacity against the encroachment of sediment during the next 200 years. Early construction would permit rapid filling of hold-over reservoirs with unused water and would allow the greatest use of undepleted flows for immediate power generation.

Echo Park Unit

A curved, concrete, gravity dam at the Echo Park site would be constructed as the first unit of the Colorado River Storage project. This dam would rise 525 feet above the present river level to a maximum elevation of 5,575 feet. It would impound 6,460,000 acre-feet of water for hold-over purposes, power production, sediment control, and other beneficial uses. Storage so located could be compatibly integrated with any future combination of potential hold-over storage developments.

Echo Park was named by Major J. W. Powell during his expedition through the canyons of the Green and Colorado Rivers in 1869. The park was formed by the Green River as it leaves Ladore Canyon at the Yampa River confluence and reverses its southern direction around the peculiar geological formation named "Steamboat Rock." The dam site is located near the entrance to Whirlpool Canyon about 2 miles downstream from Echo Park.

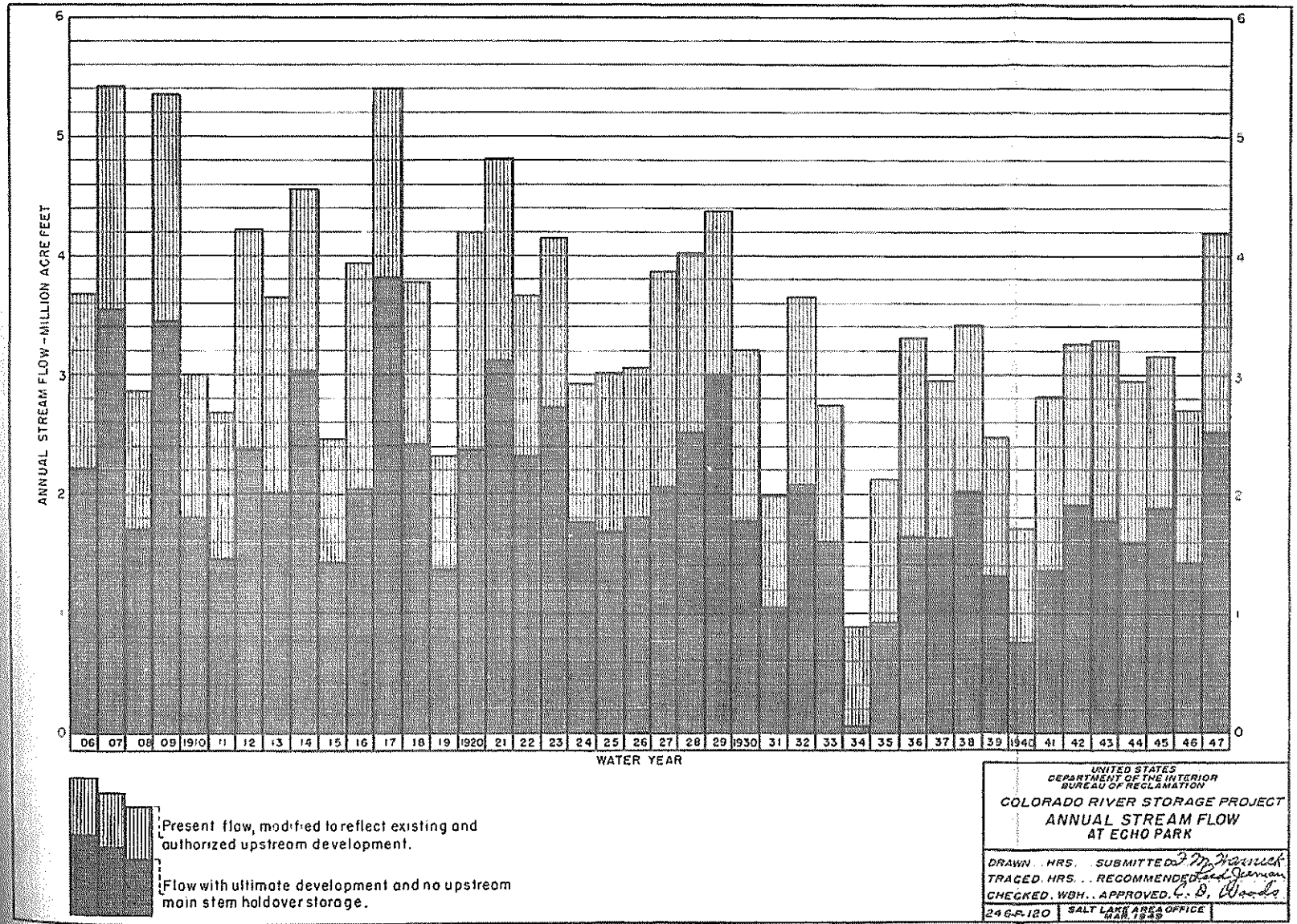
The reservoir formed by the dam would extend 63 miles upstream on the Green River and 44 miles up the Yampa River. The mean annual inflow from the two rivers would be nearly 3,500,000 acre-feet with extremes ranging from a high of nearly 5,500,000 acre-feet to a low of less than 1,000,000 acre-feet.

Present stream flow regulated at this site would produce more than 1 billion kilowatt-hours of firm energy annually. With additional beneficial consumptive use upstream from Echo Park, the firm power would be reduced by about 20 percent in 50 years. The reduced power output, however, would be integrated into the over-all system.

The physical characteristics of the reservoir basin insure a very high storage efficiency. The basin is confined by narrow canyon walls, except for the Browns Park area on the Green River and two smaller areas near the mouth of the Yampa River. The evaporation rate is comparatively low. Salvage of present losses, particularly at Browns Park, would be credited against the losses of Echo Park Reservoir.

Sediment originating upstream from Echo Park would not seriously impair the efficiency of the reservoir. With the construction of the Flaming Gorge Reservoir as planned, about 450,000 acre-feet of sediment would enter Echo Park Reservoir in 100 years. Since about one-third of the sediment would find its way to the dead storage pool only a 300,000 acre-foot reduction in the 5,000,000 acre-feet of active storage would result.

The Echo Park unit would include facilities necessary to deliver electric energy to load centers in Utah, Colorado, and Wyoming.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

ANNUAL STREAM FLOW
AT ECHO PARK

DRAWN . . HRS. SUBMITTED J. M. Harrick
TRACED. HRS. . . RECOMMENDED Fred Jarman
CHECKED. WBH. . APPROVED C. B. Woods

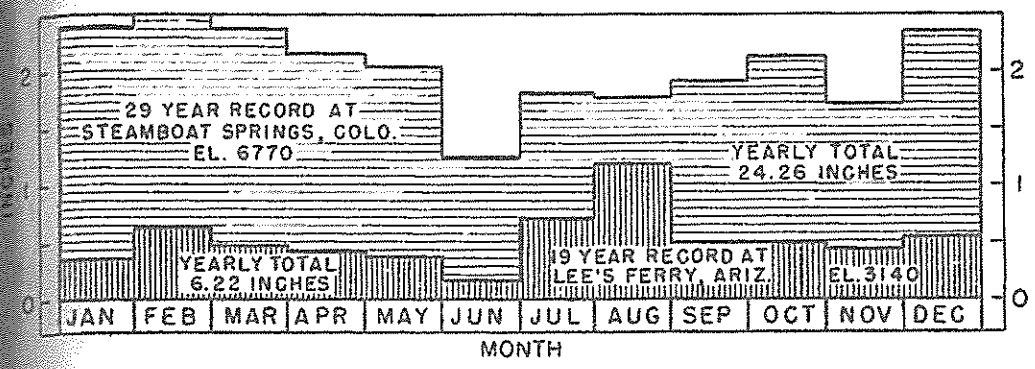
246-P-120 | SALT LAKE AREA OFFICE MAR. 1949

Construction and maintenance of the 30-mile access highway from the dam to transcontinental Highway U. S. 40 would open up an area of unexcelled scenic beauty now practically inaccessible.

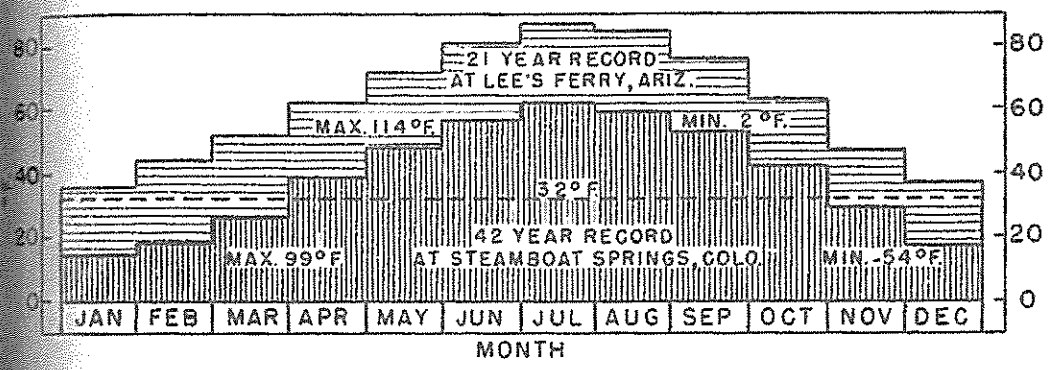
WATER RESOURCES

The first lands to be developed within the Upper Colorado River [illegible] were situated along tributary channels where a sufficient water supply was easily obtained at relatively low cost. Subsequent expansion and settlement have been limited to lands located successively farther from the streams. These have required more costly developments to obtain an irrigation supply, including works to store early season surplus flows for use in the late season when the flow in most streams fails to meet the rights of even the earlier appropriators.

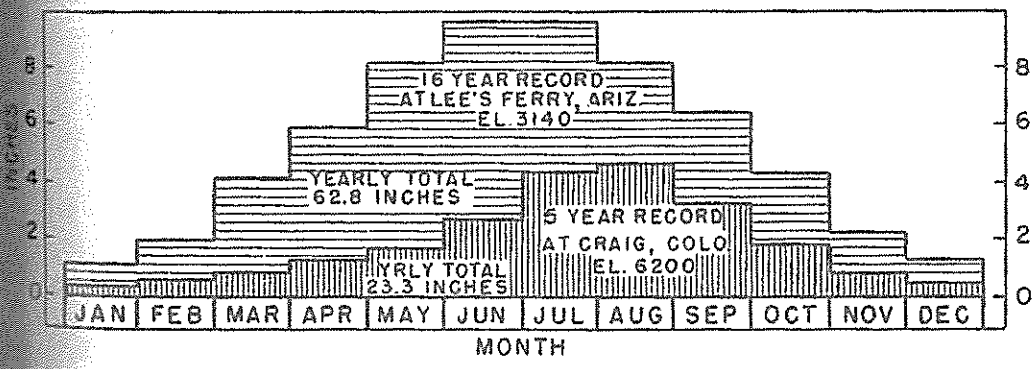
The pattern of precipitation in the basin is characteristic of most areas in the western United States. The precipitation contributing the greatest portion of the stream flow in the Colorado River and its tributaries falls as snow during the winter months in the high mountain ranges. With the higher temperatures of the late spring and early summer months, this snow cover melts and pours an uncontrolled torrent into the channels. Run-off in the river during the months of April, May, June, and early July comprises more than two-thirds of the annual flow at Lee Ferry. Normally these high flows subside by late July to near the base or minimum flow, which consists of the flow from spring-fed headwater streams and return flows from irrigation. The large areas below the mountain reaches of the basin contribute very little to the flow and then only during early spring snow melt or subsequent rain floods of short duration. The variations in temperature, precipitation, and evaporation between the headwater areas and the lower reaches of the basin are presented in the drawing on the following page.



PRECIPITATION



TEMPERATURE



EQUIVALENT RESERVOIR EVAPORATION

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

PRECIPITATION, TEMPERATURE AND EVAPORATION

DRAWN . . . HRS. . SUBMITTED	
TRACED . . . HRS. . RECOMMENDED	
CHECKED W.B.H. . APPROVED	
289-P-122	SALT LAKE AREA OFFICE JAN. 1949

The period of high stream flow does not coincide with the period of high irrigation demands. The high flows of April, May, and June pass unused into the main drainage channels while the reduced flows during the remaining months of the irrigation season are insufficient to meet the full demands of the presently irrigated lands. An increased supply for these lands and a full supply for irrigable new lands can be obtained by providing project storage.

The problem of seasonal regulation, while costly, is secondary to the need for providing the long-term regulation required to insure maximum beneficial consumptive uses and meet downstream compact and treaty obligations. Without the long-term regulation in a system of large-capacity reservoirs, the States of the upper division cannot fully consummate the consumptive uses apportioned them and meet the Lee Ferry flow obligations imposed by the Colorado River Compact. With construction of the proposed system of hold-over storage reservoirs and coordination of their operation to include all possible functions of multiple-purpose use, the States of the upper division can be assured the maximum use of their apportioned water supply and the financial assistance from power revenues necessary to accomplish this use.

Water Rights

Water for the various units of the Colorado River Storage project must be appropriated in accordance with the law of the State in which the point of diversion is located. Although the water law in each

State is fundamentally the same, the procedure for acquisition of rights is largely statutory and the law in one State differs in minor details from the law of other States. In all of the Upper Basin States, the law of appropriation obtains. Water is considered the property of the public and rights to its use can be acquired only by actual diversion and application to beneficial use. The priority of a right is determined by the date of its initiation and "first in time is first in right."

Under State law, the only water available for the Colorado River Storage project is the quantity left in a stream after all prior rights are fully satisfied. Further limitations are imposed by the Colorado River Compact, the Mexican Water Treaty, and the Upper Colorado River Basin Compact. A determination of the adequacy of the water rights for any unit of the project will thus require a finding as to the (1) quantity of water available at the proposed point of diversion and the (2) extent of existing rights.

Significance of Existing and Proposed Legislation

From the standpoint of water rights, no existing Federal laws would impede the development of the Upper Colorado River Storage project as herein outlined. The only limitations upon rights acquired in accordance with State law are (a) the paramount right of the

United States to control navigation and project navigability under the commerce clause of the Constitution of the United States; (b) limitations imposed by treaty; and (c) limitations imposed by compacts.

Water Rights for Echo Park Unit

Approval of the Upper Colorado River Basin Compact assured for the Echo Park unit rights to the waters of the Yampa River and the Green River above the Yampa. The compact provides in Article XIII (a) that:

"The State of Colorado will not cause the flow of the Yampa River at the Maybell Gaging Station to be depleted below an aggregate of 5,000,000 acre-feet for any period of

ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification and approval of this Compact. In the event any diversion is made from the Yampa River or from tributaries entering the Yampa River above the Maybell Gaging Station for the benefit of any water use project in the State of Utah, then the gross amount of all such diversions for use in the State of Utah, less any returns from such diversions to the river above Maybell, shall be added to the actual flow at the Maybell Gaging Station to determine the total flow at the Maybell Gaging Station."

Other compact provisions previously mentioned, relating to diversion of water in one State for use in another State, sharing of reservoir losses, and administrative control of regulatory reservoirs effectively permit the acquisition of the necessary water rights under Colorado law for the Echo Park unit and the orderly administration of the unit.

Available Supply

The flow of the Colorado River at Lee Ferry, a point 1 mile below the mouth of the Paria River, is the total amount contributed to the Colorado River system by the upper basin. Significant stream flow

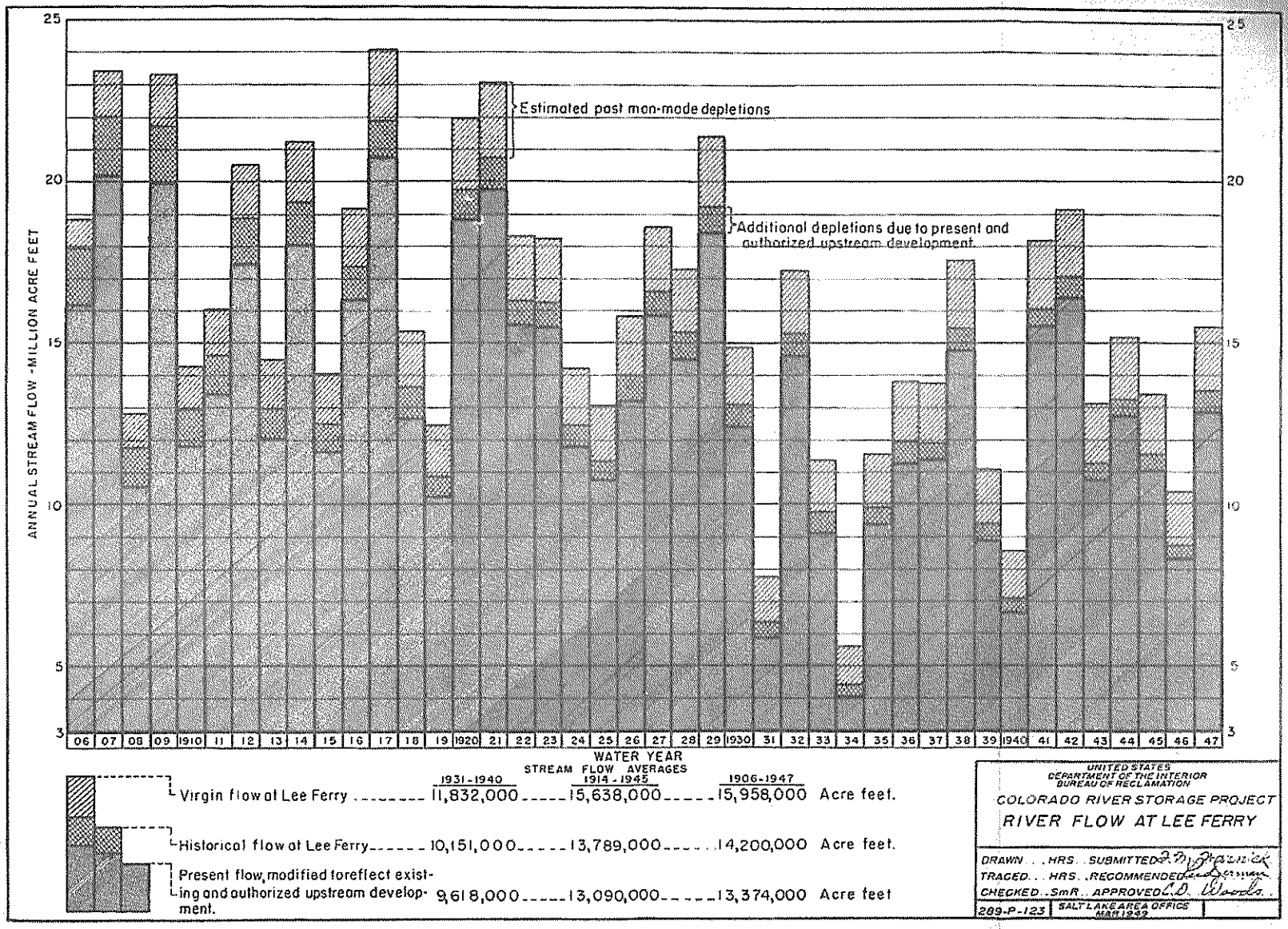
data at Lee Ferry for the period 1906-1947 are shown in chart form on the following page and in the table on page 32.

Historical Flow

The historical flow at Lee Ferry is computed by adding to the flow of the Colorado River at Lees Ferry (which is above the mouth of the Paria River) the flow of the Paria River. The run-off of the Colorado River has been measured at Lees Ferry since June 1921. The run-off of the Paria River has been measured since November 1923. The monthly historical flows at both stations were extended by correlation with upstream recorded flows to cover important periods required in water supply studies. The Engineering Advisory Committee of the Upper Colorado River Basin Compact Commission extended the monthly records to cover the period 1914 to 1945 for use in their studies. For this interim report the Bureau of Reclamation extended the Engineering Advisory Committee's data to cover the period 1906 to 1947.

Past Man-Made Depletions

The Engineering Advisory Committee determined the 1914-1945 average annual man-made depletion of the flow at Lee Ferry to be 1,849,800 acre-feet. This depletion includes consumptive use by irrigation and also uses incident to irrigation, exports from the basin, evaporation from storage reservoirs, and domestic use--all reduced by the estimated salvage of channel losses. Estimated average depletions above Lee Ferry at the sites of use and the corrections for estimated channel salvage are shown in the following table.



STREAM FLOW AVERAGES

	1931-1940	1914-1945	1906-1947	
Virgin flow at Lee Ferry	11,832,000	15,638,000	15,958,000	Acre feet.
Historical flow at Lee Ferry	10,151,000	13,789,000	14,200,000	Acre feet.
Present flow, modified to reflect existing and authorized upstream development.	9,618,000	13,090,000	13,374,000	Acre feet

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

RIVER FLOW AT LEE FERRY

DRAWN . . HRS . . SUBMITTED P. M. Patrick
TRACED . . HRS . . RECOMMENDED [illegible]
CHECKED . . SmR . . APPROVED C. D. Woods

289-P-123 | SALT LAKE AREA OFFICE MAR 1948

PAST MAN-MADE DEPLETIONS IN UPPER BASIN
(Annual Averages for 1914-1945, Inclusive)

Unit--acre-feet

Effect on stream flow	Total upper basin	States of upper division
Man-made depletions at sites of use		
Cropped lands	1,449,000	1,445,200
Incidental areas	315,400	315,400
Transmountain diversions	122,700	122,700
Reservoir evaporation losses	25,900	25,700
Domestic use	14,100	14,100
Total depletions at sites of use	1,927,100	1,923,100
Credits from importation and channel salvage		
Water supplied by importation	4,000	4,000
Channel loss salvaged for use upstream	73,300	73,300
Total credits	77,300	77,300
Net depletion at Lee Ferry	1,849,800	1,845,800

The average depletion determined by the Engineering Advisory Committee was modified and extended by the Bureau to show annual depletions for the period 1906-1947. This was accomplished by giving proper consideration to estimated and recorded exports from the basin and to in-basin uses for irrigation consummated during the period not included in the committee's studies. Depletions resulting from irrigation in the basin were estimated by multiplying the past irrigated acreage by the rate established by the Engineering Advisory Committee as an average per acre depletion rate measured at Lee Ferry. Appropriate adjustments were made to account for the annual variations in water supply.

Virgin Flow

The estimated virgin run-off at Lee Ferry for the 1906-1947 period was determined by adding the estimated consumptive use in the upper

COMPUTATION OF VIRGIN FLOW AT LEE FERRY

Unit--1,000 acre-feet

Water year	Historical flow at Lee Ferry (includes Paria River) (1)	Past trans-basin export depletions at Lee Ferry (2)	Past development of irrigated areas (1,000 acres) (3)	Correction factor for variation of annual water supplies (4)	Depletion rate 1.287 x correction (5)	Past irrigation depletions (6)	Total past depletions (Col. 2 + Col. 6) (7)	Virgin flow Colorado River at Lee Ferry (8)	Percent of 1914-45 mean Virgin flow (9)
1906	17,964*	13	800	1.11	1.43	1,144	1,157	19,121	121
07	22,003*	14	860	1.25	1.61	1,385	1,399	23,402	150
08	11,763*	17	920	0.91	1.17	1,076	1,093	12,856	82
09	21,706*	17	970	1.24	1.60	1,552	1,569	23,275	149
1910	12,969*	14	1,020	0.96	1.24	1,265	1,279	14,248	91
11	14,622*	17	1,060	1.02	1.31	1,389	1,406	16,028	102
12	18,880*	16	1,090	1.16	1.49	1,624	1,640	20,520	131
13	12,994*	78	1,130	0.96	1.24	1,201	1,279	14,273	93
14	19,335*	124	1,160	1.18	1.52	1,763	1,887	21,222	136
1915	12,500*	63	1,200	0.95	1.22	1,464	1,527	14,027	90
16	17,325*	105	1,230	1.12	1.44	1,771	1,876	19,201	123
17	21,893*	90	1,260	1.27	1.63	2,054	2,144	24,037	154
18	13,650*	63	1,290	0.99	1.28	1,651	1,714	15,364	98
19	10,858*	73	1,320	0.90	1.16	1,531	1,604	12,462	80
1920	19,739*	119	1,350	1.20	1.55	2,093	2,212	21,951	140
21	20,715*	108	1,370	1.24	1.60	2,192	2,300	23,015	147
22	16,302*	99	1,370	1.08	1.39	1,904	2,003	18,305	117
23	16,261*	104	1,370	1.08	1.39	1,904	2,008	18,269	117
24	12,481	49	1,370	0.95	1.22	1,671	1,720	14,201	91
1925	11,341	62	1,370	0.92	1.19	1,630	1,692	13,033	83
26	14,009	77	1,370	1.00	1.29	1,767	1,844	15,853	101
27	16,587	111	1,370	1.09	1.40	1,918	2,029	18,616	119
28	15,323	106	1,370	1.05	1.35	1,850	1,956	17,279	110
29	19,223	109	1,370	1.19	1.53	2,096	2,205	21,428	137
1930	13,070	76	1,380	0.98	1.26	1,739	1,815	14,885	95
31	6,388	42	1,380	0.75	0.97	1,339	1,381	7,769	50
32	15,286	94	1,380	1.05	1.35	1,863	1,957	17,243	110
33	9,745	79	1,380	0.86	1.11	1,532	1,611	11,356	73
34	4,396	30	1,380	0.68	0.88	1,214	1,244	5,640	36
1935	9,912	91	1,380	0.87	1.12	1,546	1,637	11,549	74
36	11,970	160	1,380	0.94	1.21	1,670	1,830	13,800	88
37	11,897	173	1,380	0.94	1.21	1,670	1,843	13,740	88
38	15,440	214	1,380	1.06	1.37	1,891	2,105	17,545	112
39	9,394	153	1,380	0.86	1.11	1,532	1,685	11,075	71
1940	7,082	139	1,380	0.78	1.00	1,380	1,519	8,601	55
41	16,052	178	1,380	1.08	1.39	1,918	2,096	18,148	116
42	17,029	123	1,380	1.11	1.43	1,973	2,096	19,125	122
43	11,263	198	1,380	0.92	1.19	1,642	1,840	13,103	84
44	13,221	167	1,380	0.99	1.28	1,766	1,933	15,154	97
1945	11,545	209	1,380	0.93	1.20	1,656	1,865	13,410	86
46	8,745	191	1,365	0.81	1.08	1,490	1,681	10,426	67
47	11,516	177	1,361	1.00	1.29	1,750	1,927	13,443	99
1914-45 mean	13,789	112	1,351	1.00	1.29	1,737	1,849	15,638	100
1906-47 mean	14,200	99	1,282			1,659	1,758	15,956	102
1911-40 mean	10,151	117	1,380			1,564	1,681	11,832	76

*1906-23 period for Paria River and 1906-21 period for Colorado River were estimated by correlation with upstream gaged records.

**Column 4 obtained from the following formula: Column 4 = $\frac{1}{\left(1 + \frac{\text{Annual Virgin Flow}}{\text{1914-45 Mean Virgin Flow}}\right)}$.

Note: Successive approximations of virgin flow were made in order to compute Column 4 as shown. First approximation was made using annual and mean historical flows.

basin in terms of depletions at Lee Ferry to the computed historical flow at Lee Ferry. This flow and the factors considered in its computation are shown in the table on page 32.

Present Modified Flow

The present modified flow constitutes the basic water supply for all future developments in the upper basin. It represents the flow which could be expected at Lee Ferry should a run-off period similar to the 1906-1947 period recur with all present and authorized developments under operation. The present modified flow was estimated by effecting appropriate adjustments in the historical flow at Lee Ferry to reflect progressive changes of consumptive uses since 1906. These adjustments reflect actual changes in irrigation, transbasin exports, reservoir evaporation and domestic uses, and also similar uses anticipated under new projects now authorized for construction. The adjustments made in the historical flow and the resulting modified flow are shown in the table on the following page.

Future Man-Made Depletions

In studying the problems of river regulation it was necessary to assume a distribution of apportioned consumptive use in each of the upper basin States. Reflected in this distribution were the uses at existing developments and roughly estimated uses of potential projects. An appropriate allowance was also made in each State's apportionment for evaporation from regulatory reservoirs. Several upper basin project possibilities were considered in detail in connection with the

PRESENT MODIFIED FLOW--COLORADO RIVER AT LEE FERRY

Unit--1,000 acre-feet

Water year	Computed historical flow at Lee Ferry	Adjustment for present and authorized depletions	Present modified flow at Lee Ferry
1906	17,964	1,789	16,175
1907	22,003	1,845	20,158
1908	11,763	1,182	10,581
1909	21,706	1,734	19,972
1910	12,969	1,163	11,806
1911	14,622	1,195	13,427
1912	18,880	1,425	17,455
1913	12,994	935	12,059
1914	19,335	1,297	18,038
1915	12,500	880	11,620
1916	17,325	979	16,346
1917	21,893	1,135	20,758
1918	13,650	972	12,678
1919	10,858	633	10,225
1920	19,739	901	18,838
1921	20,715	970	19,745
1922	16,302	737	15,565
1923	16,261	803	15,458
1924	12,481	686	11,795
1925	11,341	580	10,761
1926	14,009	829	13,180
1927	16,587	751	15,836
1928	15,323	827	14,496
1929	19,223	801	18,422
1930	13,070	650	12,420
1931	6,388	447	5,941
1932	15,286	668	14,618
1933	9,745	634	9,111
1934	4,396	374	4,022
1935	9,912	545	9,367
1936	11,970	685	11,285
1937	11,897	488	11,409
1938	15,440	650	14,790
1939	9,394	464	8,930
1940	7,082	375	6,707
1941	16,052	531	15,521
1942	17,029	615	16,414
1943	11,263	494	10,769
1944	13,221	474	12,747
1945	11,545	485	11,060
1946	8,745	401	8,344
1947	13,516	638	12,878
1914-45 Mean	13,789	699	13,090
1906-47 Mean	14,200	826	13,374
1931-40 Mean	10,151	533	9,618

distribution. The probable future uses were primarily determined, however, from a broad consideration of tributaries or subbasins. Adjustments in the distribution of uses assumed among the States may become necessary after future detailed project investigations, but no substantial variation is anticipated in the assumed effects at Lee Ferry.

Uses contemplated in the upper basin demand a more or less uniform annual delivery of water at the sites of final utilization. Shortages of material consequence could be tolerated only under conditions of extreme drouth. Therefore, because of variations in stream flow, storage reservoirs would be required at the sources of supply or at intermediate points. As a rule these reservoirs would carry water over into years of low run-off and would refill during years of favorable water supply. Opportunities are limited for storage regulation at the headings of some of the major projects that contemplate diversions across the basin's natural boundaries for use within the States of the upper division. Thus these projects would require regulation outside the natural boundaries of the upper basin. Diversions under the projects would vary in amount from year to year according to the availability of natural water supply. Likewise in-basin projects relying only on direct stream flow diversions would entail varying annual uses. For some of the potential projects which have been studied in detail variations in use were estimated from operational studies. In other instances departures from mean annual use were arbitrarily assumed to follow to some degree the variations of natural water supplies.

The policy of the States of the upper basin is reflected in Article VI of the Upper Colorado River Basin Compact which states that the quantity of consumptive use of water apportioned for the upper basin and for each State of the upper basin shall be determined by the inflow-outflow method in terms of man-made depletions of virgin flow at Lee Ferry. It follows, therefore, that any changes in the regimen of the system above Lee Ferry resulting from storage operations or direct diversions would be reflected to a large degree as man-made depletions at Lee Ferry.

When water is diverted and consumed upstream, changes in natural losses in downstream channels are to be expected. Stream depletions at the sites of use are, therefore, not necessarily reflected in equal magnitude at Lee Ferry. The States of the upper division, in measuring consumptive use in terms of man-made depletions at Lee Ferry, will automatically account for these differences in depletions. The differences, however, are extremely difficult to appraise at this time. The Bureau in its studies considered only the reaches of regulatory reservoirs in determining possible salvage of natural channel losses. The salvage will be further considered in future Bureau studies. Man-made depletions at Lee Ferry have been estimated over the period 1914 to 1945, inclusive, which has been selected by the Engineering Advisory Committee as a representative long-time period. A long-time period was used as the States of the upper basin contend the depletions are to be reckoned as long-time averages.

Upon completion of authorized developments, the estimated consumptive use in the upper basin would approximate 2,549,000 acre-feet annually. Thus an estimated 4,951,000 acre-feet annually would remain for future use in the upper basin. Present and authorized consumptive use and the use remaining for future development, all estimated in terms of long-time averages, are given by States in the following table.

ANNUAL CONSUMPTIVE USE MEASURED IN TERMS OF LONG-TIME AVERAGE DEPLETIONS AT LEE FERRY

Unit--acre-feet

State	Apportioned use	Present and authorized use	Use remaining for future development
Arizona	50,000	11,000	39,000
States of the Upper Division			
Colorado	3,855,000	1,592,000	2,263,000
New Mexico	838,000	79,000	759,000
Utah 23%	1,714,000	628,000	1,086,000
Wyoming	1,043,000	239,000	804,000
Subtotal States of Upper Division*	7,450,000	2,538,000	4,912,000
Total Upper Basin	7,500,000	2,549,000	4,951,000

*Subject to Lee Ferry flow obligations

Limitation on future Man-Made Depletions

Without a reservoir system of sufficient capacity to carry over into a drouth period excess flows from years of high run-off, only a partial consummation of the use (7,450,000 acre-feet annually) apportioned the States of the upper division would be possible. Limitations

could be imposed during drouth periods in order that States of the upper division could conform with Article III (d) of the Colorado River Compact specifying that the States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years.

The severity of possible limitations on consumptive use can best be demonstrated by a study of flow conditions during the drouth period 1931 to 1940, the most severe drouth period of record. The estimated virgin flow of the river during this period amounted to approximately 118,320,000 acre-feet. Thus, to meet their Lee Ferry obligations, the States could have depleted the river flow during the 10-year drouth period by only 43,320,000 acre-feet in terms of man-made depletions at Lee Ferry. Such a depletion indicates an average use of 4,332,000 acre-feet annually. The annual use, however, would have varied greatly over the 10-year period and would have been below the average in several years. The use would have been particularly curtailed in 1931, 1934, and 1940, extremely low run-off years.

Under sound engineering practices, water-use projects would be expected to absorb major shortages such as occurred in the extremely low run-off years. Appropriate allowance for over-all shortages during the 10-year period of study would permit maximum use possibly 10 per-cent greater than the average use of the period. Thus, without river regulation plans could proceed for projects which would annually consume, in terms of man-made depletion at Lee Ferry, a maximum of only about 4,750,000 acre-feet of Upper Colorado River Basin water in the States

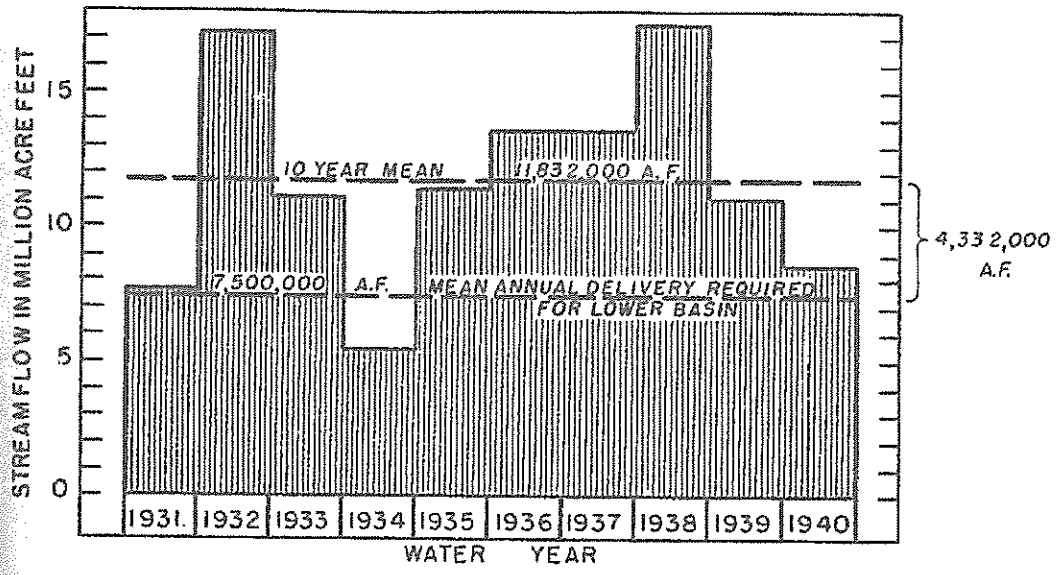
of the upper division. Present and authorized projects in the States of the upper basin (including a very minor use in Arizona) would cause a 10-year average annual depletion of 2,214,000 acre-feet. This is the difference in the 10-year mean virgin and the present modified flows shown on the following chart. Without river regulation an average annual depletion of 2,118,000 acre-feet would be permissible for new development in the upper division, neglecting the minor use in Arizona. Should the States of the upper division be required to assist in meeting deficiencies in Mexico during a critical 10-year period of low run-off, such as occurred in the 1931-1940 period, a corresponding reduction would be required in the permissible uses outlined above.

Storage Requirements

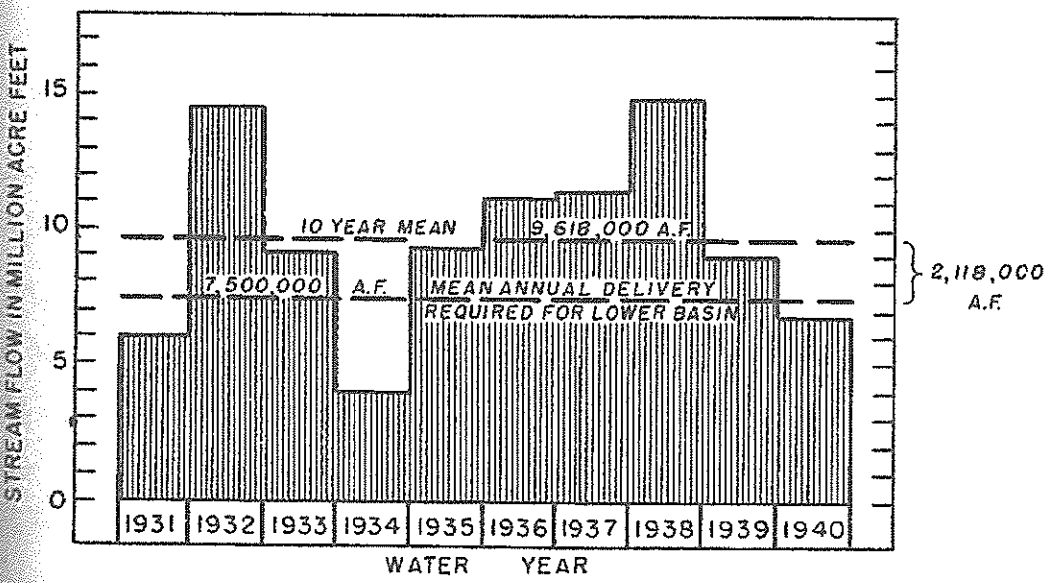
The Colorado River Storage project would provide and maintain sufficient hold-over storage capacity to permit the States of the upper division to meet Lee Ferry flow obligations and utilize the full consumptive use apportioned them under the terms of the Colorado River Compact.

Irrigation Storage Requirement

In a broad sense all Colorado River water-use projects in the States of the upper division initiated subsequent to the signing of the Colorado River Compact in 1922 would participate in the regulatory benefits afforded by the Colorado River Storage project. Most of the benefits would result from water replacements at storage sites considerably below the actual points of use. Some irrigation projects,



ESTIMATED VIRGIN FLOW



ESTIMATED PRESENT MODIFIED FLOW

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

DROUTH CYCLE RUN-OFF
AT LEE FERRY

DRAWN . . . HRS. . . SUBMITTED [signature]
TRACED . . HRS. . . RECOMMENDED [signature]
CHECKED . WBH. . . APPROVED [signature]

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owever, would require joint use of certain storage sites that would be veloped by the Colorado River Storage project.

Under the provisions of rticle IX of the Upper Colorado River Basin mpact, any signatory State can fully utilize, or participate in the ilization of, any storage site, including the sites being considered der the Colorado River Storage plan, if such utilization is necessary for the purpose of diverting, conveying, storing, or regulating water or consumptive use within the apportionment of that State.

There are two fairly well defined instances where individual projects ould share in the use of Colorado Storage project facilities. A direct flow diversion to the Central Utah project would require 1,000,000 acre-et of inactive storage in the potential Flaming Gorge Reservoir at Red anyon Dam site. Ultimately the project would also need to participate the active capacity to the extent of 300,000 acre-feet to assure iversion of a constant annual supply from the depleted flows of the een River. When upstream developments in the State of Colorado deplete stream flow below the established irrigation rights of Grand Valley nds, the Bridgeport Reservoir would function as a replacement unit quiring approximately 500,000 acre-feet of capacity for that purpose.

Other possibilities for joint use of Colorado River Storage cilities are recognized but are not included in the plan described rein. Water from Cross Mountain Reservoir could be used for irriga-n of new lands in Colorado and Utah north of the White River. esanti storage water could be used to provide replacement water for Uncompahgre Valley lands after ultimate development of projects diverting

water from the Colorado River Basin into the drainage basins of the South Platte and Arkansas Rivers. Split Mountain Reservoir could supply lands near the mouths of White and Duchesne Rivers by gravity and thus avoid pumping of a supply direct from the Green River. These possibilities, however, must be further investigated before they can be incorporated as a part of the project plan. Prior to starting the ultimate development of the Central Utah project, it may also be found desirable to make irrigation replacements by pumping from Echo Park Reservoir rather than by a gravity diversion from Flaming Gorge Reservoir. The plan of ultimate development of the Colorado River Storage project is flexible enough to accommodate any or all of these developments if the need for them should arise. Should it be found necessary to utilize Colorado River Storage project facilities further for water uses of any signatory State, proper adjustments could be effected under the terms of Upper Colorado River Basin Compact.

why? on what ground?

Active Hold-Over Requirements for River Regulation

The time and magnitude of deficiencies at Lee Ferry which must be satisfied by water released from the active hold-over reserves of the Colorado River Storage project can best be demonstrated by disregarding for the moment the 75,000,000 acre-foot 10-year Lee Ferry flow obligation (Article III (d) Colorado River Compact) and by visualizing what might be termed ultimate depleted unregulated flow at Lee Ferry. This flow is the unregulated residual flow that would occur at Lee Ferry with unrestricted consummation of the use apportioned to the upper basin.

Ultimately man-made depletions at Lee Ferry would of necessity exceed 7,500,000 acre-feet in some years and would likewise fall short of 7,500,000 acre-feet in some years if the use apportioned to the upper basin (7,500,000 acre-feet annually) were fully realized. An estimate of ultimate man-made depletions in the upper basin averaging 7,500,000 acre-feet annually at Lee Ferry over the long-time period 1914-1945 is shown on the table on page 43. Also shown on the table is the ultimate depleted unregulated flow at Lee Ferry which is equivalent to the difference between virgin flow and ultimate man-made depletions.

Arizona, being a State of the lower division, is not restricted by Article III (d) of the Colorado River Compact with regard to the utilization of her apportioned use in the upper basin. Arizona, in using her apportioned upper basin water, amounting to 50,000 acre-feet annually measured in terms of long-time average man-made depletions at Lee Ferry, could thus cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years.

Suppose, for example, Arizona were not using any of her apportionment of upper basin water and, because of uses in the States of the upper division within their apportionment, the flow of the river at Lee Ferry were being caused to be depleted below an aggregate of 75,000,000 acre-feet in a period of 10 consecutive years. Then the States of the upper division would either be required to curtail their uses or release water from hold-over storage for satisfaction of their obligation not

DETERMINATION OF ACTIVE STORAGE REQUIREMENT
TO PERMIT FULL UTILIZATION OF APPORTIONED CONSUMPTIVE USE

Unit--1,000,000 acre-feet

Water year	Virgin flow of Colorado River at Lee Ferry	Ultimate use of upper basin apportionment*	Ultimate depleted unregulated flow at Lee Ferry--Col (1) minus col (2)	Ultimate use of Arizona apportionment**	Col (3) plus col (4)	10-year moving total of col (5)	Col (6) minus 75 million acre-feet, Excess (+) Deficiency (-)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1914	21.22	9.18	12.04	0.06	12.10	-	-
15	14.03	6.97	7.06	0.05	7.11	-	-
16	19.20	8.89	10.31	0.06	10.37	-	-
17	24.04	9.43	14.61	0.08	14.69	-	-
18	15.36	7.82	7.54	0.05	7.59	-	-
19	12.46	6.50	5.96	0.05	6.01	-	-
1920	21.95	9.18	12.77	0.07	12.84	-	-
21	23.02	9.35	13.67	0.09	13.76	-	-
22	18.31	8.05	10.26	0.06	10.32	-	-
23	18.27	8.31	9.96	0.05	10.01	104.80	+29.80
24	14.20	7.15	7.05	0.05	7.10	99.80	+24.80
1925	13.03	6.76	6.27	0.05	6.32	99.01	+24.01
26	15.85	7.63	8.22	0.06	8.28	96.92	+21.92
27	18.62	8.49	10.13	0.04	10.17	92.40	+17.40
28	17.28	8.26	9.03	0.04	9.07	93.88	+18.88
29	21.43	8.53	12.90	0.06	12.96	100.83	+25.83
1930	14.89	7.45	7.44	0.05	7.49	95.48	+20.48
31	7.77	5.29	2.48	0.03	2.51	84.23	+ 9.23
32	17.24	7.80	9.44	0.05	9.49	83.40	+ 8.40
33	11.36	6.47	4.89	0.03	4.92	78.31	+ 3.31
34	5.64	4.56	1.08	0.03	1.11	72.32	- 2.68
1935	11.55	6.56	4.99	0.03	5.02	71.02	- 3.98
36	13.80	7.67	6.13	0.04	6.17	68.91	- 6.09
37	13.74	6.86	6.88	0.05	6.93	65.67	- 9.33
38	17.55	7.99	9.56	0.05	9.61	66.21	- 8.79
39	11.08	6.45	4.63	0.04	4.67	57.92	-17.08
1940	8.60	5.41	3.19	0.04	3.23	53.66	-21.34
41	18.15	7.87	10.28	0.06	10.34	61.49	-13.51
42	19.12	7.91	11.21	0.07	11.28	63.28	-11.72
43	13.10	7.24	5.86	0.04	5.90	64.26	-10.74
44	15.15	7.12	8.03	0.05	8.08	71.23	- 3.77
1945	13.41	6.87	6.54	0.04	6.58	72.79	- 2.21
46	10.42	6.19	4.23	0.04	4.27	70.89	- 4.11
47	15.47	7.78	7.69	0.08	7.77	71.73	- 3.27
Means							
1914-45	15.64	7.50	8.14	0.05	8.19		
1931-40	11.83	6.51	5.33	0.04	5.37		

*Use (apportioned by Colorado River Compact) measured in terms of man-made depletions at Lee Ferry.
**Use (apportioned by Upper Colorado River Basin Compact) measured in terms of man-made depletions at Lee Ferry.

to deplete the flow at Lee Ferry below 75,000,000 acre-feet. However, under similar conditions, should Arizona come in with a use of upper basin water within her apportionment, she would further deplete the flow at Lee Ferry to the extent of her man-made depletions as measured at Lee Ferry. With full realization in Arizona of her upper basin apportioned consumptive use of 50,000 acre-feet annually measured in terms of average long-time depletions at Lee Ferry, it can be demonstrated that, while the States of the upper division would be fully complying with their 75,000,000 10-year Lee Ferry flow obligation, the residual 10-year flow at Lee Ferry could be as low as 74,500,000 acre-feet because of nonobligated uses in Arizona.

In the last column of the table on page 43 are indicated the deficiencies or minus quantities that would have required satisfaction at Lee Ferry by the States of the upper division from 1914 to 1947 if their apportioned consumptive uses were fully consummated. Also given are the excesses or positive quantities that would have been available for storage in the regulatory reservoirs before the deficiencies occurred.

The greatest demand for storage, requiring 21,340,000 acre-feet of capacity, occurred during the 10-year period 1931-1940. It must be noted, however, that data in the table are based on annual flows. The deficiencies indicate, for illustrative purposes only, the storage that would have been required if concentrated at one site. Estimated evaporation losses at the single site are included in the 7,500,000 acre-foot average man-made depletion. More detailed studies conducted on a monthly

flow basis with storage and evaporation distributed at several sites indicate that 23,000,000 acre-feet of active hold-over capacity would actually be needed.

The 23,000,000 acre-feet of capacity would be required of the Colorado River Storage project alone for active hold-over storage. This is in addition to some 5,000,000 acre-feet of active capacity that would be provided by upstream water-use projects for their own use. The operations of water-use projects are reflected in the ultimate man-made depletions at Lee Ferry in column 2 of the table on page 43.

Sediment Storage Requirement

In view of climatic conditions, geologic structures, and other influencing factors which limit erosion control, provisions must be made for storage of sediment flow in the upper basin. Incomplete surveys conducted at the time the Colorado River Report was written indicated an average annual sediment inflow at Lake Mead of 137,000 acre-feet. Approximately 93,000 acre-feet of this inflow originated above the reservoirs of the Colorado River Storage project.

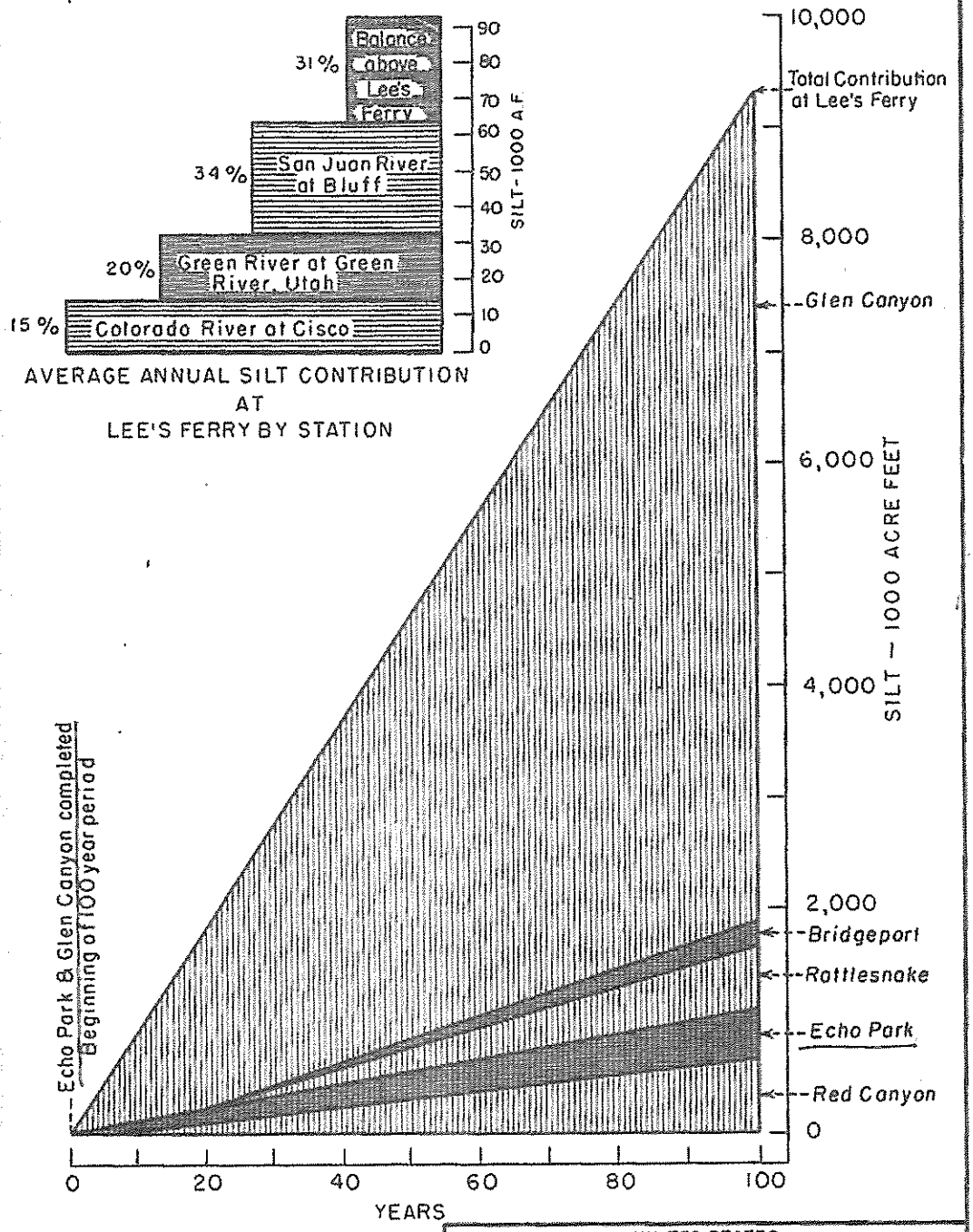
The period for which sediment storage would be provided in the reservoirs of the Colorado River Storage project is dependent upon the extent to which the States of the upper division can afford to include as part of their regulatory reservoir evaporation losses the losses that would result from larger exposed water surfaces incident to provisions for the storage of sediment. Regulatory reservoir losses are recognized in the Upper Colorado River Basin Compact as a legitimate charge against

the States' apportioned consumptive uses. For the purpose of this report the Bureau of Reclamation planned for complete sediment storage for a period of 200 years. The sediment retained over this period would be approximately 18,000,000 acre-feet. Of this amount about 12,000,000 acre-feet would be deposited in the active storage sections of the reservoirs and 6,000,000 acre-feet would be accumulated in the inactive storage pools. Succeeding generations could maintain this protection by developing remaining upstream sediment storage sites. The chart on the following page shows the reservoir capacity that would be filled with sediment deposits during the first hundred years of project operation.

Without upstream sediment retention, the useful life of Bridge Canyon Reservoir, a potential development in the lower basin above Lake Mead, would be less than 50 years. With upstream sediment retention, the reservoir would have a useful life of indefinite length. This is typical of the extensive benefit that upper basin sediment storage would bring to lower basin developments. Only limited information is now available on this major problem of sediment control in both the upper and lower basins. After a complete appraisal of the situation, lower basin interests may desire to participate in the plans for upstream sediment control and also share the evaporation losses resulting from increased reservoir capacity for sediment control.

Power Storage Requirement

The release of water from regulatory reservoirs to meet Lee Ferry flow obligations offers an excellent opportunity for the production of



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

EFFECT OF SILT CONTRIBUTION ON PROJECT RESERVOIRS

DRAWN...HRS...SUBMITTED J. McYannick
TRACED...HRS...RECOMMENDED Ted Jarman
CHECKED..WBH...APPROVED E.O. Larson

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firm electric energy. Inactive storage pools would be necessary, however, to provide minimum heads required for economical operation of the various hydroelectric plants.

A study of the operations and characteristics of the Colorado River Storage project reservoirs indicates the need for inactive storage pools with an aggregate capacity of approximately 12,000,000 acre-feet. In addition to the losses incurred during the initial filling of the inactive storage pools, there would be a consumptive use directly attributable to inactive storage. This would amount to the incremental evaporation losses incurred by superimposing the active storage capacities upon the inactive storage pools. The States of the upper division could well afford to include the inactive storage losses in their apportioned use in view of the necessity for protection against sediment encroachment and the tremendous benefits which would be derived from the generation and sale of electric energy.

Project Operations

The Colorado River Storage project would be operated primarily to regulate the Colorado River in the upper basin in order that the States of the upper division might fully realize their apportioned use and comply with the obligations established by interstate compacts and the international treaty governing the present and future operation of the river. Satisfaction of the 10-year minimum depleted flow obligation at Lee Ferry would call for a more or less uniform controlled delivery at Lee Ferry. A complete equation of the flow, however, would be neither

economical nor necessary in effecting a full realization of the use apportioned the States of the upper division. Thus the regulated flow at Lee Ferry, although fairly uniform in most years, would vary considerably in some years because of spills beyond the control of the Colorado River Storage project. The operation of the integrated reservoir system of the Colorado River project, however, lends itself extremely well to the production of firm electric energy.

It has been demonstrated that the States of the upper division could expand their consumptive uses to approximately 4,750,000 acre-feet annually, measured in terms of man-made depletions at Lee Ferry, without the assistance of river regulation. Assuming a reasonable rate of development, such a use would be attained in about 21 years. Several advantages, however, justify early construction of reservoirs on the river before the primary need exists for river regulation. Foremost advantage would be the early generation of electric energy for sale to power-deficient areas. Revenues from the sale of this power would permit the early retirement of the cost of the joint facilities. Another advantage of early construction would be that unused water would be available for rapid filling of the reservoirs. Therefore, with early construction of the project, operation of the reservoirs would first be governed largely by the energy demands of power market areas and by the process of initial reservoir filling. As river regulation assumed control of project operation, a closer integration of power facilities would be required in order to sustain as far as possible a maximum power output under depleted flow conditions. Explains problems of providing stream flows in Upper Basin Rivers when CRSP development was planned around use of all but 6,500 a/f allowed by Compton!

The table on page 50 is a summarization of detailed monthly studies for the various sites of power production based on a recurrence of conditions exhibited by the long-time period 1914-1945. In the summary year 1 represents the year (approximately 1956) when the first unit (Echo Park) would start producing power. Power that would be produced at the various sites is shown for each subsequent year until year 20 (1975) when the maximum power output would be attained. By 1956 water-use projects now authorized should be in full operation resulting in stream flow depletions previously described under present modified flow conditions. For subsequent years adjustments were made for progressive water-use project development and increased consumptive use in the upper basin States.

Increases in remaining apportioned consumptive uses, exclusive of regulatory reservoir evaporation, have been assumed to progress uniformly from present and authorized uses in year 1 to 80 percent in year 50 and to 100 percent in year 75. With respect to requirements for river regulation, initial operation of the Colorado River project would begin 2 years after construction of the final unit. The summary table on page 50 sets out the firm power generation, average consumptive uses, and average Lee Ferry flows for the 19 years of construction; for year 20, the year of initial operation for river regulation; and for year 75, the year when apportioned use in the upper basin would be fully realized.

Also shown in the table on page 50 are the estimated net evaporation losses that would be incurred by the regulatory reservoirs. Evaporation rates are only sparsely distributed in the Upper Colorado River Basin

(Based on Recurrence of 1914-1943 Long-Time Period)

Development year	Water year	Annual firm power generation (million kilowatt-hours)										Consumptive use in terms of average man-made depletions at Lee Ferry (1,000 acre-feet)				Average annual depleted flow at Lee Ferry (1,000,000 a.f.)	Minimum 10-year Lee Ferry flow (1,000,000 a.f.)
		Red Canyon	Cross Mountain	Echo Park	Split Mountain	Rattlesnake	Curecanti	Black Canyon	Bridgeport	Glen Canyon	Total Upper Basin	Regulatory reservoir evaporation	Other depletions by States of Upper Division	Depletion by Arizona	Total Upper Basin		
0	1955	-	-	-	-	-	-	-	-	-	0	0	2,538	11	2,549	13.09	96.18
1	1956	-	-	457	-	-	-	-	-	-	457	85	2,603	11	2,699	12.94	
2	1957	-	-	914	-	-	-	-	-	-	914	85	2,669	12	2,766	12.87	
3	1958	-	-	1,006	-	-	-	-	-	915	1,921	555	2,735	13	3,303	12.34	
4	1959	-	-	1,000	-	-	-	-	-	1,830	2,830	555	2,801	13	3,369	12.27	
5	1960	-	-	997	-	-	-	-	-	2,745	3,742	555	2,866	14	3,435	12.20	
6	1961	302	-	1,140	-	-	-	-	-	3,660	5,102	615	2,932	15	3,562	12.08	
7	1962	446	-	1,134	-	-	-	-	-	4,220	5,800	615	2,998	16	3,629	12.01	
8	1963	443	-	1,128	-	-	329	-	-	4,280	6,180	655	3,064	16	3,735	11.90	
9	1964	439	-	1,122	456	-	328	-	-	4,260	6,605	665	3,129	17	3,811	11.83	
10	1965	436	-	1,117	635	-	326	-	-	4,240	6,754	665	3,195	18	3,878	11.76	
11	1966	432	-	1,111	632	-	324	478	-	4,220	7,197	670	3,261	19	3,950	11.69	
12	1967	428	-	1,105	628	-	322	956	-	4,200	7,639	670	3,327	19	4,016	11.62	
13	1968	426	-	1,100	625	-	320	1,248	-	4,180	7,899	670	3,393	20	4,083	11.56	
14	1969	422	-	1,095	622	-	318	1,242	-	4,160	7,859	670	3,459	21	4,150	11.49	
15	1970	418	341	1,118	670	-	317	1,236	-	4,130	8,230	740	3,524	21	4,285	11.35	
16	1971	414	341	1,111	667	-	316	1,229	-	4,110	8,188	740	3,590	22	4,352	11.29	
17	1972	412	340	1,105	663	-	314	1,224	-	4,090	8,148	740	3,656	22	4,418	11.22	
18	1973	408	340	1,100	661	457	312	1,218	-	4,070	8,566	770	3,722	23	4,515	11.12	
19	1974	405	339	1,095	657	914	310	1,212	-	4,040	8,969	770	3,788	23	4,581	11.06	
20	1975	402	338	1,090	654	1,055	308	1,205	228	4,070	9,350	794	3,854	24	4,672	10.97	
21	1976	398	337	1,085	650	1,048	306	1,200	228	4,040	9,292	794	3,920	24	4,738	10.90	94.14
75	2030	137	313	702	420	735	231	950	228	3,070	6,786	794	6,656	50	7,500	8.14	74.65

and offer very little data directly applicable to the water surfaces of the remote reservoirs of the Colorado River Storage project. Using the available pan data as a base, the Bureau established relationships with recorded meteorologic data from which curves were projected to indicate the gross evaporation to be expected from free water surfaces at various elevations on the Colorado River and its tributaries in the upper basin. In its studies the Engineering Advisory Committee to the Upper Colorado River Compact Commission accepted the Bureau's analysis of gross reservoir water surface evaporation. The Bureau, in computing net evaporation losses, allowed a credit for present river channel losses and natural consumptive uses in areas to be inundated. As an example, the gross evaporation rate from the free water surface of Glen Canyon Reservoir is expected to be 63 inches a year. With adjustments for present channel losses and natural consumptive uses, the net rate of evaporation at the maximum water surface level is estimated at about 54 inches a year.

Operation During Construction

A construction schedule has been planned to meet the energy requirements of areas which could reasonably be serviced by the power system of the Colorado River Storage project. The schedule allows for energy requirements to be supplied first from potential local power developments not included in the project system. Power load areas within the States of the upper division would be given preference to the use of project energy. Early relief would also be furnished power-deficient areas in

the lower basin. A substantial portion of the energy supplied the lower basin would be withdrawn, however, as demands in the States of the upper division required. These withdrawals could be replaced from potential power developments in the lower basin, such as the Bridge Canyon, Kanab Creek, and Marble Canyon.

The Echo Park unit, selected for construction as the first unit of the Colorado River Storage project, would be little affected by sediment flow and would be ideally situated with respect to supplying the immediate upper basin power market needs. The Glen Canyon unit is also of substantial initial importance as it would be located at the lowest possible point for control of sediment and river discharge in the upper basin and within reach of the existing power shortage areas in the lower basin and lower part of the upper basin.

To meet estimated power market needs the construction of the last unit of the Colorado River Storage project would be required 19 years after the first unit was placed in operation. After that time the power market demands would continue to increase. Power production of the Colorado River Storage project would be limited, however, to that possible with the 23,000,000 acre-feet of active hold-over capacity required for ultimate river regulation and unoccupied sediment capacity.

Operation during the 19-year construction period, as summarized in the table on page 50, would not be concerned with river regulation. Particular attention would be devoted during this period to power production and the initial filling of the reservoir. As previously pointed out,

unused water in excess of the obligated Lee Ferry flow would permit the rapid initial filling of the reservoirs. At no time, however, would the obligation at Lee Ferry be violated.

During the 19-year construction period depletions in the flow at various sites would be continuously increased because of progressive consumptive uses upstream. These uses, as well as the beneficial effects of upstream regulation, were properly considered in the detailed studies regarding the power generation possibilities at each site.

Initial Operation for River Regulation

All power units of the Colorado River Storage project would be in full operation 20 years after the first unit was placed in operation. Up to that time the regulation afforded by the newly constructed project reservoirs would fully overcome the depletory effect of increasing upstream uses and would permit progressive gains in power generation corresponding to the growing market demands. In year 20 maximum coordinated output of firm power would be attained. After that time the output would decrease as sufficient capacity would be attained for ultimate river regulation and no additional storage would be provided to offset upstream depletions. In year 21 project operation for river regulation would be started. The operations for this year are summarized in the table on the following page.

Ultimate Operation for River Regulation

In year 75, the year of ultimate operation for river regulation when apportioned use in the upper basin would be fully realized,

INITIAL OPERATION FOR RIVER REGULATION--YEAR 21
(Final Point of Control at Glen Canyon)

Unit--1,000,000 acre-feet

Water year	Inflow (Partially regulated by upstream project reservoirs)	Net reservoir evap. loss	Outflow		Reservoir content end of year*	Inflow below reservoir (Paria River)	Regulated flow Colorado River at Lee Ferry	
			Controlled release	Spill			Annual	Ten-year moving totals
1914	14.47	0.63	8.89	3.02	26.00	.03	11.94	-
1915	11.28	0.66	8.80	1.82	26.00	.01	10.63	-
1916	13.42	0.66	8.80	3.96	26.00	.04	12.80	-
1917	16.14	0.66	8.80	6.88	26.00	.03	15.51	-
1918	10.60	0.65	8.80	1.14	26.00	.03	9.97	-
1919	10.34	0.66	8.80	0.88	26.00	.02	9.70	-
1920	15.09	0.66	8.80	5.63	26.00	.02	14.45	-
1921	15.77	0.66	8.80	6.31	26.00	.02	15.13	-
1922	13.21	0.66	8.80	3.75	26.00	.03	12.58	-
1923	12.48	0.66	8.80	3.02	26.00	.02	11.84	124.55
1924	10.62	0.66	8.80	1.16	26.00	.02	9.98	122.59
1925	9.88	0.66	8.80	0.42	26.00	.03	9.25	121.21
1926	11.49	0.66	8.80	2.03	26.00	.03	10.86	119.27
1927	13.00	0.66	8.80	3.54	26.00	.05	12.39	116.18
1928	11.58	0.66	8.80	2.12	26.00	.02	10.94	117.12
1929	15.07	0.66	8.80	5.61	26.00	.03	14.44	121.86
1930	10.82	0.66	8.80	1.36	26.00	.02	10.18	117.59
1931	7.24	0.63	8.90	-	23.71	.01	8.91	111.37
1932	11.37	0.62	8.93	-	25.53	.04	8.97	107.76
1933	8.07	0.62	8.92	-	24.06	.02	8.94	104.86
1934	8.43	0.57	9.18	-	20.74	.02	9.20	104.08
1935	9.02	0.53	9.49	-	19.74	.02	9.51	104.34
1936	9.20	0.50	9.63	-	18.81	.03	9.66	103.14
1937	10.06	0.49	9.71	-	18.67	.03	9.74	100.49
1938	11.91	0.50	9.61	-	20.47	.03	9.64	99.19
1939	8.42	0.51	9.59	-	18.79	.03	9.62	94.37
1940	7.76	0.46	9.92	-	16.17	.03	9.95	94.14
1941	13.71	0.47	9.88	-	19.53	.03	9.91	95.14
1942	13.85	0.54	9.36	-	23.48	.02	9.38	95.55
1943	8.97	0.59	9.13	-	22.73	.02	9.15	95.76
1944	11.05	0.59	9.09	-	24.10	.02	9.11	95.67
1945	9.58	0.61	9.00	-	24.07	.02	9.02	95.18
Mean 1914-45	11.31	0.61	9.06	1.64		.03	10.73	

*The minor effect of sediment encroachment on Glen Canyon storage at year 21 (about 1,600,000 acre-feet) was disregarded in this summary.

depleted stream flow conditions would cause a reduction of about 27 percent in the maximum firm power output of year 20. A summary of ultimate operation for year 75 is given in the table on the following page.

ULTIMATE OPERATION FOR RIVER REGULATION--YEAR 75
(Final Point of Control at Glen Canyon)

Unit--1,000,000 acre-feet

Water year	Inflow (Partially regulated by upstream project reservoirs)	Net reservoir evap. loss	Outflow: Release to satisfy compact*	Outflow: Additional power release & spills	Reservoir content end of year**	Inflow below reservoir (Paria River)	Regulated flow Colorado River at Lee Ferry: Annual	Regulated flow Colorado River at Lee Ferry: Ten-year moving totals
					12.49			
1914	10.76	0.46	7.41	-	15.38	.03	7.44	-
1915	7.93	0.50	7.44	-	15.37	.01	7.45	-
1916	9.99	0.54	7.40	-	17.42	.04	7.44	-
1917	12.17	0.61	7.39	1.09	20.50	.03	8.51	-
1918	6.82	0.60	7.42	2.00	17.30	.03	9.45	-
1919	6.66	0.51	7.44	2.00	14.01	.02	9.46	-
1920	11.89	0.47	7.42	3.00	15.01	.02	10.44	-
1921	13.38	0.53	7.39	3.00	17.47	.02	10.41	-
1922	10.63	0.56	7.42	3.00	17.12	.03	10.45	-
1923	10.34	0.55	7.43	3.00	16.48	.02	10.45	91.50
1924	7.44	0.51	7.43	1.00	14.98	.02	8.45	92.51
1925	6.65	0.44	7.42	.75	13.02	.03	8.20	93.26
1926	8.60	0.44	7.41	.75	13.02	.03	8.19	94.01
1927	10.49	0.47	7.41	.75	14.88	.05	8.21	93.71
1928	9.42	0.52	7.44	.50	15.84	.02	7.96	92.22
1929	13.27	0.59	7.40	.62	20.50	.03	8.05	90.81
1930	8.14	0.65	7.43	.06	20.50	.02	7.51	87.88
1931	4.35	0.60	7.46	-	16.79	.01	7.47	84.94
1932	9.28	0.57	7.41	-	18.09	.04	7.45	81.94
1933	5.69	0.56	7.45	-	15.77	.02	7.47	78.96
1934	3.97	0.46	7.45	-	11.83	.02	7.47	77.98
1935	6.65	0.38	7.46	-	10.64	.02	7.48	77.26
1936	6.95	0.34	7.43	-	9.82	.03	7.46	76.53
1937	7.68	0.33	7.42	-	9.75	.03	7.45	75.77
1938	9.64	0.36	7.42	-	11.61	.03	7.45	75.26
1939	6.07	0.36	7.42	-	9.90	.03	7.45	74.66
1940	5.55	0.31	7.44	-	7.70	.03	7.47	74.62
1941	11.11	0.33	7.41	-	11.07	.03	7.44	74.59
1942	10.89	0.42	7.41	-	14.13	.02	7.43	74.57
1943	6.42	0.45	7.44	-	12.66	.02	7.46	74.56
1944	8.47	0.43	7.43	-	13.27	.02	7.45	74.54
1945	7.09	0.43	7.44		12.49	.02	7.46	74.52
Mean 1914-45	8.57	0.48	7.42	0.67		.03	8.12	

*Release to satisfy minimum 10-year flow requirement at Lee Ferry--75,000,000 acre-feet less man-made depletion by Arizona in the upper basin.

**Capacity reduced by sediment deposits over 75 years.

PLANS AND ESTIMATES

Sufficient data have been obtained to permit preparation of rough preliminary cost estimates for all units in the Colorado River Storage project. Investigations have been essentially completed for the Echo Park unit, and preliminary designs and estimates have been prepared for the dam and appurtenant works.

Detailed geologic investigations, including construction material investigations, have been practically completed for the Echo Park and Glen Canyon units. Enough field data have been obtained from the investigations of other units to show that there are no obvious geologic features that would prohibit construction of the works contemplated. Only preliminary reservoir area and capacity data are available for all project units, and minor differences are to be expected with future detailed surveys.

Necessary new investigations consist primarily of foundation and abutment exploratory drilling, access road surveys, detailed topographic surveys of dam sites, right-of-way surveys, and construction material surveys and testing.

Project Costs

The capital cost of the Colorado River Storage project is estimated at 1,160 million dollars, based on prices prevailing on July 1, 1948. This includes the cost of dams, power plants, transmission facilities, access facilities, construction camps, rights-of-way, relocation of transportation and communication facilities, engineering and overhead, and investigations. Annual operation, maintenance, and replacement costs

are estimated at about 10 million dollars for the total project.

Investigation Costs

Present project investigations have been largely financed with non-reimbursable money from the Colorado River Development Fund, a fund that was established by the Boulder Canyon Adjustment Act of July 19, 1940, for investigation of basin plans and project developments in the Colorado River system. A small amount of reimbursable money was also used for the investigations as sufficient money was not available from the development fund. Greater expenditures of reimbursable money, estimated to amount to 5 million dollars, will be required for completion of the Colorado River Storage project investigations.

Construction Costs

Each project unit would include a dam, reservoir, and power plant. A transmission system with power plant interconnections is included. The Split Mountain, Black Canyon, and Cross Mountain power plants would be located downstream from the respective dams. Pressure tunnels would be provided from these three reservoirs to the respective plants for the development of additional power head. Power plants in the other project units would be located at the base of the respective dams. Estimated construction costs of the various units, based on July 1948 prices, are summarized in the table on the following page.

ESTIMATED PROJECT CONSTRUCTION COSTS

Project unit	Costs (July 1948 price base)		
	Dam and reservoir	Power features	Total
Echo Park	$ 96,800,000	$ 42,600,000	$139,400,000
Glen Canyon	182,000,000	165,000,000	347,000,000
Flaming Gorge (Red Canyon Dam)	74,500,000*	16,500,000	91,000,000*
Curecanti (Cottonwood Dam)	95,000,000	16,500,000	111,500,000
Split Mountain	31,300,000	36,400,000	67,700,000
Black Canyon (Crystal Dam and power tunnel)	72,900,000	84,600,000	157,500,000
Cross Mountain	29,100,000	20,000,000	49,100,000
Rattlesnake	113,500,000	42,600,000	156,100,000
Whitewater (Bridgeport Dam)	25,800,000**	9,500,000	35,300,000**
Total	$720,900,000	$433,700,000	$1,154,600,000
Total (rounded)	$721,000,000	$434,000,000	$1,155,000,000

*Including costs assigned to Central Utah project (15 million dollars).

**Including costs assigned to irrigation replacements for western Colorado lands (14 million dollars).

The estimate for the Echo Park unit was prepared by the office of the Chief Engineer. Estimates for the other units of the project are of rough preliminary nature, but all have been prepared in a uniform and consistent manner. They were made by computing quantities for all major items of excavation, concrete, and metal work, with percentage allowances made for the other items from comparisons with similar estimates recently prepared by the Bureau of Reclamation in the office of the Chief Engineer. If basic data were incomplete, estimates were increased to accommodate unforeseen contingencies.

A straight, gravity type, concrete dam was assumed for each site, except the Bridgeport, where an earth-fill structure was assumed. For the concrete dams the following design criteria were used: crest width of 40 feet, downstream face slope of 0.8:1 with the upper projection of the downstream face intersecting the axis at the crest elevation, upper 0.4 of the upstream face vertical, and lower 0.6 with slope of 0.2:1. If geological data were available on the depth of river fill and condition of abutment walls, the excavation quantities for the dam were computed accordingly. If no specific data were available, an allowance was made for about a 100-foot depth of river fill and a 12-foot depth of rock stripping throughout the entire area of contact between the dam and the walls and foundation.

The power plant costs were taken from hydroelectric power plant cost estimating curves compiled in the office of the Chief Engineer. Transmission system costs were based on a unit cost of $125 per kilowatt of installed capacity. This cost is representative of the cost of large transmission grids including switchyards and substations.

Operation, Maintenance, and Replacement Costs

Annual operation, maintenance, and replacement costs for each project unit were estimated in accordance with specific instructions outlined by the Branch of Design and Construction and the Branch of Power Utilization of the Bureau of Reclamation. Provisions were made for replacement of project works that would require replacement during the project repayment period.

Annual operation, maintenance, and replacement costs of each project unit are summarized below.

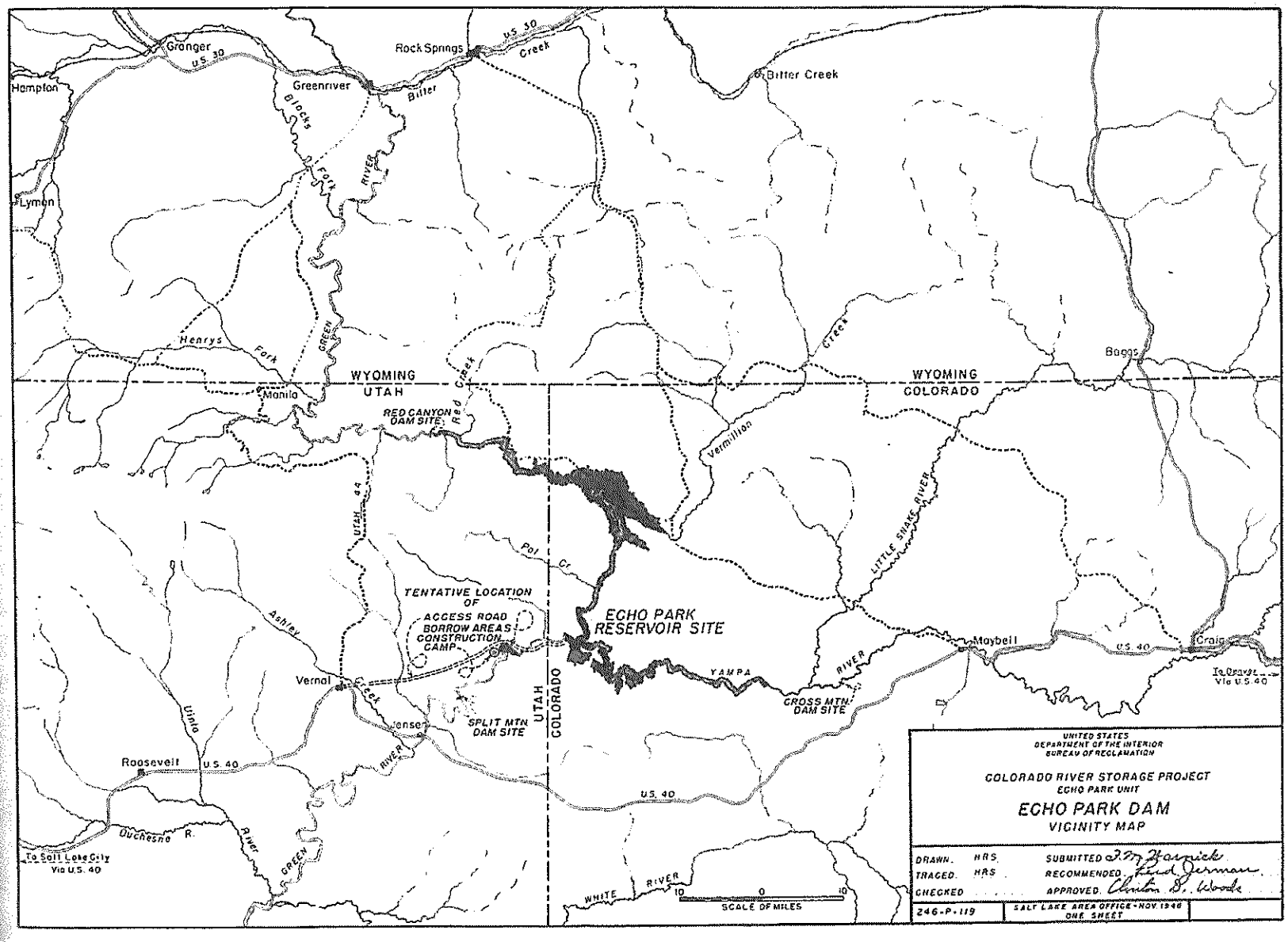
Project unit	Annual operation and maintenance costs	Annual provision for replacements	Total annual costs
Echo Park	$ 643,000	$ 527,000	$ 1,170,000
Glen Canyon	2,443,000	2,054,000	4,497,000
Flaming Gorge	264,000	207,000	471,000
Curecanti	260,000	206,000	466,000
Split Mountain	388,000	323,000	711,000
Black Canyon	664,000	577,000	1,241,000
Cross Mountain	226,000	160,000	386,000
Rattlesnake	632,000	532,000	1,164,000
Whitewater	151,000	112,000	263,000
Total	$5,671,000	$4,698,000	$10,369,000

Echo Park Unit

Accessibility

The Echo Park Dam site is in an isolated area as shown on the drawing on the following page. Therefore, an access road and a construction camp with complete utility service would be required.

The Island Park area, about 8 miles downstream from the dam site, has been assumed as the location of the camp. The access road would head on U. S. Highway 40 at either Jensen or Vernal. It would extend to Island Park and then continue about 8 miles up the canyon along the Green River to the dam site. A considerable amount of rock excavation would be required because of the steepness of the canyon walls. The entire route would be located above the highwater surface of the potential Split Mountain Reservoir. A road to the top of the dam would branch from the canyon road about 1-1/2 miles downstream from the dam and would


Granger
U.S. 30
Hampton
Greenriver
Rock Springs
U.S. 30
Creek
Bitter
Bitter Creek
Blacks Fork
RIVER
Lyman
Henrys Fork
GREEN
Manila
WYOMING
UTAH
Red Creek
RED CANYON DAM SITE
Creek
Vermillion
WYOMING
COLORADO
Baggs
UTAH 44
Pot Cr.
LITTLE SNAKE RIVER
TENTATIVE LOCATION OF ACCESS ROAD BORROW AREAS CONSTRUCTION CAMP
ECHO PARK RESERVOIR SITE
Ashley
Vernal
Creek
Jensen
SPLIT MTN DAM SITE
UTAH
COLORADO
YAMPA
RIVER
CROSS MTN DAM SITE
Maybell
U.S. 40
Craig
To Denver Via U.S. 40
Uinta
Roosevelt
U.S. 40
RIVER
U.S. 40
Duchesne R.
River
GREEN
To Salt Lake City Via U.S. 40
WHITE RIVER
10 0 10
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
ECHO PARK UNIT
ECHO PARK DAM
VICINITY MAP
DRAWN. HRS.
TRACED. HRS.
CHECKED
SUBMITTED
RECOMMENDED
APPROVED
246-P-119
SALT LAKE AREA OFFICE - NOV. 1946
ONE SHEET

ascend on a 6 percent grade. The road could be used for hauling aggregate as well as for access to the dam and camp sites. Any other route to the dam site would be subjected to more severe operating conditions during the winter months.

The nearest railhead to the dam site is at Craig, Colorado, approximately 135 miles to the east, on U. S. Highway 40. Heber, Utah, on the same highway, 140 miles to the west, could also be used as a railhead.

Rights-of-way

The Echo Park Reservoir at maximum water surface would occupy a portion of the Yampa and Green River channels extending through the Dinosaur National Monument. The upper end of the reservoir on the Green River would extend about 14 miles into the Ashley National Forest. The reservoir area would include approximately 17,000 acres of privately or State-owned lands, all of which have only minor farm improvements. Five mining claims in the area have been renewed since 1940 and are therefore classed as active although they are not operating at present. No producing oil wells are located in the area.

Geology

The canyon at the Echo Park Dam site is composed of two formations of sandstone. These have a distinct horizontal line of separation approximately halfway up the canyon walls at an elevation of about 5,400 feet. The upper formation, called the Ladore sandstone, is white in color. The lower formation, called Uinta quartzitic sandstone, is

dark red in color. Laboratory tests made on 6-inch diameter cores have shown that both types of sandstone have sufficient ultimate strength to form suitable foundations for any type of dam. Extreme differences in physical properties do exist, however. The modulus of elasticity for the Ladore sandstone is 98,000 psi while that for the Uinta is 2,673,000 psi. The coefficient of thermal expansion is 11 percent greater in the Ladore than in the Uinta sandstone. These and other differences will require special consideration in the final design of the dam. Thrust blocks have been tentatively included in the dam design pending later detailed studies.

Foundation exploration was accomplished by drilling 13 holes into the abutments and river bed to sufficient depths to reveal the necessary structural information. The holes drilled totaled 2,495 lineal feet. The depth of river fill material was found to be 148 feet.

There are no faults in the vicinity of the dam site although there is considerable jointing. Surface cracks and seams do not extend far back into the abutments. A grout program should prove entirely effective in sealing any paths of seepage.

Aggregate is available at Island Park, where a large gravel and sand deposit has been laid down by the river. Tests of samples taken from this deposit confirm its suitability for use as concrete aggregate. Tests were also made on samples of Uinta quartzitic sandstone and of a limestone formation quarried at points near the dam site; only the limestone was found suitable for use as concrete aggregate.

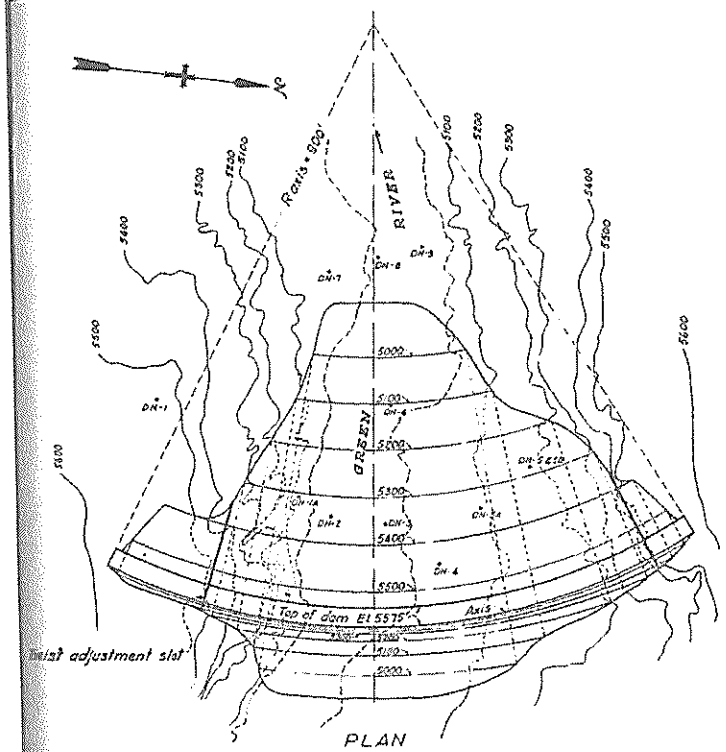
Project Works

Echo Park Dam would be a concrete, curved, gravity type structure, as shown in the design drawing on the following page. It would rise 525 feet above the river and would have a crest elevation of 5,575 feet. It would form a reservoir with a total storage capacity of 6,460,000 acre-feet, 1,500,000 acre-feet of which would be inactive. Both maximum and normal water surface elevations would be 5,570 feet.

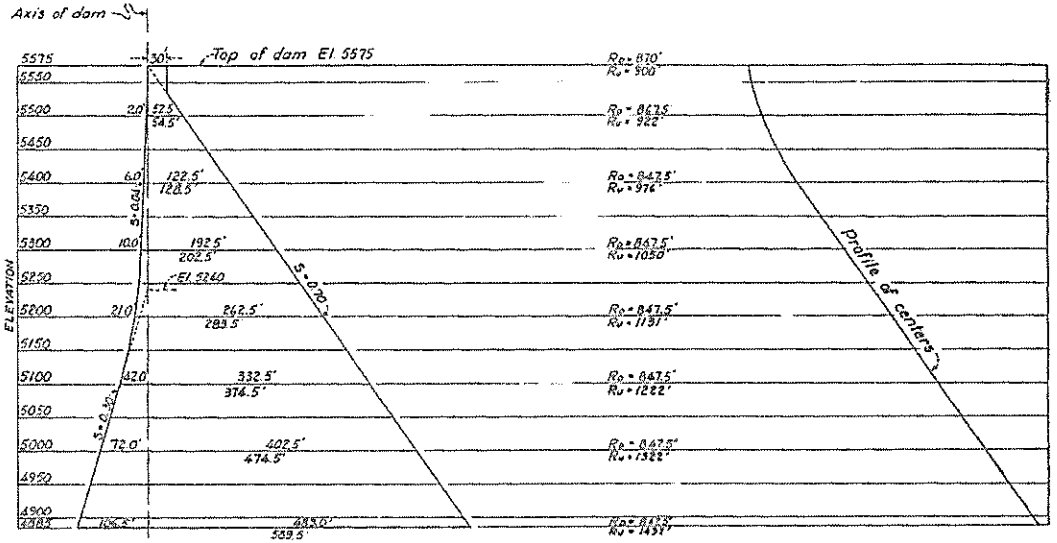
The spillway would have a capacity of 81,500 second-feet. It would consist of a discharge tunnel below a concrete crest at elevation 5,515 feet. Two 30- by 55-foot fixed wheel gates would be installed for control. The discharge tunnel, 35 feet in diameter, would join the diversion tunnel, used during construction, at a point approximately 1,400 feet from its outlet. Permanent outlet works have been designed for a discharge capacity of 20,000 second-feet with the reservoir water surface at its maximum elevation of 5,570 feet. A single intake tower of the type constructed at Hoover Dam would control the flow into a 30-foot inside diameter steel pipe imbedded in the concrete lining of the outlet tunnel.

The power plant would be located at the base of the dam and would consist of five equal-sized hydroelectric units with a total installed capacity of 200,000 kilowatts. This plant would have an initial generation of 1,006,000,000 kilowatt-hours annually. Transformers and switchyards would be located at the dam.

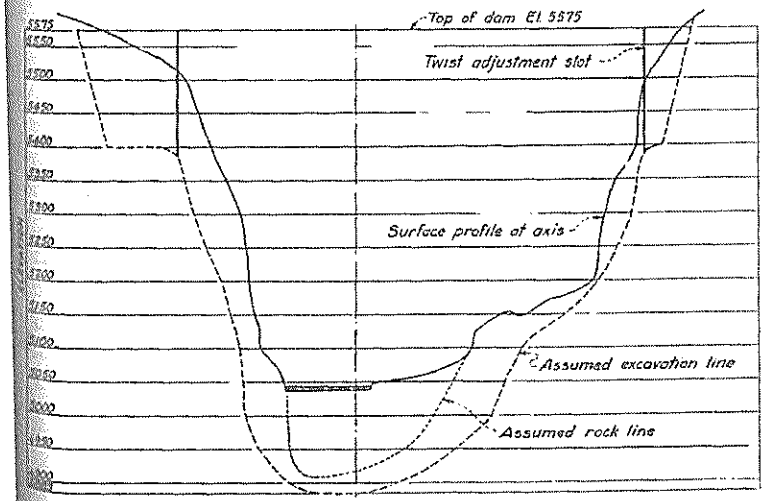
A transmission system, including the main transformers, switchyards at the power plant, transmission lines, intermediate switching stations,



PLAN

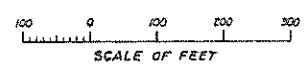


MAXIMUM SECTION



PROFILE DEVELOPED AT AXIS

Reference drawings: 317-D-11
317-D-12



STUDY NO. G-2

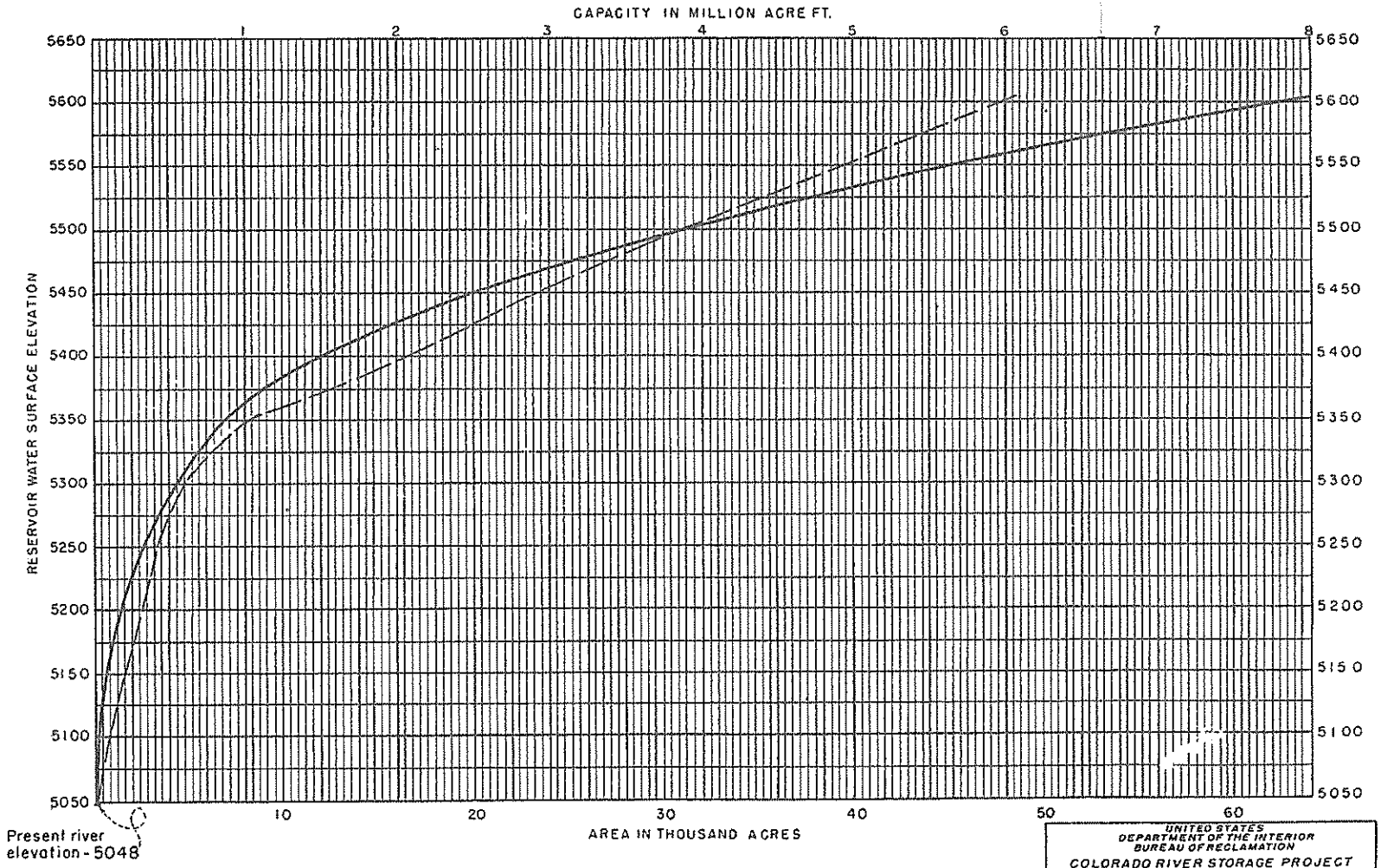
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT

ECHO PARK DAM

PLAN, PROFILE, & SECTION
ROUGH PRELIMINARY DESIGN DRAWING

DRAWN G.W.D. & S.W.C. SUBMITTED [signature]
TRACED ..... RECOMMENDED [signature]
CHECKED [signature] APPROVED [signature]

DENVER, COLORADO, JULY 30, 1948 | 317-D-10



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT
ECHO PARK UNIT

ECHO PARK RESERVOIR
AREA-CAPACITY CURVE

DRAWN .. HRS. . SUBMITTED F. M. Hamick
TRACED .. HRS. . RECOMMENDED Reed Jennings
CHECKED . WBH. . APPROVED C. D. Woods

246-P-343 | SALT LAKE AREA OFFICE JAN 1949

d substations, would deliver electric energy to load centers in north-
stern Colorado, southwestern Colorado, southwestern Wyoming, and
thern Utah.

Construction Period

Four to five years is required for the construction of a dam the
ze of the Echo Park. The progress of construction would depend upon
e rate at which funds were appropriated by Congress and upon conditions
the labor and materials markets at the time of construction. The
ccess road to the site of the construction camp would be built first.
rk could then commence on the construction camp and extension of the
ccess road to the dam site. While the first section of the access road
s being constructed, preconstruction surveys and investigations could
e made at the dam site. Driving of the diversion tunnel and construction
f the coffer dams should be started in July after the high run-off.
hese works should be sufficiently completed 9 months later to permit
iversion of the full spring flow. Two generating units would be in
eration the first year after completion of the dam. Four would be in
eration the second year, and the fifth or final unit would be in oper-
ion the third year.

st Estimates

Investigation Costs. Money for Echo Park unit investigations has
o date been supplied from the nonreimbursable Colorado River Develop-
ent Fund. Estimated costs of further preconstruction activities have
en included as construction costs.

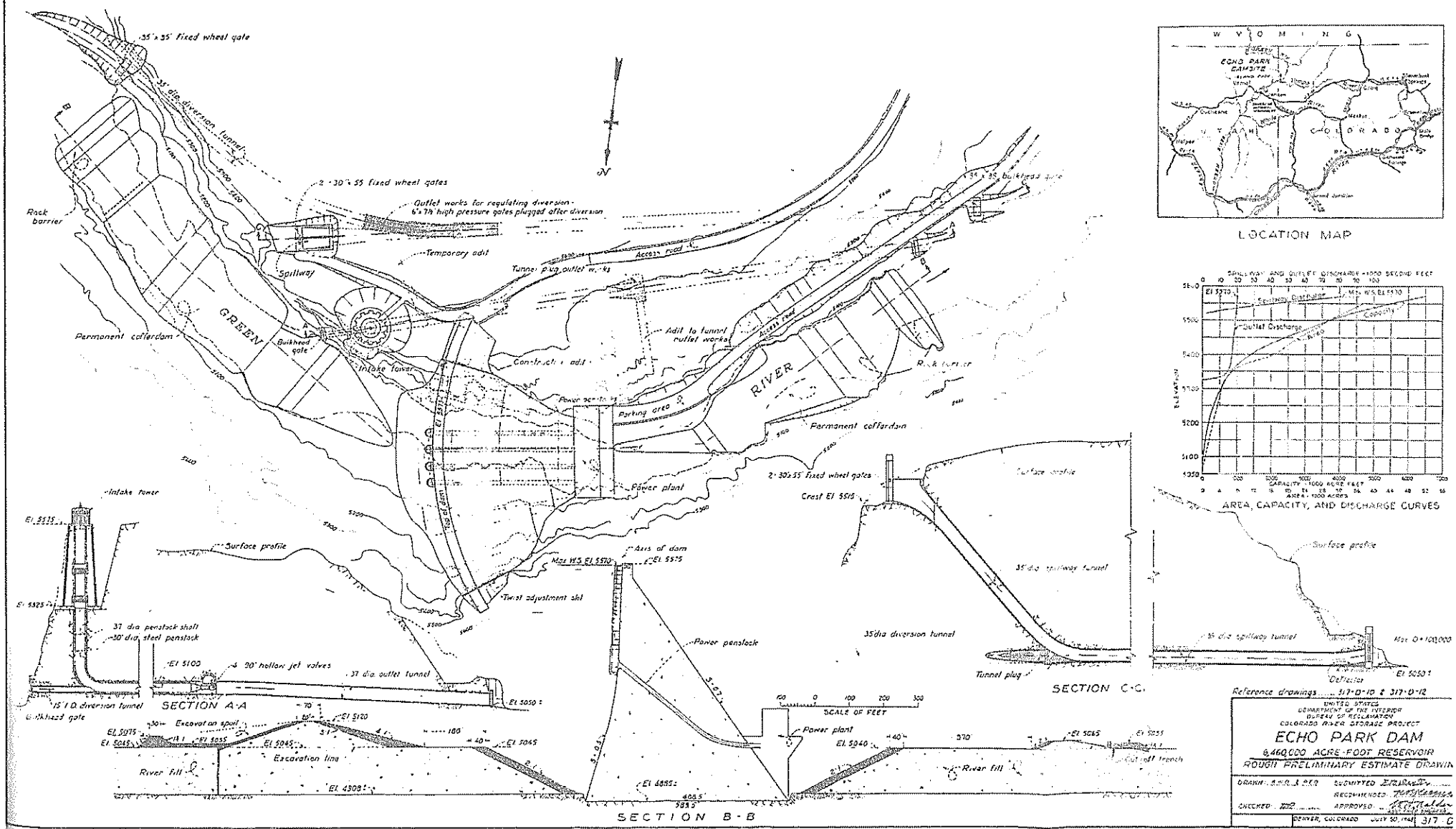
Construction costs. Estimated construction costs for the Echo Park
it are summarized in the following tabulation. Costs of the dam

were based on data depicted on the drawing on the following page.

Dam, spillway, and outlet works	$87,487,000
Construction camp	2,000,000
Access road	
Unit 1--Highway U.S. 40 to Island Park	2,600,000
Unit 2--Island Park to dam site	4,562,000
Rights-of-way	175,000
Subtotal, exclusive of power features	$96,824,000
Power plant structures and improvements	$ 3,850,000
Equipment	10,800,000
Features in and adjacent to dam	2,930,000
Transmission system	25,000,000
Subtotal, power features	$42,580,000
Total	$139,380,000
Total (rounded)	$139,400,000

Annual operation, maintenance, and replacement costs. Annual operation, maintenance, and replacement costs would include costs of operating and maintaining the power plant, transmission system, dam, and reservoir. They would also include costs of providing necessary replacements during the project repayment period in the power plant and related works, transmission system, dam, and waterways. These costs are shown below.

	Operation and maintenance	Replacement	Total
Power Plant			
Structures		$ 13,000	
Equipment		149,000	
Features in dam		15,000	
Subtotal	$293,000	$177,000	$ 470,000
Transmission system	320,000	332,000	652,000
Dams and reservoir	30,000	18,000	48,000
Total	$643,000	$527,000	$1,170,000



Reference drawings 317-D-10 & 317-D-12

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT

ECHO PARK DAM

6,460,000 ACRE-FOOT RESERVOIR

ROUGH PRELIMINARY ESTIMATE DRAWIN

DRAWN A.R.O.S. 2-52 SUBMITTED E.R.Bandy

RECOMMENDED

CHECKED ..... APPROVED .....

DENVER, COLORADO JULY 30, 1952 317-D

POWER

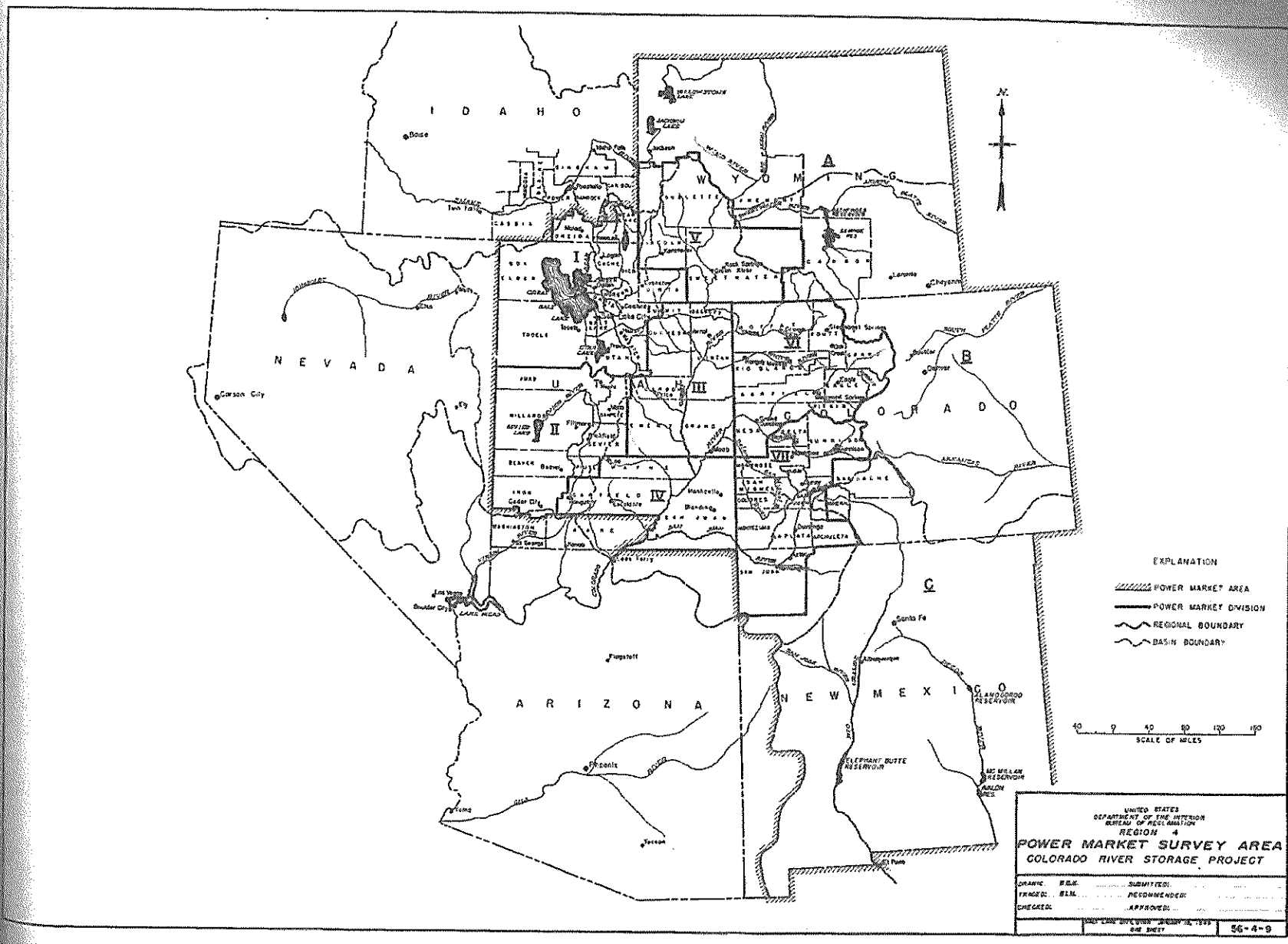
Region 4 of the Bureau of Reclamation has studied the power market area in the States of the upper division that would be served with power from the Colorado River Storage project. The studies were based on information compiled by the Federal Power Commission and information obtained by the Bureau of Reclamation from its several regions. Results of the studies are presented in a report entitled Power Market Survey--Colorado River Storage Project, dated February 1949. Information from that report is included in this chapter.

The market area that could be served power generated by the Colorado River Storage project is shown in the map on the following page. It includes as its principal portion the Colorado River Basin above Lee Ferry and the Bonneville Basin. This area, which is divided into seven subareas or divisions, lies within the boundaries of the Bureau of Reclamation's Region 4. The market area also includes three fringe areas. These include the portions of the Upper Colorado River Basin States of Wyoming, Colorado, and New Mexico that are outside the natural boundaries of the Colorado River drainage basin. The fringe areas are included in the Bureau of Reclamation's Regions 1, 5, 6, and 7.

Present Development

Present Power Resources

Power resources available to the Region 4 area as of December 31, 1947, the most recent date for which such data are available, are summarized in the table on page 68. Some of the energy


IDAHO
WYOMING
NEVADA
UTAH
COLORADO
ARIZONA
NEW MEXICO
A
B
C
I
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VI
VII
N.
EXPLANATION
POWER MARKET AREA
POWER MARKET DIVISION
REGIONAL BOUNDARY
BASIN BOUNDARY
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
POWER MARKET SURVEY AREA
COLORADO RIVER STORAGE PROJECT
56-4-9

(As of December 31, 1947) Unit--Kilowatts

Division	Type of ownership	Installed nameplate capacity: Hydro	Steam	Int. combustion	Total	Minimum hydro year dependable capacity: Hydro	Steam	Int. combustion	Total	Reserve	Net assured capacity
I	Utility	177,256	66,500	11,095	254,851	142,505	70,800	10,082	223,387	30,833	192,554
	Industrial	25	164,512	150	164,687	0	164,512	125	164,637	27,512	137,125
	Total	177,281	231,012	11,245	419,538	142,505	235,312	10,207	388,024	58,345	329,679
II	Utility	6,550	2,500	2,230	11,280	2,405	2,400	2,020	6,825	615	6,210
	Industrial	0	375	0	375	0	375	0	375	100	275
	Total	6,550	2,875	2,230	11,655	2,405	2,775	2,020	7,200	715	6,485
III	Utility	2,400	0	2,935	5,335	2,400	0	2,955	5,355	1,760	3,595
	Industrial	0	0	470	470	0	0	400	400	75	325
	Total	2,400	0	3,405	5,805	2,400	0	3,355	5,755	1,835	3,920
IV	Utility	170	0	1,109	1,279	100	0	994	1,094	354	740
	Industrial	0	1,000	135	1,135	0	1,000	115	1,115	540	575
	Total	170	1,000	1,244	2,414	100	1,000	1,109	2,209	894	1,315
V	Utility	1,560	10,500	1,031	13,091	1,560	7,350	903	9,813	1,758	8,055
	Industrial	0	20,000	0	20,000	0	15,000	0	15,000	5,000	10,000
	Total	1,560	30,500	1,031	33,091	1,560	22,350	903	24,813	6,758	18,055
VI	Utility	42,558	11,100	1,198	54,856	40,798	11,100	1,048	52,946	13,275	39,671
	Industrial	358	2,650	0	3,008	125	2,650	0	2,775	1,100	1,675
	Total	42,916	13,750	1,198	57,864	40,923	13,750	1,048	55,721	14,375	41,346
VII	Utility	10,232	6,970	2,992	20,194	9,570	7,890	2,475	19,935	4,045	15,890
	Industrial	960	2,783	0	3,743	960	2,783	0	3,743	1,060	2,683
	Total	11,192	9,753	2,992	23,937	10,530	10,673	2,475	23,678	5,105	18,573
Total - Region 4 market area	Utility	240,726	97,570	22,590	360,886	199,338	99,540	20,477	319,355	52,640	266,715
	Industrial	1,343	191,320	755	193,418	1,085	186,320	640	188,045	35,387	152,658
	Total	242,069	288,890	23,345	554,304	200,423	285,860	21,117	507,400	88,027	419,373

presently available to Divisions I and II is imported from Montana and Idaho. This energy, however, is needed to meet power shortages in the Pacific Northwest. In the future the importations to Region 4 are expected to be so reduced that they will be of little consequence.

The total net assured capacity available to the fringe areas for the year 1947 is shown in the following tabulation.

Fringe area	Net assured capacity (kilowatts) 1947
A—Wyoming	85,000
B—Colorado	247,000
C—New Mexico	71,018
Total	403,018

Present Energy Requirements

Energy requirements in the market area for the year 1947 are shown below.

Subarea	Energy requirements (million kilowatt-hours) 1947
Division I	1,733
Division II	67
Division III	108
Division IV	5
Division V	75
Division VI	105
Division VII	85
Subtotal—Region 4 area	2,178
Fringe Area A	354
Fringe Area B	1,206
Fringe Area C	425
Subtotal— Fringe areas	1,985
Total—Project market area	4,163

Anticipated Energy Requirements

Energy requirements are rapidly increasing throughout the market areas. The growing industrialization of the West and the accelerated development of natural resources, both mineral and agricultural, have resulted in such an increased use of electric energy that existing generating facilities have been taxed to capacity. Practically every utility in the market area has plans to increase its generating capacity to meet the requirements of the immediate future.

Estimated energy requirements for the years 1950, 1960, 1970, 1980, and 1990, as given in the Power Market Survey are summarized below.

	Energy requirements (million kilowatt-hours)				
	1950	1960	1970	1980	1990
Division I	1,925	3,113	4,450	5,667	6,837
Division II	80	156	239	280	350
Division III	124	356	710	1,075	1,430
Division IV	9	18	28	50	75
Division V	84	235	403	560	710
Division VI	93	174	243	310	390
Division VII	88	155	220	300	370
Subtotal--Region 4 area	2,403	4,207	6,293	8,242	10,162
Fringe Area A	499	1,289	2,448	3,734	5,075
Fringe Area B	1,690	3,253	5,095	6,949	8,940
Fringe Area C	563	930	1,210	1,373	1,550
Subtotal--Fringe areas	2,752	5,472	8,753	12,056	15,565
Total--Project market area	5,155	9,679	15,046	20,298	25,727

Additional Power and Energy Needed

In arriving at the additional amounts of power and energy needed to meet the demands, careful consideration was given to the capabilities of all existing facilities and of facilities scheduled by other agencies for the forecast period. Scheduled facilities considered included probable Bureau of Reclamation works in the fringe areas outside of Region 4. Consideration was also given to reductions in capabilities that would result from the aging and retirement of equipment and from reductions in power importations. The resulting estimates, amounting to the additional power and energy that would be needed in the market area from Bureau of Reclamation plants in Region 4, are shown in table on the following page.

The needs to be satisfied by the Colorado River Storage project were determined by deducting the capabilities of all potential Bureau of Reclamation plants in Region 4, except Colorado River Storage project plants, from the estimates of additional power and energy required in the region from Bureau plants. The estimated amounts of energy and power required from the project are summarized below.

Year	Power and energy needed from project (kilowatts)	(million kilowatt-hours)
1950	0	0
1960	262,600	563
1970	934,300	3,787
1980	1,682,300	8,170
1990	2,742,300	13,595

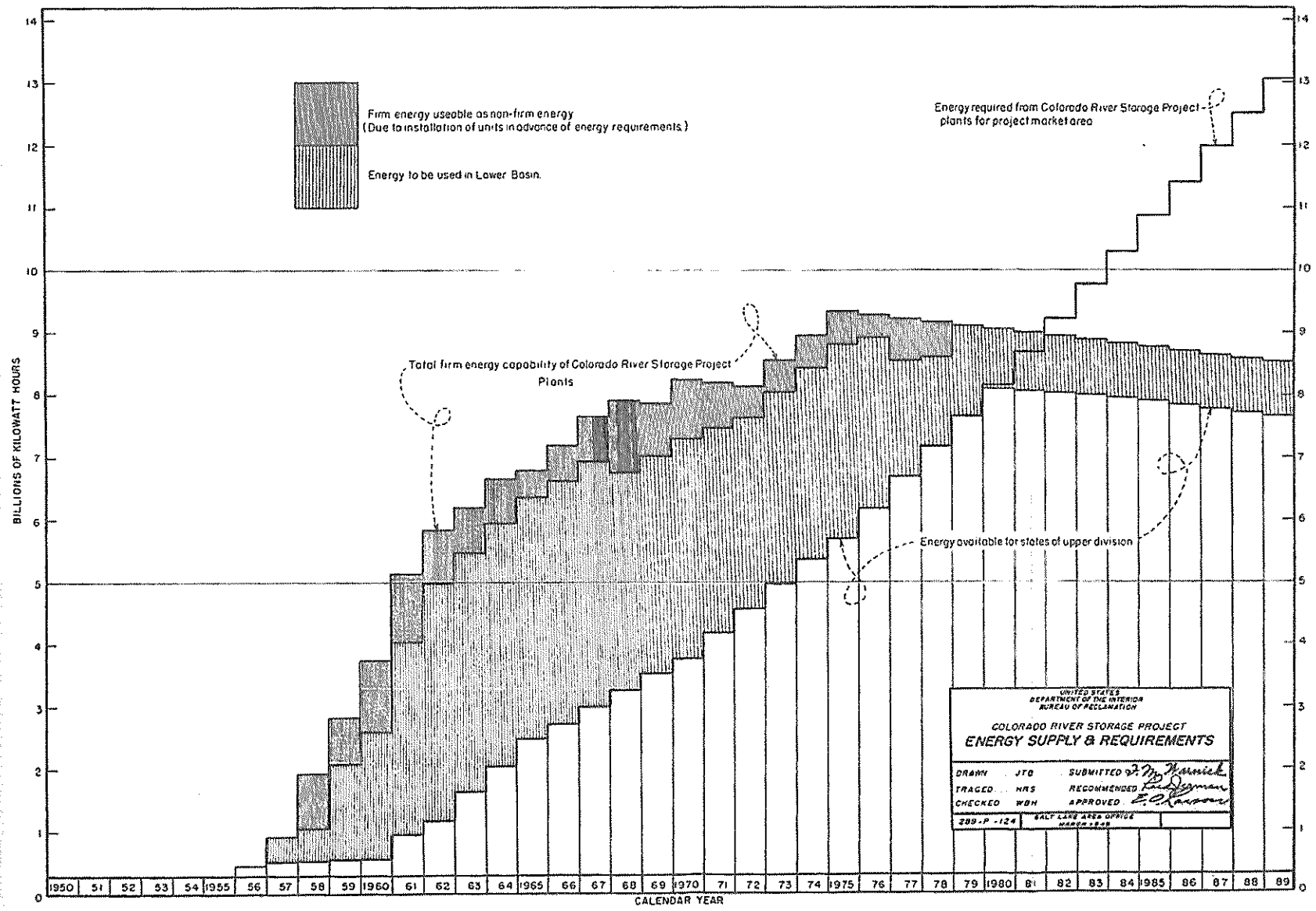
ADDITIONAL POWER AND ENERGY NEEDED FROM BUREAU OF RECLAMATION PLANTS IN REGION 4
FOR PROJECT MARKET AREA

Year	Region 4 market area		Fringe Area A (Wyoming)		Fringe Area B (Colorado)		Fringe Area C (New Mexico)		Total - project market area	
	kw	million kwh	kw	million kwh	kw	million kwh	kw	million kwh	kw	million kwh
1947	44,473	56	0	0	21,774	0	17,982	0	84,229	56
1950	43,878	3	0	51	24,670	290	0	0	68,548	344
1960	245,349	558	0	205	9,490	0	41,787	0	296,626	763
1970	736,353	3,331	124,000	1,186	140,590	429	72,787	56	1,073,700	5,002
1980	1,139,549	5,279	287,300	2,155	510,890	2,283	106,187	219	2,043,926	9,936
1990	1,538,549	7,199	521,600	3,492	903,890	4,2 '4	142,187	396	3,106,226	15,361

Project Power Development

As outlined in the plan of development, several large dams would be built on the Colorado River and its principal tributaries in the upper basin in order that States of the upper division might fulfill their Lee Ferry flow obligations and still consummate their full apportionment of consumptive use. A substantial power head would be made available at each dam. The charts on the two following pages indicate the contemplated schedule of construction for the project power facilities, the capacity of the facilities, and their ability to supply the power needed from the project.

Under the plan of development, a substantial amount of energy from the Glen Canyon unit would be available to the States of the lower division for a number of years. The power would be gradually withdrawn, however, as needed for use in the States of the upper division. A total of 160,000 kilowatts from the Glen Canyon unit would be permanently available to the States of the lower division. New power developments in the lower basin, made possible through upstream regulation and sediment control in the upper basin, would be expected to replace the withdrawn energy. These developments would include the potential Bridge Canyon, Kanab Creek, and Marble Canyon projects. Construction of regulatory reservoirs by the States of the upper division would incidentally result in immediate benefits to major Federal power facilities in the States of the lower division whose functions are being limited by the lack of upstream sediment control.


Firm energy useable as non-firm energy
(Due to installation of units in advance of energy requirements.)
Energy to be used in Lower Basin.
Energy required from Colorado River Storage Project plants for project market area
Total firm energy capability of Colorado River Storage Project Plants
Energy available for states of upper division
BILLIONS OF KILOWATT HOURS
CALENDAR YEAR
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
1950 51 52 53 54 1955 56 57 58 59 1960 61 62 63 64 1965 66 67 68 69 1970 71 72 73 74 1975 76 77 78 79 1980 81 82 83 84 1985 86 87 88 89
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
ENERGY SUPPLY & REQUIREMENTS
DRAWN JTG
TRACED HRS
CHECKED WBH
SUBMITTED
RECOMMENDED
APPROVED
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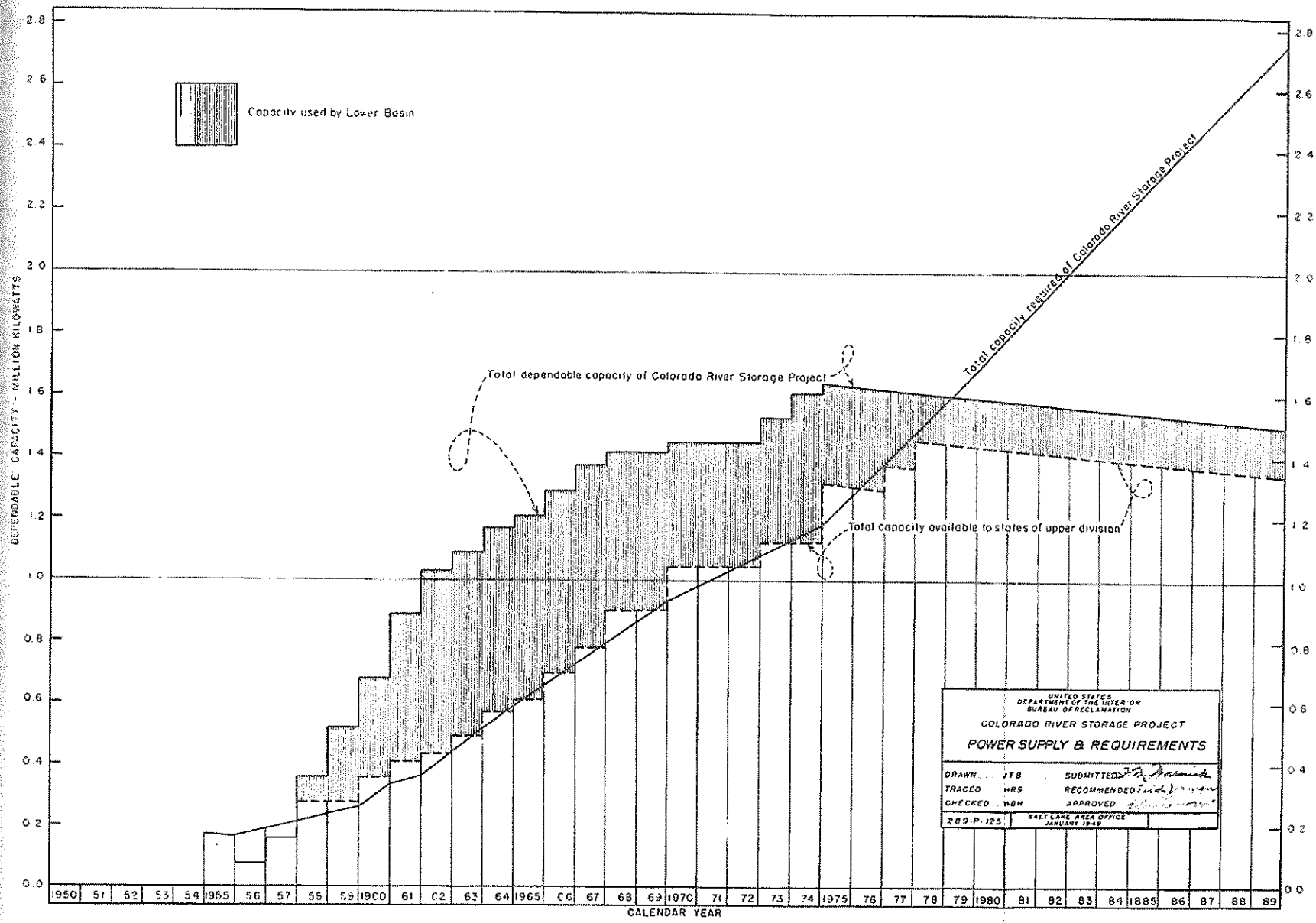
SALT LAKE AREA OFFICE
MARCH 1948


Capacity used by Lower Basin
Total dependable capacity of Colorado River Storage Project
Total capacity required of Colorado River Storage Project
Total capacity available to states of upper division
DEPENDABLE CAPACITY - MILLION KILOWATTS
CALENDAR YEAR
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
1950 51 52 53 54 1955 56 57 58 59 1960 61 62 63 64 1965 66 67 68 69 1970 71 72 73 74 1975 76 77 78 79 1980 81 82 83 84 1985 86 87 88 89
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
POWER SUPPLY & REQUIREMENTS
DRAWN JTB
TRACED HRS
CHECKED WBH
SUBMITTED
RECOMMENDED
APPROVED
289-P-125
SALT LAKE AREA OFFICE
JANUARY 1949

Investigations so far conducted on projects in the basin indicate that some projects would require electric energy for irrigation pumping purposes. Investigations have not progressed far enough to determine the amount of energy that would be required for this purpose nor the exact places where it would be used. These questions will be answered as detailed studies for water-use projects are completed.

A substantial amount of energy would be produced by the Colorado River Storage project in advance of the market for firm energy. This energy would be produced while new generating units were being tested and contract negotiations being carried on for the delivery of firm energy. The energy thus produced would be salable at a nonfirm rate. An amount of nonfirm energy would also be available while Glen Canyon capacity was being withdrawn from use in the lower basin. It is anticipated that all nonfirm energy would be easily absorbed in both the upper and lower basins as fuel replacement energy and for sales to industries using secondary energy.

The following tabulation shows the estimated annual production from the Colorado River storage project that would be possible in 1980 with all units of the project in operation. The estimates are based on 1980 stream flow conditions that would result from the development of water-use projects in the States of the upper basin and from the river regulation of the Colorado River Storage project.

	Project installed capacity (kilowatts) 1980	Annual project generation (million kilowatt-hours) 1980
Red Canyon	75,000	385
Cross Mountain	60,000	335
Echo Park	200,000	1,062
Split Mountain	120,000	637
Rattlesnake	200,000	1,018
Curecanti	75,000	298
Black Canyon	210,000	1,175
Bridgeport	40,000	228
Glen Canyon	800,000	3,950
Total	1,780,000	9,088

Under conditions expected to exist in 1980 the capabilities of all the plants listed above would just supply the energy and power required from the Colorado River Storage project for that year. By 1990 estimated energy requirements of the market area would be considerably above the capabilities of all production facilities.

Power could also be produced at the Dewey, Moab, Bluff, Goose Necks, and Slick Horn Canyon sites. It is doubtful, however, whether these sites should be developed because of the high reservoir evaporation losses which would result. The sites selected for the Colorado River Storage project would provide sufficient river regulation as

far as the Lee Ferry flow obligation is concerned. Development of additional sites for the purpose of power production would leave a smaller amount of apportioned water available for water-use projects in the States of the upper division.

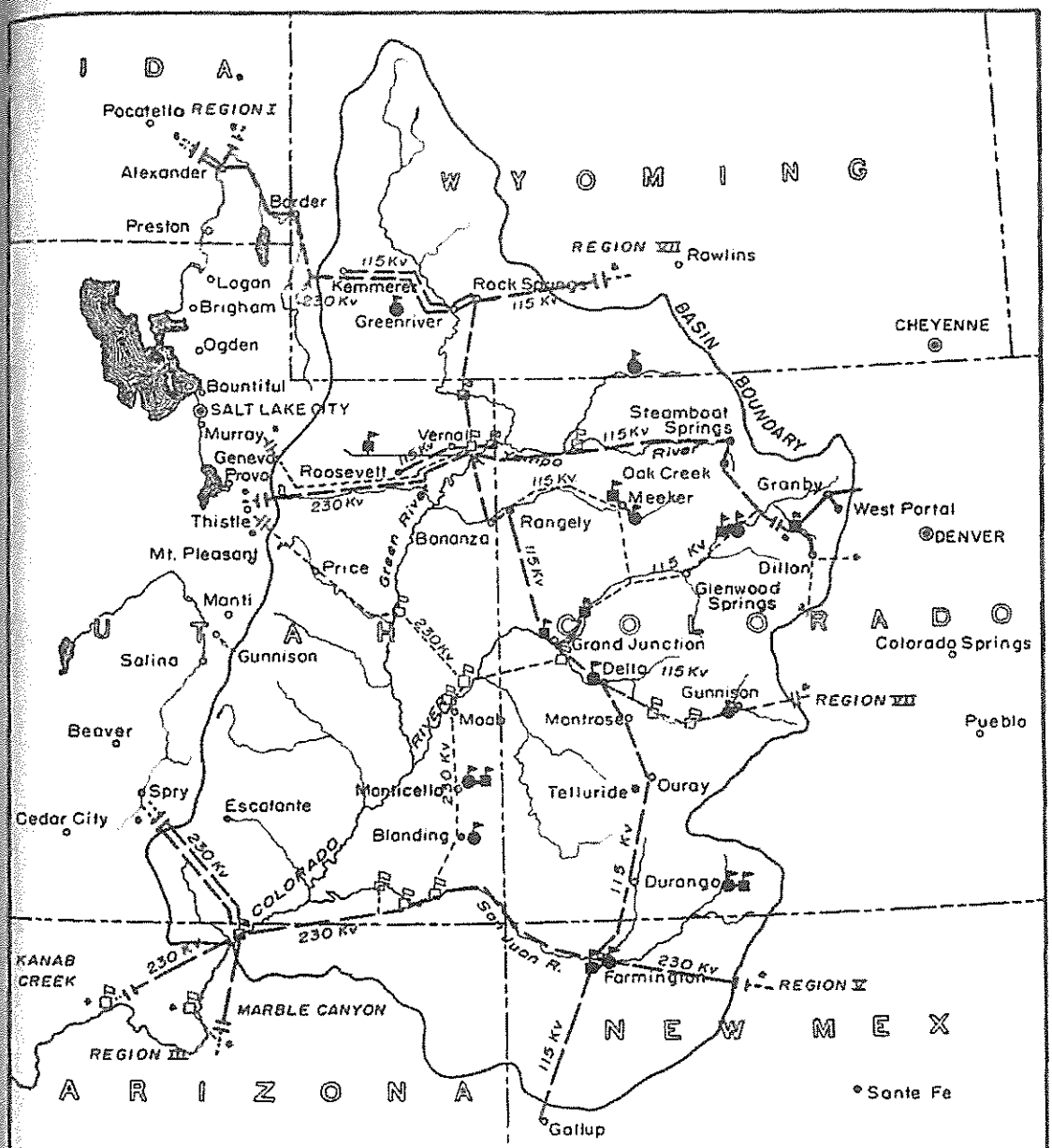
Steam-electric generating equipment may be desirable as a supplementary source of power. In some cases power for the construction of project works may also be obtained from present or new steam-electric plants. Integration of steam-electric plants and the proposed hydroelectric developments would be particularly desirable for stand-by service, peaking purposes, and fuel conservation.

The Echo Park unit would be the first undertaken because of its strategic location near areas critically short of energy in northwestern Colorado, southwestern Wyoming, and northern Utah. An installed capacity of 200,000 kilowatts is planned at the site. Initial annual production is estimated at 1,006 million kilowatt-hours. With additional regulation brought about by construction of the Flaming Gorge unit, the production at Echo Park would be increased to a maximum of 1,140 million kilowatt-hours annually. Subsequent depletions by upstream water-use projects would reduce the annual generation until the Cross Mountain unit was constructed. With construction of this unit the output would show a slight increase. Under ultimate stream flow conditions, the annual power output at Echo Park would be reduced to a minimum of 702 million kilowatt-hours.

The map on the following page shows a tentative plan for a "backbone" high voltage transmission system to transmit the energy from the various project power plants to the probable load centers within the basin and to points of interconnection with other power systems at or near the basin boundary. The map does not show the number of lines needed for complete development nor the final routing of the lines. Marketing lines to serve small communities, rural distribution systems, and other power systems would be added as needed.

Power Revenues

A preliminary financial study for project repayment has been prepared, based on data presented under the section, Financial Analysis. For the study it was assumed all facilities would be completed 19 years after completion of the first unit, with construction of the facilities undertaken in accordance with the energy requirements of the project power market area. On this basis, power revenues could repay the costs of all project facilities in 60 years after the 19-year construction period. The costs allocated to power, however, would be repaid at 3 percent interest in 46 years following the installation of the last generating unit. Power revenues that would accrue after payment of all project costs, together with revenues from interest payments, could be applied on costs of potential Federal reclamation projects using Colorado River water in the States of the upper division that are beyond the repayment ability of irrigation water users.



Upper Colorado River Basin Boundary ——
State Boundary. . . . . ——

Note:
* Development by other than Upper Colorado River Basin Projects.

GENERATING PLANTS	EXISTING	INITIAL STAGE	POTENTIAL
Hydro — Bureau of Reclamation			
Hydro — Publicly owned			
Fuel — Publicly owned			

TRANSMISSION LINES
Bureau of Reclamation —— —— ----
Other publicly owned... ——
Interconnection. . . . . —|— --|-

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

TENTATIVE PROJECT POWER SYSTEM

DRAWN.. HRS..SUBMITTED C.E.H.
TRACED.. HRS..RECOMMENDED Fred Jerman
CHECKED. OWB..APPROVED C. D. Woods

289-P-7 | SALT LAKE AREA OFFICE MAR. 1949

The repayment, as summarized below, is based on the sale of firm energy at an average rate of 5.2 mills per kilowatt-hour and on the sale of nonfirm energy at an average rate of 3.0 mills per kilowatt-hour. The summary is based on a 100-year period of analysis.

Total net power revenues for 100 years		$2,521,185,400
Distribution of revenues		
Repayment of power investment	860,305,000	
Repayment of river regulation costs	191,750,000	
Repayment of sediment storage costs	74,028,000	
Repayment of investigation costs	5,000,000	
Excess power revenues (interest component)	592,216,782	
Earned surplus	797,885,618	
Total of distributed net revenues		2,521,185,400

Value of Power

The value of power in the several subareas of the project power market area was computed by the Federal Power Commission's method. Steam-electric coal- and gas-burning plants at the principal load centers in the subareas were considered to be competitive with the project hydroelectric plants. The values were based on the combined use of gas and coal for fuel in Fringe Areas A and B, the use of gas in Fringe Area C, and the use of coal in all divisions of the Region 4 area.

The values of power at the high voltage sides of the plant substations, based on a 60 percent plant factor, are summarized below for the several subareas.

	Plant considered (kilowatts)	Value (mills per kilowatt-hour)
Divisions I and III	60,000	7.35
Division II	10,000	8.69
Division IV	2,500	11.54
Division V	5,000	9.30
Division VI	10,000	8.80
Division VII	10,000	7.46
Fringe Area A	20,000	7.88
Fringe Area B	40,000	7.22
Fringe Area C	10,000	7.66

Conservation of Natural Resources

Supplies of falling water, which are being constantly renewed, must be used for power production wherever possible to save the limited fuel resources for other uses. If burned unnecessarily for power production, our fuel resources will be prematurely depleted without rendering the greatest benefit to the Nation.

With integration of hydroelectric and fuel-electric plants use could be made of existing and new fuel-burning plants for supplemental power, firming up, standby service, and for peaking purposes. Even with maximum development of hydroelectric resources, the fuels—coal, oil, and gas—would be required for production of power in possibly greater quantities than are being used at present. As industrialization of the West progresses, hydroelectric developments would relieve the need for consumption of fuel for power and would allow the fuel resources to be used for other industrial purposes. Coal, the most abundant fuel, is especially needed for its many important derivatives.

FINANCIAL ANALYSIS

Annual Benefits and Costs

To determine the economic justification of a project, the tangible National benefits are compared with the related costs. Both benefits and costs are considered as annual equivalents over a common time period.

Estimated benefits and costs of the Colorado River Storage project were considered over a 100-year period. All estimates were based on current price levels. Under project operation changes may result in the benefit-cost ratio now indicated as the actual costs of construction would be incurred during a limited period while benefits would be realized through the long useful life of the project during which different price levels would probably prevail.

Annual Benefits

Tangible benefits from the Colorado River Storage project would result from irrigation developments, made possible through water replacements from project storage; sediment storage; power generation; fish and wildlife conservation; recreation; and flood control. Only power benefits have been measured and considered in the benefit-cost analysis. All other tangible benefits should be measured and considered, but they cannot be properly analyzed until investigations now in progress are completed. Benefits from river regulation have been assumed to accrue to individual water-use projects as preliminary studies have not evolved a suitable method for prorating these National benefits between the individual projects and the Colorado River Storage project.

Tangible power benefits, both direct and indirect, would have a total annual value of $71,100,000. The value of the direct power benefit is estimated at $34,800,000. This value is measured by the gross power revenues expected from the sale of electric energy produced by the project. The value of indirect power benefits is estimated at $36,260,000 annually. This value is measured from the following items:

Savings in costs of energy from cheapest alternative source	$16,080,000
Proportionate share of retailing utilities benefits arising from resale of power at a higher rate	17,580,000
Proportionate share of commercial and industrial benefits arising from use of power	2,600,000
Total	$36,260,000

In addition to the tangible benefits, real and valuable benefits of an intangible nature would result from the project. These intangible benefits, while not measurable in monetary terms, would definitely contribute to the public welfare and National security.

Annual Costs

The annual equivalent project costs are estimated at $41,146,000, including $31,522,000 as the annual construction cost and $9,624,000 as the average annual cost for operation, maintenance, and replacements. The construction cost is based on amortization of the total project cost (1,131 million dollars, exclusive of costs allocated to Central Utah project and to irrigation of western Colorado lands) over a 100-year period at 2.5 percent interest. Allowance was made in this estimate for interest during construction and salvage values of structures that would be useful beyond the 100-year period considered in the analysis.

Benefit-Cost Ratio

The estimated annual benefits would compare with the annual equivalent costs in a ratio of 1.73 to 1.00. Thus, for each dollar spent for project development $1.73 in National benefits would result from electric energy sales alone.

Cost Allocations

A modified "use of facilities" method was considered the most suitable basis for allocating the joint costs of this multiple-purpose project. This method is sound, practicable in application, and is considered equitable for a tentative distribution of the costs of jointly used facilities. Each purpose would share in the economy of the joint use of project storage facilities.

The table on the following page shows the estimated portion of the storage capacity at each reservoir site that would be utilized for each project purpose after ultimate upstream depletions. River regulation was assumed to use the capacity reserved for hold-over storage, and sediment storage was assumed to use the capacity that sediment deposits would fill in 100 years. Power was assumed to use all inactive capacity and all active capacity unoccupied by sediment in 100 years. Participation of water-use projects was based on the estimated capacity that would be required at the Flaming Gorge Reservoir for irrigation of Central Utah project lands and at Bridgeport Reservoir (Whitewater unit) for irrigation of western Colorado lands.

ULTIMATE USE OF RESERVOIR STORAGE CAPACITY

Unit--acre-feet

Project unit	River regulation	Sediment storage (100 years)	Power production	Water-use projects
Echo Park	4,400,000	439,000	6,170,000	--
Glen Canyon	10,300,000	7,310,000	21,130,000	--
Flaming Gorge	1,960,000	670,000	2,430,000	1,300,000
Curecanti	2,000,000	0	2,500,000	--
Split Mountain	0	0	335,000	--
Cross Mountain	4,200,000	0	5,200,000	--
Rattlesnake	641,000	588,000	1,610,000	--
Black Canyon	0	0	510,000	--
Whitewater	0	219,000	234,000	500,000
Total	23,500,000	9,230,000	40,100,000	1,800,000

The costs of jointly used facilities at each site were allocated to each project purpose in proportion to the use of reservoir storage capacity. These allocations for individual units, together with the total amounts allocated to each purpose, are shown in the table on page 84.

Project Repayment

The schedule of project repayment is presented in detail in the table on page 85. As shown by the repayment schedule, the power revenues, averaging approximately $34,800,000 annually over the 100 years of study, would repay the annual operation, maintenance, and replacement costs of the entire project, could pay all construction costs of the project, and would provide approximately 1,390 million dollars in excess of project needs. The excess revenues would be applied toward repayment of costs of Federal reclamation projects utilizing Upper Colorado River Basin water in the States of the upper division that are beyond the repayment ability of the irrigators.

Project unit	Joint Costs					Direct costs	
	River regulation	Sediment storage	Power production	Water use projects	Total joint costs	Power production	Total costs
Echo Park	$ 38,700,000	$ 3,960,000	$ 54,240,000		$ 96,800,000	$ 42,560,000	$ 139,360,000
Glen Canyon	48,500,000	34,300,000	99,200,000		182,000,000	165,040,000	347,040,000
Flaming Gorge	23,000,000	7,850,000	28,450,000	15,200,000	74,500,000	16,530,000	91,030,000
Curecanti	42,200,000	0	52,800,000		95,000,000	16,530,000	111,530,000
Split Mountain	0	0	31,300,000		31,300,000	36,380,000	67,670,000
Cross Mountain	13,000,000	0	16,100,000		29,100,000	19,960,000	49,060,000
Rattlesnake	25,650,000	23,500,000	64,350,000		113,500,000	42,640,000	156,140,000
Black Canyon	0	0	72,900,000		72,900,000	84,580,000	157,520,000
Whitewater	0	5,930,000	6,340,000	13,530,000	25,800,000	9,530,000	35,280,000
Project investigations							5,000,000
Totals (rounded)	$191,000,000	$75,400,000	$425,700,000	$28,700,000	$720,900,000	$433,700,000	$1,160,000,000
Percent of total joint costs	27	10	59	4	100		

COLORADO RIVER STORAGE PROJECT
POWER SYSTEM
FINANCIAL OPERATION STUDY FOR EXAMINATION OF AVERAGE RATE
AND INVESTMENT REPAYMENT FROM POWER REVENUES

Year of Study	Calendar Year	Sales of Electric Energy (Million Kilowatthours)			Operating Revenues			Revenue Deductions			Net Operating Revenues	Transfer (Reductions) Repayment of Investment		Investment Repayment From Power Revenues Plant in Service at End of Year			Allocable Unpaid Balance (Year Beginning)		Power Revenues in Excess of Project Needs (Int. Component)	Annual Operating Deficiencies	Unpaid Operating Deficiencies (Cum.)	Remarks
					Sales of Electric Energy									Interest Bearing		Interest Free						
		Firm	Non-Firm	Total (Col. 3+4)	Firm ($.2 Mills)	Non-Firm ($.0 Mills)	Total (Col. 6+7)	Operation Maintenance & Overhead	Provision For Replacement	Total (Col. 9+10)	(Col. 5-11)	Interest	Principal	Electric Plant	Balance to Be Repaid	Power Regulation, Sediment Storage & Investigation	Balance to Be Repaid	Electric Plant	Power Regulation, Sediment Storage & Investigation			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0	1953															47,570,000	47,570,000					
1	1956	425	0	425	2,710,000	0	2,710,000	275,000	238,000	513,000	1,697,000	2,252,900	(552,900)	75,330,000	90,107,000		47,570,000	75,330,000	47,570,000		0	
2	1957	453	397	850	2,555,800	1,191,000	3,746,800	570,000	131,000	701,000	3,045,800	2,755,187	290,613	89,660,000	87,351,813		47,570,000	89,660,000	47,570,000	1,167,066		
3	1958	959	826	1,785	4,966,800	2,478,000	7,444,800	1,102,000	1,060,000	2,772,000	5,242,800	7,183,793	(1,940,993)	276,990,000	270,881,580		47,570,000	276,990,000	47,570,000	3,180,619		
4	1959	1,472	706	2,178	10,608,800	2,118,000	12,726,800	1,628,000	1,825,000	3,453,000	9,273,800	9,939,457	(665,657)	304,650,000	304,219,277		47,570,000	304,650,000	47,570,000	6,845,619		
5	1960	1,648	1,023	2,671	11,880,800	3,069,000	14,949,800	2,116,000	1,811,000	3,927,000	11,022,800	9,613,353	1,409,447	313,650,000	313,832,724		47,570,000	313,650,000	47,570,000	10,573,066		
6	1961	1,727	1,018	2,745	12,217,200	3,054,000	15,271,200	2,179,000	2,343,000	4,522,000	10,749,200	9,965,453	783,747	323,650,000	323,798,471	190,770,000	47,570,000	323,650,000	47,570,000	14,538,519		
7	1962	1,461	784	2,245	10,237,200	2,352,000	12,589,200	2,330,000	2,789,000	5,119,000	7,470,200	10,139,065	(2,668,865)	333,650,000	326,466,606	190,770,000	47,570,000	333,650,000	47,570,000	17,008,719		
8	1963	5,070	873	5,943	35,490,000	2,619,000	38,109,000	3,810,000	4,956,000	8,766,000	29,343,000	23,791,000	5,552,000	343,650,000	350,018,606	190,770,000	47,570,000	343,650,000	47,570,000	25,774,719		
9	1964	5,180	693	5,873	36,260,000	2,079,000	38,339,000	3,912,000	5,219,000	9,131,000	29,208,000	23,615,000	5,593,000	353,650,000	355,611,606	190,770,000	47,570,000	353,650,000	47,570,000	31,367,719		
10	1965	5,676	196	5,872	39,732,000	588,000	40,320,000	4,017,000	5,114,000	9,131,000	31,189,000	23,615,000	7,574,000	363,650,000	363,185,606	190,770,000	47,570,000	363,650,000	47,570,000	38,941,719		
11	1966	6,126	766	6,892	42,882,000	2,298,000	45,180,000	4,218,000	5,340,000	9,558,000	35,622,000	23,615,000	12,007,000	373,650,000	375,192,606	190,770,000	47,570,000	373,650,000	47,570,000	46,948,719		
12	1967	6,425	684	7,110	44,975,000	2,052,000	47,027,000	4,423,000	5,557,000	9,980,000	37,047,000	23,615,000	13,432,000	383,650,000	388,624,606	190,770,000	47,570,000	383,650,000	47,570,000	60,380,719		
13	1968	6,635	1,097	7,732	46,445,000	3,291,000	49,736,000	4,634,000	5,784,000	10,418,000	39,318,000	23,615,000	15,703,000	393,650,000	404,327,606	190,770,000	47,570,000	393,650,000	47,570,000	76,083,719		
14	1969	6,503	801	7,304	45,521,000	2,403,000	47,924,000	4,844,000	6,048,000	10,892,000	37,032,000	23,615,000	13,417,000	403,650,000	417,744,606	190,770,000	47,570,000	403,650,000	47,570,000	89,500,719		
15	1970	6,755	898	7,653	47,285,000	2,694,000	49,979,000	5,058,000	6,313,000	11,371,000	38,608,000	23,615,000	14,993,000	413,650,000	432,737,606	190,770,000	47,570,000	413,650,000	47,570,000	104,493,719		
16	1971	6,935	676	7,611	48,545,000	2,028,000	50,573,000	5,282,000	6,594,000	11,876,000	38,697,000	23,615,000	15,082,000	423,650,000	447,819,606	190,770,000	47,570,000	423,650,000	47,570,000	119,575,719		
17	1972	7,120	669	7,789	49,840,000	2,007,000	51,847,000	5,508,000	6,884,000	12,392,000	39,455,000	23,615,000	15,840,000	433,650,000	463,659,606	190,770,000	47,570,000	433,650,000	47,570,000	135,415,719		
18	1973	7,195	669	7,864	50,365,000	2,007,000	52,372,000	5,753,000	7,191,000	12,944,000	39,428,000	23,615,000	15,813,000	443,650,000	479,472,606	190,770,000	47,570,000	443,650,000	47,570,000	151,228,719		
19	1974	7,866	678	8,544	55,062,000	2,034,000	57,096,000	6,007,000	7,509,000	13,516,000	43,580,000	23,615,000	19,965,000	453,650,000	499,437,606	190,770,000	47,570,000	453,650,000	47,570,000	171,193,719		
20	1975	8,179	648	8,827	57,253,000	1,944,000	59,197,000	6,271,000	7,839,000	14,110,000	45,087,000	23,615,000	21,472,000	463,650,000	521,052,606	190,770,000	47,570,000	463,650,000	47,570,000	192,665,719		
21	1976	8,538	330	8,868	59,766,000	990,000	60,756,000	6,548,000	8,188,000	14,736,000	46,020,000	23,615,000	22,405,000	473,650,000	544,457,606	190,770,000	47,570,000	473,650,000	47,570,000	215,280,719		
22	1977	7,977	611	8,588	55,839,000	1,833,000	57,672,000	6,833,000	8,541,000	15,374,000	42,298,000	23,615,000	18,683,000	483,650,000	563,140,606	190,770,000	47,570,000	483,650,000	47,570,000	233,963,719		
23	1978	8,038	534	8,572	56,266,000	1,602,000	57,868,000	7,126,000	8,907,000	16,033,000	41,835,000	23,615,000	18,220,000	493,650,000	581,360,606	190,770,000	47,570,000	493,650,000	47,570,000	252,183,719		
24	1979	8,500	0	8,500	59,500,000	0	59,500,000	7,429,000	9,286,000	16,715,000	42,785,000	23,615,000	19,170,000	503,650,000	600,530,606	190,770,000	47,570,000	503,650,000	47,570,000	271,353,719		
25	1980	8,500		8,500	59,500,000		59,500,000	7,742,000	9,678,000	17,420,000	42,080,000	23,615,000	18,465,000	513,650,000	619,995,606	190,770,000	47,570,000	513,650,000	47,570,000	289,818,719		
26	1981	8,500		8,500	59,500,000		59,500,000	8,065,000	10,082,000	18,147,000	41,353,000	23,615,000	17,738,000	523,650,000	637,733,606	190,770,000	47,570,000	523,650,000	47,570,000	307,556,719		
27	1982	8,352		8,352	58,464,000		58,464,000	8,398,000	10,498,000	18,896,000	39,568,000	23,615,000	15,953,000	533,650,000	653,686,606	190,770,000	47,570,000	533,650,000	47,570,000	323,509,719		
28	1983	8,197		8,197	57,379,000		57,379,000	8,743,000	10,929,000	19,672,000	37,707,000	23,615,000	14,092,000	543,650,000	667,778,606	190,770,000	47,570,000	543,650,000	47,570,000	337,601,719		
29	1984	8,049		8,049	56,343,000		56,343,000	9,103,000	11,379,000	20,482,000	35,861,000	23,615,000	12,246,000	553,650,000	680,024,606	190,770,000	47,570,000	553,650,000	47,570,000	349,847,719		
30	1985	8,203		8,203	57,421,000		57,421,000	9,479,000	11,849,000	21,328,000	36,093,000	23,615,000	12,478,000	563,650,000	692,502,606	190,770,000	47,570,000	563,650,000	47,570,000	362,325,719		
31	1986	8,113		8,113	56,791,000		56,791,000	9,873,000	12,341,000	22,214,000	34,577,000	23,615,000	10,962,000	573,650,000	703,464,606	190,770,000	47,570,000	573,650,000	47,570,000	373,287,719		
32	1987	8,085		8,085	56,595,000		56,595,000	10,282,000	12,852,000	23,134,000	33,461,000	23,615,000	9,846,000	583,650,000	713,310,606	190,770,000	47,570,000	583,650,000	47,570,000	383,133,719		
33	1988	8,031		8,031	56,217,000		56,217,000	10,707,000	13,384,000	24,091,000	32,126,000	23,615,000	8,511,000	593,650,000	721,821,606	190,770,000	47,570,000	593,650,000	47,570,000	391,644,719		
34	1989	7,955		7,955	55,685,000		55,685,000	11,151,000	13,939,000	25,090,000	30,595,000	23,615,000	6,980,000	603,650,000	728,801,606	190,770,000	47,570,000	603,650,000	47,570,000	398,624,719		
35	1990	7,935		7,935	55,545,000		55,545,000	11,612,000	14,515,000	26,127,000	29,418,000	23,615,000	5,803,000	613,650,000	734,604,606	190,770,000	47,570,000	613,650,000	47,570,000	404,427,719		
36	1991	7,808		7,808	54,656,000		54,656,000	12,091,000	15,114,000	27,205,000	27,451,000	23,615,000	3,836,000	623,650,000	738,440,606	190,770,000	47,570,000	623,650,000	47,570,000	408,263,719		
37	1992	7,831		7,831	54,817,000		54,817,000	12,591,000	15,739,000	28,330,000	26,487,000	23,615,000	2,872,000	633,650,000	741,312,606	190,770,000	47,570,000	633,650,000	47,570,000	411,135,719		
38	1993	7,776		7,776	54,432,000		54,432,000	13,115,000	16,394,000	29,509,000	24,923,000	23,615,000	1,308,000	643,650,000	742,620,606	190,770,000	47,570,000	643,650,000	47,570,000	412,443,719		
39	1994	7,747		7,747	54,229,000		54,229,000	13,665,000	17,081,000	30,746,000	23,483,000	23,615,000	(132,000)	653,650,000	742,488,606	190,770,000	47,570,000	653,650,000	47,570,000	412,311,719		
40	1995	7,651		7,651	53,557,000		53,557,000	14,241,000	17,801,000	32,042,000	21,515,000	23,615,000	(2,100,000)	663,650,000	740,388,606	190,770,000	47,570,000	663,650,000	47,570,000	410,211,719		
41	1996	7,602		7,602	53,214,000		53,214,000	14,842,000	18,553,000	33,395,000	19,819,000	23,615,000	(3,796,000)	673,650,000	736,592,606	190,770,000	47,570,000	673,650,000	47,570,000	406,415,719		
42	1997	7,538		7,538	52,766,000		52,766,000	15,469,000	19,336,000	34,805,000	17,961,000	23,615,000	(5,654,000)	683,650,000	730,938,606	190,770,000	47,570,000	683,650,000	47,570,000	400,761,719		
43	1998	7,485		7,485	52,395,000		52,395,000	16,122,000	20,153,000	36,275,000	16,120,000	23,615,000	(7,495,000)	693,650,000	723,443,606	190,770,000	47,570,000	693,650,000	47,570,000	393,266,719		
44	1999	7,427		7,427	51,989,000		51,989,000	16,802,000	21,002,000	37,804,000	14,185,000	23,615,000	(9,430,000)	703,650,000	713,013,606	190,770,000	47,570,000	703,650,000	47,570,000	383,836,719		
45	2000	7,381		7,381	51,667,000		51,667,000	17,511,000	21,889,000	39,400,000	12,267,000	23,615,000	(11,348,000)	713,650,000	701,665,606	190,770,000	47,570,000	713,650,000	47,570,000	372,488,719		
46	2001	7,338		7,338	51,366,000		51,366,000	18,247,000	22,809,000	41,056,000	10,310,000	23,615,000	(13,305,000)	723,650,000	688,360,606	190,770,000	47,570,000	723,650,000	47,570,000	359,183,719		
47	2002	7,295		7,295	51,065,000		51,065,000	19,013,000	23,766,000	42,779,000	8,286,000	23,615,000	(15,329,000)	733,650,000	673,031,606	190,770,000	47,570,000	733,650,000	47,570,000	343,854,719		
48	2003	7,236		7,236	50,652,000		50,652,000	19,813,000	24,766,000	44,579,000	6,073,000	23,615,000	(17,542,000)	743,650,000	655,489,606	190,770,000	47,570,000	743,650,000	47,570,000	326,312,719		
49	2004	7,186		7,186	50,302,000		50,302,000	20,647,000	25,809,000	46,456,000	3,846,000	23,615,000	(19,769,000)	753,650,000	635,720,606	190,770,000	47,570,000	753,650,000	47,570,000	306,543,719		
50	2005	7,121		7,121	49,847,000		49,847,000	21,516,000	26,895,000	48,411,000	1,436,000	23,615,000	(22,179,000)	763,650,000	613,541,606	190,770,000	47,570,000	763,650,000	47,570,000	284,364,719		
51	2006	7,098		7,098	49,686,000		49,686,000	22,419,000	28,024,000	50,443,000	(757,000)	23,615,000	(24,372,000)	773,650,000	589,169,606	190,770,000	47,570,000	773,650,000	47,570,000	259,992,719		
52	2007	7,052		7,052	49,364,000		49,364,000	23,356,000	29,195,000	52,551,000	(3,187,000)	23,615,000	(26,802,000)	783,650,000	562,367,606	190,770,000	47,570,000	783,650,000	47,570,000	233,190,719		
53	2008	7,019		7,019	49,133,000		49,133,000	24,330,000	30,413,000	54,743,000	(5,610,000)	23,615,000	(29,225,000)	793,650,000	533,142,606	190,770,000	47,570,000	793,650,000	47,570,000	203,965,719		
54	2009	6,980		6,980	48,860,000		48,860,000	25,340,000	31,675,000	57,015,000	(8,155,000)	23,615,000	(31,770,000)	803,650,000	501,372,606	190,770,000	47,570,000	803,650,000	47,570,000	172,195,719		
55	2010	6,941		6,941	48,587,000		48,587,000	26,388,000	32,985,000	59,373,000	(10,786,000)	23,615,000	(34,401,000)	813,650,000	467,971,606	190,770,000	47,570,000	813,650,000	47,570,000	137,794,719		
56	2011	6,904		6,904	48,328,000		48,328,000	27,475,000	34,344,000	61,819,000	(13,491,000)	23,615,000	(37,106,000)	823,650,000	430,865,606	190,770,000	47,570,000	823,650,000	47,570,000	100,688,719		
57	2012	6,866		6,866	48,062,000		48,062,000	28,599,000	35,749,000	64,348,000	(16,286,000)	23,615,000	(39,901,000)	833,650,000	390,964,606	190,770,000	47,570,000	833,650,000	47,570,000	60,787,719		
58	2013	6,866		6,866	48,062,000		48,062,000	29,759,000	37,199,000	66,958,000	(18,896,000)	23,615,000	(42,511,000)	843,650,000	348,453,606	190,770,000	47,570,000	843,650,000	47,570,000	18,276,719		
59	2014	6,832		6,832	47,826,000		47,826,000	30,949,000	38,686,000	69,635,000	(21,809,000)	23,615,000	(45,424,000)	853,650,000	302,929,606	190,770,000	47,570,000	853,650,000	47,570,000	(27,147,281)		
60	2015	6,832		6,832	47,826,000		47,826,000	32,187,000	40,234,000	72,421,000	(24,595,000)	23,615,000	(48,210,000)	863,650,000	254,719,606	190,770,000	47,570,000	863,650,000	47,570,000	(75,357,281)		
61	2016	6,798		6,798	47,586,000		47,586,000	33,475,000	41,844,000	75,319,000	(27,733,000)	23,615,000	(51,348,000)	873,650,000	203,371,606	190,770,000	47,570,000	873,650,000	47,570,000	(126,705,281)		
62	2017	6,736		6,736	47,027,000		47,027,000	34,814,000	43,518,000	78,332,000	(31,305,000)	23,615,000	(54,920,000)	883,650,000	148,451,606	190,770,000	47,570,000	883,650,000	47,570,000	(181,625,281)		
63	2018	6,708		6,708	46,831,000		46,831,000	36,207,000	45,259,000	81,466,000	(34,635,000)	23,615,000	(58,250,000)	893,650,000	90,201,606	190,770,000	47,570,000	893,650,000	47,570,000	(239,875,281)		
64	2019	6,673		6,673	46,587,000		46,587,000	37,655,000	47,069,000	84,724,000	(38,137,000)	23,615,000	(61,752,000)	903,650,000	28,449,606	190,770,000	47,570,000	903,650,000	47,570,000	(301,627,281)		
65	2020	6,635		6,635	46,322,000		46,322,000	39,161,000	48,951,000	88,112,000	(41,790,000)	23,615,000	(65,405,000)	913,650,000	(36,955,394)	190,770,000	47,570,000	913,650,000	47,570,000	(367,032,281)		
66	2021	6,606		6,606	46,121,000		46,121,000	40,731,000	50,914,000	91,645,000	(45,524,000)	23,615,000	(69,139,000)	923,650,000	(106,094,394)	190,770,000	47,570,000	923,650,000	47,570,000	(436,171,281)		
67	2022	6,579		6,579	45,933,000		45,933,000	42,360,000	52,950,000	95,310,000	(49,377,000)	23,615,000	(72,992,000)	933,650,000	(179,086,394)	190,770,000	47,570,000	933,650,000	47,570,000	(509,163,281)		
68	2023	6,539		6,539	45,654,000		45,654,000	44,054,000	55,068,000	99,122,000	(53,468,000)	23,615,000	(77,083,000)	943,650,000	(256,169,394)	190,770,000	47,570,000	943,650,000	47,570,000	(586,246,281)		
69	2024	6,508		6,508	45,441,000		45,441,000	45,811,000	57,264,000	103,075,000	(57,634,000)	23,615,000	(81,249,000)	953,650,000	(337,418,394)	190,770,000	47,570,000	953,650,000	47,570,000	(667,495,281)		
70	2025	6,477		6,477	45,224,000		45,224,000	47,643,000	59,554,000	107,197,000	(61,973,000)	23,615,000	(85,588,000)	963,650,000	(423,006,394)	190,770,000	47,570,000	963,650,000	47,570,000	(753,083,281)		
71	2026	6,447		6,447	45,014,000		45,014,000	49,549,000	61,936,000	111,485,000	(66,471,000)	23,615,000	(90,086,000)	973,650,000	(513,092,394)	190,770,000	47,570,000	973,650,000	47,570,000	(843,169,281)		
72	2027	6,411		6,411	44,764,000		44,764,000	51,532,000	64,415,000	115,947,000	(71,183,000)	23,615,000	(94,798,000)	983,650,000	(607,890,394)	190,770,000	47,570,000	983,650,000	47,570,000	(937,967,281)		
73	2028	6,382		6,382	44,562,000		44,562,000	53,593,000	66,991,000	120,584,000	(76,022,000)	23,615,000	(99,637,000)	993,650,000	(707,527,394)	190,770,000	47,570,000	993,650,000	47,570,000	(1,037,604,281)		
74	2029	6,360		6,360	44,409,000		44,409,000	55,737,000	69,671,000	125,408,000	(80,999,000)	23,615,000	(104,614,000)	1,003,650,000	(812,141,394)	190,770,000	47,570,000	1,003,650,000	47,570,000	(1,142,218,281)		
75	2030	6,335		6,335	44,234,000		44,234,000	57,966,000	72,458,000	130,424,000	(86,190,000)	23,615,000	(109,805,000)	1,013,650,000	(921,946,394)	190,770,000	47,570,000	1,013,650,000	47,570,000	(1,252,023,281)		
76	2031																					
77	2032																					
78	2033																					
79	2034																					
80	2035																					
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99	2054																					
100	2055	6,315	0	6,315	32,859,000	0	32,859,000	5,671,000	4,698,000	10,369,000	22,489,000	0	0	0	0	0	0	0	0	797,085,618	1,390,102,000	100
Totals		661,492	18,595	676,087	3,439,758,400	53,785,000	3,493,543,400	526,092,000	436,266,000	962,358,000	2,521,185,400	910,054,758	660,305,000	860,305,000		270,778,000	0			592,226,782	797,085,618	1,390,102,000	

Notes:

1. Column 4. The non-firm energy considered in this column represents that energy that is not salable as "firm" under the estimated load curve at time of production. This results from the planned installation of generating units in advance of market requirements.

2. Column 13. Interest at 3 percent on power investment for determination of average firm energy rate.

3. Column 19. Each unit of power investment considered to be repaid within 50 years after that unit is placed in operation.

4. Column 20. Each item of investment considered to be repaid within 60 years after the investment is made.

CHAPTER III

U P P E R D I V I S I O N D E V E L O P M E N T A C C O U N T

Because of the river regulation it would afford, the Colorado River Storage project would possess many of the attributes of simpler reclamation projects now utilizing project power revenues to assist users of irrigation water in paying project irrigation costs. If a complete appraisal had been possible at this time of all potential uses of the water of the Colorado River system in the upper basin within the States of the upper division, a single project plan encompassing all such uses may have been appropriate. Extensive investigations over many years, however, will be necessary to assure a complete and systematic development of the system's water. Progressive future development prompts a slight departure from usual reclamation financial concepts. In the States of the upper division a need will exist for substantial financial assistance for Federal reclamation projects utilizing Upper Colorado River Basin waters. This assistance could be provided by establishment of an account known as the Upper Division Development Account.

To the Upper Division Development Account would be credited all revenues from the sale of electric energy generated or to be generated by the Colorado River Storage project in excess of revenues required to pay project operation, maintenance, and replacement costs.

All construction costs of the Colorado River Storage project which are assigned for repayment from power revenues would be charged against the Upper Division Development Account in accordance with an established project payout schedule.

UPPER DIVISION DEVELOPMENT ACCOUNT

Net credits, being the difference between aggregate credits and aggregate charges in the account, would be used for the purpose of showing complete reimbursement of the reimbursable costs of irrigation projects or units thereof utilizing Upper Colorado River Basin water in the States of the upper division which would not produce sufficient revenues to repay construction costs allocated to irrigation. The annual net credits that would accrue in the Upper Division Development Account under the Colorado River Storage project development plan are shown in column 23 of the tabulation on page 85.

In 100 years the net credits would amount to approximately 1,390 million dollars. Of this amount 592 million dollars would accrue as excess power revenues (interest component) during the period of repayment of power construction costs. The remaining 798 million dollars would accrue as earned surplus during the balance of the 100-year period.

Qualifying criteria for participation in the privileges of the account are suggested herein in an attempt to assure orderly development and equitable participtation of projects of all States of the upper division. Participation of projects or units thereof would be brought about by action of the Congress. The Secretary would recommend to the Congress a project or unit thereof to participate in the privileges of the account if all sources of estimated revenues available to such project or unit thereof over a period of 60 years were insufficient to return the reimbursable costs of the project or unit thereof. A project could participate in the account if it had a benefit-cost ratio of at least unity and could pay its own operation, maintenance, and replacement costs and a part of its construction cost. Projects qualifying for assistance have been designated participating projects.

CHAPTER IV

P A R T I C I P A T I N G P R O J E C T S

In addition to the 100 potential in-basin projects and several major water exportation projects outlined in the Colorado River Report, other potential uses of Upper Colorado River Basin water no doubt remain to be discovered. The consumptive use requirements of all possibilities far exceed the uses apportioned to the upper basin. From the many potentialities projects must be segregated that have consumptive use requirements compatible with the uses apportioned the respective States of the upper division. This, however, will require considerable investigation and detailed study. Thus, to designate features and projects constituting the ultimate plan of development is not practical at this time.

Existing and authorized projects are considered as a first stage of basin development. Construction could now proceed on the second stage of basin development. Included in this second stage would be private undertakings and Federal reclamation projects. Most of the Federal projects would require special financial assistance.

In a broad sense all water-use projects in the States of the upper division beyond the first stage of development would participate indirectly in the regulatory benefits that would be afforded by the Colorado River Storage project through storage water replacements permitting the greatest possible upstream use of apportioned water. Most of these projects, although highly desirable from the National standpoint, would be unable to meet annual operation and maintenance charges and fully repay project construction costs

as the least expensive sites and most convenient water supplies were utilized by earlier developments. Therefore, they would require special financial assistance of the type that could be provided by the Upper Division Development Account.

The plan suggested herein would fit in with comprehensive development of the Upper Colorado River Basin. Construction could proceed concurrently with, independently of, this plan on private undertakings and also on Federal reclamation projects not requiring special financial assistance.

In 60 years net credits of approximately 70 million dollars would accrue to the Upper Division Development Account from the Echo Park unit of the Colorado River Storage project. These credits would allow initial participation of a substantial group of Federal reclamation projects utilizing Upper Colorado River Basin water in the States of the upper division. Construction of other units of the storage project would allow additional Federal reclamation projects to participate in the privileges of the account to the extent of accrued net credits. In this connection the Upper Division Development Account would offer an opportunity for complete development of Upper Colorado River Basin water in the States of the upper division.

The group of projects selected in cooperation with the States of the upper division for initial participation in the development account are as follows:

(tabulation)

PARTICIPATING PROJECTS

All the projects selected for initial participation are in Region 4 except _____ which are in Regions ___ and ____. The latter projects are covered by project reports entitled _____.

The projects selected for initial participation are briefly described as follows:

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1951

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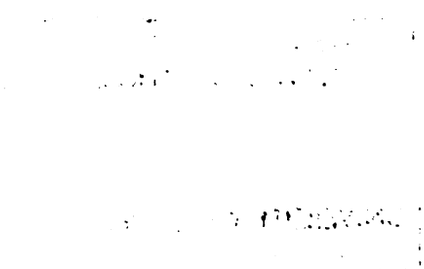

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WATER AND POWER RESOURCES SERVICE

PROJECT DATA

1981

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FOREWORD

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resoures and works to assure that their development is in the best interests of all our people.

The importance of this Nation's water resources is more evident than ever before; it is the purpose of this edition of *Project Data* to add to the understanding of the effort which is being made to conserve and use beneficially this most vital national asset.

Although this book contains considerable statistical and technical material, it is also intended to inform the increasing number of persons in all walks of life who realize that reclamation and conservation of our natural resources such as water is a job for everyone.

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PREFACE

This 1981 edition of Water and Power's *Project Data* introduces the change in organization name, announced on November 6, 1979, from the Bureau of Reclamation to the Water and Power Resources Service. The new name more closely identifies the agency with its principal functions—supplying water and power. As the text and drawings used in this publication were prepared prior to the adoption of the new name, all references to the Bureau of Reclamation, or any derivative thereof, are to be considered synonomous with the Water and Power Resources Service.

Compilations of this kind of information have been published beginning in 1941 under the title *Summarized Data on Federal Reclamation Projects* to 1966 as *Reclamation Project Data* (Supplemental). These publications have served the continuing need for historical, statistical, and technical information on the projects of the Water and Power Resources Service by legislators, State and Federal officials, water users, engineers, educators, students, and others, in foreign countries as well as the United States, who are concerned about water resource development.

As you read about these individual projects, most of which are located west of the 100th Meridian, you will quickly realize that the original statement by the Congress in the Reclamation Act of 1902, " . . . . the construction and maintenance of irrigation works for the storage, diversion, and development of waters for reclamation of arid and semiarid lands. . . . . ," has been expanded by the concept of multiple-purpose development. By applying this concept, the Service assures the Nation that maximum benefits are being derived today and will be in the future as we manage our water resources.

Today attention is focused on the Nation's energy needs and concern for the quality of our environment. These factors have become major considerations in the making of decisions on how our water resources are allocated to agriculture, municipalities and industries, the development of hydroelectric power, fish and wildlife enhancement, and recreation.

In this publication, Service projects, substantially complete and in operation, are reviewed in detail with considerable attention to history, costs, beneficiaries, engineering, and productivity. Newer projects in the early stages of construction, and projects which are authorized but not yet started, have been treated briefly and can be expected to be covered more fully in a future edition.

The names of projects and their chief features are sometimes changed. Names used during the planning and development stages of projects may later be changed by action of the Congress or upon review by the Board on Geographic Names. Statistical data are also subject to change. Dimensions of structures may change because of structural alterations. Reservoir capacities are subject to revision as a result of siltation studies. Changes are sometimes introduced because of different methods of measurement, or because of revised definitions.

The contributions of the individual projects to the Nation's economic strength and recreation resource, when combined, are of major importance. As of September 30, 1978, the Water and Power Resources Service had constructed storage and distribution facilities to serve 11.4 million acres of land with irrigation water.

Crops harvested on farms receiving water from the Service in 1978 were valued at $4,993 million, and cumulative harvest values since the first project crop report was made in 1906 total in excess of $63,061 million.

Municipal and industrial water, 524,000 million gallons of it from Service projects, was delivered to areas populated by 16.6 million people in 1978.

The 50 hydroelectric powerplants constructed and operated by the Service in 1978 had an installed capacity of 10.4 million kilowatts. Within the next 5 years, it is planned that uprating units at existing plants will provide an additional 1-million-kilowatt capacity. The hydroelectric energy totaling 40.6 billion kilowatt-hours generated in the 1978 fiscal year was sufficient to supply the residential needs of over 14 million people.

There were 281 recreation areas, including reservoirs and other facilities, on Service projects at the end of 1978. Recreational use of these areas increased during 1978 to a new record of 69.9 million visitor days. Copies of reprints of individual projects presented in this edition can be obtained by writing to: Water and Power Resources Service, Attn D-922, P O Box 25007, Denver CO 80225.

The Water and Power Resources Service also produces nontechnical and technical publications and maps on its work which are available to the public. These are included in two listings, "Publications for Distribution Without Charge" and "Publications for Sale" which may be obtained by writing to this same address.

We invite your request for these materials. Increasing the public concern and awareness on the role of the Nation's natural resources in our future prosperity and well-being is a responsibility of the Department of the Interior.



Commissioner,
Water and Power Resources Service

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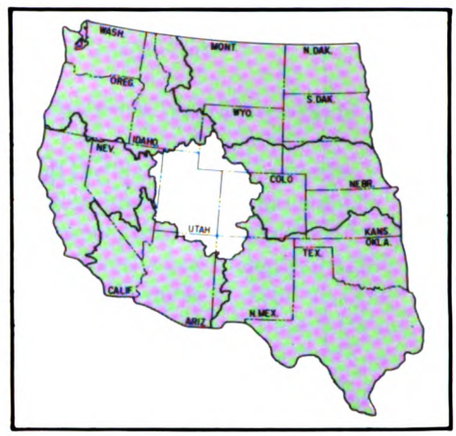
Colorado River Storage Project
(Under Construction)

Arizona, New Mexico, Colorado, Utah, and Wyoming

Upper Colorado Region
Water and Power Resources Service



Glen Canyon Unit

The Colorado River Storage Project (CRSP) provides for the comprehensive development of the Upper Colorado River Basin. The project furnishes the long-time regulatory storage needed to permit States in the upper basin to meet their flow obligation at Lees Ferry, Wyoming, as defined in the Colorado River Compact, and still utilize their apportioned water.

Water stored by the project provides a portion for direct use in the upper basin. Sediment and flooding are better controlled and recreation development and fish and wildlife conservation have benefited. Because of project development, a significant amount of electrical energy is produced to meet the needs of the upper basin and adjacent areas.

The project includes four storage units: Glen Canyon on the Colorado River in Arizona near the Utah border; Flaming Gorge on the Green River in Utah near the Wyoming border; Navajo on the San Juan River in New Mexico near the Colorado border; and Curecanti on the Gunnison River in west-central Colorado. Authorized with, but not part of, are a number of participating projects which will share in the power revenues of the larger project to help pay for irrigation construction costs. These participating projects are listed in the authorization paragraphs.

PLAN

The reservoirs formed by four units of the CRSP have a total capacity of nearly 34 million acre-feet. During periods of low streamflow, the stored water in the upper basin is released to meet the Lees Ferry obligation. Powerplants and other facilities are provided at each dam except Navajo, and a complex transmission system also has been provided. This transmission system carries CRSP power to key load points in the marketing area. The system is integrated with preference-user and private-company transmission lines to form the CRSP Interconnected Transmission System. CRSP hydropower is delivered to preference-user organizations for distribution to their consumers as required by Federal Reclamation Law.

Glen Canyon Dam, Lake Powell, and Glen Canyon Powerplant

Glen Canyon Dam, 15 miles upstream from Lees Ferry, is the key feature of the CRSP. This 710-foot-high structure provides more storage capacity than all other storage features of the project combined. The concrete arch dam has a crest length of 1,560 feet and contains 4,901,000 cubic yards of concrete. Thickness of the dam at the crest is 25 feet, and the maximum base thickness is 300 feet.

A separate spillway is constructed in each abutment. Each spillway consists of an intake structure with two

40- by 52.5-foot radial gates and a lined spillway tunnel. The downstream portions of the spillway tunnel were used during construction as diversion tunnels. Each spillway tunnel reduces in size from 48 to 41 feet in diameter. The combined spillway discharge capacity is 208,000 cubic feet per second at elevation 3700.

The outlet works near the left abutment of the dam consists of four 96-inch-diameter pipes. Each outlet is controlled by one 96-inch-ring follower gate and one 96-inch hollow-jet valve. The combined river outlet works capacity is 15,000 cubic feet per second.

Total capacity for Lake Powell is 27 million acre-feet, and the active capacity is 20,876,000 acre-feet. At normal water surface elevation, the reservoir has a length of 186 miles and a surface area of 161,390 acres.

The powerplant at the toe of the dam consists of eight 118,750-kilowatt generators, driven by eight 155,500-horsepower turbines. Total nameplate generating capacity for the powerplant is 950,000 kilowatts. Eight penstocks through the dam convey water to the turbines. Each penstock reduces in size from 15 to 14 feet in diameter.

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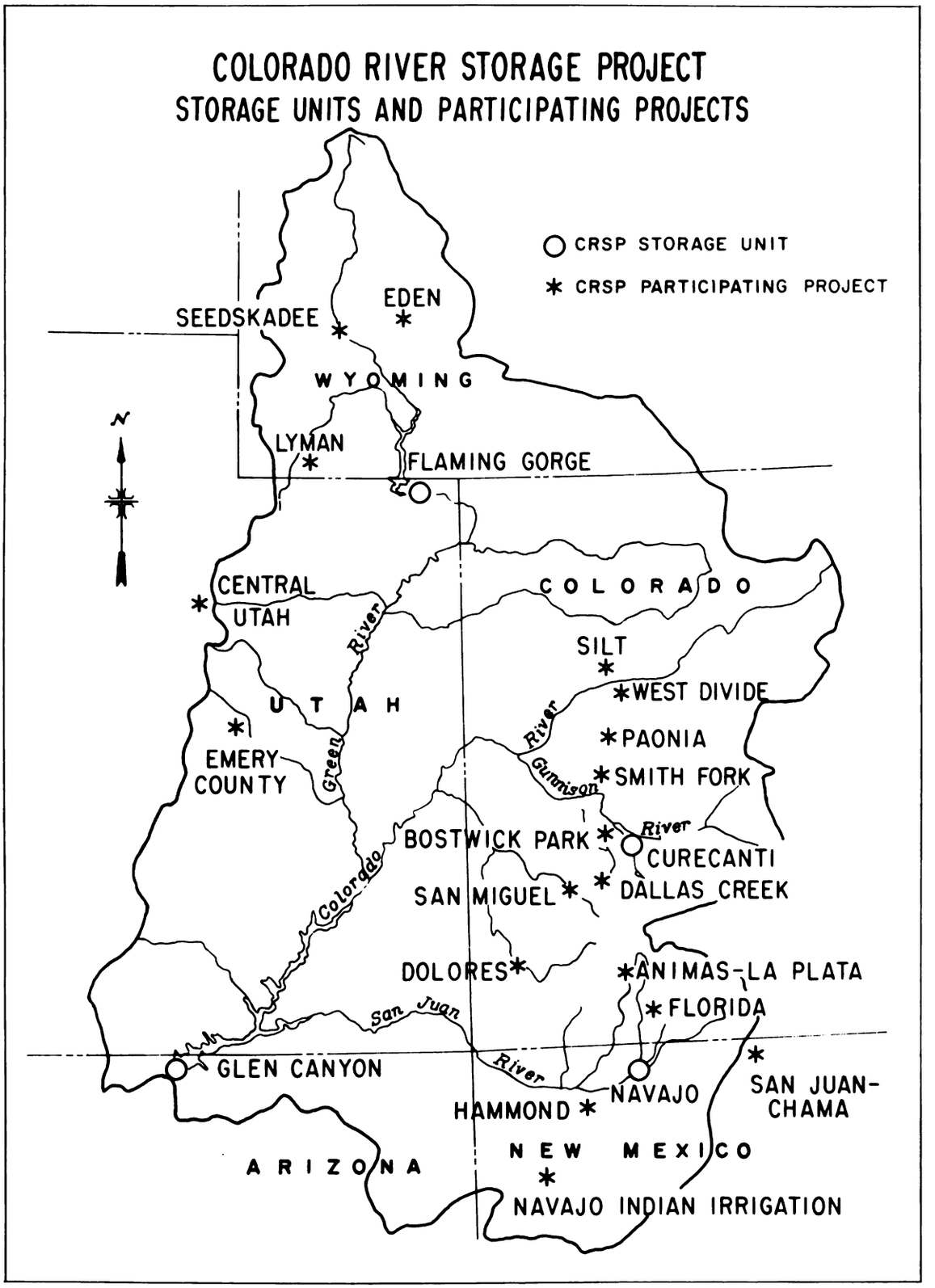

Colorado River Storage Project

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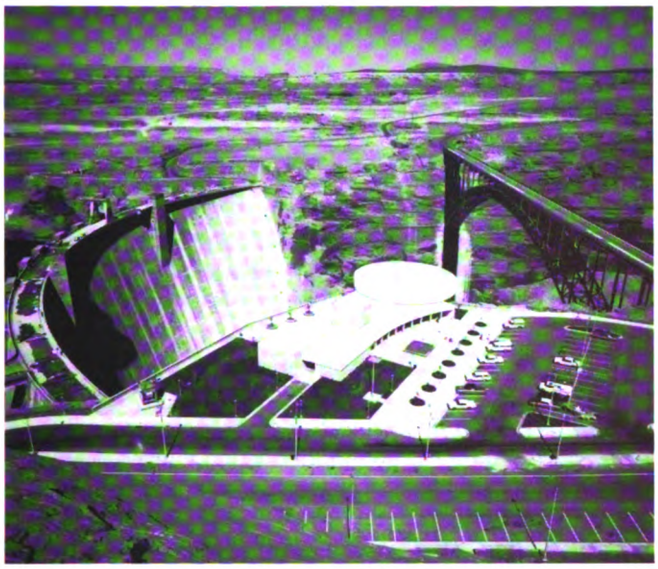
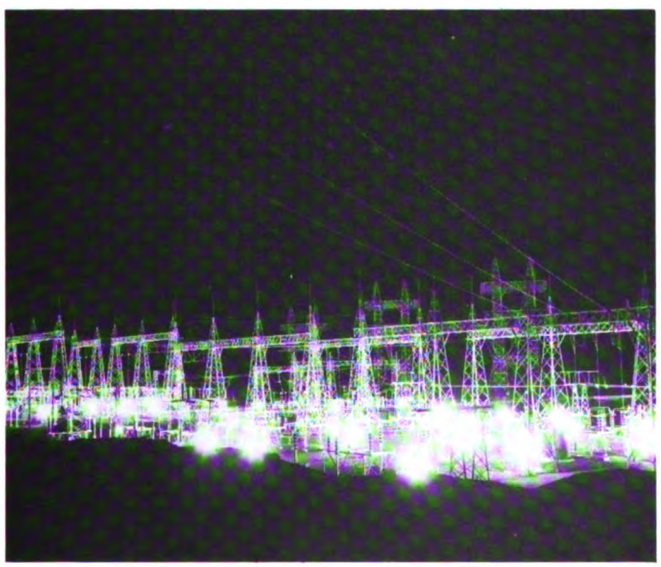


Glen Canyon Dam and Bridge

Glen Canyon Bridge

The absence of rail facilities near the construction site of Glen Canyon Dam necessitated construction of Glen Canyon Bridge for the transportation of construction materials and equipment from railheads to the site. A single-span, steel-arch structure, the bridge has an overall length of 1,271 feet. At its completion in 1959, it was the highest arch bridge in the world and the second longest of its type in the United States. The bridge spans the Colorado River 865 feet downstream from the dam. The deck of the bridge is 700 feet above river level.



Glen Canyon Powerplant Switchyard

Flaming Gorge Unit

Flaming Gorge Dam, Reservoir, and Powerplant

Flaming Gorge Dam is on the Green River in northeastern Utah about 32 miles downstream from the Utah-Wyoming border. The concrete thin-arch structure has a maximum height of 502 feet and a crest length of 1,285 feet, and contains 987,000 cubic yards of concrete. The top thickness is 27 feet, and the maximum base thickness is 131 feet.

Floodwaters are spilled through a 675-foot-long tunnel spillway extending through the left abutment. The concrete-lined tunnel has a maximum capacity of 28,800 cubic feet per second and reduces in size from 26.5 feet in diameter at the upstream portal to 18 feet in diameter at the downstream portal. The spillway intake structure is controlled by two 16.75- by 34-foot hydraulically operated fixed-wheel gates.



Flaming Gorge Dam

The outlet works consist of two 72-inch steel pipes through the dam, reducing to 66 inches at the toe of the dam and continuing downstream to a valve structure on the left riverbank where discharge is directed into the river channel. Each outlet is controlled by a 66-inch hydraulically operated ring-follower gate at the downstream toe of the dam and a 66-inch hydraulically operated hollow-jet valve at the valve structure. Discharge capacity at elevation 6045.0 feet is 4,000 cubic feet per second.

The Flaming Gorge Reservoir has a total capacity of 3,788,900 acre-feet and an active capacity of 3,515,700 acre-feet. At normal water surface elevation, the reservoir has a surface area of 42,020 acres.

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Three 10-foot-diameter penstock pipes near the center of the dam convey water to the powerplant. The powerplant is at the downstream toe of the dam and houses three 36,000-kilowatt generators driven by three 50,000-horsepower Francis-type turbines.

Navajo Unit

Navajo Dam and Reservoir

Navajo Dam is on the San Juan River in northwestern New Mexico about 34 miles east of Farmington. The dam is a rolled earthfill embankment with a structural height of 402 feet and a crest length of 3,648 feet. The dam contains 26,840,863 cubic yards of materials. The top width of the dam is 30 feet, and the maximum base width is 2,566 feet.

The spillway, on the right abutment, consists of an approach channel, concrete crest structure without gates, spillway bridge, concrete chute and stilling basin, and outlet channel. The width of the spillway ranges from 138 feet in the chute section to 195 feet in the stilling basin. The design capacity at maximum water surface elevation is 34,000 cubic feet per second.

Releases of water for downstream requirements are made through the outlet works, consisting of a concrete tower intake structure, an 18.75-foot-diameter concrete-lined tunnel, and valve house. Control is by one 6- by 13-foot fixed-wheel gate, two 72-inch ring-follower gates, and two 72-inch hollow-jet valves. The outlet works tunnel, located in the right abutment, is 1,603 feet long. Discharge capacity is 4,200 cubic feet per second at elevation 6101.5.

An auxiliary outlet works consisting of a concrete intake structure and a concrete-lined tunnel with gate chamber for two 4-foot-square gates also is located in the right abutment. Discharge is into the spillway stilling basin.

Navajo Reservoir extends 35 miles up the San Juan River, 13 miles up the Pine River, and 4 miles up the Piedra River in southern Colorado. When filled, the reservoir occupies 15,610 acres, with a total capacity of 1,708,600 acre-feet and an active capacity of 1,036,100 acre-feet.

Curecanti Unit

The Curecanti Unit developed the water storage and hydroelectric power generating potential along a 40-mile section of the Gunnison River in Colorado by the construction of three dams and powerplants: Blue Mesa, Morrow Point, and Crystal.

Blue Mesa Dam, Reservoir, and Powerplant

Blue Mesa Dam is on the Gunnison River about 30 miles below Gunnison, and 1.5 miles below Sapinero, Colo. The zoned earthfill embankment has a structural height of 390 feet, a crest length of 785 feet, and a volume of 3,093,000 cubic yards of materials.

The spillway consists of a concrete intake structure with two 25- by 33.5-foot radial gates, concrete-lined tunnel, concrete flip bucket structure, and stilling basin. Maximum discharge of the spillway is 34,000 cubic feet per second.

The outlet works consists of an intake structure, tunnel, and manifold anchor block. The outlet works is control-



Navajo Dam and Reservoir



Blue Mesa Dam, Powerplant, and Reservoir

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led by one 16- by 18-foot fixed-wheel gate in the intake structure and by two 84-inch ring-follower gates and two 84-inch hollow-jet valves in a gate house at the terminus of the outlet conduits. Maximum discharge from the outlet works is 5,000 cubic feet per second at maximum water surface elevation, with two 84-inch hollow-jet valves 62 percent open.

Blue Mesa Reservoir has a total capacity of 940,800 acre-feet and an active capacity of 748,500 acre-feet. At maximum water surface elevation, the reservoir occupies 9,180 acres.

The Blue Mesa Powerplant consists of two 30,000-kilowatt generators, driven by two 41,500-horsepower turbines. Each turbine is designed to operate at a maximum head of about 360 feet.

One 16-foot-diameter penstock conveys water to the two turbines and also carries water for the outlet works. After branching from the main penstock, each of the penstock laterals is controlled by 156-inch butterfly valves. The main penstock is reduced by a wye branch to the outlet works control valves.

Morrow Point Dam, Reservoir, and Powerplant

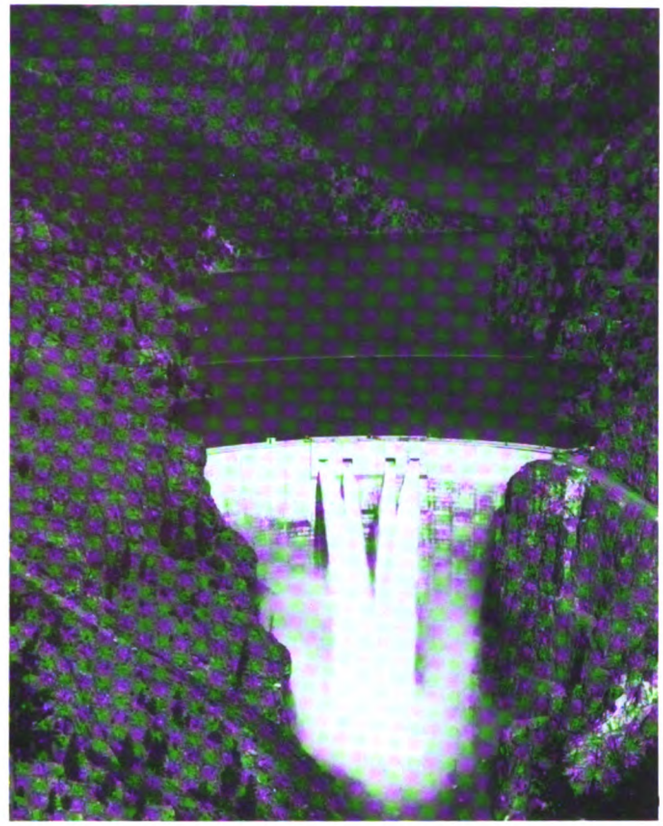
Morrow Point Dam, 12 miles downstream from Blue Mesa Dam, is Reclamation's first thin-arch, double-curvature dam. It is 468 feet high, 52 feet thick at the base, and 12 feet thick at the crest. The dam has a crest length of 724 feet and a volume of 365,180 cubic yards of concrete.

The spillway consists of four orifice-type openings in the top central part of the dam, providing a free-fall discharge higher than 350 feet to the concrete stilling basin at the toe of the dam. Each of the four spillway openings is controlled by a 15- by 16.83-foot fixed-wheel gate. Maximum capacity of the spillway is 41,000 cubic feet per second.

The outlet works consists of one stainless-steel lined 4-foot-square conduit through the dam. Control is by two 3.5-foot-square slide gates. Discharge capacity of the outlet works is 1,500 cubic feet per second.

Reservoir capacity behind Morrow Point Dam is 117,190 acre-feet at maximum water surface. The active capacity is 42,120 acre-feet. Surface area for Morrow Point Reservoir is 817 acres at elevation 7160.

The powerplant chamber is tunnelled into the canyon wall in the left abutment about 400 feet below the ground surface. The powerplant chamber is 231 feet long and 57 feet wide with a height ranging from 65 to 134 feet. There are two 60,000-kilowatt generators driven by two 83,000-horsepower turbines. The power penstocks consist of 13.5-foot-diameter steel liners in 18-foot-diameter tunnels.



Morrow Point Dam and Reservoir

Crystal Dam, Reservoir, and Powerplant

Crystal Dam is located 6 miles downstream from Morrow Point Dam and approximately 20 miles east of Montrose, Colo. The dam is a double-curvature thin-arch type, 323 feet high, with a crest length of 635 feet, and a volume of 147,000 cubic yards of materials.

The spillway consists of an ungated ogee crest on the right side of the dam and a plunge pool at the toe of the dam. The crest is at elevation 6756.0 feet, 1 foot above normal water surface. The plunge pool is unlined except for a downstream retaining wall to contain the river fill material.

Water is conveyed from the reservoir to the hydraulic turbine by an 11.5-foot-diameter concrete penstock, the lower portion of which is steel lined. The intake structure consists of a metal trashrack, a 10.58- by 17.27-foot bulkhead gate, an 8.33- by 13.58-foot fixed-wheel gate, and a transition. The fixed-wheel gate is provided for emergency closure and for inspection and maintenance of the penstock. Water from the turbine exits through the draft tube to the tailrace.

The river outlets consist of an intake structure on the upstream face of the dam and two 54-inch pipes through the dam and powerplant. The 54-inch ring-follower

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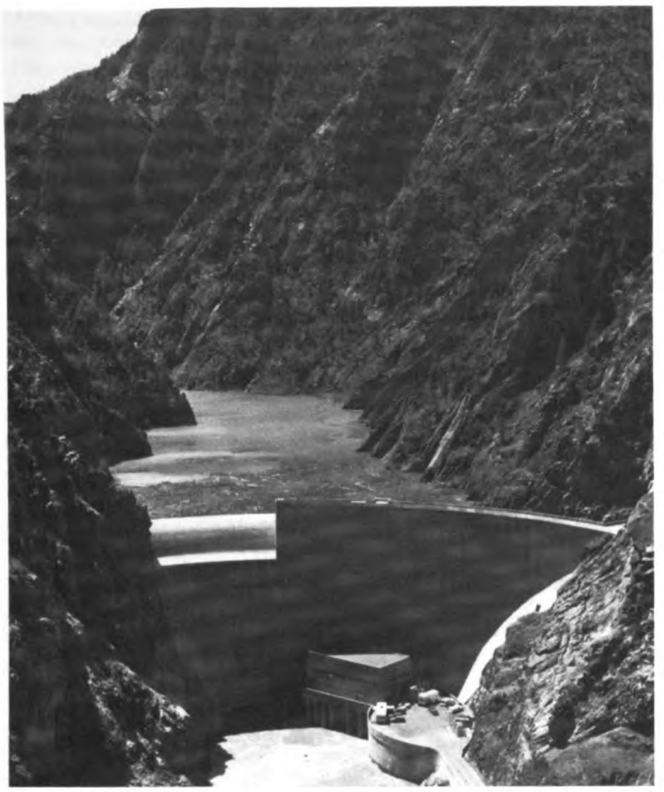

Crystal Dam and Powerplant

emergency gates and 48-inch jet-flow regulating gates in the powerplant control outlet flows. The intake structure includes a metal trashrack, a concrete arch conduit to convey water to the 54-inch pipes, and provisions for installing a bulkhead gate. The Morrow Point Dam river outlet bulkhead gate can be used to close off the outlet pipes for inspection or maintenance.

The reservoir has a total capacity of 26,000 acre-feet and an active capacity of 13,000 acre-feet at above elevation 6700, with a surface area of 340 acres.

The powerplant, completed in 1978, has a generating capacity of 28,000 kilowatts from one unit driven by a 39,000-horsepower hydraulic turbine. It is connected to the main CRSP transmission system at the Curecanti substation by a 115-kilovolt line.

DEVELOPMENT

Early History

Settlement of the upper drainage basin began in 1854 when the early pioneers established Fort Supply in Wyoming on the Emigrant Trail and diverted water from Blacks Fork to the adjacent lands. Breckenridge, Colo., on the basin's eastern rim, was settled in 1859 by miners and prospectors pushing over the mountains from older mining districts on the eastern slope of the Continental Divide. Within the next decade, other mining camps were established nearby. Unsuccessful miners turned to farming and supplied agricultural products to the mining communities. Settlements grew downward from the mountains to the valleys, the advance being slowed somewhat by conflicts with the Indians who occupied the territory. Grand Junction, Colo., now the largest community in the upper drainage basin, was not settled until 1882. The greater part of the Uinta Basin in northeastern Utah was established as an Indian reservation in 1861, and lands unoccupied by Indians were not open to settlement until 1905. Numerous tributary streams in the upper drainage basin have been diverted to irrigate mountain meadows and valleys, farmlands, and broader valleys at the base of the mountains.

Investigations

Investigations of means to develop the waters of the Upper Colorado River system were started by the Reclamation Service in 1902, the year of its organization. Since that year, many of the larger irrigation projects within the basin have been undertaken with Federal assistance, and the Bureau of Reclamation has constructed, or is now constructing, 25 projects to utilize water in the upper basin. The need for the Colorado River Storage Project was envisioned at the time of the Colorado River Compact of 1922. In dividing Colorado River water between the Upper and Lower Colorado River Basins, the compact set aside for consumption in the upper basin 7,500,000 acre-feet of water each year. However, this allocation is contingent upon the upper basin's delivering to the lower basin not less than 75 million acre-feet of water in any period of 10 consecutive years and delivering additional water for use in Mexico under certain circumstances. The dividing point between the two basins is at Lees Ferry, near the northern border of Arizona.

Water allocated to the upper basin was further apportioned to the individual States of Arizona, Colorado, New Mexico, Utah, and Wyoming by the Upper Colorado River Basin Compact of 1948. This compact also created the Upper Colorado River Commission, consisting of representatives of the Federal Government and each contracting State except Arizona.

The flow of the Colorado River is extremely erratic, varying from 4 to 22 million acre-feet annually at Lees Ferry. There is a tendency for the high years or the low years to be grouped, thus accentuating problems of river regulation and use. In prolonged dry periods, there is not enough water to permit the upper basin to increase its use of water under the 1922 compact and, at the same time, make the required deliveries to the lower basin. In wetter periods, however, flows are more than sufficient for these purposes. Large storage reservoirs, that can be

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filled when flows are high and can provide additional water when needed for compact fulfillment, are required. Favorable sites for such reservoirs are found in the deep canyons of the Colorado River and its principal tributaries in the upper basin. A plan for the CRSP, including a series of dams and reservoirs to provide storage capacity in combination with power development and other services, was presented in a Bureau of Reclamation report in 1950, which was subsequently printed as House Document 364, 83d Congress, 2d session. The report was formulated in cooperation with other Federal agencies and with the Upper Colorado River Commission. An initial group of participating projects that would develop water for irrigation and other purposes in the upper basin and would be linked financially with the storage project also was described in the 1950 report.

Authorization

Construction of four storage units of the Colorado River Storage Project and 11 participating projects was authorized by the act of April 11, 1956 (Public Law 485, 84th Cong., 70 Stat. 105). Additional projects have been added since the original legislation was adopted.

Authorized developments are:
Glen Canyon Unit on the Colorado River in Arizona and Utah,
Flaming Gorge Unit on the Green River in Utah and Wyoming,
Navajo Unit on the San Juan River in New Mexico and Colorado, and
Curecanti Unit, consisting of three dams on the Gunnison River in Colorado.

Participating projects originally authorized are:
Central Utah (initial phase), Utah,
Emery County, Utah,
Florida, Colorado,
Hammond, New Mexico,
La Barge, Wyoming,[1]
Lyman, Wyoming and Utah,
Paonia, Colorado (works additional to existing project),
Pine River Extension, Colorado and New Mexico,[1]
Seedskadee, Wyoming,
Silt, Colorado, and
Smith Fork, Colorado.

The Eden Project in Wyoming, by terms of its authorizing act of June 28, 1949, became financially related to the Colorado River Storage Project as a participating project. In 1962, authorizing legislation named the following two as participating projects:

San Juan-Chama, Colorado and New Mexico, and Navajo Indian Irrigation (being constructed for the Bureau of Indian Affairs by the Bureau of Reclamation).

[1]Later found to be infeasible and deleted from the plan.

In 1964, the following three projects also were named:
Bostwick Park, Colorado,
Fruitland Mesa, Colorado, and
Savery-Pot Hook, Colorado and Wyoming.

The Colorado River Basin Project Act of September 30, 1968, authorized five additional projects as participating projects:
Animas-La Plata, Colorado and New Mexico,
Dallas Creek, Colorado,
Dolores, Colorado,
San Miguel, Colorado, and
West Divide, Colorado.

CONSTRUCTION

Construction of the Glen Canyon and Flaming Gorge Units began in October 1956. Glen Canyon Dam was topped out in 1963. Hydroelectric power from the powerplant started on line in 1964. Flaming Gorge Dam was topped out in late 1962, and the powerplant began commercial operation in 1963. Navajo Dam was commenced in 1957 and completed in 1963. Construction of the Curecanti Unit began with the start of Blue Mesa Dam in 1962. Blue Mesa was completed in 1966. Morrow Point Dam was started in 1963 and was completed in 1968. Power generation was initiated in September 1967 at the Blue Mesa Powerplant, and in December 1970 at Morrow Point. Construction on Crystal Dam commenced in June 1973 and was completed in 1976. The powerplant, completed in 1978, started power generation in July 1978.

Operating Agency

The Bureau of Reclamation operates and maintains the storage units of the CRSP.

BENEFITS

The Upper Colorado River Basin has a scarcely tapped potential of agricultural, industrial, and recreational assets. It contains tremendous quantities of uranium, coal, and other minerals. Realization of the potential in economic growth and contribution to the national welfare are dependent on maximum utilization of limited water supplies. The Colorado River Storage Project and participating projects conserve the very limited precipitation which falls principally in the form of snow in the high mountains and use it for municipal, industrial, and agricultural growth. Project development provides municipal and industrial water supplies, flood control, extensive recreation, and fish and wildlife preservation.

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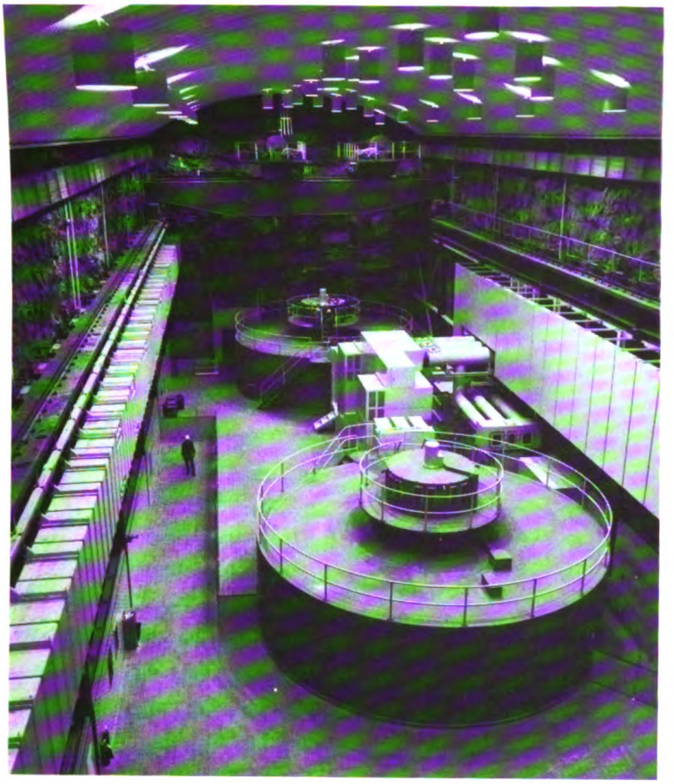


Morrow Point Powerplant

Recreation

Construction and completion of these major units of the CRSP with subsequent filling of the reservoirs have created scenic and recreational attractions of unique national significance. Visitors come from every State in the union as well as from many foreign countries. The Congress has officially designated Glen Canyon, Flaming Gorge, and the Curecanti Unit as National Recreation Areas. Glen Canyon National Recreation Area is administered by the National Park Service, where visitation during 1977 totaled 2,127,419. Flaming Gorge, administered by the Forest Service, had a visitation during 1977 of 680,870. Blue Mesa, Morrow Point, and Crystal recreation areas are administered by the National Park Service. Attendance there during 1977 totaled 869,895. Navajo Unit recreation areas are administered by Colorado Division of Parks and Outdoor Recreation, and the New Mexico State Parks and Recreation Commission; visitation during 1977 totaled 486,743.

PROJECT DATA

Facilities in Operation or Under Construction

Storage dams	6
Powerplants	5

ENGINEERING DATA

Water Supply

COLORADO RIVER

Drainage area at Glen Canyon Dam	108,335	mi²
Annual discharge:		
Maximum (1917)	21,859,000	acre-ft
Minimum (1934)	4,377,000	acre-ft
Average	11,724,000	acre-ft

GUNNISON RIVER—CRSP

Drainage area at Blue Mesa Dam	3,500	mi²
Annual discharge:		
Maximum (1957)	1,715,000	acre-ft
Minimum (1934)	537,000	acre-ft
Average	1,108,000	acre-ft

SAN JUAN RIVER

Drainage area at Navajo Dam[2]	3,558	mi²
Annual discharge:		
Maximum (1932)	1,856,000	acre-ft
Minimum (1934)	364,000	acre-ft
Average	928,000	acre-ft

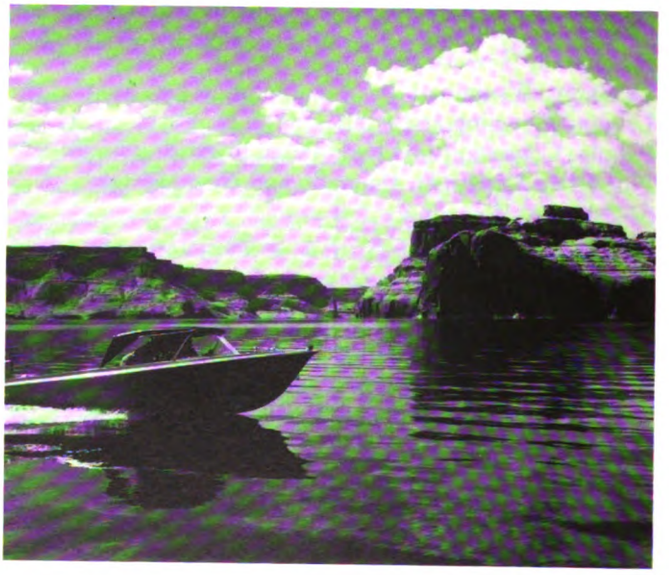
[2]Gage station near Blanco, N. Mex., used as streamflow at Navajo Dam.

Storage Facilities

GLEN CANYON DAM

Type: Concrete arch
Location: On the Colorado River, 15 mi upstream from Lees Ferry, Ariz.
Construction period: 1957-64
Reservoir, Lake Powell:

Total capacity at El. 3700	27,000,000	acre-ft
Active capacity	20,876,000	acre-ft
Surface area	161,390	acres



Boating on Lake Powell

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Dimensions:		
Structural height	710	ft
Hydraulic height	583	ft
Top thickness	25	ft
Maximum base thickness	300	ft
Crest length	1,560	ft
Crest elevation	3715.0	ft
Total volume	4,901,000	yd^3
Spillways: One concrete-lined tunnel spillway in each abutment, controlled by two 40- by 52.5-ft radial gates.		
Elevation top of gates	3700.0	ft
Crest elevation	3648.0	ft
Combined capacity at El. 3700	208,000	ft^3/s
Outlet works: Four 96-in-diameter pipes, each controlled by one 96-in ring-follower gate and one 96-in hollow-jet valve.		
Capacity of all outlets at El. 3648	15,000	ft^3/s

Flaming Gorge Dam

Type: Concrete thin arch		
Location: On the Green River, 32 mi downstream from the Utah-Wyoming border.		
Construction period: 1956-64		
Reservoir, Flaming Gorge:		
Total capacity at El. 6040	3,788,700	acre-ft
Active capacity	3,515,700	acre-ft
Surface area	42,020	acres
Dimensions:		
Structural height	502	ft
Hydraulic height	455	ft
Top thickness	27	ft
Maximum base thickness	131	ft
Crest length	1,285	ft
Crest elevation	6047.0	ft
Total volume	987,000	yd^3
Spillway: Concrete-lined tunnel through left abutment, controlled by two 16.75- by 34-ft hydraulically operated fixed-wheel gates.		
Crest elevation	6006.0	ft
Capacity at El. 6046	28,800	ft^3/s
Outlet works: Two 72-in steel pipes reducing to 66-in, each controlled by a 66-in ring-follower gate and a 66-in hollow-jet valve.		
Capacity at El. 6045	4,000	ft^3/s

Navajo Dam

Type: Zoned earthfill		
Location: On the San Juan River, about 34 mi east of Farmington, N. Mex.		
Construction period: 1957-63		
Reservoir, Navajo:		
Total capacity at El. 6085	1,708,600	acre-ft
Active capacity	1,036,100	acre-ft
Surface area	15,610	acres
Dimensions:		
Structural height	402	ft
Hydraulic height	388	ft
Top width	30	ft
Maximum base width	2,566	ft
Crest length	3,648	ft
Crest elevation	6108.0	ft
Total volume	26,840,863	yd^3
Spillway: Uncontrolled concrete crest and concrete-lined chute at right abutment.		
Crest length	138	ft
Crest elevation	6085.0	ft
Capacity at El. 6101.5	34,000	ft^3/s
Outlet works: Concrete-lined tunnel, controlled by one 6- by 13-ft fixed-wheel gate, two 72-in ring-follower gates, and two 72-in hollow-jet valves.		
Capacity at El. 6101.5	4,200	ft^3/s
Auxiliary outlet works: Concrete-lined tunnel in right abutment, controlled by two 4-ft-square tandem outlet gates.		
Capacity at El. 6085	1,700	ft^3/s

Blue Mesa Dam

Type: Zoned earthfill		
Location: On the Gunnison River, 30 mi below Gunnison, Colo.		
Construction period: 1962-66		
Reservoir, Blue Mesa:		
Total capacity at El. 7519.4	940,800	acre-ft
Active capacity	748,500	acre-ft
Surface area	9,180	acres
Dimensions:		
Structural height	390	ft
Hydraulic height	342	ft
Top width	30	ft
Maximum base width	1,550	ft
Crest length	785	ft
Crest elevation	7528.0	ft
Total volume	3,093,000	yd^3
Spillway: Concrete-lined tunnel, controlled by two 25- by 33.5-ft radial gates.		
Elevation top of gates	7528.0	ft
Crest elevation	7487.9	ft
Capacity at El. 7519.4	34,000	ft^3/s
Outlet works: Concrete-lined tunnel, controlled by one 16- by 18-ft fixed-wheel gate, two 84-in ring-follower gates, and two 84-in hollow-jet valves.		
Capacity at El. 7519.4 with hollow-jet valves 62 percent open	5,000	ft^3/s

Morrow Point Dam

Type: Double-curvature, thin-arch concrete		
Location: On the Gunnison River, 12 mi downstream from Blue Mesa Dam.		
Construction period: 1963-68		
Reservoir, Morrow Point:		
Total capacity at El. 7160	117,190	acre-ft
Active capacity	42,120	acre-ft
Surface area	817	acres
Dimensions:		
Structural height	468	ft
Hydraulic height	400	ft
Top thickness	12	ft
Maximum base thickness	52	ft
Crest length	724	ft
Crest elevation	7165.0	ft
Total volume	365,180	yd^3
Spillway: Four orifice-type free-fall spillways at the top center of the dam, each controlled by 15- by 16.83-ft fixed-wheel gates.		
Elevation top gates	7140.0	ft
Crest elevation	7123.0	ft
Capacity at El. 7165	41,000	ft^3/s
Outlet works: One stainless steel-lined 4-ft-square conduit through the center of the dam near the base, controlled by two 3.5-ft-square slide gates.		
Capacity at El. 7165	1,500	ft^3/s

Crystal Dam

Type: Double-curvature, thin-arch concrete		
Location: On the Gunnison River, 6 mi downstream from Morrow Point Dam.		
Construction period: 1973-76		
Reservoir, Crystal:		
Total capacity at El. 6755	26,000	acre-ft

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Active capacity	13,000	acre-ft
Surface area	340	acres
Dimensions:		
Structural height	323	ft
Hydraulic height	227	ft
Top width	10	ft
Maximum base width	29	ft
Crest length	635	ft
Crest elevation	6772.0	ft
Total volume	147,000	yd^3

Spillway: Ungated ogee crest on the right side of the dam and a plunge pool at the toe of the dam. Crest is at El. 6756 ft, 1 ft above normal water surface. Plunge pool is unlined except for downstream retaining wall to contain river fill material.

Outlet works: Two 54-in pipes through the dam and powerplant controlled by two 54-in ring-follower emergency gates and two 48-in jet-flow regulating gates.

Power Facilities

Glen Canyon Powerplant

Location: At the toe of Glen Canyon Dam.

Year of initial operation: 1964		
Nameplate capacity	950,000	kW
Number and capacity of generators (8)	118,750	kW
Maximum head	560	ft

Flaming Gorge Powerplant

Location: At the toe of Flaming Gorge Dam.

Year of initial operation: 1963		
Nameplate capacity	108,000	kW
Number and capacity of generators (3)	36,000	kW
Maximum head	440	ft

Blue Mesa Powerplant

Location: At the toe of Blue Mesa Dam.

Year of initial operation: 1967		
Nameplate capacity	60,000	kW
Number and capacity of generators (2)	30,000	kW
Maximum head	360	ft

Morrow Point Powerplant

Location: Underground tunnel below left abutment of Morrow Point Dam.

Year of initial operation: 1970		
Nameplate capacity	120,000	kW
Number and capacity of generators (2)	60,000	kW
Maximum head	405	ft

Crystal Powerplant

Location: At the toe of Crystal Dam.

Year of initial operation: 1978		
Nameplate capacity	28,000	kW
Number and capacity of generators (1)	28,000	kW
Maximum head	224	ft

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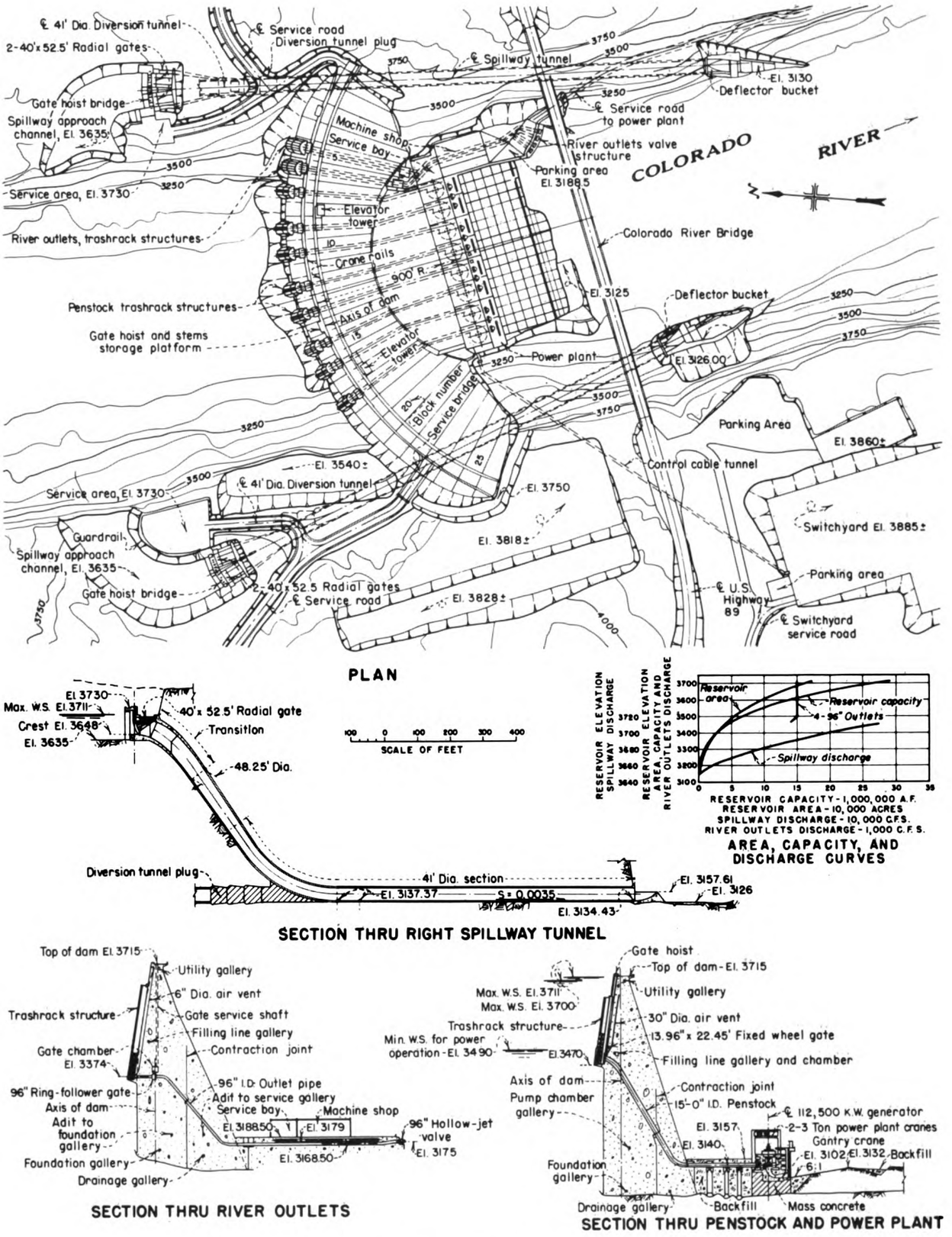

PLAN

SECTION THRU RIGHT SPILLWAY TUNNEL

AREA, CAPACITY, AND DISCHARGE CURVES

SECTION THRU RIVER OUTLETS

SECTION THRU PENSTOCK AND POWER PLANT

Glen Canyon Dam and Powerplant, Plan and Sections

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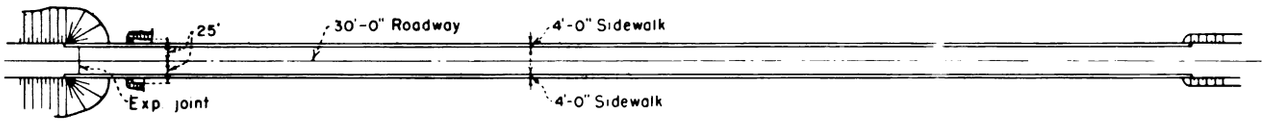
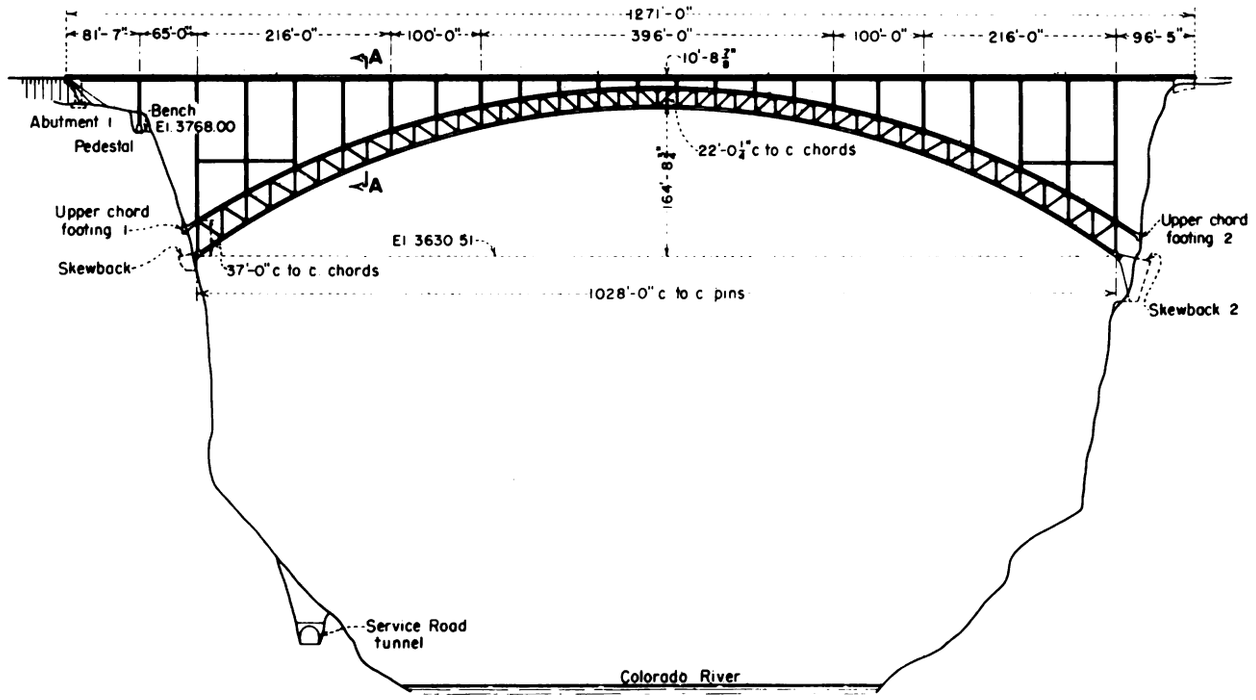
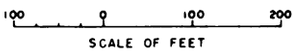
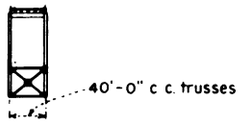


PLAN



ELEVATION





SECTION A-A

Glen Canyon Bridge, Plan and Elevation

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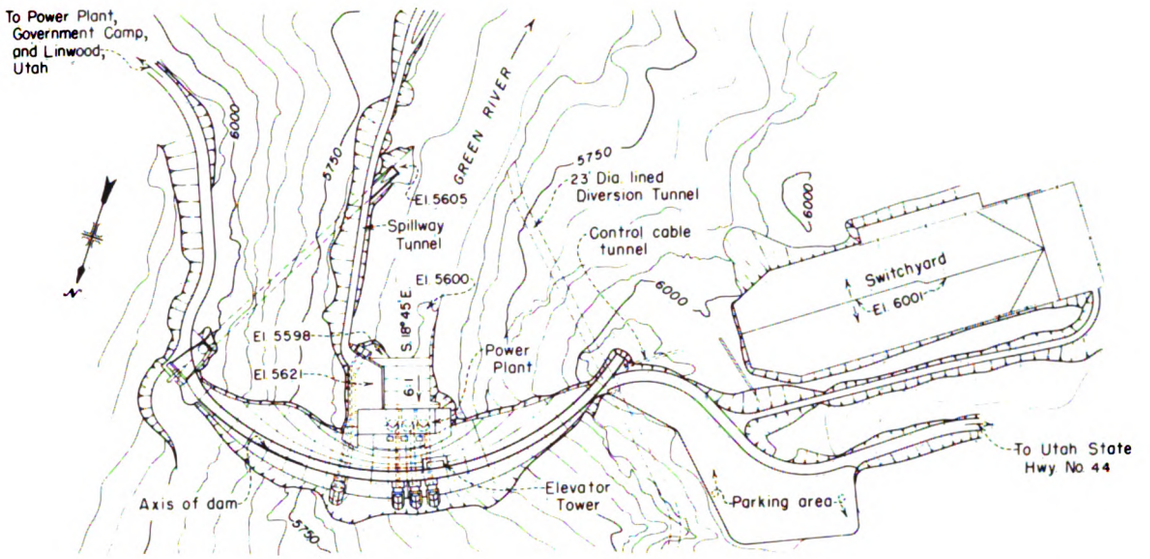

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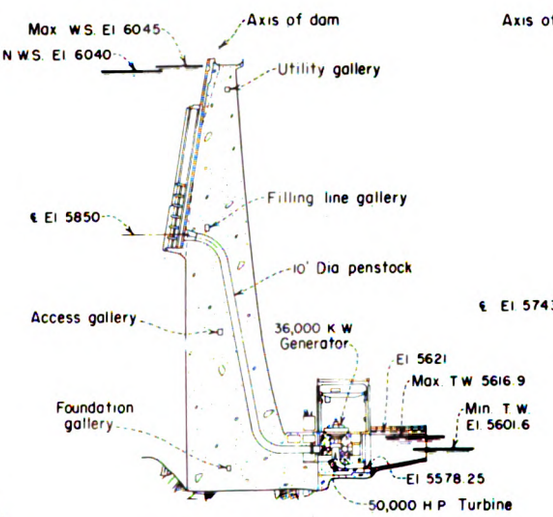

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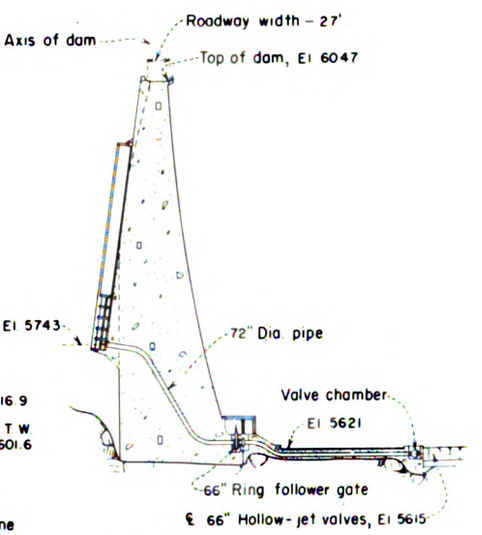

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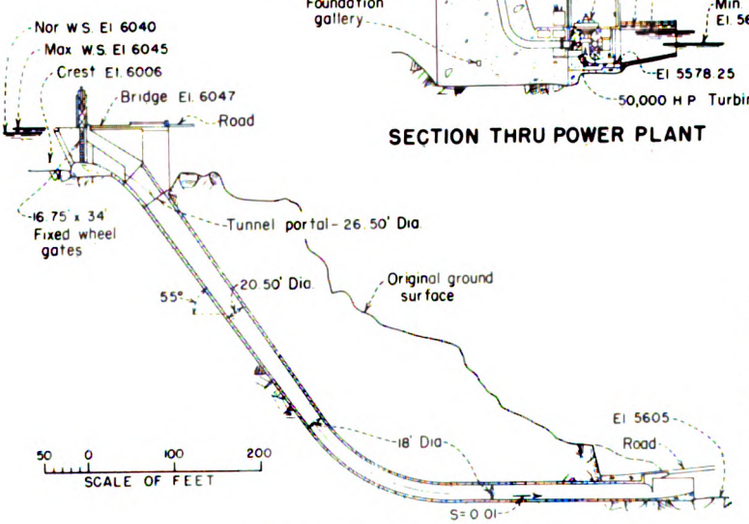

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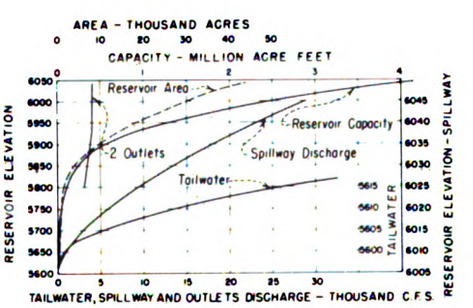

TAILWATER, AREA, CAPACITY, AND DISCHARGE CURVES

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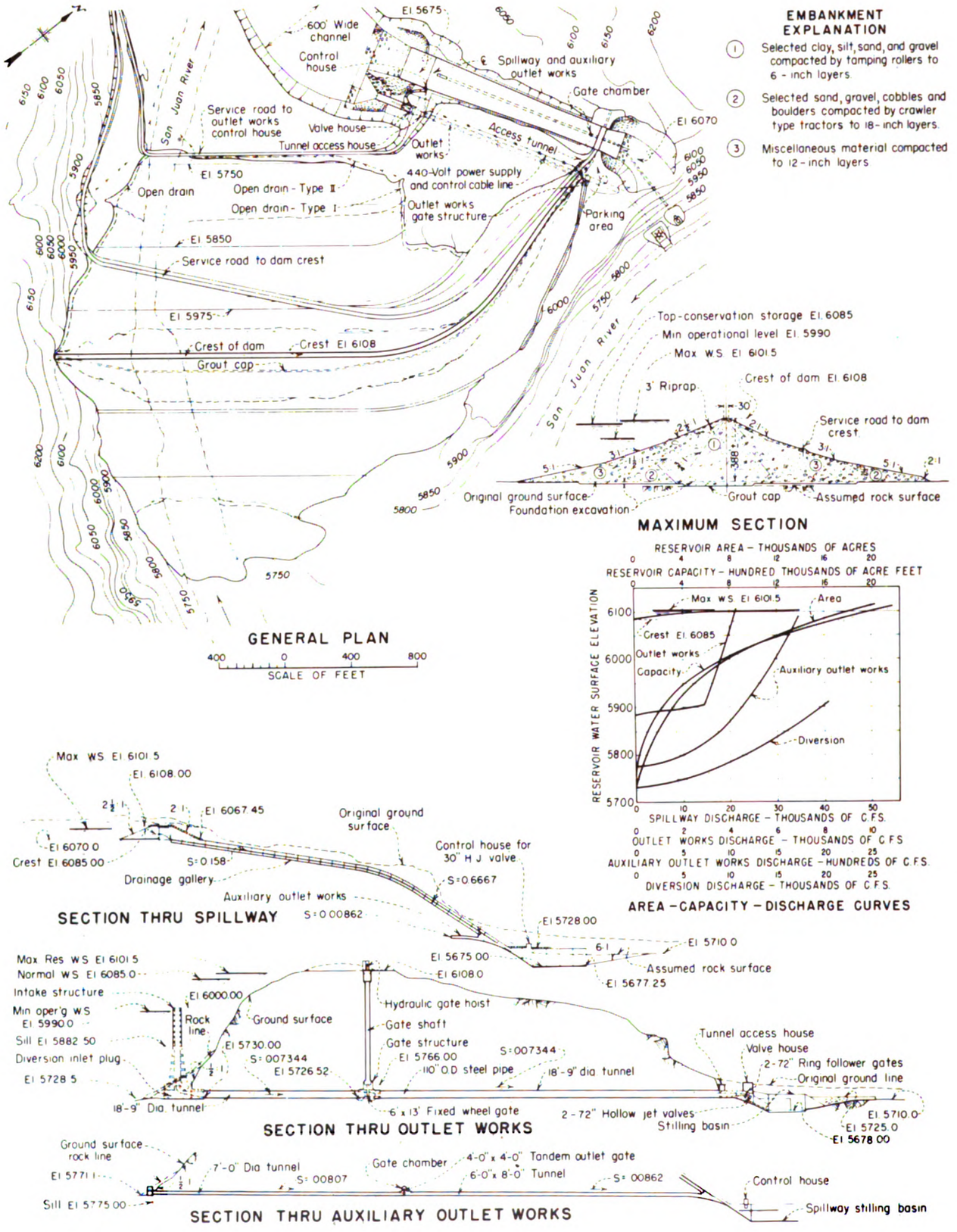

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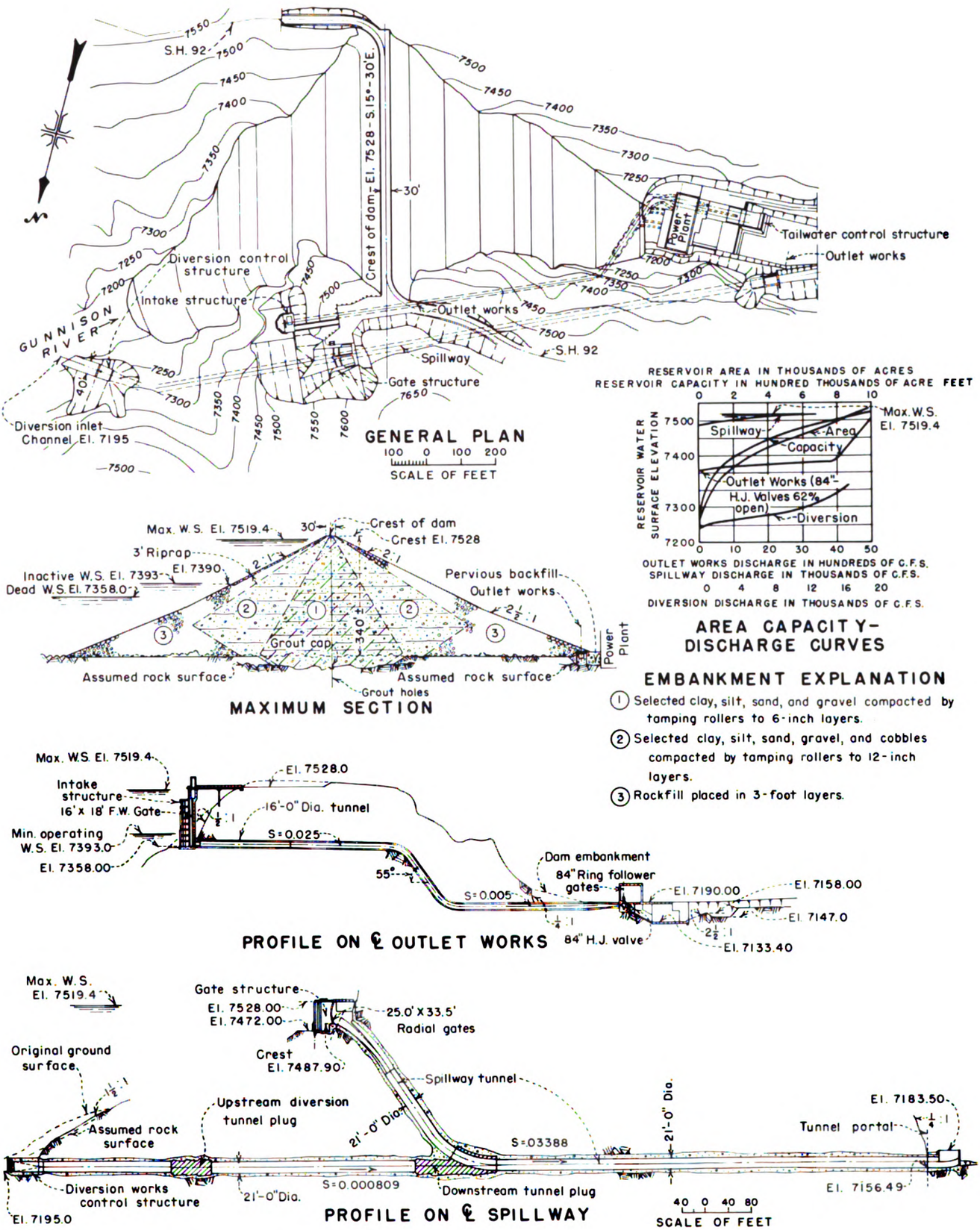

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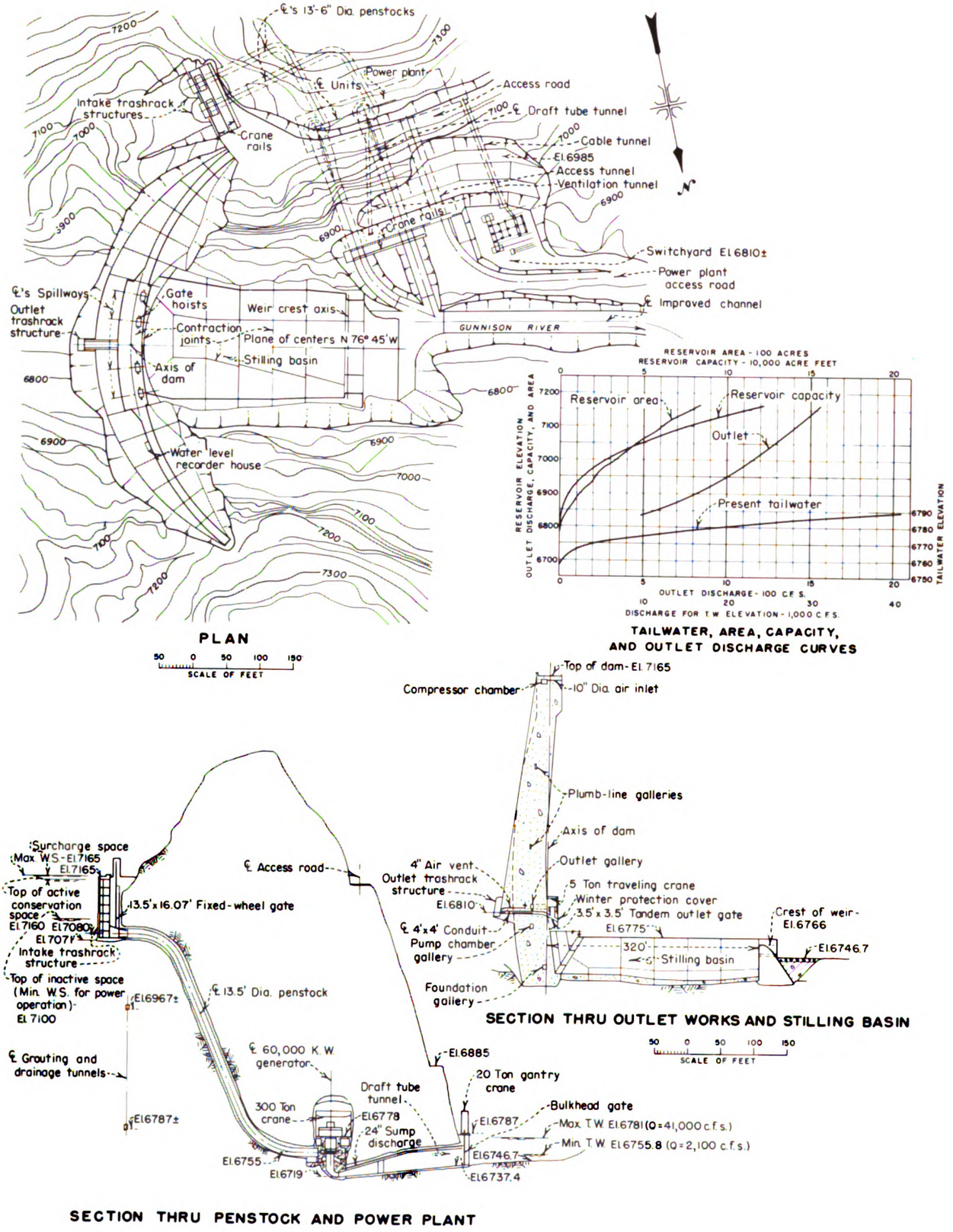

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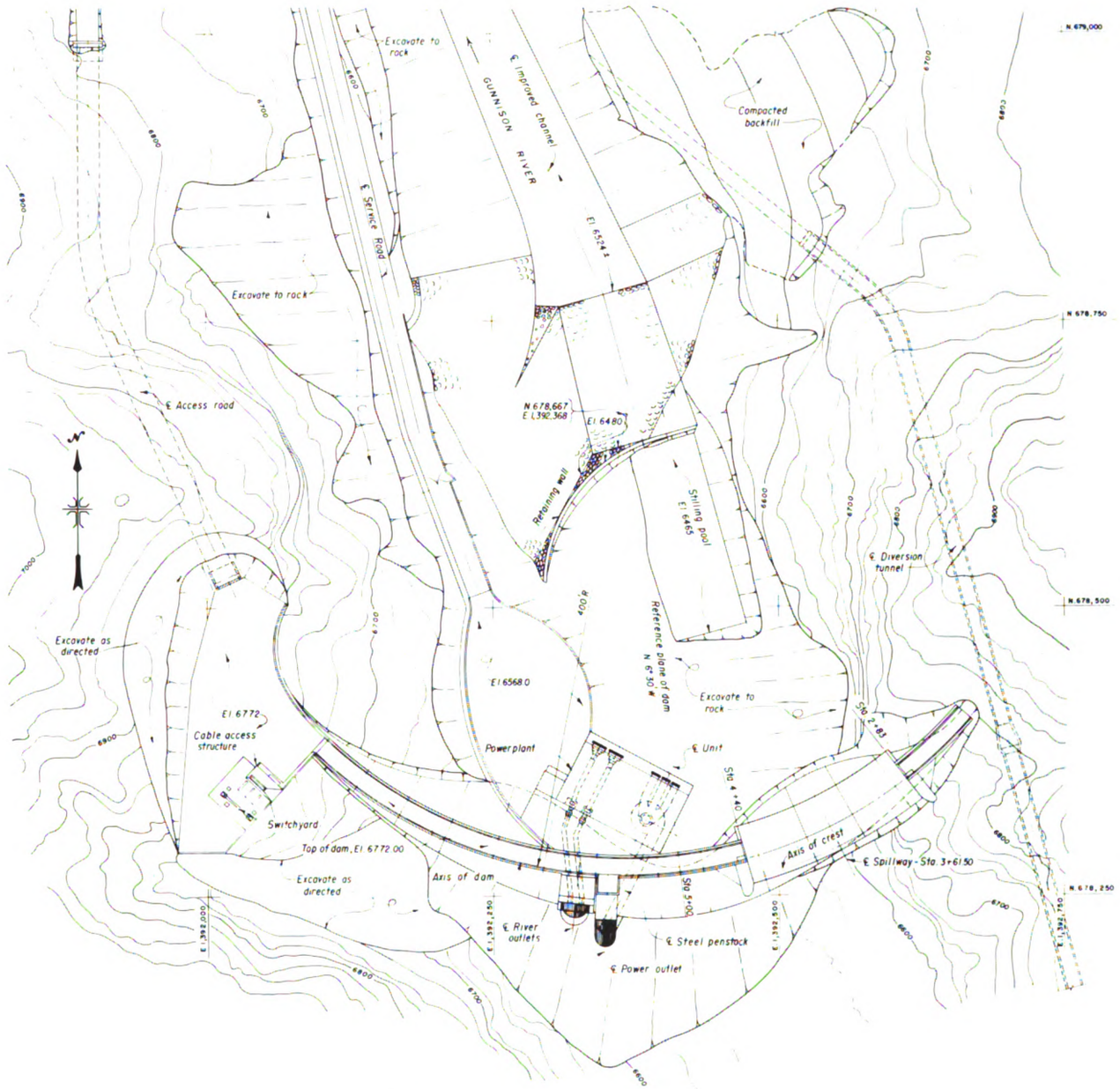

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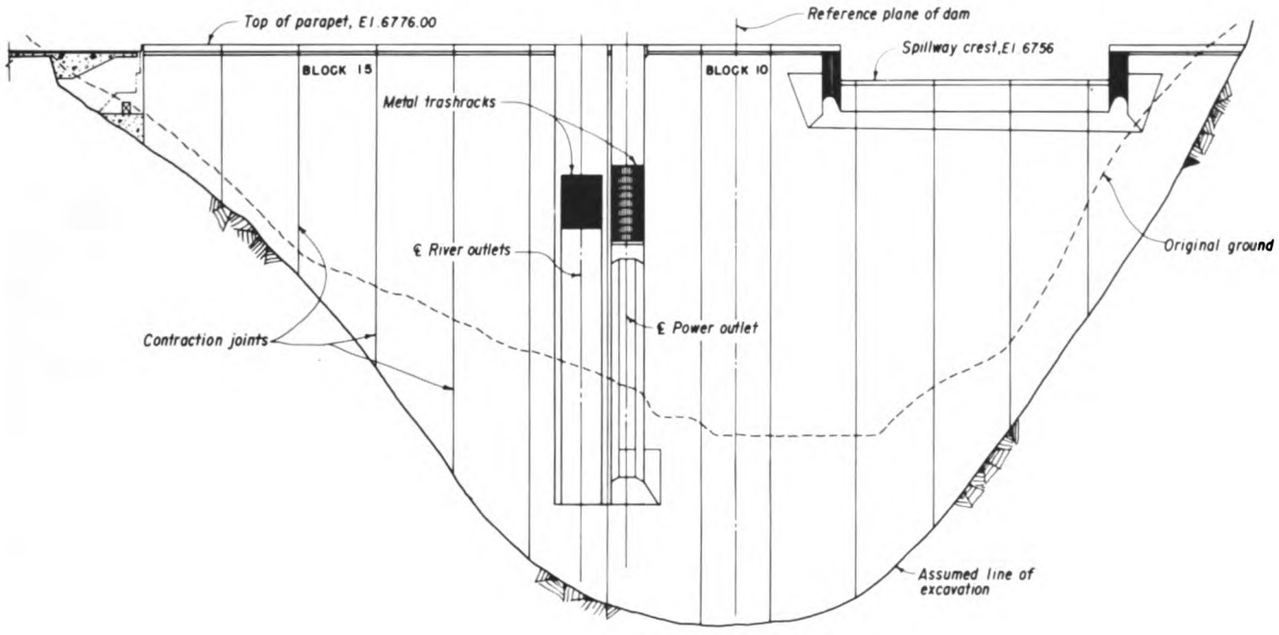

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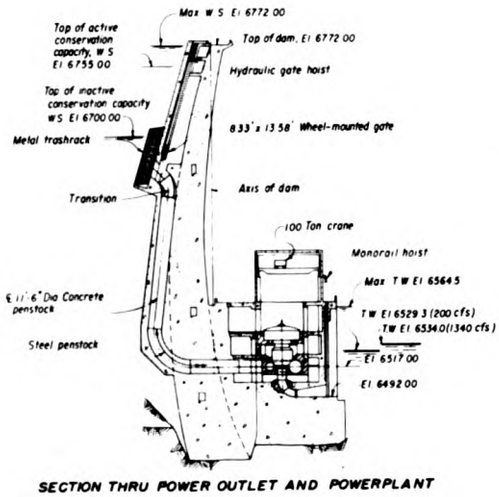

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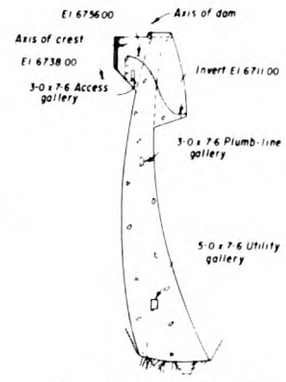

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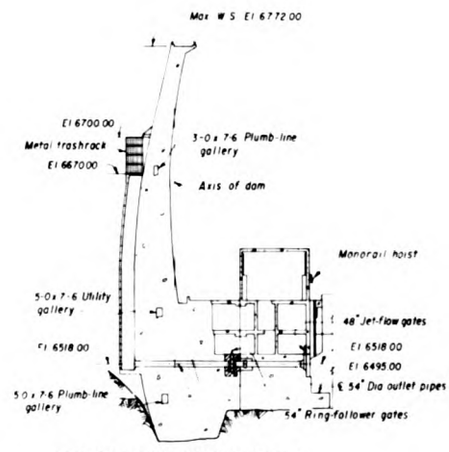

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JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	**S, T**	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. C. Mendenhall, Director

Water-Supply Paper 680

DROUGHTS OF 1930-34

BY

JOHN C. HOYT

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DROUGHTS OF 1930-34

By JOHN C. HOYT

INTRODUCTION

During the 5-year period 1930–34 a serious drought occurred over some broad region of the United States in each year except 1932. The humid States were seriously affected in 1930 and to a lesser extent in 1931 and 1934. The semiarid States underwent minor droughts in 1931 and 1933, which added to the catastrophe of 1934. Drought conditions during these years are of more than academic interest. They stand out as a limiting basis in the availability of surface and ground waters in works involving many millions of capital outlay. If future water supplies are to be unfailing, sufficient storage must be provided to withstand the recurrence of similar shortages at any time.

This report summarizes, as an aid to the more detailed analyses that will arise in the consideration of specific projects, some of the more outstanding questions related to droughts, both physical and economic. It outlines the nature and extent of the droughts of 1930–34; compares them with past dry periods in terms of precipitation, run-off, ground water, evaporation, and transpiration; and sketches the effects of droughts on water supplies as related to a variety of human purposes, including agriculture, domestic and industrial uses, health, power, navigation, and recreation and wild life; it also touches upon the relief, political, and economic elements.

This report is based on information collected in the various States under the direction of the 36 district engineers of the United States Geological Survey, supplemented by data made available through the United States Weather Bureau, Bureau of Agricultural Economics, Bureau of Public Health Service, Office of the Chief of Engineers, Bureau of Reclamation, Emergency Relief Administration, American National Red Cross, and various State agencies. The assistance and suggestions of Geological Survey engineers and geologists and of the personnel of the other organizations listed above is hereby acknowledged. In the arrangement and preparation of the tables and graphs special assistance has been given by Lloyd L. Harrold, Francis M. Bell, and Arthur H. Frazier, assistant engineers, United States Geological Survey. The suggestions of J. B. Kincer, chief of the Division of Climate and Crop Weather, United States Weather Bureau;

Edward T. Kotok, director California Forest and Range Experiment Station, United States Forest Service; and Guy C. Stevens, hydraulic engineer, United States Geological Survey, have been especially helpful.

When in an area that is ordinarily classed as humid natural vegetation becomes desiccated or defoliates unseasonably and crops fail to mature owing to lack of precipitation, or when precipitation is insufficient to meet the needs of established human activities, drought conditions may be said to prevail. Although water for irrigation or other uses in arid areas is always limited, special shortages in such areas are also regarded as droughts. Unsatisfactory distribution of precipitation throughout the year may be as effective a factor in causing a drought as a shortage in the total amount. Temperature and wind may also play an important part, especially in relation to the damage done.

As interest in droughts may relate either to their physical characteristics, as determined by the phenomena that cause them, or to their economic effects, as reflected by damage, they may be considered either as a natural phenomenon or as an economic phenomenon—usually both—and it is therefore essential to take into account in drought studies not only physical data but also information as to the extent and nature of human activities in the area affected.

Although a deficiency in precipitation is the prime cause of droughts it is not possible to set for any region an exact limit of the total annual precipitation above which a drought does not exist and below which a drought may be produced. In general, however, in the humid and semiarid States serious drought effects do not result unless the annual precipitation is as low as 85 percent of the mean—that is, an annual deficiency of 15 percent or more. This limit is here used in defining a drought year and will serve for many drought studies. Although no definite limit can be set for the arid States on account of the wide variations in distribution of precipitation within these States, the same criterion has been used for certain comparisons in this report.

Under the definition given above there have been 38 droughts in the humid States during the period 1881–1934, and in 12 of these droughts over 23 percent of the area of the States was affected. In the semiarid States there were 28 droughts during the same period, and in 11 of these droughts over 44 percent of the area was affected. The years in which these droughts occurred are shown by the black portions of the squares on figure 1. Each square represents a year. The one in the upper left corner represents the year 1880; the next to the right is 1881, then 1882, etc. The horizontal dimension of the black portion of a square indicates the percentage of the area in which there was a drought. If the entire width of the square is black 100 percent of the area was affected. The vertical dimension indicates the deficiency in precipitation, expressed in percentage of the mean annual.

Records of precipitation and stream flow give an index for studying droughts and generally will serve to answer questions relative to the area covered, the severity, the frequency, and the duration. Additional facts, however, are needed in considering the nature and extent

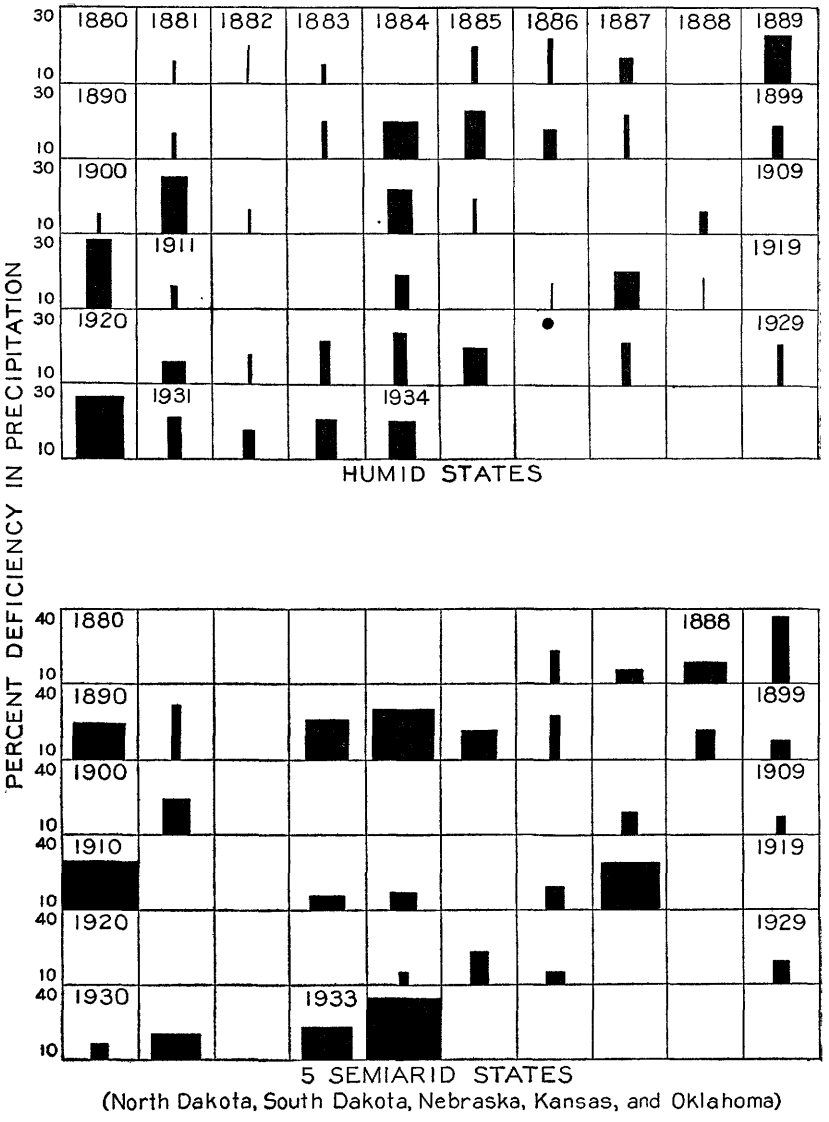

FIGURE 1.—Drought years, 1881–1934.

of resulting damages. Press statements relative to droughts that appear before full physical and other information have been made available and analyzed are generally exaggerated and should be used with caution.

The records of precipitation and stream flow used in this study were made available through the United States Weather Bureau and the United States Geological Survey. Unfortunately, neither of these sets of records extends over a period long enough to enable adequate consideration of drought conditions. Precipitation data are incomplete and scattering for years prior to 1889, and records of monthly precipitation by States were not generally made until about 1890. The annual precipitation for each State [1] has been compiled by the Weather Bureau on a comparable basis, beginning with 1881, and is given in table 1. In the years prior to 1895 the number and distribution of precipitation stations in many States were inadequate, and as a result it was necessary to make adjustments in order to bring the records on a comparable basis. The annual precipitation for each State is indicated graphically in figures 21 to 69 (pp. 75–103), which show also the monthly precipitation for each State from June 1929 to December 1931. Records of annual precipitation are indicative only of general drought conditions: to be of value for detailed drought studies they must be supplemented by monthly records, and even then care must be taken in their use. Systematic records of stream flow on a country-wide basis were started in 1895, and there are but few continuous records that began prior to that date.

The climatic character of an area—that is, whether it is humid, arid, or semiarid—is a major factor in determining the effects of droughts. The one hundredth meridian is commonly considered the approximate border line between the humid and arid sections of the United States. There is, however, no well-defined line, as a wide belt extending on both sides of this meridian may be either humid or arid, depending upon the weather conditions in any particular year. This belt, which includes North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and western Texas, is sometimes called the "Great Plains" and is the principal semiarid section of the country. The 31 States east of this belt and eastern Texas can all be classed as humid, and the 11 States to the west can be classed in the main as arid with the exception of the Pacific Northwest, which is humid.

Agricultural and many other activities are conducted so differently in these three groups of States that for the consideration of droughts on a comparable basis each group must be treated separately. The precipitation, stream flow, and other data used in this report are included for all three groups. The discussion based on these data, however, applies primarily to the humid and semiarid States unless otherwise stated.

There are alternating periods in which precipitation and resulting ground and surface water supplies are successively above or below

[1] This report follows the Weather Bureau publications in treating Delaware and Maryland as a unit.

TABLE 1.—*Annual precipitation, in inches, by States, 1881–1934*

[Figures in parentheses are estimates]

State	Mean*	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934
Humid States:																																																							
Maine	41.20	46.22	42.12	40.69	53.43	47.02	47.72	47.66	53.69	43.57	50.65	44.77	38.87	39.58	35.16	37.02	36.97	30.60	45.48	35.64	50.91	47.11	46.91	37.81	39.17	33.23	41.75	43.21	34.73	43.65	34.51	35.63	43.69	38.46	32.98	38.45	42.87	45.04	41.57	37.54	49.70	33.55	41.04	39.06	34.37	41.98	38.79	42.79	39.84	37.05	35.66	*40.32	39.87	41.08	39.75
New Hampshire	39.52	57.46	45.58	40.40	49.25	47.05	46.73	47.03	49.24	41.60	48.03	38.28	38.50	38.40	31.38	39.11	34.37	32.33	44.19	31.66	44.39	43.39	46.57	37.40	36.30	37.04	37.67	35.19	30.76	34.36	38.41	34.80	39.06	34.46	32.58	39.73	41.73	35.91	37.71	38.20	46.84	35.60	41.96	38.09	35.60	39.49	36.41	40.82	38.48	37.88	33.59	*39.01	41.57	43.62	41.23
Vermont	37.03	32.54	29.67	34.80	35.81	38.80	37.73	44.63	50.78	46.48	47.88	38.58	38.81	37.92	32.14	34.68	28.78	31.18	42.56	34.09	39.67	38.01	42.22	35.54	34.85	36.29	34.03	37.99	30.24	35.68	31.93	30.54	40.71	36.40	30.16	36.06	35.62	33.95	38.64	36.84	43.54	33.55	37.82	37.15	35.33	41.47	36.94	42.80	36.77	39.46	32.88	*39.87	39.78	39.36	38.73
Massachusetts	42.39	41.80	39.57	35.77	45.74	42.68	45.04	46.50	57.51	49.80	51.15	46.00	40.63	45.40	36.89	41.47	38.51	32.43	54.16	38.43	46.94	49.98	44.03	43.86	42.20	39.02	44.67	43.96	36.04	41.50	34.96	40.46	40.71	41.18	36.92	42.72	41.45	39.56	37.31	44.84	48.26	41.71	44.70	39.68	36.68	42.15	40.23	47.17	42.65	40.90	33.84	*43.54	45.98	49.46	44.97
Rhode Island	44.07	52.12	51.30	41.22	56.08	38.23	54.52	47.63	51.86	49.34	47.33	49.23	38.17	48.28	41.18	49.10	37.25	34.60	63.15	45.63	41.47	49.36	44.26	47.65	43.17	38.38	44.82	42.84	39.68	41.13	37.66	43.70	45.00	42.07	37.58	40.03	41.76	38.32	36.57	51.05	47.62	38.46	46.99	44.08	37.46	37.20	42.09	48.46	42.13	43.32	32.83	*39.96	52.00	45.26	39.24
Connecticut	44.96	45.92	43.65	38.62	48.51	44.98	42.63	49.79	57.86	56.41	50.32	49.45	38.77	49.10	38.01	43.34	40.01	37.50	55.16	41.08	46.12	58.99	51.63	50.24	43.73	40.09	46.33	47.74	41.44	42.70	38.33	43.76	43.75	46.07	38.44	45.04	41.32	40.79	40.78	49.88	55.99	42.18	45.45	46.71	34.84	43.72	43.05	50.90	43.04	41.89	32.02	*40.73	48.53	45.09	52.75
New York	39.01	35.44	35.48	35.33	35.23	37.89	37.47	36.28	43.88	47.57	*49.74	38.45	42.60	42.11	38.54	33.89	39.07	40.15	43.56	34.18	38.03	43.30	42.95	43.27	38.63	39.02	37.48	38.45	33.54	36.03	37.26	36.61	38.34	39.66	36.39	40.91	38.03	38.73	38.23	39.69	40.57	35.41	39.53	35.46	36.98	41.41	40.19	45.50	39.03	43.02	32.18	38.08	42.19	37.53	34.97
New Jersey	45.89	44.10	54.75	43.80	46.63	*37.87	46.54	47.66	52.20	63.33	49.34	47.98	42.04	47.90	47.37	37.29	42.51	51.72	52.35	45.84	42.71	51.80	59.44	56.25	43.78	42.06	46.38	51.65	42.53	40.86	39.73	50.36	46.61	46.99	39.23	47.37	38.17	40.80	37.65	52.10	51.87	38.16	41.57	40.38	44.17	42.15	44.41	49.68	46.22	42.96	35.28	37.07	46.80	49.80	45.34
Pennsylvania	42.47	39.29	45.45	43.57	45.94	40.98	42.63	43.10	*45.91	52.67	51.28	45.65	41.30	44.26	43.69	38.51	41.95	42.73	45.49	40.93	37.31	45.54	47.29	46.27	40.44	43.84	42.78	45.45	39.58	37.38	38.99	45.52	44.13	45.25	38.24	44.26	40.98	41.71	41.06	46.86	40.63	41.80	44.88	39.17	43.13	37.86	43.11	47.30	42.06	44.21	28.82	37.36	39.02	45.43	39.34
Maryland-Delaware	41.89	41.68	42.26	42.24	54.84	39.91	40.20	37.68	44.95	50.77	55.67	45.62	50.20	39.39	38.76	38.24	*34.47	37.11	44.97	42.11	40.84	36.66	45.08	49.20	46.94	36.49	42.84	48.01	38.85	40.01	37.47	37.42	43.61	43.42	38.88	35.97	43.08	40.47	40.65	37.96	47.62	44.95	37.72	40.15	40.27	46.28	34.91	43.90	40.37	45.09	42.46	23.78	38.68	47.15	46.43
Virginia	42.18	35.40	45.88	41.24	40.54	38.56	54.09	45.38	47.44	59.59	41.62	*47.94	39.45	46.22	35.76	38.23	42.64	39.19	44.71	42.20	39.52	49.99	40.67	44.09	36.11	43.27	50.03	44.41	46.17	38.02	41.37	41.00	40.88	42.33	36.66	40.03	38.94	40.11	43.48	41.65	45.91	34.94	45.15	40.90	47.84	52.53	41.41	41.64	43.07	46.31	24.99	38.00	44.78	39.46	45.58
North Carolina	50.44	50.81	59.73	58.23	54.42	53.73	53.06	*52.09	54.98	50.76	46.49	54.55	47.04	52.66	46.57	50.23	47.54	46.06	50.04	52.08	48.40	62.66	44.46	50.13	43.27	51.94	59.53	48.64	57.79	47.78	48.42	42.65	47.27	52.37	47.09	50.09	50.91	49.85	50.98	48.80	56.67	42.92	56.88	45.11	54.57	57.33	53.48	59.45	52.38	39.28	53.70
South Carolina	48.21	(50.00)	(52.00)	43.54	49.94	52.04	46.27	*43.43	54.63	46.76	42.29	47.52	47.36	53.68	50.49	48.99	44.95	46.40	49.26	46.76	49.79	54.98	46.43	50.87	40.98	45.10	54.81	47.79	53.33	44.61	45.31	39.80	54.32	47.57	43.39	48.89	43.91	43.49	46.48	46.79	52.24	42.83	58.17	46.60	56.99	35.82	42.63	42.16	61.66	66.13	40.15	37.17	54.08	35.95	45.79
Tennessee	50.30	50.35	65.77	56.32	*55.57	44.36	51.75	44.97	48.29	45.50	57.60	52.80	54.17	45.56	42.65	43.10	47.09	50.89	50.45	47.97	51.43	46.96	49.42	47.23	40.74	50.85	53.86	49.14	45.59	50.63	45.17	53.11	54.40	47.42	43.97	54.18	50.79	51.51	47.30	57.65	56.46	49.94	54.35	57.63	46.20	40.50	54.69	55.98	53.13	59.78	39.80	43.24	59.31	51.08	47.53
Kentucky	45.81	41.56	61.97	56.48	50.13	40.08	43.54	43.23	44.96	*35.97	38.82	49.69	44.25	44.71	34.81	38.47	44.08	46.72	52.38	46.38	44.40	55.65	44.35	41.16	35.10	47.68	48.84	47.76	41.94	51.41	50.67	46.77	47.93	47.46	41.80	51.92	45.49	46.01	40.64	52.13	46.90	49.42	44.43	53.92	42.68	41.11	49.95	53.45	45.61	48.46	27.86	41.98	44.19	50.61	37.00
West Virginia	43.53	40.10	(60.00)	51.53	48.85	37.23	39.80	35.33	50.54	42.19	57.53	*45.96	38.33	39.82	34.52	32.82	43.49	41.59	47.61	40.97	37.62	44.78	42.19	40.55	33.33	45.53	44.36	52.15	40.47	43.02	38.60	47.13	43.83	48.29	39.71	44.14	45.52	43.56	45.28	47.89	42.04	45.46	41.30	45.04	47.21	40.57	49.00	49.14	43.29	46.77	25.43	42.26	43.86	48.65	37.56
Ohio	38.44	52.53	45.03	*44.98	36.19	38.06	36.71	33.63	39.64	33.41	50.33	38.61	37.16	36.63	29.75	28.46	39.58	38.59	43.78	34.32	32.82	32.36	37.58	36.85	36.19	39.08	36.88	42.85	34.10	42.66	36.03	42.63	37.82	44.75	35.41	40.83	37.24	36.51	36.54	34.21	43.69	43.01	34.89	45.83	27.00	37.39	36.62	37.39	26.60
Michigan	31.29	40.04	38.69	39.68	36.58	35.00	31.96	29.81	*28.68	25.86	34.23	30.65	33.69	34.55	28.00	26.90	31.74	31.23	32.29	28.35	32.31	28.06	32.53	32.72	29.73	33.32	31.41	30.67	29.64	32.43	25.69	34.26	32.34	29.79	30.02	30.75	33.97	27.21	29.47	30.23	29.10	31.84	32.10	28.80	29.79	25.51	33.03	31.52	33.33	31.22	22.62	29.80	33.13	30.30	25.46
Indiana	40.17	44.98	51.72	51.78	42.42	38.47	39.79	*36.12	39.79	36.02	49.58	40.05	41.83	41.54	32.21	30.99	40.62	40.44	45.71	34.97	37.83	39.56	40.06	36.73	38.22	43.18	39.62	44.83	34.30	48.32	37.53	39.85	40.69	44.20	31.54	41.77	40.69	36.82	40.83	39.01	36.97	45.80	38.76	42.86	37.73	34.59	43.73	49.19	36.76	47.04	29.70	38.36	42.82	40.74	29.70
Illinois	37.26	45.71	47.98	47.24	43.09	39.41	34.48	32.38	37.80	35.55	38.65	34.01	41.37	34.09	28.89	*31.89	36.99	36.59	35.85	46.64	33.02	35.38	25.72	41.88	34.94	37.69	36.71	37.26	40.65	35.34	43.11	32.09	38.95	35.55	35.40	28.99	41.90	37.17	32.54	37.94	37.56	32.80	40.74	34.15	37.99	35.81	32.83	42.94	49.38	37.40	41.94	27.89	37.58	36.56	34.59	33.12
Arkansas	48.97	42.32	72.97	59.41	62.05	37.55	42.96	41.89	48.94	45.78	65.33	*44.49	57.75	47.91	49.05	44.69	57.72	46.13	56.82	41.49	49.03	55.27	51.70	44.62	43.45	62.17	55.99	49.73	48.88	44.05	45.21	49.54	45.83	54.01	42.85	53.68	42.18	40.72	44.64	54.52	54.38	47.46	46.50	59.85	37.03	42.19	49.24	65.85	50.50	46.10	46.62	46.56	51.11	49.08	42.42
Missouri	40.17	39.28	39.96	41.63	40.93	34.94	38.91	32.77	*41.22	37.91	35.71	38.04	42.76	38.19	33.18	39.30	44.63	38.82	53.67	37.32	38.34	44.96	40.15	41.68	45.41	37.09	41.87	43.56	45.16	37.91	38.94	38.68	37.47	38.72	34.77	39.99	41.53	39.73	39.06	43.07	44.16	37.17	43.77	39.99	41.53	39.73	39.06	43.07	45.59	46.61	31.27	40.27	37.79	36.21	34.19
Iowa	31.48	*44.16	33.40	34.54	35.59	32.23	24.71	26.31	31.44	24.95	29.48	32.90	36.58	27.59	21.94	26.77	37.23	26.98	31.34	28.68	35.05	24.41	43.82	35.39	28.51	36.56	31.60	31.61	35.09	40.01	19.87	31.37	28.65	29.95	31.93	39.53	28.90	27.81	32.78	36.76	31.75	32.03	29.98	29.50	31.39	28.24	33.07	29.35	35.96	30.20	26.10	35.37	32.28	24.94	26.90
Wisconsin	31.63	46.38	37.15	35.38	40.86	34.48	33.74	32.66	31.02	27.04	37.04	*26.12	34.98	29.80	27.96	22.45	32.21	27.77	28.04	30.54	35.07	28.34	32.59	35.81	31.55	35.10	34.20	30.14	29.36	31.48	23.41	37.00	32.51	32.81	32.30	32.79	33.79	27.35	29.69	33.22	29.99	30.73	31.42	26.39	33.06	27.62	35.05	30.94	33.09	28.09	25.08	29.68	25.37	27.11	30.34
Minnesota	25.91	33.52	28.35	26.11	29.48	23.18	26.02	*23.70	25.10	19.08	25.01	24.52	28.38	24.45	21.63	22.68	31.02	27.23	24.21	30.14	29.79	24.26	29.46	32.85	29.65	33.10	31.66	24.03	29.49	29.27	14.73	29.10	22.45	25.49	28.46	28.42	28.27	20.99	24.98	27.56	25.25	23.00	22.95	19.81	24.77	23.93	24.68	24.44	25.56	20.56	22.59	22.53	21.68	20.97	20.30
Florida	52.94	55.76	56.57	45.17	52.41	63.48	57.07	51.04	54.42	50.21	51.65	48.14	*47.99	53.01	52.51	45.50	49.62	56.69	48.36	53.93	61.19	58.47	51.24	55.79	48.15	61.43	53.76	49.16	48.54	49.52	50.88	47.40	54.88	48.02	49.08	56.30	47.10	41.36	50.09	57.35	57.79	45.24	57.53	50.17	61.62	52.64	59.38	49.71	60.12	59.04	60.24	43.97	52.56	55.87	53.38
Georgia	50.48	52.88	53.45	47.21	49.82	58.50	48.08	49.48	58.07	53.90	51.78	46.63	*51.12	49.29	49.75	49.57	45.15	49.23	53.14	44.20	57.33	57.58	49.99	53.84	47.17	51.03	54.60	48.73	50.03	48.31	43.90	48.23	53.02	46.47	46.58	49.63	43.50	47.41	48.73	54.91	58.73	40.94	55.38	52.76	54.27	41.00	50.54	49.63	59.02	59.83	46.13	56.75	46.89	41.01	47.35
Alabama	53.11	57.09	60.95	49.74	*52.58	53.07	55.33	47.55	57.42	43.30	49.99	52.85	56.81	50.11	47.42	49.92	45.25	47.30	49.09	47.84	66.16	55.61	49.27	49.96	39.21	55.03	55.93	54.08	48.01	58.32	45.20	52.54	56.45	52.06	44.90	53.75	53.21	53.74	56.22	65.14	64.20	45.34	58.78	60.87	47.23	45.20	60.79	45.48	55.51	76.48	46.17	42.78	63.76	48.27	55.22
Mississippi	53.32	(56.00)	66.99	55.75	64.01	48.59	49.69	44.57	50.82	*38.31	56.23	56.24	57.47	51.54	47.60	47.69	43.13	46.62	54.58	44.52	66.54	57.10	48.07	46.59	41.48	65.43	54.35	54.12	54.76	57.97	47.12	49.47	66.32	57.29	46.59	53.94	51.49	45.16	49.73	69.24	62.85	48.25	59.43	71.03	40.06	49.24	56.18	55.29	51.27	60.03	47.32	52.39	67.71	50.33	53.40
Louisiana	55.64	60.39	61.70	58.90	66.26	57.39	51.36	51.41	55.10	40.25	55.43	*51.55	61.67	49.90	50.85	54.52	46.56	51.60	63.49	42.35	66.45	60.24	46.77	48.95	43.83	75.57	48.59	58.21	58.54	53.28	49.63	61.68	65.58	65.57	53.35	53.05	50.62	40.27	54.72	69.66	62.68	47.54	65.57	72.19	38.34	52.19	65.98	59.81	56.04	63.65	55.01	52.90	62.79	54.96	39.11
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Oklahoma	32.63	(30.00)	(50.00)	(35.00)	38.39	36.36	(25.00)	27.29	23.40	30.24	38.42	22.31	35.79	*25.49	25.57	35.08	23.78	30.61	39.45	36.07	32.51	22.78	40.54	29.41	29.79	39.76	36.88	33.85	47.23	27.01	18.92	28.93	28.40	33.05	25.07	45.42	29.18	22.39	33.56	34.41	36.35	30.02	38.89	44.98	27.86	28.31	39.04	39.55	36.45	35.39	30.70	31.59	33.99	30.66	27.54
Kansas	27.48	33.16	25.35	31.71	32.39	36.02	25.11	*23.37	23.43	29.44	21.16	31.14	29.02	20.25	20.72	28.08	28.72	24.45	31.79	26.26	27.96	21.35	34.42	31.35	31.01	30.77	28.58	26.46	32.30	31.15	19.67	24.53	26.69	23.02	23.08	40.77	23.84	19.60	27.60	25.65	26.65	24.19	29.01	31.88	24.23	25.08	24.80	32.40	33.40	27.96	26.87	25.90	23.76	22.18	19.92
Nebraska	23.50	*30.91	23.51	30.74	24.00	25.98	23.71	22.99	22.86	22.64	17.18	30.62	24.12	16.80	13.30	18.75	26.19	23.54	20.70	19.61	24.46	22.75	29.10	27.27	23.37	31.64	27.00	20.52	26.95	25.55	17.03	21.69	21.81	21.97	20.77	35.59	19.02	20.73	22.36	25.46	24.93	20.48	20.61	28.03	21.05	20.89	21.07	23.50	22.31	23.05	25.73	19.65	20.98	20.11	14.40
South Dakota	20.77	23.62	20.56	24.90	19.93	22.00	22.12	23.46	17.61	19.85	*16.43	20.05	24.41	17.93	15.30	16.05	24.14	21.09	16.50	20.16	23.06	22.76	19.92	22.92	18.46	26.68	27.95	18.92	25.10	23.69	15.49	19.18	18.50	17.89	21.57	28.54	20.90	16.77	21.91	20.06	27.44	18.83	21.61	22.17	18.47	15.90	17.73	23.21	17.81	20.93	18.10	14.66	19.16	15.31	13.18
North Dakota	17.70	18.73	21.12	16.76	20.91	17.50	16.49	19.57	16.40	11.30	17.12	22.25	*18.34	15.91	15.64	17.30	23.57	15.88	16.15	17.67	19.05	19.48	19.34	23.25	19.02	19.96	19.72	14.41	18.64	17.73	12.19	19.40	20.35	14.69	19.16	19.42	20.50	10.92	16.02	15.76	15.34	10.59	19.75	17.76	17.55	16.81	15.70	21.52	18.40	14.32	14.90	14.09	17.11	13.84	9.49
Texas	30.84	32.33	30.76	28.78	34.53	29.95	26.25	29.71	*42.30	38.06	34.62	30.45	29.40	20.47	27.65	32.92	27.41	27.32	28.43	28.70	42.17	22.23	33.92	32.03	30.02	41.73	31.51	33.86	32.91	23.45	21.46	29.13	26.12	36.05	37.88	32.01	24.59	16.21	28.90	45.64	34.24	28.64	32.91	40.34	23.50	25.79	36.33	27.77	29.03	31.17	29.67	29.26	34.06	25.96	26.78
Arid States:																																																					
New Mexico	14.49	22.57	12.57	11.30	15.23	12.43	16.56	13.48	17.97	10.74	13.10	14.84	*9.51	12.40	10.47	15.36	13.23	16.52	14.03	10.98	13.52	14.50	9.97	11.25	14.41	20.95	15.89	16.13	12.68	12.83	9.46	17.92	13.92	15.36	19.45	17.64	15.95	9.49	15.08	20.95	14.87	16.46	10.86	19.46	10.65	13.86	17.44	13.94	15.09	16.48	14.64	18.32	16.20	12.83	9.96
Colorado	16.79	22.61	15.21	16.43	14.66	16.84	17.38	15.22	*12.00	13.73	11.97	19.88	15.56	12.89	14.37	18.33	15.07	19.46	15.61	14.67	14.43	14.14	13.88	13.80	16.30	18.09	19.71	16.33	17.09	20.96	14.35	19.24	18.84	17.78	19.26	19.44	18.70	14.74	18.75	17.14	17.75	19.37	15.60	21.23	13.75	16.96	16.98	20.32	17.05	18.16	17.32	14.03	14.17	15.16	10.93
Wyoming	14.05	11.88	(12.00)	19.24	15.54	16.12	7.16	8.50	15.22	10.81	12.76	14.90	*11.92	10.67	11.87	16.90	15.00	12.26	12.50	13.58	10.95	12.14	9.81	12.87	14.29	16.03	17.82	14.63	17.28	16.33	12.12	13.98	18.40	15.88	12.69	19.42	12.70	13.75	16.05	10.46	14.88	12.58	14.16	19.31	12.69	15.62	14.58	18.16	14.23	15.06	14.70	11.57	13.31	12.16	10.94
Montana	15.21	16.00	12.54	13.50	17.87	14.15	11.98	15.98	15.03	9.24	10.78	18.03	14.32	13.88	15.28	*12.97	17.50	15.71	16.82	15.28	13.34	15.08	15.26	15.03	11.04	14.38	18.47	17.00	20.09	19.57	15.99	18.50	17.39	15.26	15.05	18.71	15.72	12.44	13.78	11.14	14.59	14.64	15.42	18.12	13.71	16.34	13.79	20.63	13.06	13.08	12.38	10.99	16.17	11.25
Idaho	17.17	17.44	16.15	17.88	19.87	16.64	14.27	16.21	10.08	12.05	17.96	16.29	17.51	19.98	*19.52	13.63	20.02	17.91	14.22	17.87	16.12	15.40	16.51	16.60	14.70	15.68	20.69	20.47	16.46	22.18	17.08	17.68	21.62	19.88	16.20	19.09	20.63	20.29	15.98	16.44	17.77	18.34	15.45	18.07	12.46	18.86	16.27	22.88	13.60	13.06	16.35	14.30	19.22	17.28	15.34
Nevada	9.01	7.21	10.39	9.77	13.66	7.81	10.88	5.18	5.76	10.17	*12.88	14.06	10.54	9.22	10.80	7.90	10.61	9.79	6.49	9.12	8.25	13.20	7.25	7.06	10.62	8.32	15.87	13.06	6.34	11.03	5.53	7.84	6.99	10.99	9.43	7.97	9.76	6.72	9.28	7.08	8.89	8.30	9.56	8.70	5.49	10.16	6.39	7.84	4.87	8.83	9.77	7.98	8.24	6.67	8.06
Utah	12.67	9.57	9.67	7.72	15.15	13.00	13.48	6.55	13.62	10.41	9.00	14.36	*9.50	11.01	11.43	10.66	12.20	14.55	10.61	12.10	8.38	10.05	9.17	10.21	11.43	13.58	18.34	16.07	14.82	19.31	11.25	13.02	14.15	12.88	13.60	13.33	15.93	11.88	14.12	11.83	16.57	16.51	14.83	13.60	10.57	14.50	12.43	16.58	10.70	13.60	15.14	10.06	13.36	10.57	9.49
Arizona	13.10	11.68	11.75	11.49	16.66	7.12	12.58	12.20	*13.18	14.04	17.73	9.81	9.85	11.60	10.77	12.34	13.47	11.93	12.77	8.70	8.17	10.46	9.80	8.43	9.24	28.42	15.91	15.40	15.15	13.19	9.36	15.33	12.74	12.02	16.86	15.62	17.06	12.83	14.74	19.83	13.25	13.95	12.76	16.95	8.68	12.77	16.43	15.68	9.67	17.14	15.21	19.30	13.43	11.46	10.11
California	23.52	21.46	20.22	16.60	26.61	19.52	18.63	14.63	18.51	30.99	22.49	20.22	23.60	21.28	25.78	14.85	30.01	*18.99	10.35	22.47	19.84	22.12	24.22	20.69	30.39	21.59	28.70	32.49	18.78	42.13	16.77	29.39	22.27	25.20	21.13	33.82	34.84	18.48	24.47	21.29	26.71	25.89	28.96	14.18	17.05	21.13	27.06	27.50	18.64	15.00	18.38	24.37	15.60	20.18	17.08
Eastern Oregon	13.81	----	----	----	----	----	----	----	----	----	*11.99	18.14	13.38	16.41	19.14	11.39	17.76	15.69	9.72	15.23	11.94	11.29	12.60	12.61	14.69	10.80	16.49	17.89	9.32	17.00	14.59	11.85	17.81	16.61	12.74	14.21	15.17	12.43	10.53

normal. The records, however, do not disclose—at least on the basis of present interpretation—that these periods conform to fixed cycles or that their occurrence is affected by any acts of man. Man's relation to drought has to do with damages and not causes. In the main, droughts result from climatic conditions immediately before or during the drought period, and the only effect of climatic conditions of previous years relates to any excess of precipitation that may have accrued to surface- and ground-water storage. Such accretion aids in alleviating damages during drought years, especially in the arid sections.

Attention has usually been drawn to droughts by their economic, social, and political aspects, as related to human activities, and not by their physical side. In earlier years they were judged largely by the extent of their damage to vegetation, especially agricultural crops. In recent years, however, as demands and uses of water have increased, more consideration is directed to the effect of droughts on surface and ground water supplies as related to normal activities. Therefore, in determining the damages and losses caused by a drought in a given area many factors must be considered. Among these are the climatic conditions, geology, topography, character and extent of agriculture and other activities, and facilities for the conservation and storage of water. The whole drought problem is so complex that it is difficult to compare those that occur in different areas or in different years. A drought in a certain locality may be detrimental to vegetation and not to water supply, or vice versa.

Water-supply conditions for the 5-year period 1930–34 fully indicate that we have now reached a point in the development of the country when serious consequences will result unless much more careful consideration is given to droughts than has been given in the past. Modern needs and uses for water are rapidly exceeding the limits of free natural supplies. Cities and industries are not only undertaking the full utilization of local supplies but are seeking remote sources. Provision of adequate supplies during low-water periods is becoming more and more of a problem. The economic losses that will result from interruption of service, on the one hand, or from overdevelopment, on the other, can be reduced only through accurate knowledge of frequency, duration, and quantity of minimum surface-water flows and ground-water yields during periods of drought.

DROUGHTS OF 1930 AND 1931

Unfavorable crop reports and low stream flow early in the summer of 1930 first called attention to the approaching seriousness of the drought. These were followed by reports from many localities of the shortage of water supplies for domestic and other uses. The principal drought area was in the north Atlantic, Ohio River, and Great Lakes

drainage basins. By the middle of the summer the effects of the drought were receiving general attention by the press of the country, and the situation was referred to as "the great drought of 1930." At the end of the summer it became evident that in many localities relief measures would be necessary, and steps were taken by both private and governmental agencies to meet needs as they arose. Differences of opinion as to methods of providing the relief created marked political issues and resulted in much emotional publicity, in which great emphasis was given to conditions in certain localities where the effects of the drought were most severe. All this tended to magnify the unfavorable aspects of the situation.

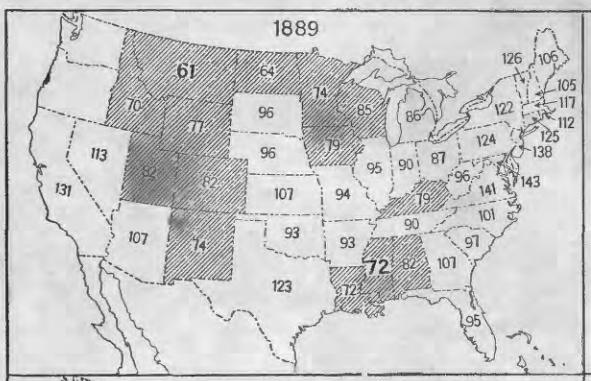
CAUSES

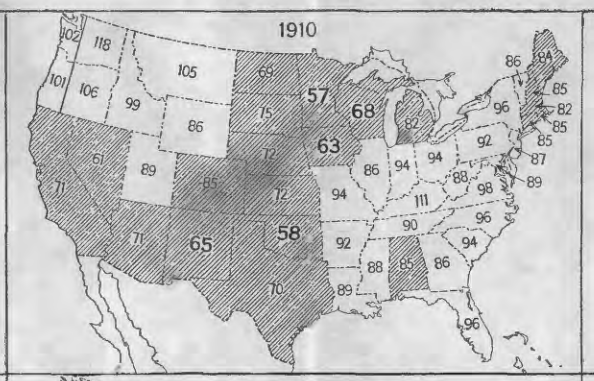
The climatic conditions—deficient and poorly distributed precipitation, high temperatures, and hot winds—which are the basic cause of all droughts, have been summarized from Weather Bureau statistics in table 2 and on plate 1 and figures 3, 4, 13, and 14. These tables and figures, with graphs on figures 21 to 69, provide a basis for studying the progress of the droughts of 1930 and 1931 in each State and for making comparisons between other States. During 1928–29 the annual precipitation was generally in excess of normal, and although deficiency in monthly precipitation appeared in later months of 1929 the records indicate that at the beginning of 1930 water conditions were practically normal and that the droughts of 1930 and 1931 cannot in any large measure be attributed to conditions that occurred in preceding years.

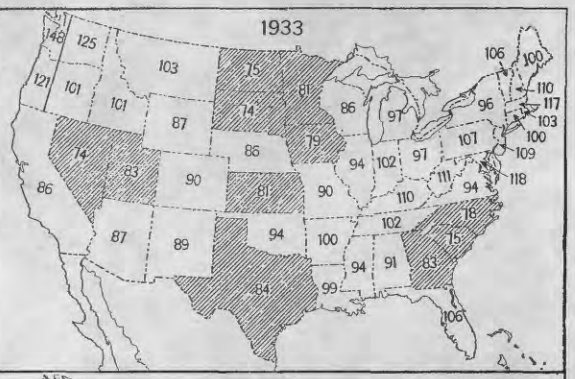
PRECIPITATION

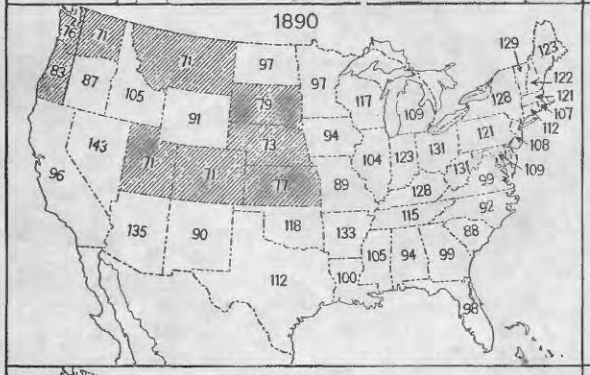
During 1930 precipitation was 85 percent of the mean or less in 27 States. This deficiency was rather uniformly distributed throughout the year, as indicated on the monthly graphs in figures 21 to 69, and was accompanied by excessive heat and warm winds, which resulted in wide-spread droughts varying in severity in different localities.

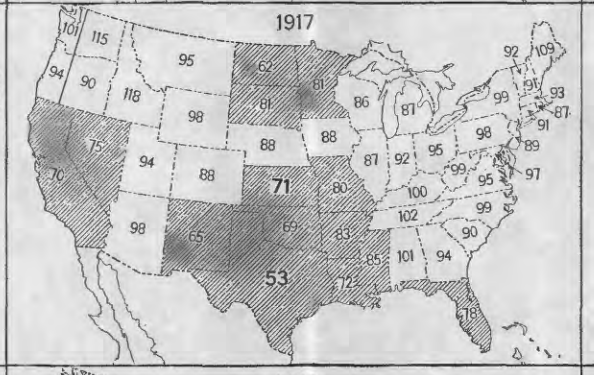
The precipitation in 1930 exceeded 85 percent of the mean in only 9 of the 31 humid States. It was above normal in only 1, Florida, and in 12 it was the lowest on record. These 12 States were in the North Atlantic, Ohio River, and Great Lakes drainage basins, and the deficiency was greatest in Maryland and Delaware, West Virginia, Virginia, and Kentucky, where the precipitation ranged from 57 to 61 percent of the mean. In the 6 semiarid States precipitation was below 94 percent of the mean in only 2—North Dakota, 84 percent; South Dakota, 87 percent—and no previous records of minima were broken. In the 11 arid States the precipitation was above normal except in Montana, Idaho, Washington,

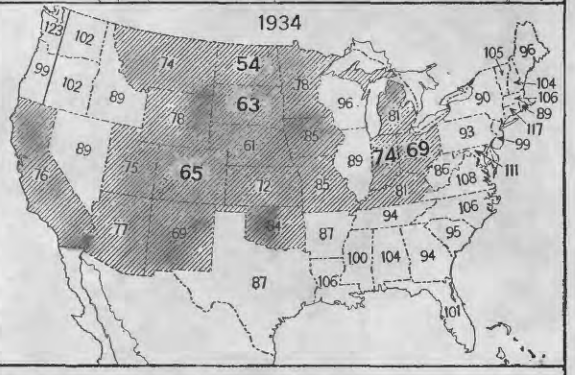


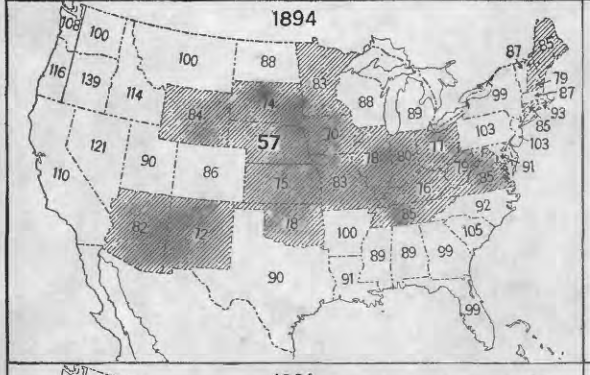


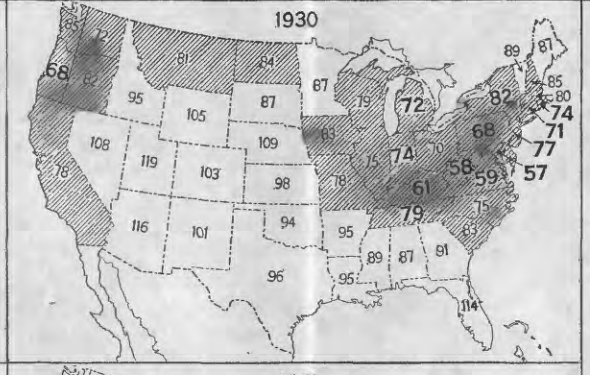


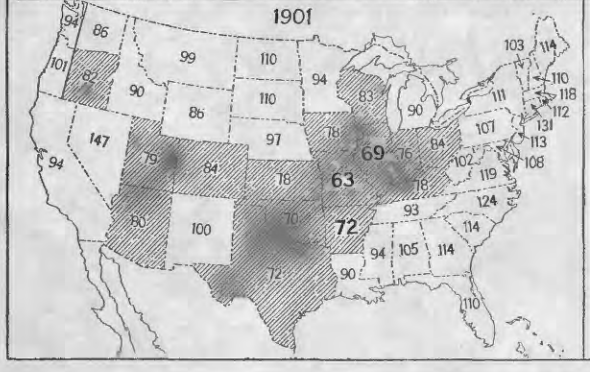


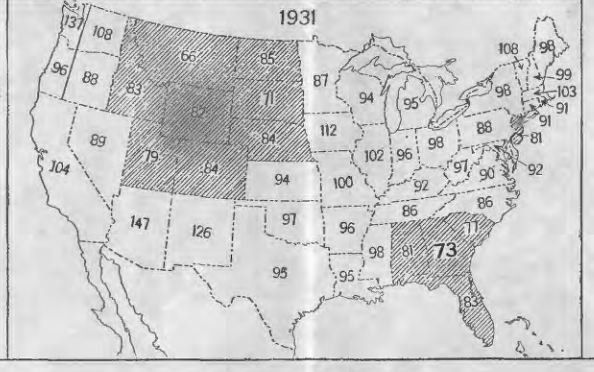












PRECIPITATION BY STATES FOR MAJOR DROUGHT YEARS

All figures indicate percentage of mean. Large figures indicate minimum recorded. When annual precipitation falls to 85 percent of the mean, a deficiency of 15 percent, a drought may be said to exist. Shaded areas show the States having droughts under this definition. The percentages are for the calendar year, and in the arid States precipitation on that basis is not a true index of the water supply available for vegetation

Oregon, and California, and in these 5 States it was below 85 percent except in Idaho (95 percent). In western Oregon it was only 68 percent of the mean, breaking all records of previous lows.

Deficiencies in precipitation continued during the first 10 months of 1931, but they were not as great or wide-spread as during the corresponding period in 1930, and the distribution of precipitation was much better. November and December 1931 were months of high precipitation, which made up for the deficiencies earlier in the year and brought the annual precipitation to more than 85 percent of the mean in 35 States.

In 1931 the precipitation was 85 percent or less in only 5 of the humid States—Alabama, Florida, Georgia, South Carolina, and New Jersey. It was lowest in Georgia, with 73 percent, which broke all records of previous lows. There were only 2 semiarid States in which the precipitation was below 85 percent—Nebraska, 84 percent, and South Dakota, 71 percent, the latter breaking previous records. Precipitation in all the arid States was 82 percent or more, except Montana, 66 percent, and Utah, 79 percent, and no previous records were broken, but there were areas where water supplies for irrigation were short, owing largely to unfavorable distribution of precipitation and inadequate storage. An example is California, where, although the annual precipitation was 104 percent of the mean, agriculture was seriously affected by water shortages.

Although in 1931 deficiency in the precipitation was not extreme in most States, it was sufficient, with the possible carry-over effects from the drought of 1930, to cause many localities to suffer from shortages in both surface-water and ground-water supplies. Vegetation, however, was not materially affected, as there was ample precipitation during the growing season to supply both natural growth and agricultural crops.

A comparison of the 1930–31 drought with other droughts is given on pages 65–69.

TABLE 2.—*Precipitation and composite yields of crops per acre, 1929–34, by States*

[Yields are expressed as percentage of average for 10-year period, 1919–28]

State	Mean [a] (inches)	1929				1930				1931				1932				1933				1934				Months below mean, June 1929–December 1931
		Precipitation				Precipitation				Precipitation				Precipitation				Precipitation				Precipitation				
		Percent of mean	Months below mean [b]	June, July, August (inches)	Percent crop yields	Percent of mean	Months below mean	June, July, August (inches)	Percent crop yields	Percent of mean	Months below mean	June, July, August (inches)	Percent crop yields	Percent of mean	Months below mean	June, July, August (inches)	Percent crop yields	Percent of mean	Months below mean	June, July, August (inches)	Percent crop yields	Percent of mean	Months below mean	June, July, August (inches)	Percent crop yields	
Humid States:																										
Maine	41.20	90	6	7.8	115.5	87	9	9.8	102.9	98	6	12.9	104.6	97	6	10.5	98.7	100	7	9.7	106.8	96	7	10.4	116.7	21
New Hampshire	39.52	96	5	9.4	112.0	85	8	11.0	125.4	99	6	13.3	112.3	105	5	11.0	105.7	110	5	11.4	106.5	104	5	10.1	95.4	19
Vermont	37.03	107	5	9.5	110.5	89	7	10.4	110.7	108	6	13.6	118.5	107	5	11.1	111.1	106	5	10.8	93.1	105	6	10.3	93.7	18
Massachusetts	42.39	96	6	6.2	98.0	80	9	9.3	116.6	103	7	14.8	101.5	108	6	10.3	107.7	117	5	9.9	110.0	106	7	9.8	93.7	22
Rhode Island	44.07	98	5	6.2	104.3	74	11	7.8	121.8	91	6	13.8	112.8	118	5	11.0	115.4	103	8	8.2	113.6	89	7	6.3	94.2	22
Connecticut	44.96	93	6	6.3	102.5	71	9	9.2	114.8	91	8	13.9	104.1	108	5	12.4	111.2	100	7	11.8	106.7	117	7	10.4	102.7	23
New York	39.01	110	4	9.4	91.8	82	8	9.7	102.2	98	7	11.9	110.8	108	6	11.8	106.0	96	8	7.7	93.5	90	10	8.8	89.7	19
New Jersey	45.89	94	5	7.3	92.9	77	10	11.5	110.0	81	9	14.2	117.3	102	7	9.2	106.5	109	7	17.0	104.6	99	9	14.4	103.8	24
Pennsylvania	42.47	104	4	8.9	93.3	68	10	7.9	88.7	88	10	13.0	115.7	92	7	9.4	89.0	107	7	14.4	97.8	93	9	12.6	103.8	24
Maryland-Delaware	41.89	101	3	9.2	98.8	57	12	6.0	80.9	92	8	15.5	117.8	113	6	9.3	88.0	118	7	18.4	88.0	111	7	11.6	105.6	23
Virginia	42.18	110	4	12.0	105.2	59	12	6.8	72.7	90	8	15.2	120.6	106	6	8.4	81.7	94	7	13.3	102.0	108	5	13.0	107.5	24
North Carolina	50.44	123	3	15.9	92.4	75	10	11.1	100.3	86	7	16.1	109.1	104	7	11.4	87.8	78	8	13.7	108.7	106	4	17.2	114.9	20
South Carolina	48.21	137	2	13.3	103.4	83	8	11.6	119.3	77	9	12.4	128.0	112	7	15.4	95.3	75	11	12.6	124.0	95	6	14.4	121.5	19
Tennessee	50.30	119	2	11.4	105.2	79	9	6.4	74.4	86	9	11.4	120.0	118	4	12.8	93.9	102	5	12.4	111.2	94	6	14.5	111.8	20
Kentucky	45.81	106	4	10.1	97.8	61	10	5.2	63.9	92	8	12.0	113.8	96	4	13.4	95.2	110	4	10.9	103.4	81	7	13.7	101.6	22
West Virginia	43.83	107	5	10.9	94.8	58	12	7.0	57.0	97	6	14.4	115.3	100	5	13.5	83.0	111	4	13.3	100.2	86	7	13.4	87.2	23
Ohio	38.44	119	1	11.6	97.4	70	10	6.2	77.3	98	7	12.3	129.3	95	7	10.1	96.7	97	7	7.7	89.1	69	10	10.4	87.0	18
Michigan	31.29	100	4	7.4	88.3	72	9	5.5	84.4	95	7	7.0	100.3	106	5	9.9	110.2	97	7	6.0	95.1	81	10	6.1	86.8	20
Indiana	40.17	117	3	11.4	95.2	74	10	6.5	84.9	96	7	11.1	116.5	107	5	11.8	103.6	102	7	6.5	84.0	74	10	10.6	80.2	20
Illinois	37.26	113	3	11.8	99.2	75	9	6.4	83.6	102	6	10.0	109.4	98	6	10.8	112.9	94	7	6.6	78.5	89	9	10.1	62.3	18
Arkansas	48.97	94	6	8.0	102.2	95	6	4.2	62.0	96	7	13.3	140.0	104	6	11.6	99.6	100	6	10.7	104.6	87	9	7.3	94.3	19
Missouri	40.17	116	4	12.4	88.0	78	9	6.8	67.1	100	6	10.9	111.0	94	7	14.6	100.9	90	8	8.1	93.6	85	10	7.9	51.0	19
Iowa	31.48	96	4	9.8	103.8	83	9	9.7	91.7	112	8	9.8	85.4	103	7	15.4	112.8	79	9	8.1	91.3	85	9	10.2	55.5	21
Wisconsin	31.63	89	7	9.1	105.0	79	10	8.9	101.0	94	8	9.4	84.2	80	7	9.4	96.4	86	8	3.6	85.8	96	9	9.6	83.4	25

Minnesota	25.91	79	5	6.6	102.9	87	8	7.5	101.9	87	9	9.1	81.6	84	8	9.5	104.2	81	7	6.2	76.5	78	8	8.3	59.8	22
Florida	52.94	112	4	22.5	83.8	114	4	19.4	98.1	83	8	14.3	93.0	99	6	21.9	79.4	106	6	22.1	87.3	101	6	22.9	98.2	16
Georgia	50.48	138	3	13.1	116.6	91	7	11.9	126.5	73	11	11.6	124.2	113	4	17.7	92.0	83	8	13.1	131.6	94	6	14.9	120.0	21
Alabama	53.11	144	3	11.1	113.0	87	9	9.5	114.2	81	9	12.0	125.9	120	4	13.7	93.1	91	8	14.5	109.9	104	5	17.4	121.9	21
Mississippi	53.32	113	4	10.1	123.0	89	7	6.2	90.6	98	9	15.0	117.7	127	5	13.2	84.0	94	8	12.8	101.8	100	8	14.3	111.3	20
Louisiana	55.64	114	4	12.6	117.3	95	7	9.0	103.7	95	7	13.2	127.1	113	4	12.7	105.3	99	7	17.7	100.6	106	5	15.2	105.9	18
Semiarid States:																										
Oklahoma	32.63	108	4	7.0	85.9	94	7	6.6	70.0	97	7	7.8	111.2	104	8	12.9	99.0	94	8	8.9	114.5	84	9	5.7	56.2	18
Kansas	27.48	102	3	9.7	90.6	98	6	8.7	86.8	94	9	7.7	115.3	86	9	10.6	88.1	81	8	8.9	65.5	72	9	5.2	50.2	18
Nebraska	23.50	98	4	8.0	101.3	109	6	8.8	104.5	84	8	6.6	78.5	89	9	10.0	95.6	86	7	7.9	82.4	61	9	5.8	29.3	18
South Dakota	20.77	101	5	5.9	90.7	87	7	6.4	84.9	71	9	5.4	38.3	92	7	8.0	89.7	74	8	6.2	43.5	63	11	6.6	31.1	21
North Dakota	17.70	81	4	3.5	81.5	84	8	5.6	93.9	85	8	7.5	53.6	97	8	7.7	89.6	75	8	4.5	59.7	54	12	5.4	47.4	20
Texas	30.84	101	5	5.0	84.3	96	9	4.7	84.6	95	7	7.1	118.1	110	7	8.9	108.5	84	8	8.0	128.4	87	9	4.0	79.9	21
Arid States:																										
New Mexico	14.49	114	2	7.5	116.6	101	8	6.8	99.2	126	5	6.4	130.7	112	5	6.8	89.5	89	9	7.5	109.4	69	9	4.4	98.4	15
Colorado	16.79	108	2	6.8	98.7	103	7	7.1	113.4	84	10	4.0	80.2	84	8	5.9	76.4	90	7	5.0	85.2	65	10	3.6	61.3	19
Wyoming	14.05	107	5	3.2	93.8	105	9	5.5	98.2	82	8	3.3	75.1	95	8	3.8	83.1	87	9	2.4	81.5	78	10	3.6	67.4	22
Montana	15.21	86	6	3.1	72.1	81	9	3.5	67.0	66	9	3.5	55.6	106	5	6.2	96.2	103	6	4.6	63.4	74	8	4.1	73.3	24
Idaho	17.17	76	5	2.0	103.0	95	6	2.6	114.6	83	8	1.1	97.0	112	5	2.8	113.4	101	8	1.5	95.5	89	7	1.9	92.9	19
Nevada	9.01	65	5	1.6	91.8	108	6	1.2	101.9	89	8	1.5	70.5	91	6	1.7	102.7	74	8	.6	88.5	89	9	1.4	67.7	19
Utah	12.67	107	3	3.5	102.9	119	6	4.2	106.3	79	10	1.8	77.4	105	5	4.3	101.5	83	7	1.6	86.0	75	9	2.2	58.9	19
Arizona	13.10	85	4	5.6	109.6	116	5	5.9	117.1	147	3	7.0	113.2	103	8	4.9	113.9	87	6	3.9	110.3	77	8	4.6	115.2	12
California	23.53	64	4	1.5	89.3	78	11	.2	109.0	104	7	1.0	90.7	66	11	.2	101.2	86	8	.3	96.2	76	8	.9	95.1	22
Eastern Oregon	13.81	84	----	2.1	101.9	82	----	.9	111.1	88	----	1.5	93.2	106	----	.7	97.7	101	5	1.4	97.5	102	8	2.1	88.0	-----
Western Oregon	54.22	71	----	4.6		68	----	1.2		96	----	4.1		99	----	1.7		121	4	3.3		99	8	1.6		-----
Eastern Washington	16.89	60	----	1.6	94.5	72	----	1.4	97.1	108	----	1.8	92.5	107	----	.8	98.6	125	6	1.4	96.2	102	6	1.2	100.6	-----
Western Washington	56.98	77	----	5.1		85	----	2.6		137	----	7.2		146	----	6.2		148	3	4.9		123	5	2.3		-----

* For 50-year period 1881–1930, except for eastern and western Washington and Oregon, which are for period of record.

[b] June to December.

The mean precipitation for each State for the years 1881–1930 is given in table 2. The table also gives for the years 1929–34 the precipitation expressed in percent of the 50-year mean, the number of months for each year when the average precipitation was below the mean for the respective months, the total precipitation for the growing months, June, July, and August, and the crop yields in percent of normal. In most States the deficiency in monthly precipitation started in the later months of 1929 and persisted throughout 1930 and the first 10 months of 1931, as shown in figures 21 to 69. During this 31-month period the number of months when the precipitation was below the mean ranged in the various humid and semiarid States from 16 to 25.

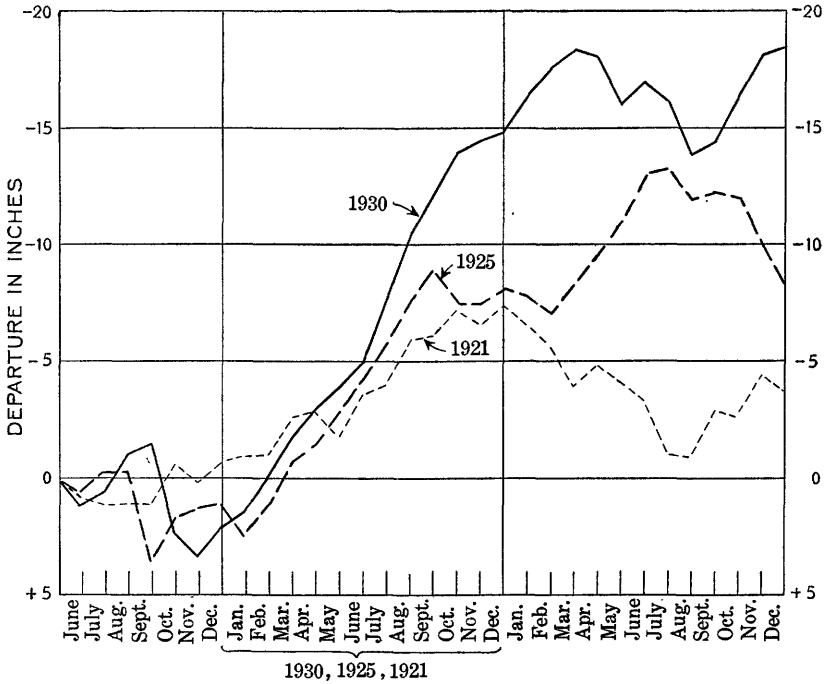


FIGURE 2.—Accumulated departures from the mean of the monthly precipitation for the periods of 31 months including the 3 years of lowest precipitation in Virginia.

In Virginia the three most severe drought years of record were 1921, 1925, and 1930. The graphs in figure 2 indicate the accumulated departures from the mean of the monthly precipitation for three 31-month periods that include these three droughts, thus affording a means of comparing them.

The intensity of each drought is revealed by the steepness of its graph, the duration by the length of time the deficiencies continued to accumulate, and the severity by a combination of the two. For example, the graph from February to September 1925 is almost as

steep as that for the corresponding period in 1930, indicating that the intensity of the drought was nearly the same for that period during both years. In the drought of 1930, however, the deficiencies in precipitation continued to accumulate for 6 months longer, and for that reason this drought is classed as the most severe experienced in Virginia.

Records of stream flow (see pp. 26–32 and table 17) give an even better picture of the drought of 1930–31 and also another means for comparing it with other major droughts.

TEMPERATURE

During 1930 and 1931 temperatures in the drought area were unusually high, as indicated in figures 3 and 4. In 1930 previous recorded maxima were broken in Indiana, Kentucky, Tennessee, Virginia, West Virginia, Maryland, Florida, Alabama, and Mississippi, and they were equaled in Pennsylvania, Louisiana, and New Mexico. In July 1931 previous maxima were broken only in Florida and Idaho and equaled only in Georgia and South Dakota.

WIND

Warm winds, both in 1930 and in 1931, contributed in a large measure to the effects of the drought on vegetation. In many areas warm winds persisted both night and day and in a large measure may have accounted for low humidity, high evaporation, and absence of the usual dews, which are of great benefit to vegetation.

EFFECT ON GROUND AND SURFACE WATER

GENERAL EFFECT

The quantity and distribution of both surface and subsurface water, and also their relation to each other, are determined by a combination of factors, including climate, vegetation, topography, geology, geographic location, and the works of man.

The relation between droughts and water supplies and between water supplies and vegetation depends upon the basic principles of hydrology, and these three subjects are so closely related that it is difficult to consider or discuss any one of them independently of the others.

Of the water that reaches the earth by precipitation, a part is promptly returned to the atmosphere by evaporation; another part remains on the surface, either as snow or impounded water, or in flowing streams, as surface water; and the remainder enters the ground and becomes subsurface water.

With respect to the occurrence of subsurface water [2] the earth's crust may be divided into the zone of saturation and the zone of

[2] See Meinzer, O. E., Occurrence of ground water in the United States: U. S. Geol. Survey Water-Supply Paper 489, 1923; Outline of ground-water hydrology: U. S. Geol. Survey Water-Supply Paper 494, 1923.

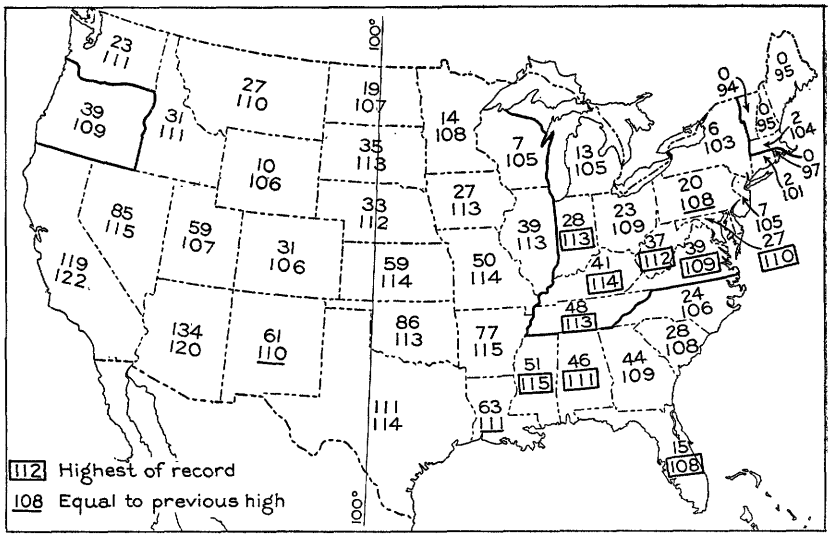


FIGURE 3.—Temperatures, 1930. Upper figure, number of days with maximum of 100° F. or more. Lower figure, maximum temperature during June, July, and August. In areas indicated by heavy outline the precipitation in 1930 was lowest of record.

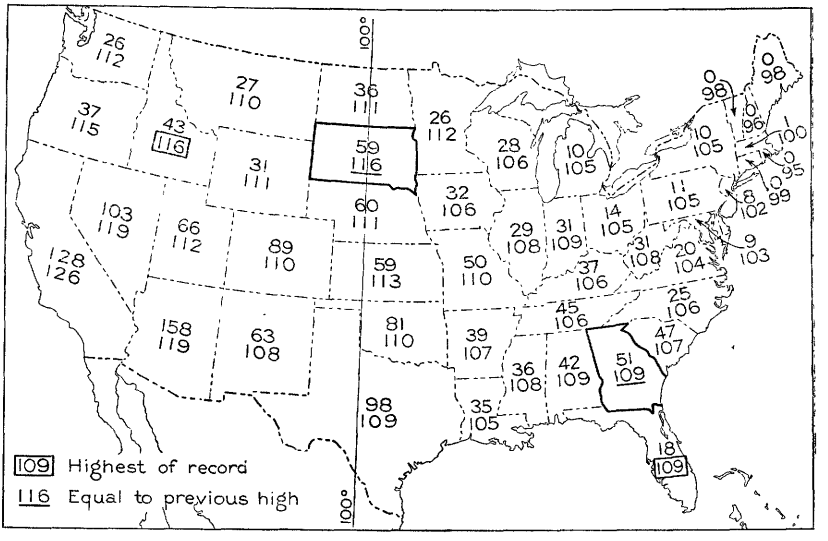


FIGURE 4.—Temperatures, 1931. Upper figure, number of days with maximum of 100° F. or more. Lower figure, maximum temperature during June, July, and August. In areas indicated by heavy outline the precipitation in 1931 was lowest of record.

aeration, as indicated in figure 5. In the zone of saturation the interstices are filled with water under hydrostatic pressure. This zone constitutes the great reservoir from which stream flow is maintained and deep-rooted plants are, in part, fed during the periods of slight rainfall. The water in this zone is commonly called "ground water." In the zone of aeration the interstices are largely filled with air. Many of the interstices in this zone contain water, and at times some of them may be completely filled. This water is not, except temporarily, under hydrostatic pressure and is, for the most part, held by molecular attraction. This zone acts as a distributing reservoir, and its water content is subject to rapid fluctuations.

The depth to the water table or upper surface of the zone of saturation varies in different localities, depending on topography and the geologic formation. It also has seasonal variations, which depend on the differences in the rate at which water enters and leaves the zone of

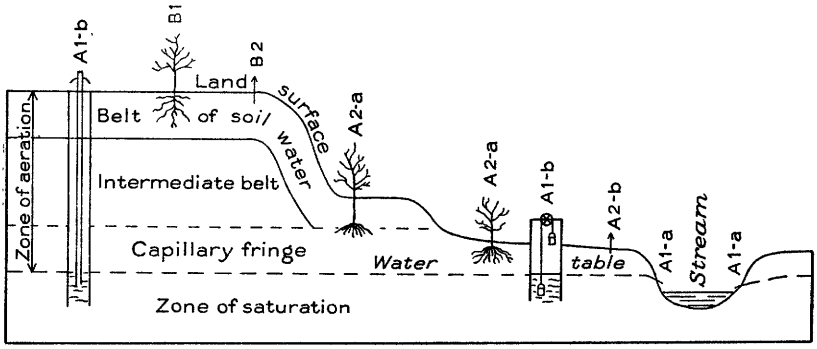


FIGURE 5.—Diagrammatic section showing different kinds of discharge of subsurface water. *A*, Groundwater or phreatic-water discharge: *A1-a*, spring; *A1-b*, well; *A2-a*, phreatophyte; *A2-b*, soil which is acting like the wick of a lamp in drawing water from the zone of saturation. *B*, Vadose-water discharge: *B-1*, ordinary plant, the roots of which do not extend to the capillary fringe; *B-2*, soil above the capillary fringe, which is losing moisture by evaporation. (After Meinzer.)

saturation. These variations indicate and determine the gradient of the water table. This gradient is important, because its fluctuations correspond to the amount of water that is released from the zone of saturation.

The zone of aeration may be divided, as indicated in figure 5, with respect to the occurrence and circulation of its water, into the belt of soil water, the capillary fringe, and the intermediate belt.

The belt of soil water is the part of the earth's crust immediately below the surface, from which water is discharged into the atmosphere in perceptible quantities by evaporation from the soil or transpiration from plants. Its thickness is limited by the character of the vegetation and the texture of the soil. It is essentially the same as the so-called "root zone." The capillary fringe is the belt that overlies the zone of saturation and contains interstices, some or all of which contain water

that is continuous with the zone of saturation but is held above that zone by capillary action against gravity. Its thickness is determined by the texture of the material in which it occurs.

The intermediate belt is the residual part of the zone of aeration. It varies in thickness and will be missing entirely when the belt of soil moisture joins the capillary fringe. In general, the intermediate belt is of but little importance in connection with water supplies.

The precipitation that passes below the surface first enters the belt of soil water, from which it is discharged in four ways—(1) to the atmosphere by evaporation directly from the soil; (2) to plants, which return a large portion of it to the atmosphere by transpiration; (3) to the surface water by shallow subsurface flow; (4) to the intermediate belt, through which it percolates and ultimately reaches the water table, where it enters the zone of saturation.

Where the water table meets the earth's surface, springs occur and water flows from the zone of saturation upon the land surface or into a body of surface water. Where the water table is near the surface, water may be withdrawn from the zone of saturation by evaporation directly through the soil or by plants, mostly by transpiration. Water is also withdrawn from the zone of saturation through wells, filtration ditches, and tunnels.

The precipitation reaches the surface streams either directly by flow over the surface of the ground or indirectly through the ground, either as suspended water or as ground water. Low-water flows are derived largely from ground water; when this is supplemented by water from the zone of aeration, medium flows exist; and if there is a large contribution from the surface, flood flows are produced.

The relation between vegetation and water is not fully understood, it is not readily susceptible of laboratory study, and there are varying opinions relative to the many phases that enter into it. Certain principles, however, have been usually agreed to by many students of the subject. Plants draw their moisture through their root systems from the earth's zone in which they are embedded and give it off by transpiration through their leaves. Root systems are particularly susceptible to the influence of changes in soil texture and moisture and are more or less modified by environment. There are wide variations in their character. Some penetrate deeply into the soil; others lie near the surface. The root systems reach out and take the water which is most readily available. Their principal source of supply is the belt of soil water, and not the zone of saturation, for with the exception of certain trees, the roots of most plants do not extend

deeply into the ground and, in general, do not reach the water table. Hence, there appears to be but little direct relation between most vegetation, other than deep-rooted trees, and the ground-water table. The principal draft on the zone of saturation by vegetation is that from growth on lands adjacent to watercourses.

During the average growing season practically all the precipitation is lost through evaporation or utilized in plant growth, so that stream flow during the growing period is largely dependent upon ground water. Low flows, therefore, generally prevail except when the precipitation is intense or excessive.

Water in the belt of soil water fluctuates in quantity with precipitation and is continually being lost either by evaporation and transpiration or by percolation laterally to the surface or downward to the zone of saturation. The capacity of the belt of soil water for holding water is comparatively small; therefore the quantity of water available in it is not greatly affected by long-time carry-over derived from previous precipitation. In general this belt contains sufficient water to supply vegetation for only a few weeks, and during the growing season of June, July, and August ample replenishment is required or most plant life will suffer. Crop-yield statistics for the humid and semiarid sections (see pp. 32–35) indicate that, in general, after germination, from 7 to 8 inches of favorably distributed precipitation is the minimum requirement for the production of average yields, unless temperatures are abnormally low or high, or there are excessively hot winds.

A comparison of available records of precipitation and run-off in the northeastern United States prior to 1906 [3] as given in table 3 indicates that in the humid areas during the growing period evaporation and plant growth will consume as much as 3½ inches of precipitation a month. Therefore, unless the monthly precipitation during the growing season exceeds that amount or comes so rapidly that it cannot all be consumed, there will be little water available for replenishing either the surface or the ground water.

[3] See Hoyt, J. C., Comparison between rainfall and run-off in northeastern United States; Am. Soc. Civil Eng. Trans., vol. 59, paper 1061, 1907.

TABLE 3.—*Losses between precipitation and run-off prior to 1906 for the winter and summer months*

Station	December to April				June, July, August				Total yearly loss (inches)
	Precipitation (inches)	Run-off		Loss (inches)	Precipitation (inches)	Run-off		Loss (inches)	
		Inches	Percent of precipitation			Inches	Percent of precipitation		
Connecticut River at Orford, N. H.	12.89	11.19	87	1.70	12.00	3.87	32	8.13	15.10
Housatonic River at Gaylordsville, Conn.	17.80	17.12	96	.68	16.02	5.12	32	10.90	18.43
Susquehanna River at Harrisburg, Pa.	14.48	13.58	94	.90	12.25	2.85	23	9.40	18.29
Susquehanna River at Wilkes-Barre, Pa.	14.47	16.48	114	−2.01	14.00	2.74	20	11.26	16.66
Susquehanna River at Williamsport, Pa.	15.48	14.76	95	.72	12.87	3.30	26	9.57	17.76
Ohio River at Wheeling, W. Va.	16.23	15.16	93	1.07	12.61	3.12	25	9.49	19.02
Potomac River at Point of Rocks, Md.	14.14	9.14	65	5.00	11.80	2.44	21	9.36	22.64
Shenandoah River at Millville, W. Va.	14.38	7.72	54	6.66	12.60	2.80	22	9.80	24.69
James River at Cartersville, Va.	16.95	10.76	63	6.19	13.69	3.51	26	10.18	24.77
James River at Buchanan, Va.	15.99	10.37	65	5.62	12.87	2.97	23	9.90	24.26
North Fork of James River at Glasgow, Va.	15.89	9.57	60	6.32	12.69	2.98	23	9.71	24.77
Appomattox River at Mattoax, Va.	16.87	9.89	59	6.98	14.36	3.05	21	11.31	26.50
Roanoke River at Roanoke, Va.	16.50	9.84	60	6.66	13.48	3.63	27	9.85	24.99
Roanoke River at Randolph, Va.	17.53	9.53	54	8.00	14.60	4.62	32	9.98	25.14

Surface and subsurface water supplies are usually at a minimum at the end of the growing season, which for most sections of the United States is about October 1. From that time until the beginning of the next growing season, about April 1, the losses through evaporation and plant life are comparatively small, and the precipitation is mostly available for replenishing surface and subsurface waters. For this reason October 1 may be used as the beginning of the water year in presenting stream-flow records. The major part of stream flow depends on the precipitation during the nongrowing season.

In the humid areas, where cultivated crops depend wholly on rain, there will obviously be a drought when an absence of rain occurs in the growing season. In the semiarid regions dependence on rain also makes a dry period a drought period. In the true arid country, however, where crops depend for their moisture largely on impounded water, a drought is not caused by absence of precipitation during the growing season but rather by absence of precipitation during the nongrowing seasons, as precipitation during these seasons furnishes a larger part of the water for storage.

The demand for water for natural vegetation is different from that for cultivated crops. Through the centuries the natural vegetation

has adapted itself to its environment, so that it can withstand to a large degree absence of moisture for long periods, extremes in temperatures, and high desiccating winds. Ecologists state that this is a part of the process of "edaphic adaptation." Therefore, in a sense, natural vegetation, including arborescent flora, can survive droughts that would affect cultivated crops. The effect of a drought on such vegetation, however, may consist in lessening cellulose produced, reducing the growing season, and as a corollary increasing the dormant season.

As related to agriculture, a drought depends largely on the extent to which man has entered into the picture.

In ordinary years the humid areas have adequate precipitation to supply the needs of vegetation. Nevertheless, there may be in any year small areas in which vegetation is affected by shortages of water, and at intervals ranging from 15 to 20 years there may be major shortages that may seriously affect vegetation over large areas. The correction of these effects is largely outside the control of man, and to be successful, agricultural activities in the humid section should be so planned as to provide for carrying over these lean years.

The precipitation in the semiarid sections of the country is so small that vegetation is affected in a large measure not only by fluctuations in the total annual precipitation but also by unsatisfactory distribution throughout the year. These areas, which may be for alternate years either humid or arid, according to the precipitation, were originally natural range and produced, in the main, only vegetation for stock raising, which was successfully carried on for many years. In 1873 the Director of the United States Geological Survey, in testifying before a congressional committee on public lands, indicated that most of the country lying west of Minnesota was an arid region and in the main could not be used for agriculture except by irrigation. Five years later he reiterated this statement before another committee. While irrigation has been successfully carried on in the arid sections, unfortunately it has not been found economically feasible in most semiarid sections. The United States Weather Bureau has repeatedly expressed cautions against any great extension of agriculture in the semiarid States.

The reason for the failure to heed these warnings is shown in figures 1 and 19, which indicate that since 1880 drought years in the semiarid States have been more or less bunched, with several years of no drought between each group. The periods of no drought were 1880 to 1885, 1902 to 1906, and 1918 to 1923. With adequate precipitation, these semiarid areas are especially adapted to the growing of wheat, and during nondrought years large areas were converted from range to wheat culture. It was this section that suffered so greatly during the drought period 1930–34, which again called attention to the ever-present danger to many types of agriculture that

have been undertaken in the semiarid regions and have not fully succeeded. If the future is to be judged by the past, there is no indication that such activities can be continued in these areas with any assurance of success under the present methods of farming.

In the arid regions vegetation is limited both in character and in extent, except in subirrigated bottom lands and artificially irrigated areas. Successful irrigation depends primarily upon the way in which available water supplies are developed, the character of the land, and the methods of distribution and application of water. Detrimental effects of droughts on agriculture in these regions depend largely on the character and extent of farming activities.

In most irrigated areas ample water is usually available to meet present requirements if it is wisely developed and used. This fact was clearly shown during the period 1930–34, when on projects that had been properly developed and were scientifically operated losses due to inadequate water were generally not serious.

The marked effect that vegetation has on surface and ground water was clearly shown during the droughts of 1930 and 1931, as after light precipitation there was a noticeable increase in the flow of springs and small streams, even though no great amount of water could have been contributed. This effect was also indicated on cloudy days and during nights, when there was a slowing up of plant growth. At the end of the growing season the flow of springs and small streams increased, even though there was no precipitation, and water appeared in many springs and small streams that had been dry during the growing season.

Examples of the effect of the consumptive use of water by vegetation on water supplies in Maryland and Virginia are given in the Monthly Weather Review for October 1930. Among these observations were those of the flow of a small stream at Cabin John, Md., a suburb of Washington. The behavior of this stream, which has a drainage area of only a few acres and is in effect a spring, was typical of that of numerous other springs and small streams in Maryland and Virginia. During the summer there was a diurnal fluctuation in which the low flow was at times only one-sixth of the high flow. In September the stream became intermittent each day, but in October, although there had been no appreciable precipitation, the flow became continuous again, with diurnal fluctuations similar to those that existed before the intermittent period.

The gage-height graph (fig. 6) of the South Fork of the Mills River at The Pink Beds, N. C., which has a drainage area of 9.87 square miles, mostly wooded, indicates how diurnal fluctuations in stream flow due to transpiration and evaporation vary throughout the year. In the winter the flow is steady, the graph being almost a straight line. Through the growing season the graph shows regular diurnal fluctuations as transpiration takes its share of the supply

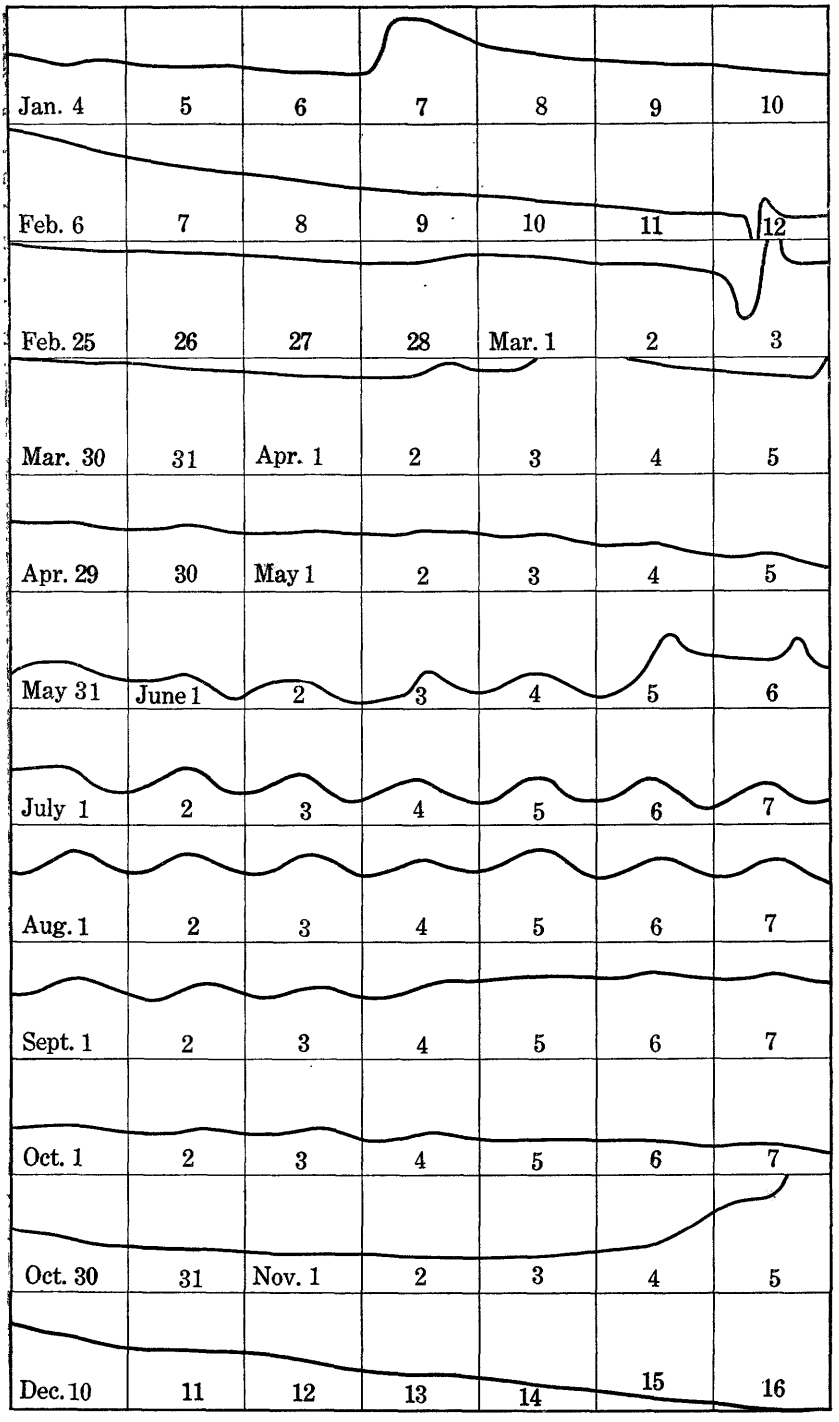


FIGURE 6.—Gage-height graph of South Fork of Mills River at The Pink Beds, N. C., showing diurnal and seasonal effect of evaporation and transpiration.

during daylight and diminishes during the night, with a lag before the effect appears in stream flow. Translated into flow, the daily variations are as large as 30 percent.

The magnitude of losses through transpiration and evaporation is illustrated by variations of flow for Owens Creek at Lantz, Md. This stream has a drainage area of 5.99 square miles, located in a wooded mountain region at an altitude of about 1,500 feet. Figure 7 shows the diurnal fluctuations in the gage height of this stream from June 1 to 5, 1932. These fluctuations, as indicated on the graph, correspond to a daily variation of flow that averages over 20 percent and aggregates about 820,000 gallons a day, enough to furnish an average municipal supply for 8,000 people.

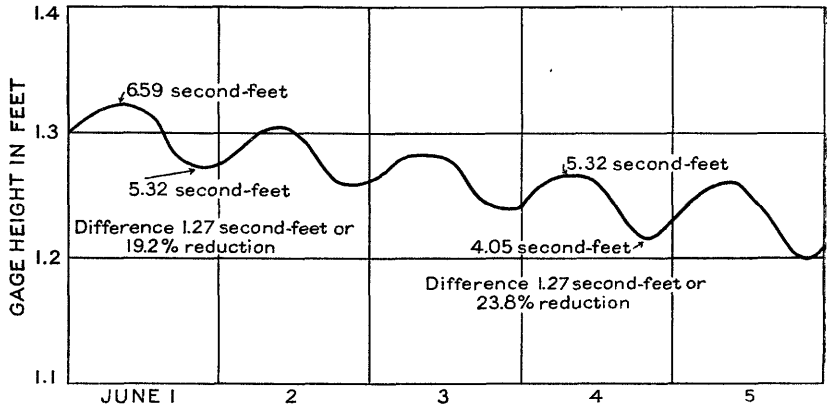


FIGURE 7.—Gage-height graph of Owens Creek at Lantz, Md., June 1–5, 1932, showing effect of transpiration and evaporation on stream flow.

Diurnal fluctuations in low-water flow of streams caused by daily evaporation and transpiration apparently vary inversely as the depth to the water table, as indicated in figure 8, a graph of hourly discharge over a weir on Piney Run near Sykesville, Md. (drainage area, 11 square miles), for two similar 2-day periods, both of which are representative of the low-water flow for their respective years. Prior to each 2-day period there had been no rainfall for a considerable length of time, so that all of the direct surface run-off from the last rains had passed out of the basin, and the stream flow as shown in the figure was derived mostly from the ground-water reservoir and therefore gives a fair indication of the depth of the water table in this small basin. The graphs indicate a marked fluctuation in flow, the high flow resulting from hours of little or no evaporation and transpiration, and the minimum flow showing the effects of the hours when transpiration and evaporation are greatest. The difference between the high and low rate of discharge for the day indicates the maximum rate at which evaporation and transpiration were depriving the stream.

The areas in figure 8 which are enclosed between the dashed line and the graph provide a measure of the daily loss to the stream, which has been computed, as shown in the figure, in million gallons a day. No records of ground-water levels are available, but it was observed that the precipitation in 1933 was ample to maintain a higher ground-water table than in 1932, when there was less precipitation. In 1933, a year of ample rainfall and correspondingly high ground water, the low flow was about 150 percent greater on June 3 and 4 than for the same 2 days in 1932, which was a year of low rainfall and correspondingly low ground water. The estimated evaporation and transpira-

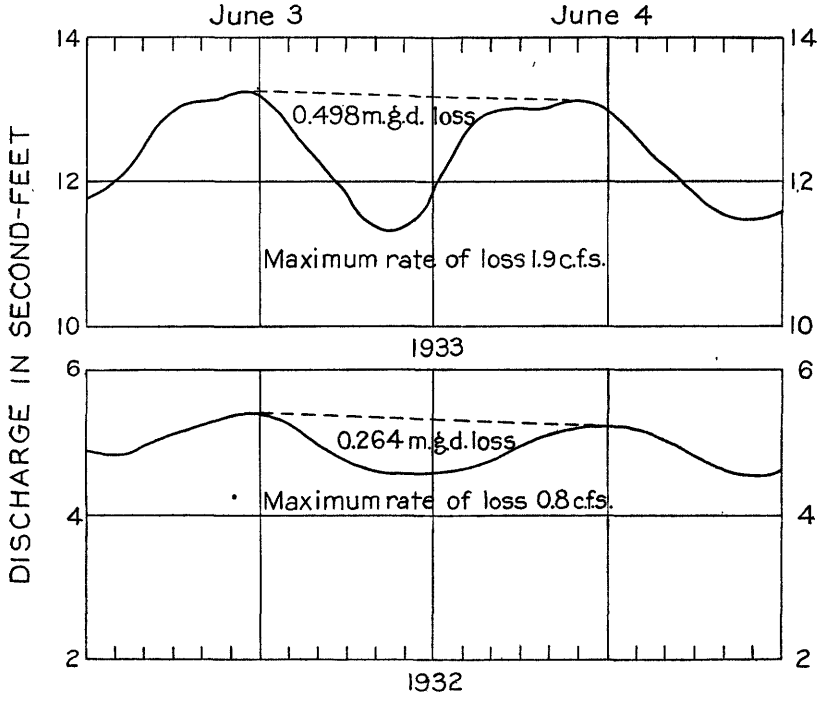


FIGURE 8.—Discharge graph of Piney Run near Sykesville, Md., showing effect of transpiration, evaporation, and altitude of water table on stream flow.

tion losses producing diurnal fluctuations in the low stream flow were about 90 percent greater in 1933 than in 1932. The indications are that this difference was largely due to the fact that less evaporation and transpiration from ground water takes place when the water table is at a greater depth.

Evaporation from surfaces of impounded water and of flowing streams is an important factor in connection with the effect of drought on both surface and ground water. During the summer of 1930 measurements of flow of the Potomac River at Point of Rocks, Md., indicated less discharge than the combined flow as recorded at river-

measurement stations at Shepherdstown, Millville, and other points on tributary streams above Harpers Ferry. The distance between Point of Rocks and the upper measurement stations is about 28½ miles. The area of water surface in this stretch of the river is about 5.75 square miles. An evaporation of 0.01 foot for 24 hours from this area of water surface would be equivalent to a flow of 18.6 second-feet. There were many days during the summer of 1930 when the humidity was extremely low, with brisk winds, on which the evaporation probably approached 0.1 foot a day. The loss due to this evaporation was sufficient to account for apparent discrepancies in the discharge as measured at Point of Rocks, where the minimum daily flow in 1930 was 594 second-feet, and at points on tributary streams above.

GROUND WATER

Comparatively few systematic records of fluctuations of ground-water levels have been collected, and most of these cover only short periods. Therefore any statement relative to the effect of the drought on ground water is more qualitative than quantitative. In general, however, it is known that during 1930 and 1931 there were marked lowerings of ground-water levels, which severely affected many communities that depend on ground water for domestic and other uses, and in many localities flowing springs and wells either became intermittent or ceased to flow until the end of the drought.

An example of the effect of the drought on the ground-water table is indicated in figure 9, which shows the precipitation at Washington, D. C., and corresponding fluctuations of the water surface of the Ross well, in nearby Virginia.[4] This graph, produced by a water-stage recorder, shows that in the winter of 1928–29 replenishment of the ground-water supply began late in January, and in the winter of 1929–30 it began about the middle of January, whereas in the winter of 1930–31 it did not begin until near the end of March. In the winter of 1931–32 it began about the first of January. The winter replenishment raised the ground-water table somewhat over 2 feet in 1928–29 and in 1929–30, over 4 feet in 1931–32, and over 6 feet in 1932–33, but less than 1 foot in 1930–31.

On account of the great draw-down caused by the drought of 1930, the water table at the site of the Ross well dropped to an extreme low stage and reached its greatest depression in March 1931. The summer of 1931 was unusually favorable for replenishment, however, and hence at the well site there was a small net rise in the water table, which was in striking contrast to the decline of about 3 feet in the summer and autumn of 1930. A rise of nearly half a foot was produced by the heavy rains that occurred at the end of May and the be-

[4] Cady, R. C., Investigations of the fluctuations of water levels in observation wells in Virginia: Am. Geophys. Union Trans., 1932, pp. 370–373.

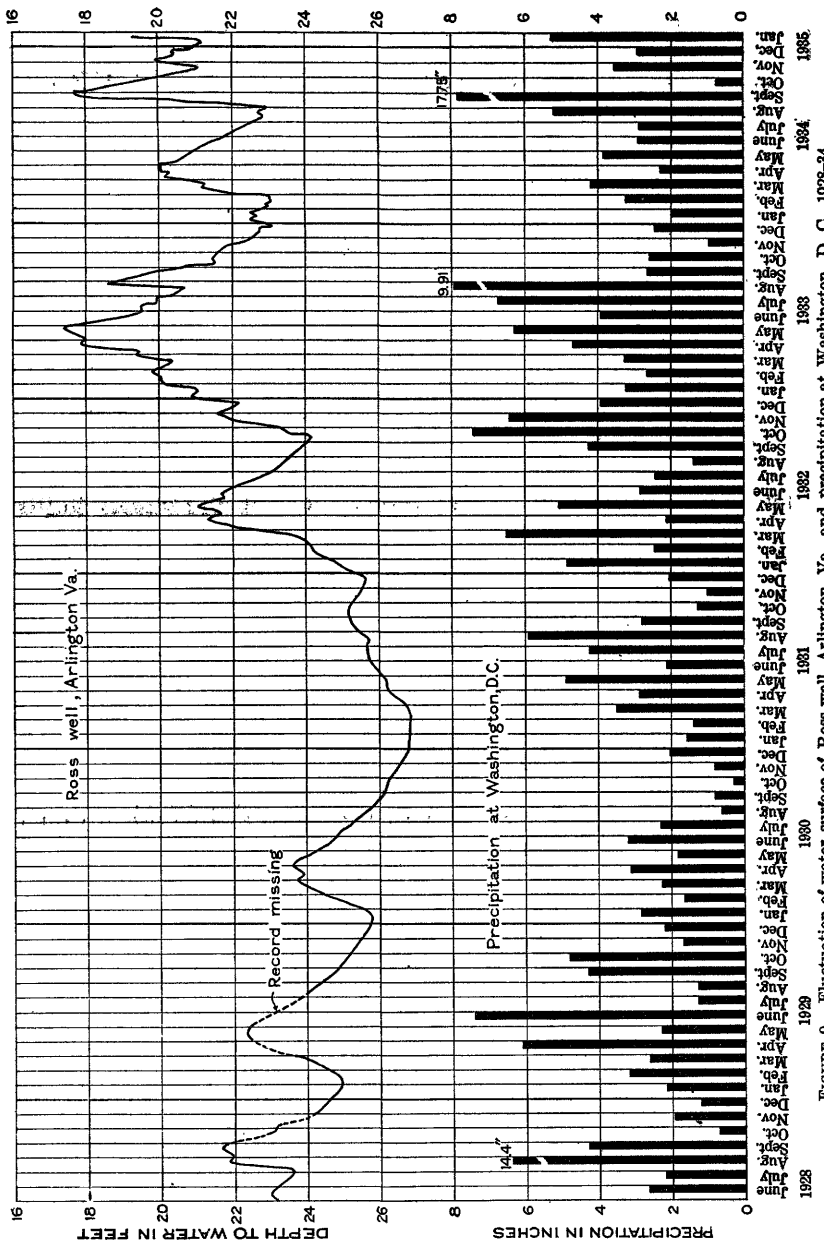


FIGURE 9.—Fluctuation of water surface of Ross well, Arlington, Va., and precipitation at Washington, D. C., 1928–34.

ginning of June 1931, and a further rise of about the same amount was produced by the combined effect of heavy rains in July and August. Later in the season the water level declined about to the July level. The most notable summer replenishments within the period of record occurred in August 1928, August 1933, and September 1934; in August 1928 the precipitation amounted to 14.4 inches, and the water table rose about 2 feet; in August 1933 the precipitation amounted to 9.91 inches, and the water table rose about the same amount; in September 1934, however, the precipitation was 17.45 inches, and the water table rose 5 feet.

It should be explained that in the summer of 1931 there was more replenishment at this observation well than at several other wells in Arlington and Fairfax Counties, in which measurements of the water level were made. For example, in one of these other wells the water level dropped slightly more than 1 foot from August 22 to December 26, whereas during this period the water level in the observation well first rose and then fell, with almost no net change. This was probably due to geologic conditions that were favorable to percolation.

Comparison of the Ross well records with the barograph observations at Washington indicates that the ground-water table fluctuates in response to variations in atmospheric pressure. These fluctuations have only a small range. They can, however, readily be distinguished from any rise produced by replenishment. Apparently when the soil is dry changes in atmospheric pressure are transmitted through the air-filled interstices in the soil almost as easily as through the air column in the well. Hence the changes in pressure on the water table are essentially equal to the changes in pressure on the water surface in the well. On the other hand, when the pore spaces in the soil contain more water, the barometric changes cannot be transmitted so readily to the water table as to the water surface in the well, and hence the water surface is depressed when the barometer rises and recovers when the barometer falls. In some wells that extend into water-bearing formations overlain by impervious confining beds the barometric fluctuations have been found to be nearly 100 percent of the fluctuations of a water barometer. As the locality of the observation well near Washington has a water table without any competent confining bed, the barometric fluctuations are much smaller. Thus they amounted to only about 15 percent from April 27 to May 4, 1930, when the soil moisture was fully replenished, and to a much smaller percentage from November 22 to 29, 1930, when the soil was very dry.[5]

[5] Meinzer, O. E., Methods of estimating ground-water supplies: U. S. Geol. Survey Water-Supply Paper 638, pp. 140–142, 1932.

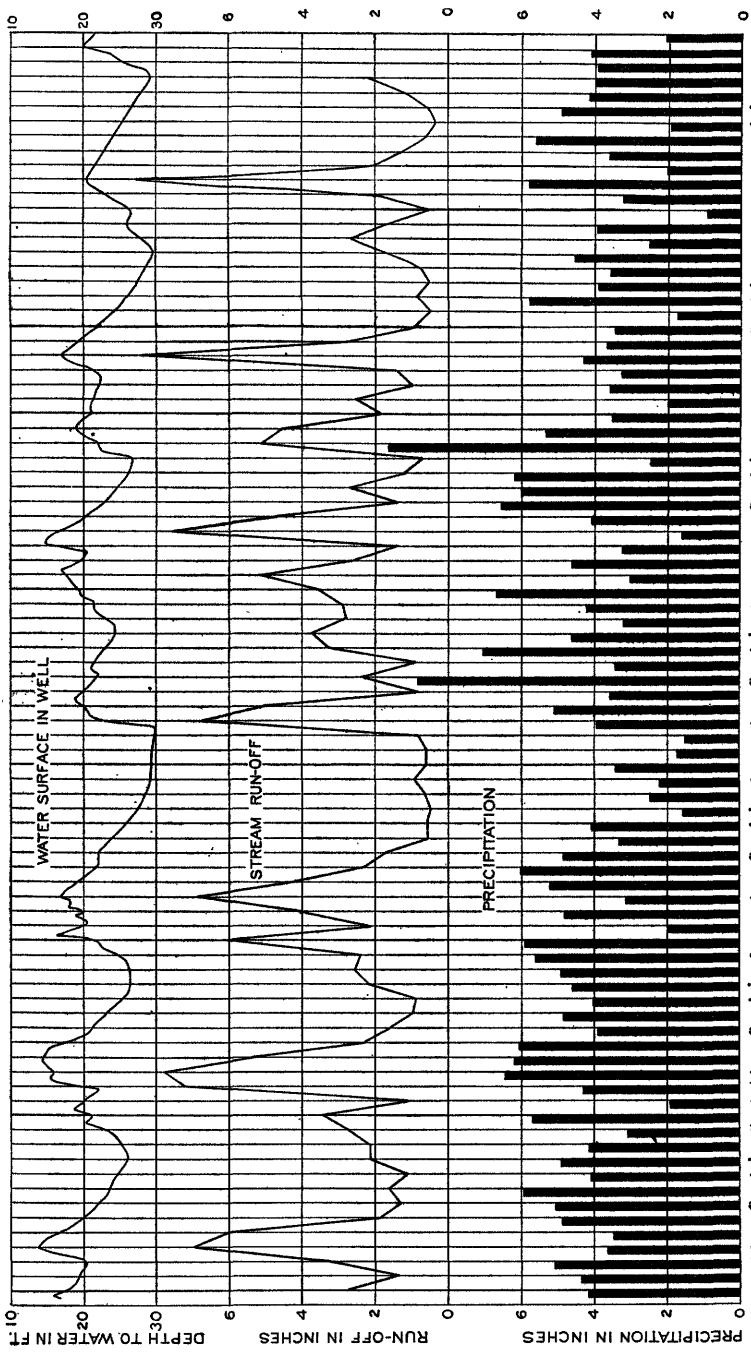


FIGURE 10.—Fluctuations of water surface of a well, run-off, and precipitation on South Branch of Moose River in New York, 1928–34.

Ground-water levels recorded at White Lake Corners, Oneida County, N. Y., since 1928, are shown in figure 10.[6] The same diagram also shows the run-off from the South Branch of the Moose River, a nearby stream with a drainage area of 216 square miles, and the average rainfall over this area as obtained from rain gages at McKeever, North Lake, and Raquette Lake. These records, like others, show that in the main the fluctuation of both ground water and stream flow follow closely the precipitation, and there is no indication of large carry-over effects from either high or low precipitation.

The general trend of the ground-water fluctuations starting with the end of the growing season is a rise in level until January or February, when, apparently owing to frost conditions, the level falls until the spring break-up; then it rises again until the beginning of the growing season; and then, owing to the demands for water by vegetation, it drops until the end of the growing season.

Prior to the beginning of the drought of 1930 the precipitation and corresponding ground-water level and also the stream flow were average or above. In spite of the severity of the drought both the stream flow and the ground-water levels responded almost immediately to the increased precipitation late in 1931, and continued on an upward trend until the beginning of the growing season of 1932, when they were not materially lower than at the corresponding dates in 1928 and 1929.

SURFACE WATER

Surface waters in lakes, ponds, reservoirs, and flowing streams were severely depleted as a result of the droughts of 1930 and 1931. There was a material lowering of the surface of bodies of impounded water. Many reservoirs were drained entirely, the surfaces of larger lakes and ponds were materially lowered, and many of the smaller ones practically dried up. Many new minima for the flow of streams were established during the calendar years 1930 and 1931. In general, however, the minimum daily flows did not fall much below those previously recorded. On the other hand, the weekly and monthly flows for many streams reached new minima, and many records of long-continued low flows were broken.

During 1930 minimum flows for the period of record were reached on many streams as early as July, and the flow did not go much lower while the drought lasted. The drought continued long enough in most drainage basins to test available ground-water supplies thoroughly, and the records indicated that the available ground-water supply for some basins may be so great that it is adequate to maintain the stream flow above a fixed minimum for a considerable length of time and probably through most droughts.

[6] Unpublished data furnished by Edwin S. Cullings, member Am. Soc. Civil Eng., Watertown, N. Y.

The records of stream flow indicate that the small variations in flow during low-water periods, caused by occasional rains, are of short duration, as shown in table 4, which gives the daily flow of the Potomac River at Shepherdstown, W. Va., during the last 7 months of 1930. The effect of the drought on stream flow started late in June, was well established by July 11, and continued until December 27. A minimum flow of 300 second-feet was recorded on one day each in July and August. In September the flow was between 330 and 340 second-feet on several days, in October it was 307 second-feet on 4 days, in November it was 325 second-feet on 2 days, and in December it was 371 second-feet on 3 days.

TABLE 4.—*Daily discharge, in second-feet, of Potomac River at Shepherdstown, W. Va., June 1 to Dec. 31, 1930*

[Drainage area, 5,970 square miles]

Day	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,080	1,130	554	428	371	325	401
2	1,000	1,050	384	489	371	334	381
3	1,000	918	320	428	371	334	371
4	1,000	780	450	450	381	343	371
5	931	780	825	417	371	343	371
6	931	825	855	406	381	361	391
7	1,040	825	636	395	381	381	431
8	821	825	541	395	391	381	834
9	917	580	463	384	381	381	391
10	931	855	406	373	371	381	656
11	945	489	373	351	371	381	692
12	1,320	489	362	340	371	391	889
13	3,750	384	362	340	371	401	903
14	2,870	463	351	340	371	421	808
15	2,160	594	330	340	371	421	584
16	1,760	692	300	340	352	451	743
17	1,730	594	310	351	352	821	494
18	1,730	489	310	330	343	644	472
19	1,690	439	310	340	343	431	717
20	1,630	351	330	351	334	411	717
21	1,540	528	384	351	343	381	483
22	1,120	594	384	362	361	343	692
23	1,210	608	362	450	334	325	644
24	1,090	594	406	401	316	343	527
25	1,100	706	439	371	307	334	431
26	1,360	300	450	371	316	361	483
27	1,530	340	439	352	307	352	959
28	973	502	428	352	307	352	931
29	987	567	417	361	307	361	808
30	1,310	515	406	371	316	361	861
31	-------	528	417	-------	325	-------	808
Mean	1,380	624	429	378	351	395	621

The combined flow from the Tennessee and Cumberland River drainage basins [7] as compared with the precipitation in the same area for the 30-year period 1900–29 is shown in figure 11. For this 30-year period the average run-off was 45 percent of the precipitation. In wet years it exceeded 50 percent, and in dry years it dropped to 35 percent or less, indicating that the losses through evaporation and

[7] See King, W. R., Surface waters of Tennessee: Tennessee Dept. Education Bull. 40, p. 56, 1931.

transpiration do not vary materially between wet and dry years as long as there is sufficient precipitation to satisfy the evaporation and transpiration demands, and that deficiency in rainfall may mean a relatively greater deficiency in stream flow. This is important in planning municipal water supplies.

A wide variation in the unit run-off of different areas is found, even in areas adjacent to each other. Observations in 1930 showed that some streams became dry while others of comparable size in adjacent basins continued through the drought with a fair discharge. As conditions in different drainage basins vary, estimates of low flow

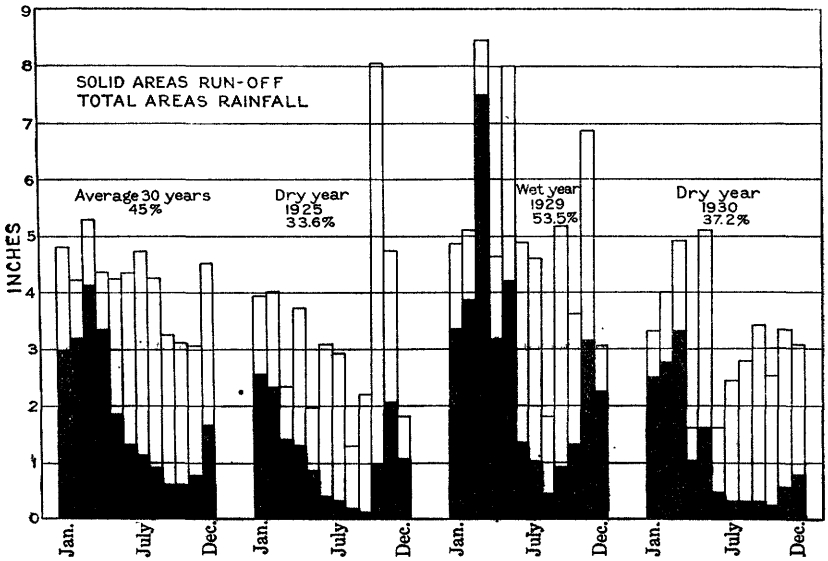


FIGURE 11.—Rainfall and run-off for combined drainage basins of Tennessee and Cumberland Rivers, by months, showing variation between wet and dry years. Ratio of run-off to rainfall is indicated in percent on diagram.

based on comparison with adjacent areas or on precipitation data cannot be made with any degree of certainty. Records of flow on the stream that is to be utilized afford the only safe basis for making studies in connection with a given development. Records of daily flow are essential for detailed studies, but for general comparative studies records of mean monthly flow and deficiency tables will serve many needs. Such data for the Potomac River at Point of Rocks, Md., are presented in tables 5 and 6 as typical records showing the general effect of the droughts of 1930 and 1931 on stream flow.

TABLE 5.—*Monthly and yearly discharge, in second-feet, of Potomac River at Point of Rocks, Md., 1895–1931*

[Drainage area, 9,650 square miles]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
1895	------	------	24,560	14,500	12,540	3,910	4,462	1,997	1,565	1,163	1,333	2,259	--------
1896	5,257	10,470	------	------	------	5,429	9,283	3,449	2,185	12,490	6,928	4,723	--------
1897	4,284	42,660	20,850	10,830	22,950	5,997	5,315	4,092	2,337	1,968	2,096	6,579	10,800
1898	14,660	8,339	15,330	15,970	18,060	4,178	2,418	22,140	2,497	13,670	8,557	15,330	11,800
1899	18,680	28,130	35,240	11,750	11,600	5,314	2,519	2,335	2,345	1,663	3,171	4,068	10,600
1900	8,166	13,340	18,470	9,295	4,466	8,394	3,008	1,917	1,344	1,333	4,570	6,218	6,710
1901	4,950	3,649	13,800	39,750	26,920	19,180	10,720	8,337	7,636	4,303	4,648	25,610	14,100
1902	17,520	32,520	54,260	28,760	5,973	3,186	3,086	2,464	1,490	2,767	2,837	18,590	14,500
1903	17,200	22,190	26,730	28,900	6,212	17,970	12,760	4,826	4,669	3,212	2,175	2,926	12,500
1904	7,287	17,480	11,170	7,406	9,362	10,160	4,510	2,394	1,592	1,164	1,340	2,201	6,340
1905	8,626	5,625	23,480	6,581	4,493	6,979	10,190	5,830	3,205	2,888	2,267	10,640	7,570
1906	14,990	5,116	15,900	22,440	5,538	7,007	4,381	15,200	4,275	16,310	6,341	11,100	10,700
1907	27,000	9,560	30,500	14,900	11,100	23,200	6,010	3,710	6,430	3,550	7,850	17,800	13,500
1908	25,400	24,100	28,600	10,200	32,100	7,250	4,470	3,880	2,500	2,780	2,670	2,440	12,200
1909	6,950	11,300	8,700	16,700	8,660	11,000	2,700	2,110	1,780	2,190	1,850	3,130	6,420
1910	11,700	13,800	9,960	10,100	5,520	26,400	5,500	2,000	1,740	1,560	1,440	2,090	7,650
1911	12,200	11,300	9,670	15,100	4,330	3,690	2,160	2,440	12,600	8,510	5,970	10,200	8,180
1912	9,450	16,400	28,700	14,900	19,800	5,280	8,550	3,460	6,360	3,090	3,270	3,390	10,200
1913	11,700	5,890	18,200	16,100	13,600	10,400	4,490	3,010	1,770	6,850	13,500	8,120	9,470
1914	20,000	15,900	19,300	20,900	9,600	3,190	3,020	1,750	1,270	1,400	1,540	6,000	8,660
1915	28,600	27,000	8,230	4,370	5,900	20,400	2,670	6,760	5,350	6,730	3,590	6,650	10,500
1916	12,500	15,600	24,700	19,800	7,950	14,000	7,170	3,600	2,330	2,190	1,550	3,250	9,550
1917	9,170	7,630	38,400	10,700	5,590	7,870	3,890	2,620	1,380	4,770	3,830	2,550	8,200
1918	2,500	28,300	13,600	39,800	5,990	3,310	3,360	2,910	3,940	1,710	5,610	13,000	10,300
1919	14,800	5,980	12,700	8,860	18,300	7,130	7,220	3,130	1,720	2,420	4,620	6,880	7,810
1920	10,800	18,200	32,300	14,500	8,700	8,550	3,790	7,150	4,960	2,720	4,780	9,500	10,500
1921	6,360	6,170	12,900	4,940	20,700	4,150	4,260	3,910	3,650	1,750	4,400	11,300	7,040
1922	8,110	17,500	21,600	9,120	9,710	6,660	4,400	2,080	1,760	1,270	989	2,340	7,130
1923	6,780	12,500	10,700	10,300	5,420	2,510	1,560	2,860	3,770	1,040	2,030	6,880	5,530
1924	18,700	8,170	33,800	21,000	42,000	14,400	8,960	3,120	2,680	7,100	3,810	4,680	14,000
1925	10,400	23,600	9,680	5,990	11,300	2,710	2,420	1,580	952	2,760	6,820	5,290	6,960
1926	9,210	23,000	10,800	11,500	4,550	2,640	2,650	9,600	8,200	6,570	18,100	12,900	9,980
1927	10,700	21,600	14,500	23,200	14,000	9,420	3,210	3,110	1,540	12,400	8,400	11,800	11,100
1928	6,100	10,700	14,200	21,200	21,600	16,100	9,560	6,240	5,770	2,750	1,930	4,600	10,100
1929	4,620	8,030	24,600	27,400	14,700	7,070	3,920	1,500	1,500	15,200	13,000	7,430	10,700
1930	6,880	8,970	10,900	7,530	3,280	2,230	1,100	771	834	706	840	1,420	3,790
1931	2,370	2,930	5,400	14,200	14,200	5,610	5,520	3,630	2,060	1,240	944	2,330	5,040
Minimum	2,370	2,930	5,400	4,370	3,280	2,230	1,100	771	834	706	840	1,420	3,790
Minimum year	1931	1931	1931	1915	1930	1930	1930	1930	1930	1930	1930	1930	1930

NOTE.—Minimum monthly discharge for all months except April occurred in the 11 consecutive months May 1930 to March 1931.

The conditions on the Potomac River apply in general to the areas which were most severely affected by the droughts of 1930 and 1931. At Point of Rocks, Md., the drainage area is 9,650 square miles, and the mean flow for the calendar years 1897 to 1931 was 9,350 second-feet. The mean flow for 1930 was 3,790 second-feet, or only 69 percent of the previous lowest annual flow, which was 5,530 second-feet, in 1923.

Prior to 1930 there were only 2 months when the mean flow was below 1,000 second-feet—September 1925, 952 second-feet, and November 1922, 989 second-feet. During the calendar year 1930 the mean flow was below 1,000 second-feet for 4 months—August, 771; September, 834; October, 706; November, 840. The minimum daily flow for 1930 was 594 second-feet. Previous minima below 700 second-feet were recorded in 1911, 1914, 1917, and 1923. In 1923

the flow was below 1,000 second-feet consecutively for 18 days, in 1925 for 15 days, and in 1930 for 116 days except on 2 days when it did not exceed 1,100 second-feet. During the period of record the minimum monthly discharge for all months except April occurred in the 11 consecutive months, May 1930 to March 1931.

TABLE 6.—*Deficiency table for Potomac River at Point of Rocks, Md., 1897–1931*

Calendar year	Number of days with discharge, in second-feet, less than—										
	550	610	700	800	1,000	1,300	1,600	2,000	2,500	3,100	3,800
1897							9	29	73	107	137
1898							6	8	46	71	95
1899							23	50	115	152	172
1900						39	101	110	129	152	173
1901								2	15	60	88
1902						12	25	51	97	124	162
1903								52	60	86	113
1904					6	58	86	107	132	150	196
1905								14	37	62	130
1906										17	59
1907									2	15	57
1908							5	15	58	110	150
1909							25	112	132	163	178
1910					1	7	64	121	147	175	198
1911			1	1	1	16	24	40	51	83	109
1912								8	42	91	121
1913				1	1	4	17	29	42	69	107
1914	1	1	4	12	28	63	83	110	133	166	191
1915						1	3	6	22	72	99
1916					2	13	30	65	92	134	148
1917			1	2	6	24	45	67	94	126	167
1918						6	15	27	47	144	183
1919						9	26	48	59	87	113
1920							4	33	45	75	94
1921						6	25	47	64	96	116
1922				3	43	67	78	110	131	156	182
1923			1	12	23	38	68	102	121	153	178
1924							3	17	32	78	108
1925					21	42	63	89	111	159	182
1926							7	20	43	94	127
1927					5	15	32	39	48	82	107
1928							6	25	47	64	93
1929						16	40	62	77	85	102
1930		1	19	75	141	163	178	198	208	225	236
1931					33	65	88	122	149	186	218

A typical illustration of the persistence in trend of deficient stream flow after a trend of excess precipitation has begun is presented in figure 12, which gives for the period 1922 to 1931 the accumulated departures from the average (1897–1932) of the monthly discharge of the Potomac River at Point of Rocks, Md., and the precipitation recorded at two representative stations, Westernport and Frederick, Md., within this drainage basin. The deficiency of precipitation during 1922 and 1923 was followed by 6 months of excessive precipita-

tion. The discharge graph shows a corresponding general trend, but the stream flow did not increase materially until nearly 4 months after the precipitation had begun to exceed the normal. An example

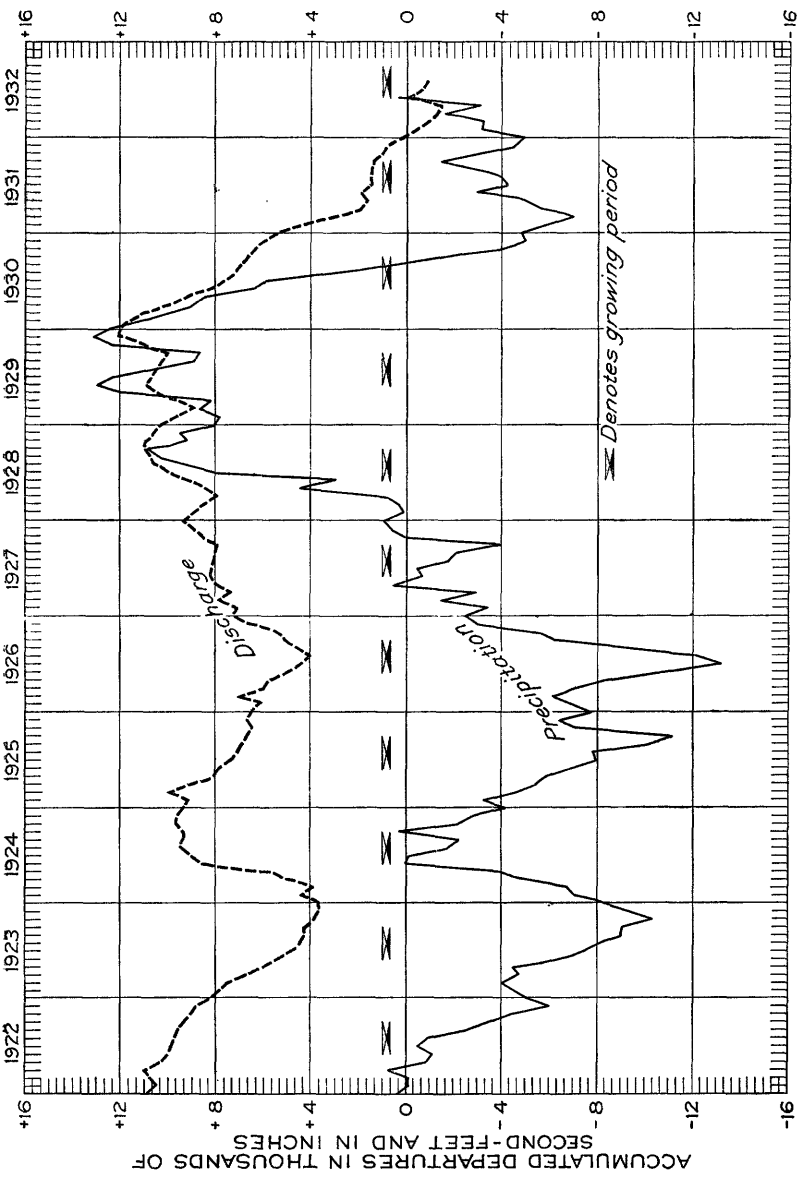


FIGURE 12.—Accumulated departures from the average of the monthly discharge of Potomac River at Point of Rocks, Md., and of the precipitation recorded at Westernport and Frederick, Md.

of this lag or carry-over is shown by the downward trend of the discharge graph that persisted 17 months after general excesses of precipitation began, in March 1931. The recovery of the stream flow

undoubtedly depends to a considerable degree on the way in which the precipitation occurs—that is, if moderate and well-distributed excesses in precipitation occur during the growing season, vegetation utilizes so much of the supply that there is little left to feed the streams. On the other hand, streams usually respond promptly to deficiencies in precipitation, for the run-off is the residual of the available supply remaining after the deduction of that consumed by transpiration and evaporation. Figure 12 shows several periods that illustrate this condition.

DAMAGE

Drought damages may be considered as affecting vegetation, domestic and industrial water supplies, health, power, navigation, and recreation and wild life. The droughts of 1930 and 1931 greatly interfered with many activities under each head, and the resulting losses in 1930 were probably greater than those sustained during any previous drought, owing partly to the fact that the uses and demands for water have vastly increased, even in the past few years.

VEGETATION

A general discussion of the relation of water supplies to vegetation is given on pages 14–21. The crop reports of the United States Bureau of Agricultural Economics afford a means for studying and comparing the effects of droughts on vegetation as related to agriculture. No systematic statistical information, however, is available in regard to the effects of droughts on natural vegetation, and the only bases for a statement relative to such effects are miscellaneous reports based upon personal observation.

During 1930 the detrimental effect of the drought on vegetation, both natural and cultivated, was marked. In 1931, however, the precipitation was adequate and sufficiently well distributed to supply the needs of vegetation in most parts of the country, and no detrimental effects of the drought appeared, except in a few localities, principally in North Dakota, South Dakota, Montana, and adjacent areas in Minnesota, Nebraska, and Wyoming. In fact, it was observed that in most parts of the country vegetation was especially vigorous in 1931. This may have been due to the lessened demands on the fertility of the soil that had been made by the stunted vegetation in 1930.

Although in 1930 the drought undoubtedly caused much damage to natural growth, no definite data are available to show its extent. Its effect on agriculture is indicated in table 2 and figures 13 and 14, which give for each State the composite yields of crops and the total precipitation during the principal growing months. The reports concerning the effect of the drought on crops indicate that as the yields

for the country as a whole do not indicate conditions in individual States, neither do the yields for individual States indicate the extreme conditions that prevailed in certain localities.

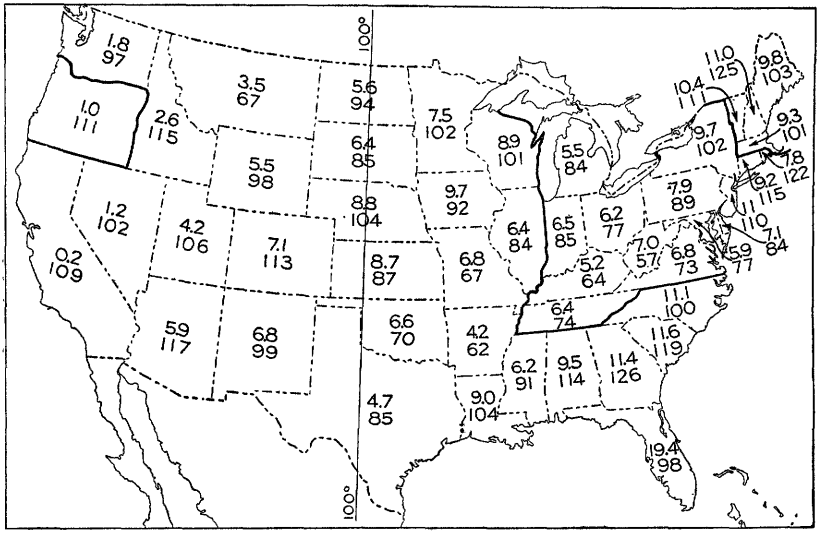


FIGURE 13.—Total precipitation for June, July, and August, in inches (upper figure), and composite yields of crops per acre, expressed as percentage of average yields (lower figure), 1930. In areas indicated by heavy outline the precipitation in 1930 was the lowest of record.

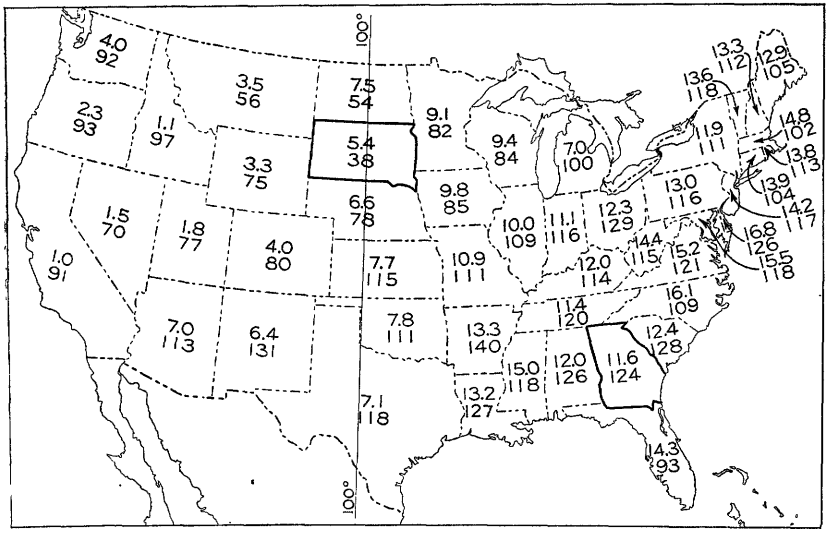


FIGURE 14.—Total precipitation for June, July, and August, in inches (upper figure), and composite yields of crops per acre, expressed as percentage of average yields (lower figure), 1931. In areas indicated by heavy outline the precipitation in 1931 was the lowest of record.

In humid sections of the country the growth of crops depends primarily on the quantity and distribution of rainfall during the grow-

ing period. Temperature, humidity, and wind also have a marked effect. During the growing months of 1930 not only was the precipitation low but temperatures were unusually high, as indicated in figure 3, and hot winds prevailed. The humidity was low, the evaporation was high, and the usual dews were lacking. Plant growth was unable to withstand this combination of unfavorable climatic conditions.

Comparison of the precipitation for June, July, and August with the composite yields of crops in the humid and semiarid States for 1930 and 1931 as given in table 2 and shown in figure 15 indicates that in States where the rainfall during the three growing months was 7½ inches or more the yields were nearly average or above and

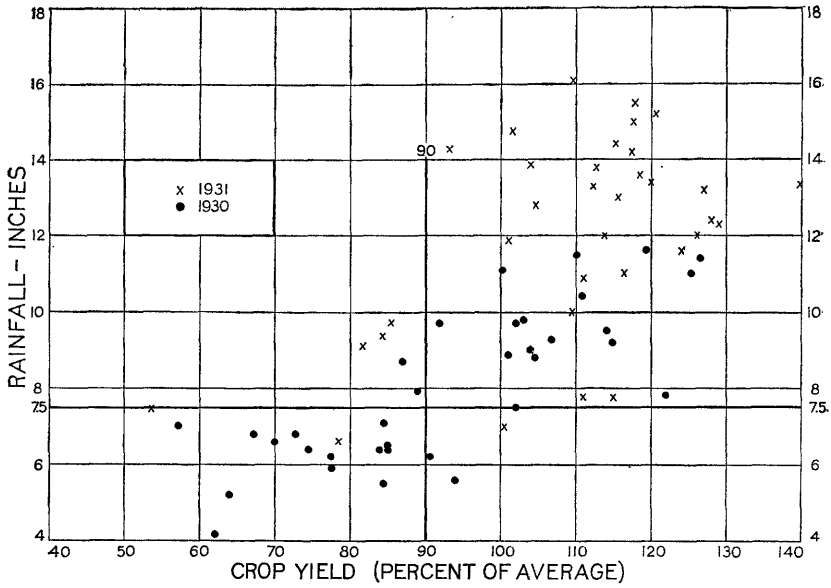


FIGURE 15.—Relation of composite yields of crops per acre in 1930 and 1931 to total precipitation in June, July, and August for the 36 humid and semiarid States.

that in States where the rainfall during those months was less than 7½ inches the yields were below average. Most of the exceptions to this general rule can be explained by the character of the vegetal growth, the distribution of precipitation, abnormally low or high temperature, or excessively hot winds.

The data on composite yields of crops and precipitation for 1930 show that the annual rainfall may not always be an indication of yields. The precipitation in Arkansas in 1930 was 95 percent of the mean, but the crop yields per acre were only 62 percent of the 10-year average, owing to the fact that conditions were not favorable for germination and that there was only 4.2 inches of rain during the 3 growing months. On the other hand, in New York the precipitation

was only 82 percent of the normal, but the crop yield was 102 percent, as conditions were favorable for germination and there was adequate precipitation during the growing season. In Rhode Island, Connecticut, and New Jersey the precipitation in 1930 was also lower than in any other year of record, yet yields of crops for all these States were above normal.

Care must be taken in using precipitation records expressed as percentage of the mean to show the effect of droughts on agriculture or other activities, as a certain percentage of deficiency may not have the same effect in an area of high precipitation as it will in an area of low precipitation. This is illustrated by the data given in table 7.

TABLE 7.—*Composite yields of crops per acre and precipitation in North Carolina, Missouri, and Illinois, 1930*

	North Carolina	Missouri	Illinois
Yields—percent of 10-year mean	100	67	84
Precipitation:			
Annual:			
Mean—inches	50.44	40.17	37.26
1930—do	38.04	31.27	27.89
1930—percent of mean	75	78	75
June, July, and August:			
Mean—inches	16.2	12.7	10.6
1930—do	11.1	6.8	6.4
1930—percent of mean	69	54	60

In North Carolina a deficiency of 50 percent in the growing months would still leave over 8 inches of rainfall, which is adequate for the needs of vegetation, but in Missouri or Illinois a similar percentage of deficiency would reduce the precipitation to less than 7 inches, which is insufficient for the normal needs of vegetation.

The effect of the drought in the irrigated sections of the country was reduced to a minimum in both 1930 and 1931, because stored water was available to make up for deficiencies in the current supply, and also because it was possible to limit crop acreage to conform to the probable available water supply, as indicated by water in storage, snow surveys, and other information. The importance of adequate storage systems in connection with all irrigation projects as insurance against loss during years of low water was fully emphasized during 1930 and 1931. As indicated in table 13, in 24 reservoirs of the United States Bureau of Reclamation having a total capacity of 12,000,000 acre-feet there was a net reduction in storage of 710,000 acre-feet in 1930 and of 1,500,000 acre-feet in 1931.

DOMESTIC AND INDUSTRIAL WATER SUPPLIES

In most States in 1930 there were marked and long-continued deficiencies in the flow of streams and the yields from ground water. These deficiencies persisted in many areas through 1931 and in some areas into 1932, resulting in a shortage of water for both domestic and industrial uses. The localities supplied by the natural flow of medium and small streams or by shallow wells were most seriously affected. In localities where facilities were available for storage, the total stream flow for the year was in general ample for usual activities. Communities that obtained their supplies from deeper wells that tapped productive water-bearing formations were also not much affected by the drought.

Indications of scarcity of water appeared early in the summer of 1930. In many localities usual supplies failed, so that for several months, especially in the larger towns and cities where municipal supplies were not provided with adequate reserves, it was necessary to curtail use and to provide additional supplies by drilling wells, laying temporary pipe lines, or hauling water in tank cars.

The effect of the drought on domestic water supplies, both rural and urban, in New York, Ohio, and Kentucky is indicative of conditions that prevailed in other major drought areas.

In New York the State department of health reported that 65 municipalities were seriously affected in 1930. Of these, 29 derived their supplies from surface-water sources and 36 from ground-water sources. In 1931 the effect of the drought continued in 32 of these municipalities, and in addition 3 others were affected. In 13 others that had been affected in 1930 shortage was averted in 1931 by the development of additional supplies. Hundreds of private wells and springs failed, and it became common practice for farmers to haul water several miles for stock and domestic purposes.

In Ohio the State department of health made surveys of 115 public water supplies, of which 94 depended on wells and 21 on surface sources. Considerable difficulty in respect to both quantity and quality was experienced in cities supplied from surface water, but little in cities served by wells, as their supplies had been adequately developed to provide for the contingency. In a few cities it was necessary to drill to deeper levels. Private wells in the southern part of the State failed almost entirely, and hauling water for many miles was necessary. In April 1931 the State legislature appropriated funds for use by the department of health to drill and install pumps in so-called "seal of safety" wells in southern and southeastern Ohio. The result was 48 successful wells out of 69 that were attempted.

In Kentucky the State board of health investigated 110 public water supplies and found that 33 cities had been on water rations. Conditions in Lexington, with a water-consuming population of about

60,000, supplied from four reservoirs with a small tributary drainage area, illustrate the seriousness of the situation. Restriction in the use of water became necessary in September 1930, and in October the city began the construction of a pumping plant with a 20-inch pipe line to a point 8 miles away on the Kentucky River. This supplementary supply was made available in December and relieved the shortage. There were noticeable shortages in most rural sections.

Many industries were handicapped by an inadequate supply of water for process use and for the disposal of wastes. In numerous localities the provision of enough water for cooling and condensing in steam-power plants was a serious problem.

The rainfall during 1931 was greater and better distributed than that of 1930, and many localities that had suffered from shortage of water during 1930 had enlarged their systems of supply. As a result comparatively few localities experienced any serious difficulty in 1931 from shortage of water for either domestic or industrial use.

HEALTH

In addition to shortage of water for municipal and industrial uses, considerable difficulty was encountered in many localities owing to the effect of the drought on the quality of the water, in regard to both mineral content and pollution. During the drought period the streams were almost wholly supplied from ground water, which normally has a higher mineral content than surface run-off. The lack of diluting run-off caused considerable difficulty and necessitated modifications in treatment at many filter plants. The serving of water of excessive hardness led to many complaints, both on account of trouble in the use of the water and on account of deposits in heaters and in pipe lines, where no difficulty had been experienced with the water normally supplied. A menace to health was created in many localities because the streams fell so low that they were unable to carry sewage and other wastes.

Owing to the efforts and watchfulness of the health, water, and sanitation authorities, no widespread epidemic of communicable diseases occurred during the drought and there was comparatively little illness. Although a few cases of diphtheria, smallpox, scarlet fever, measles, and typhoid were reported by health officers in different sections, they were limited to small areas and were not a serious menace.

Pellagra, a disease due to certain deficiencies in diet and usually present in many Southern sections, caused the most concern. Its remedy lies in foods that supply these deficiencies, and such foods were issued to pellagra sufferers in addition to the staple rations. These foods consisted of milk, canned salmon, canned tomatoes, fresh fruit and vegetables, and powdered yeast. In the drought

period prior to June 30, 1931, more than 30 tons of powdered yeast had been distributed to 18,302 persons in the drought area. The generous donations of hundreds of carloads of citrus fruits and fresh vegetables, especially from Florida and California, and of potatoes, cabbage, and other vegetables and foodstuffs from northern, central, western, and other States aided materially in maintaining standards of health.

School lunches were served for a period to more than 3,500 schools, attended by over 184,000 children. These no doubt aided considerably in maintaining satisfactory health conditions.

As an aid to the situation Congress provided, by an act approved February 6, 1931, $2,000,000, to be administered through the United States Bureau of Public Health Service, to aid local health departments in the drought-affected areas. The Public Health Service reports as follows [8] relative to the effect of drought on health conditions:

> The years 1930 and 1931 were among the best years of which records have been kept, so far as the general health of the people is shown by mortality statistics and by reports of the prevalence of notifiable diseases.
>
> The effect of the drought on the health of the people of the United States cannot at this time be measured with any degree of accuracy. This does not mean that it has not had an effect, but merely that, whatever the effects may have been, they cannot be segregated from the many other factors which, taken together, cause high or low sickness and death rates in the population as a whole.
>
> Serious outbreaks of such diseases as dysentery and typhoid fever, which might have resulted from interference with the usual water supplies in many places, have been avoided by scientific examination and treatment of the supplies. Epidemics of some other diseases have been prevented by immunization campaigns and other means. It may be, if food supplies have been deficient, that the consequent weakening effects will result in increases in the causes of illness and in the death rates in subsequent years. This cannot be definitely predicted, however.

POWER[9]

Practically all important hydroelectric power plants generating electricity for public use are interconnected with steam plants in large systems. Water power and steam power are thus no longer competitors but have become partners, united to produce electric power as economically as possible. As the cost of operating a water-power plant is considerably less than that of operating a steam plant, water-power plants are kept in operation as long as water is available—that is, the supply of water instead of the demand for power is in general the controlling factor in the utilization of water-power plants.

The effect of the drought on hydroelectric power plants in the humid and semiarid States during 1930 and 1931 is probably best indicated by a comparison of the changes in the production of elec-

[8] Personal communication.

[9] Statement by A. H. Horton, chief, division of power resources, U. S. Geological Survey.

tricity by the use of water power from 1929 to 1930 and from 1930 to 1931 with the corresponding changes in the total production of electricity. The business depression lessened the demand for electricity during these periods, and this factor tends to disguise the effect of the drought on the production of electricity at hydroelectric plants. However, a comparison of the change in total production of electricity in the humid and semiarid States with the change in output by water power will indicate in a general way the effect of the drought on water-power plants, because a decrease in the production of electricity by the use of water power, especially if the change is relatively greater than that in the total production of electricity, will indicate a lack of water for the generation of power.

Table 8 shows that in 1930 the production of electricity by water-power plants in all sections of the humid and semiarid portions of the United States was reduced as a result of the drought, and also that in 1931 the output by water power was reduced by the same cause in all sections except New England. There was no extended drought in New England in 1931.

TABLE 8.—*Percentage change in production of electricity for public use in the humid and semiarid sections of the United States, 1929–31*

Division	1929 to 1930		1930 to 1931	
	Total output	Output by water power [a]	Total output	Output by water power [a]
New England	−3	−20	0	+16
Middle Atlantic	+1	−10	−3	−9
East North Central	−5	−15	−7	−19
West North Central	+6	−10	−2	−33
South Atlantic	−8	−29	−6	−13
East South Central	+6	−3	+1	−1

[a] Figures for output by water power are adjusted for increase in capacity of water-power plants.

NAVIGATION

The Chief of Engineers, United States Army,[10] reports on the effect of the drought on navigation on the inland-waterway system of the Mississippi Valley as follows:

The more important components of the inland-waterway system of the Mississippi Valley are the lower Mississippi, below the mouth of the Ohio, where a depth of 9 feet is maintained by dredging through the river bars; the Ohio River, where a depth of 9 feet is secured by locks and dams; feeder tributaries of the Ohio, including the Monongahela, the Allegheny, the Kanawha, the Cumberland, the Tennessee, and others, the most used of which are also improved by locks and dams; the middle Mississippi to above St. Louis, where a depth of 9 feet is to be provided by contraction works and dredging; the upper Mississippi from St. Louis to St. Paul and Minneapolis, the immediate status of which is a project for a 6-foot channel obtained principally by contraction works and by dredging

[10] Personal communication.

but where a 9-foot channel is to be provided by locks and dams; the Missouri, in process of improvement by contraction works to afford a depth of 6 feet; and the Illinois, in course of improvement to afford a 9-foot connection with the Great Lakes.

The 1930 drought brought about a prolonged low-water season on these rivers, the effect of which was mitigated to some extent by the stabilized condition of low water. On the more important parts of the system navigation was kept in motion without serious interruption. Channel dredges had to be kept in operation for a much longer period than normal. On the upper reaches of some of the tributaries of the Ohio, with limited drainage areas, the evaporation, leakage, and lockage losses at the navigation dams exceeded the inflow, and the pool depths could not be maintained; but by using special effort in preventing leakage at the dams throughout the system, supplemented by channel dredging, the navigable capacity of the Ohio and its most important feeders was well maintained. Despite heavy drafts on the reservoirs at the headwaters of the Mississippi, the deficient flow in the upper Mississippi reduced the limiting channel depth to about 4½ feet.

In summary, the effect of the 1930 drought was felt by navigation, but the consequences were not highly serious as far as navigation was concerned.

In the lower Mississippi River the maintenance of the 9-foot channel was rather less difficult in 1931 than in 1930, even though lower river stages were reached. On this river bars occasionally form which delay navigation until they can be reached by the dredges and a channel provided. The time lost from this cause during 1931 did not exceed that occurring during an average year, and the amount of material dredged in channel maintenance during 1931 was 12 percent less than in 1930. The prolonged and continuous low stages resulted in a condition of stability favorable to channel maintenance.

On the Ohio River the project depth of 9 feet was maintained throughout the year. The shortage of water to fill the pools on the Monongahela River, which had been experienced in 1930, was relieved by rainfall in December 1930, and navigation on that stream experienced no difficulties from water shortage in 1931. The water supply on the other tributaries of the Ohio was also adequate for navigation purposes.

On the middle Mississippi, from the mouth of the Ohio to the mouth of the Illinois, above St. Louis, the extremely low stages reached in 1931 required the execution of intensive maintenance dredging, but satisfactory navigation conditions were maintained on this reach, as well as up the completed portion of the Illinois.

Serious effects of the drought were experienced in 1931 in the upper Mississippi between the mouth of the Illinois and St. Paul and Minneapolis. The storage reservoirs on the headwaters of this stream were depleted by the preceding deficient run-off, and their supply was completely exhausted at the end of 1930. The storage recovered in the winter and spring of 1931 was too small to be utilized in increasing the low-water flow below St. Paul. New low-water stages were attained, and the navigation depth was reduced to as little as 4 feet. Navigation was seriously impaired. The construction of the locks and dams provided in the project now authorized for the improvement of this reach, when completed, will make this section of the river independent of drought conditions.

Since the Missouri River was not completed to an extent sufficient for commercial navigation, the low-water conditions had no serious effect. They produced a favorable situation for the prosecution of the regulating works. Since, however, these works become effective in correcting the channel through their influence on high flows, the lack of high water deferred the completion of the project.

The drought in the South Atlantic States in 1931 had an injurious effect upon the navigation of some of the upper reaches of streams still used for that purpose. The packet-boat service on the Savannah River between Augusta and Savannah began carrying partial loads in the latter part of May 1931 and suspended operations from the latter part of August to the middle of December because of low stages resulting from the drought. Navigation was also suspended for a period of about 6 weeks on the Alabama River. In general, however, the lack of high flows during the year materially reduced the sediment deposits in the lower reaches of the stream, to the advantage of navigation conditions, and with a reduction in necessary maintenance dredging.

In general, while drought conditions in 1931, as in 1930, called for increased activities of the department in the maintenance of navigable channels on nontidal rivers, the consequences were not serious so far as navigation is concerned.

RECREATION AND WILD LIFE

During the last few years the use of water for recreation has greatly increased, and this use is recognized as a factor in the consideration of questions relating to water supply. The low water during 1930–31 interfered with fishing, bathing, and boating, both on account of inadequate water supply and on account of increased pollution. Water supplies of many refuges and breeding grounds were so reduced that adequate feed was not available for migratory birds.

RELIEF

In many rural localities the droughts of 1930 and 1931 caused hardship through the failure of food, forage, and cash crops and through scarcity of water for both human beings and stock. The effect throughout the country, however, was not severe enough to prevent the building up of heavy surpluses of almost every agricultural product. The resultant low price levels, already beaten down by the economic depression, greatly reduced the ability of those in the drought areas to meet the situation adequately without outside relief. Such relief was provided by Federal appropriations and by gifts through the American Red Cross. Because the drought effects were spotty, varying widely even between adjacent counties, it is difficult to generalize. Without question, however, the drought caused much hardship, with corresponding needs for relief, especially among the "marginal" farmers, who are none too well off in the most prosperous times.

In its effect on water supplies the drought made haulage of water, sometimes in tank cars over long distances, necessary to keep stock alive. Transportation of fodder was also necessary, with the alternative of moving stock out of the area or else selling at a heavy loss.

Failure and low price of cash products, whether in cotton, cattle, wheat, or corn, was a principal cause for need of drought relief. Many families dependent on cash crops, with no vegetable gardens whereby they might live directly off the land, found that low prices

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and depleted yields left them without sufficient means to buy the bare necessities.

Enough relief needs were traceable to the drought to bring the American National Red Cross into action under its policy of functioning to prevent suffering due to an "act of God." Relief measures were started in several States late in the summer of 1930 by local Red Cross chapters, and early in the fall it became evident that outside help would be needed. Accordingly, the Red Cross took up the work and appropriated $5,000,000 from its reserve. In addition, $10,589,780.19 was raised by a special campaign for the period ending June 30, 1931. Notwithstanding this, many believed that the situation was so serious that it could be adequately handled only by aid from the Federal Government. As a result Congress passed four measures for drought relief.

Federal aid to drought sufferers was first made in the fall of 1930 from the balance in a loan fund which Congress had provided in the preceding March under the Department of Agriculture for aid in certain States that had suffered from storms and other causes. From this fund $230,350 was distributed in small loans for sowing pasturage crops in Alabama, Missouri, Oklahoma, and Virginia. The terms under which this fund was made available prohibited its use in other States, and to meet the situation Congress made available $67,000,000, to be administered by the Secretary of Agriculture, for loans and advances to drought sufferers, by the acts of December 20, 1930 ($45,000,000), February 14, 1931 ($20,000,000), and February 23, 1931 ($2,000,000). In addition $2,000,000, to be administered by the United States Public Health Service, was made available by the act of February 6, 1931.

The areas that suffered the most are shown in figure 16, which indicates where relief measures under the Red Cross were necessary.

From August 1930 through June 1931 direct expenditures for relief amounted to $10,894,835.62, and aid was given to 614,504 families, aggregating 2,765,000 persons[11] in 1,057 counties in 23 States. In addition to the direct expenditures, food, clothing, etc., having an estimated value of $990,000 were distributed. The services of relief agents were in the main contributed. The peak of the relief was reached the last of February 1931, when assistance was being given to 460,240 families aggregating 2,081,000 persons.

Conditions improved so greatly during the spring and early summer of 1931 that after June 30 the only States in which extensive drought relief was necessary were Iowa, North Dakota, South Dakota, Nebraska, Montana, and Washington. An additional expenditure of $2,266,860.73 was required to cover the needs of these States after June 30, 1931, and aid was given to 243,368 persons.

[11] The total number of persons receiving aid was arrived at by using an esimate of 4½ persons to the average family, and no family that received several types of assistance was counted more than once.

In all the counties where drought relief was given, the recipients of aid were strongly urged to plant the garden seeds being given to them, as a further safeguard to the health of their families. Reports during 1931 from various States indicate that the garden-planting plan was generally followed in the areas that had suffered during 1930. This was a large factor in eliminating food shortage in 1931. During 1931, 611,000 seed collections were distributed. The seeds in each of these collections were sufficient to plant about a one-fourth-acre garden plot and included from 13 to 18 varieties of vegetables selected by the United States Department of Agriculture with respect to their suitability to the areas in which they were to be used. An important

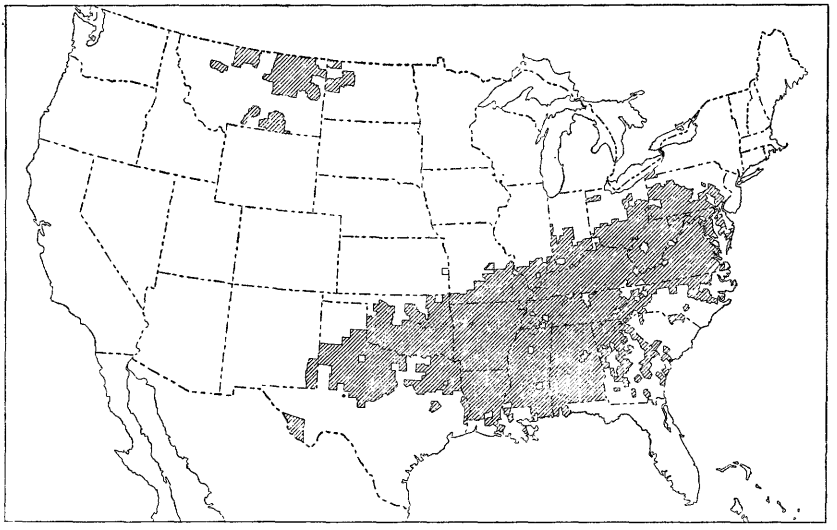

FIGURE 16.—Areas where Red Cross gave drought relief, August 1930 to June 1931.

indirect benefit from the drought has been that it has taught people in the areas affected to grow sufficient food crops for family needs. It is estimated that the retail money value of vegetables produced from Red Cross garden seeds in 1931 amounted to $20,000,000.

More than 600 freight carloads of foodstuffs were donated to the Red Cross for the drought sufferers. These were distributed in the most severly affected regions. Quantities of clothing for children were made by Red Cross women volunteers, and used clothing was reconditioned for adults. School attendance everywhere in the drought sections was materially improved by the Red Cross school-lunch program and by the distribution of warm clothing to the children.

One type of relief given extensively by the Red Cross was stock feed. Feed was given to 61,841 families in all but 4 of the 23 affected States. Reports indicated that thousands of cattle, horses, mules, hogs, and

chickens were saved through this feed. In Arkansas alone 34,018 families received free feed for livestock from the Red Cross.

This huge relief task was conducted by 1,225 chapter-paid and 517 nationally paid workers with the aid of 37,762 volunteers. The areas in which Red Cross relief was necessary were in general those of marginal production and lack of diversification, both in agriculture and in other activities. This largely accounted for the inability of the people to handle the situation locally. There were other areas where the drought was fully as severe in which outside relief was not necessary.

Tables 9 and 10, from a report entitled "Relief work in the drought of 1930–31", indicate the extent and type of the aid given by the Red Cross from August 1, 1930, to June 30, 1931.

TABLE 9.—*American National Red Cross drought relief, financial statement June 30, 1931*

Available funds:		
American National Red Cross		$5, 000, 000. 00
Contributions to drought relief fund		10, 589, 780. 19
		15, 589, 780. 19
Expenditures:		
Food	$7, 229, 104. 79	
Clothing	488, 668. 85	
School lunches	165, 599. 52	
Feed for livestock	346, 415. 60	
1930 garden and pasturage seed	276, 122. 51	
1931 garden seed	492, 119. 52	
Yeast for pellagra control	15, 903. 06	
Other medical aid	91, 906. 95	
Family service	109, 052. 30	
Field supervision, accounting, and other field expenses	835, 095. 72	
Cash grants to chapters, final distribution of which was not reported by June 30, 1931	582, 130. 96	
Provision for chapter continuation of service and relief	146, 979. 04	
Other relief expenditures including fuel, bedding, miscellaneous supplies, etc	115, 736. 80	
		10, 894, 835. 62
Balance available for completion of drought relief program		4, 694, 944. 57

TABLE 10.—*American National Red Cross drought relief, character and extent of aid, by States, Aug. 1, 1930, to June 30, 1931*

State	Total expenditures	Number of families receiving—								Total families aided (exclusive of 1930 seed, 1931 garden seed, and yeast)	Persons given yeast	Chapter-paid workers	Nationally paid workers	Total personnel
		Pasturage seed 1930	Garden seed		Food	Clothing	Fuel	Feed	Medical aid (excluding yeast)					
			1930	1931										
Alabama	$299,265.73			58,574	29,972	2,862	42	203	410	30,602	835	54	4	2,060
Arkansas	3,140,946.51	20,828	4,234	123,018	172,634	37,967	1,224	34,018	11,468	180,188	6,792	354	17	7,304
Georgia	32,345.40			9,896	2,153	122	7		5	2,158	75	3	1	140
Illinois	112,821.06			7,548	5,212	1,393	322	390	199	6,225		20	2	457
Indiana	108,185.54			9,100	4,279	1,262	75	931	14	5,251		30	5	589
Kansas	1,134.63			24	62	22	2	10		62				3
Kentucky	1,490,353.72	15,502	14,928	78,846	58,260	9,240	1,192	13,185	787	63,608	610	172	17	5,046
Louisiana	955,453.65	13,121	6,522	53,200	71,860	10,960	144	6	1,441	73,024	1,472	105	11	2,782
Maryland	22,995.80			2,410	940	483	47	320	53	1,311		10	1	226
Mississippi	483,006.81	2,972	915	77,100	45,848	5,078	329	497	1,027	46,884	1,746	83	15	3,128
Missouri	498,291.20			18,088	26,766	9,307	1,976	2,409	2,529	27,324	81	37	7	1,949
Montana	57,550.34			1,572	883	517	92	136	12	1,154		6	1	286
New Mexico	522.54				11				1	12				1
North Carolina	54,310.34			9,075	3,743	916		457	96	4,193	568	5	3	464
North Dakota	24,067.04			696	469	185	39	27	3	560		1	4	61
Ohio	228,623.20			19,580	10,153	4,295	1,102	359	165	12,287		64	4	1,625
Oklahoma	1,385,879.50		822	25,000	65,790	6,562	2,671	1,931	4,035	66,765	4,092	72	15	3,905
Pennsylvania	10,827.62			8,596	530	388	50		25	632		7		103
South Carolina	435.82			750							56			
Tennessee	389,073.97			33,171	26,146	5,131	424	1,757	1,009	27,029	1,025	69	9	2,640
Texas	623,126.32	5,929	73	24,986	35,132	8,187	2,432	1,522	2,448	36,808	691	64	16	3,076
Virginia	268,904.38			22,640	12,718	5,421	178	1,851	356	14,462	259	40	10	2,062
West Virginia	184,768.58			21,552	11,631	2,216	109	1,842	132	13,965		29	8	1,230
Not classified by States	521,945.92												367	367
	10,894,835.62	58,352	27,494	605,422	585,192	112,514	12,457	61,851	26,215	614,504	18,302	1,225	517	39,504

DROUGHT OF 1934

During much of 1934 for most sections of the country the major weather phenomena—precipitation, temperature, and wind movements—were in some respects abnormal. As a result, noticeable drought conditions in varying degrees of severity prevailed, as indicated on plate 1, in all the arid States except Washington, Oregon, California, Nevada, northern Idaho, and western Montana; in all the semiarid States except most of Texas; and in portions of the humid States in the upper Mississippi, Ohio River, and Great Lakes drainage basins. Drought conditions were most severe in the semiarid States, especially in the Dakotas, Nebraska, and Kansas, and in the adjoining States on both the east and the west, and it was in this area that the damage effect of the drought was the greatest. In California, although the annual precipitation was only 76 percent of the mean, it was so well distributed during the rainy season that with the available storage agriculture did not suffer seriously except in Imperial Valley, which obtains its water supply from the Colorado River. The extremely low run-off of the Colorado River was due to drought conditions in the upper basin States.

In 1931 the annual precipitation in California was 104 percent of the mean, but its distribution during the rainy season was so unfavorable that the irrigation supply, including storage, was insufficient to meet the needs of agriculture. As a result there were severe economic effects due to deficient water supply. Conditions in California during 1931 and 1934 illustrate the errors that are liable to enter into any conclusions as to droughts in the arid and semiarid States based upon annual records of precipitation.

CAUSES

Although in certain areas climatic conditions in previous years contributed in some degree, the drought of 1934 resulted primarily from deficient and unfavorably distributed precipitation, excessive heat, and warm winds, which in general prevailed in that year in all States except those bordering on the Atlantic seaboard, eastern Gulf of Mexico, and northern Pacific coast. These climatic conditions are indicated in table 11, plate 1, and figures 17 and 18, and are summarized in general on pages 47–52.

PRECIPITATION

In 7 of the 31 humid States the precipitation for 1934 was 85 percent of the mean or less. These 7 States were in the Ohio River, Great Lakes, and upper Mississippi River drainage basins. In Ohio precipitation was 69 percent of the mean, breaking the previous record. In Indiana it was 74 percent of the mean, which equaled the low point of 1930. Precipitation in all the semiarid States except Texas was below 85 percent of the mean. Previous minima were broken in North Dakota, with 54 percent, and South Dakota, with 63 percent. In all the arid States it was below 85 percent of the mean, except in Washington and Oregon, where it was above the mean, and in Idaho and Nevada, where it was 89 percent of the mean. In the remaining arid States Wyoming had the least deficiency, with the precipitation 78 percent of the mean. Colorado broke previous records with 65 percent.

The serious effects of the drought resulted as much from unfavorable distribution of precipitation as from the deficiency for the year. During the 3 winter months, starting with December 1933, 25 States had noticeable deficiencies in precipitation, receiving less than 85 percent of the normal. These included all the humid States except Louisiana, Arkansas, West Virginia, Maryland and Delaware, New York, and the New England States. In the semiarid region the shortage was limited to the Dakotas; in the arid region, to Wyoming, Nevada, Arizona, and New Mexico. The States where major shortages occurred were in the Missouri, upper Mississippi, Ohio, and Great Lakes drainage basins.

During the spring (March through May) shortages in precipitation were greater and more widespread than during the winter, 27 States having noticeable deficiencies. These included the humid States in the upper Mississippi, Ohio, and Great Lakes drainage basins, all the arid States except Washington, and all the semiarid States except Texas. In these areas there were only 5 States in which the precipitation was as great as 70 percent of the normal, and in 9 States it was less than 50 percent. In the critical areas, especially in the Dakotas, Nebraska, Minnesota, and Iowa, the total precipitation ranged from only 29 to 44 percent of normal. Conditions were better in the southern and eastern humid regions, where precipitation was almost normal or above in all the Atlantic coast and Gulf States and in Arkansas and Tennessee.

During the summer (June through August) major shortages in precipitation disappeared in all but 17 States—those in the semiarid region and the States bordering it on the east and west except Louisiana, also New York, Washington, Idaho, and Utah. In no State, however, was the deficiency as great as during the two preceding quarters, and the effects would probably not have been especially serious if it had not been for the shortage in the winter and spring.

TABLE 11.—*Precipitation, temperature, and crop yields in 1934, by States*

State	Precipitation											Temperature				Crop yields (percent of 10-year average, 1921–30)
	Mean[a] (inches)	1934		Seasonal, December 1933 to November 1934							Number of months below mean in 1934	Maximum of record		Maximum, 1934 (°F.)	Number of days in 1934 with 100° or more	
				December, January, February		March, April, May		June, July, August		September, October, November						
		Inches	Percent of mean	Inches	Percent of mean	Inches	Percent of mean	Inches	Percent of mean	Inches	Percent of mean		°F.	Year		
Humid States:																
Maine	41.20	39.75	96	9.55	99	8.62	88	10.40	104	11.55	109	7	106	1907	96	0	116.7
New Hampshire	39.52	41.23	104	8.55	98	10.36	110	10.14	94	11.99	120	5	104	1911	95	0	95.4
Vermont	37.03	38.73	105	7.95	102	9.35	106	10.30	95	10.98	110	6	104	1916	96	0	93.7
Massachusetts	42.39	44.97	106	10.69	100	11.18	104	9.83	93	13.71	128	7	106	[b] 1894	100	1	93.7
Rhode Island	44.07	39.24	89	11.58	101	11.49	100	6.33	65	10.03	99	7	101	1911	98	0	94.2
Connecticut	44.96	52.75	117	10.52	94	14.20	124	10.41	92	17.38	155	7	105	1926	101	1	102.7
New York	39.01	34.97	90	7.36	86	8.40	88	8.80	77	10.69	110	10	108	1926	102	3	89.7
New Jersey	45.89	45.34	99	8.51	79	11.83	107	14.40	142	10.94	82	9	109	1895	103	4	103.8
Pennsylvania	42.47	39.34	93	6.73	72	8.53	79	12.59	100	11.77	122	9	108	[b] 1918	107	12	103.8
Maryland-Delaware	41.89	46.43	111	8.43	89	11.95	116	11.65	93	14.23	165	7	110	1930	107	9	105.6
Virginia	42.18	45.58	108	7.69	82	12.05	113	13.03	100	12.81	153	5	109	1930	107	18	107.5
North Carolina	50.44	53.70	106	7.86	68	14.08	118	17.15	107	13.55	137	4	108	[b] 1925	105	18	114.9
South Carolina	48.21	45.79	95	7.10	62	12.89	122	14.40	88	9.90	105	6	111	1925	106	33	121.5
Tennessee	50.30	47.53	94	11.26	83	13.29	95	14.52	114	10.83	115	6	113	1930	109	42	111.8
Kentucky	45.81	37.00	81	9.04	77	8.64	69	13.68	115	8.65	93	7	114	1930	110	36	101.6
West Virginia	43.83	37.56	86	8.71	87	8.92	78	13.38	103	8.50	100	7	112	1930	107	19	87.2
Ohio	38.44	26.60	69	5.33	63	5.85	57	10.36	95	6.33	76	10	113	[b] 1897	113	20	87.0
Michigan	31.29	25.46	81	3.72	66	5.15	65	6.11	71	10.99	130	10	110	1911	108	12	86.8
Indiana	40.17	29.70	74	4.49	53	5.77	52	10.65	101	9.07	98	10	113	[b] 1930	113	26	80.2
Illinois	37.26	33.12	89	3.53	52	5.21	49	10.09	94	14.00	154	9	115	1901	114	55	62.3
Arkansas	48.97	42.42	87	10.27	87	13.40	92	7.29	63	13.09	130	9	116	[b] 1901	116	77	94.3
Missouri	40.17	34.19	85	4.33	69	6.66	57	7.86	62	15.47	165	10	117	1934	117	67	51.0
Iowa	31.48	26.90	85	2.35	70	3.18	37	10.19	85	11.56	150	9	118	1934	118	42	55.5
Wisconsin	31.63	30.34	96	2.43	66	4.93	62	9.63	89	13.46	171	9	111	1901	109	13	83.4

Minnesota	25.91	20.30	78	1.87	83	2.82	44	8.33	78	7.37	124	8	114	1917	113	19	59.8
Florida	52.94	53.38	101	5.94	69	14.32	144	22.92	110	9.75	73	6	109	1931	103	1	98.2
Georgia	50.48	47.35	94	8.54	64	14.75	126	14.91	97	8.54	94	6	111	1925	105	34	120.0
Alabama	53.11	55.22	104	11.66	77	13.69	97	17.35	122	12.35	132	5	112	1925	106	27	121.9
Mississippi	53.32	53.40	100	12.54	82	11.99	80	14.32	106	13.64	155	8	115	1930	110	44	111.3
Louisiana	55.64	59.11	106	16.56	112	14.74	106	15.24	96	13.76	125	5	112	1909	109	63	105.9
Semiarid States:																	
Oklahoma	32.63	27.54	84	4.54	100	7.04	68	5.66	57	11.08	138	9	118	1922	116	83	56.2
Kansas	27.48	19.92	72	2.85	112	4.79	62	5.18	49	8.05	134	9	119	1934	119	71	50.2
Nebraska	23.50	14.40	61	2.31	117	2.32	33	5.85	59	4.66	104	9	118	1934	118	67	29.3
South Dakota	20.77	13.18	63	.98	58	2.15	34	6.55	77	3.84	105	11	118	1934	118	39	31.1
North Dakota	17.70	9.49	54	1.14	77	1.28	29	5.41	68	2.25	68	12	124	1912	112	21	47.4
Texas	30.84	26.78	87	7.27	125	8.37	94	4.04	49	7.22	91	9	119	1910	114	91	79.9
Arid States:																	
New Mexico	14.49	9.96	69	1.05	53	2.12	76	4.43	70	2.27	66	9	116	[b] 1918	116	79	98.4
Colorado	16.79	10.93	65	3.01	114	2.77	56	3.64	125	2.04	62	10	115	1888	112	71	61.3
Wyoming	14.05	10.94	78	1.83	79	2.74	56	3.61	89	2.53	86	10	114	1900	111	18	67.4
Montana	15.21	11.25	74	3.05	124	2.43	56	4.06	78	2.77	82	8	113	1900	112	20	73.3
Idaho	17.17	15.34	89	7.62	132	3.31	69	1.92	76	4.91	110	7	118	1934	118	47	92.9
Nevada	9.01	8.06	89	2.46	77	1.25	48	1.41	102	2.15	134	9	122	1914	118	80	67.7
Utah	12.67	9.49	75	3.35	96	1.18	31	2.15	85	2.78	91	9	116	1892	112	54	58.9
Arizona	13.10	10.11	77	1.38	39	1.36	75	4.61	98	1.53	54	8	127	1896	124	83	115.2
California	23.53	17.98	76	11.60	91	2.05	33	.90	188	6.16	149	8	134	1913	125	81	95.1
Eastern Oregon	13.81	14.07	102	5.07	102	2.92	79	2.07	122	4.59	137	8	119	1898	110	15	88.0
Western Oregon	54.22	53.53	99	26.02	110	9.95	78	1.65	58	20.81	141	8			105	6	
Eastern Washington	16.89	17.17	102	10.18	153	3.07	83	1.17	62	6.88	148	6	118	1928	115	14	100.6
Western Washington	56.98	69.97	123	39.97	193	10.54	102	2.30	56	24.91	149	5			102	3	

[a] For 50-year period 1881–1930, except for eastern and western Washington and Oregon, which are for period of record.
[b] Also in other years.

During the fall (September through November) precipitation was normal or above in 34 States. It was less than 85 percent of normal in only 8 States—New Jersey 82 percent, Ohio 76, Florida 73, North Dakota 68, Colorado 62, Arizona 54, New Mexico 66, Montana 82.

TEMPERATURE

During 1934, especially in the first 8 months, unusual temperatures were noticeable in most sections of the country. The winter in the Northeastern States was much colder than usual, and in February most previous records as to both severity and duration were broken in this area as far south as Virginia. On the other hand, States west of the Mississippi River had a mild winter. The spring, in general, was late in the Northeastern States and early in the Northwestern States.

The summer was unusually warm in all parts of the country, and the year's accumulated temperatures in practically all sections were above normal, as indicated in table 11 and by the lines on figure 17. The number of days during June, July, and August in each State on which temperatures of 100° or more were recorded and the maximum temperature for the same months are also indicated in figure 17. Previously recorded maxima were equaled or exceeded in 10 States. Temperatures of 100° or more occurred in 7 States on 75 days or more, and in 14 States on 50 days or more. Kansas City, Mo., had temperatures of over 100° on 14 consecutive days. All States west of the Mississippi had maximum temperatures of 112° or more except Louisiana, Oregon, and Wyoming, where the maxima were 109°, 110°, and 111°, respectively. East of the Mississippi, and exclusive of New England, there were only 3 States in which maximum temperatures did not exceed 102°, and in 3 States 110° was exceeded.

The fall and early winter temperatures were generally above normal except for a short cold spell in December in the Southeastern States.

WIND

Except for their warmth and accompanying dust, wind conditions were not unusual during 1934. Dust storms were so frequent during the period November 1933 to May 1934 that the Weather Bureau circularized its stations east of the Rocky Mountains for reports relative to their character. A summary of these reports [12] indicates that there were five major storms, considering only those that overspread a considerable section of the country. In addition to these major storms, there were many others confined to portions of the Great Plains and adjacent sections.

[12] Mattice, W. A., Dust storms, November 1933 to May 1934; Monthly Weather Rev., February 1935, pp. 53.

The principal causes of the disastrous soil blowing in 1933 and 1934 were continuous high winds, intensive cultivation, the practices of burning stubble, low rainfall, and lack of organic matter and soil moisture to hold the soil in place. At the beginning of the plowing and planting season of 1934 there was a marked shortage of soil moisture. This, combined with deficient precipitation during the spring, resulted in the ground becoming too dry to withstand wind action.

The surface material over large areas of the country, especially in the arid and semiarid regions, consists in part of loess—that is, wind-blown material that has been deposited throughout the ages and has always been more or less subject to movement by winds when it becomes dry. The close cropping of vegetation due to overgrazing, the unwise breaking up of lands that are valuable chiefly for

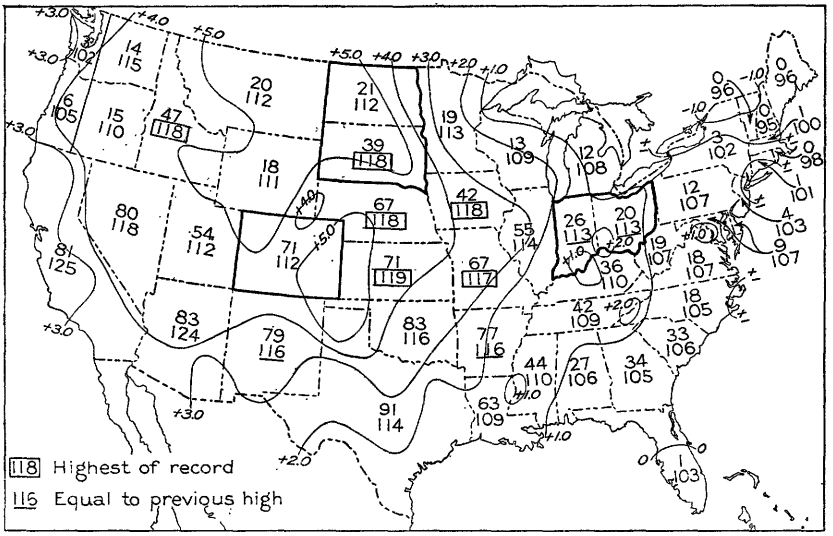

FIGURE 17.—Temperatures, 1934. Upper figure, number of days with maximum of 100° F. or more. Lower figure, maximum temperature during June, July, and August. In areas indicated by heavy outline the precipitation in 1934 was lowest of record. Lines denote variation in average temperature from normal.

grazing, and the drying of the surface, especially in years of drought, have greatly reduced the ability of this material to resist movement by the winds. Although the effects have been serious in many localities, they were probably not as bad as would be indicated by the photographs and descriptions that appeared in press statements.

The great mantle of wind-blown silt that covers a large part of the interior of the country indicates that dust storms have been a common occurrence in the geologic past. Although we are now chiefly concerned with the damage done by wind erosion in the recent dust storms, it is interesting to note that to these ancient silt deposits, called loess, is largely due the productivity of the great farming regions

included in the Mississippi Valley, and there are many who believe that though the effects in the areas in which the dust originates may be detrimental, there may be counterbalancing benefits in areas in which it is deposited.

Of the major dust storms that of May 9–12, 1934, created much widespread interest as to both its extent and its intensity. Following are reports from various weather bureau stations in regard to this and other storms:

Bismarck, N. Dak.: Although frequent dust storms have visited North Dakota this spring, those on 11 days warrant special mention. The most severe of these storms occurred on April 21 and 22. The velocity of the wind was greater on the 21st, but the volume and density of the dust were greater on the 22d. The latter storm caused the most comment, because of the fact that the 22d fell upon a Sunday, and travel by both automobile and by plane was hazardous and difficult. Several aviators have reported that dust was encountered at all levels up to 14,000 feet. A report on the storm of April 22 follows: A severe dust storm began 11 a. m. and continued all day, ending the night following. Visibility at the station was as low as 200 yards at various times. * * * This was the most severe dust storm experienced at the Bismarck station during the 28 years that I have been in charge.

Milwaukee, Wis.: Dust reported on about 19 dates previous to May. The storm on May 9–10, the worst dust storm of which there is any recollection in Wisconsin, covered the entire State. There were fresh to strong winds, which drifted the soil in the fields and in places uncovered newly sown grains. By the morning of the 10th dense dust clouds covered the sky, and this condition continued all day.

Cincinnati, Ohio: First evidence of the western dust storm reached Cincinnati shortly after noon on May 10. It was first observed on the hilltops at about 12:15 p. m. and at the Lunken Airport at 12:30 p. m. Visibility was greatly reduced, being only 3.4 miles from 2:30 p. m. to after 3 p. m.

Pittsburgh, Pa.: The dust storm that was reported at several western stations on the morning of May 10, 1934, was first observed in the vicinity of Pittsburgh as a peculiar pale-yellow haze in the upper air about 6:15 p. m. of the 10th. At the airport station the dust was most dense at the 6 and 7 a. m. observations on the 11th, when the visibility was reduced to 1 mile.

Boston, Mass.: A veil of dust appeared in the air shortly after daybreak on May 11 in New England and undoubtedly moved eastward over the ocean during that day. The dust was so fine that it appeared much as a high haze and was at an altitude of some 500 feet or more, where visibility was reduced to a fraction of a mile, whereas visibility on the ground was up to 2 miles.

Baltimore, Md.: The dust was in the lower and upper atmosphere, within 2 to 3 miles of the earth's surface. In the lower atmosphere the density thickened after 8 a. m. May 11, at which time visibility was between 6 and 8 miles, decreasing to 1 and 2 miles between 10:30 a. m. and 2:30 p. m.

Charleston, S. C.: Southerly winds on May 10 and 11 prevented the dust in the air over the central sections of the country from reaching this station, but on the 12th there was a sudden shift to northerly at 4:20 a. m. By 5:45 a. m. our airport station was reporting dust, and dustiness increased until 7:40 a. m., when the visibility had decreased to 4 miles.

Vicksburg, Miss.: May 11, sunset yellow due to dust. Visibility 2½ miles in the west. Continued until 9 a. m. of the 13th.

EFFECT ON GROUND AND SURFACE WATER

GENERAL EFFECT

A brief discussion of the general effect of droughts on ground and surface water is given on pages 11–22 and may be summarized as follows: That part of the precipitation which is not taken up directly by plant growth or by evaporation passes as surface flow into streams and lakes or goes to make up soil moisture and to replenish the ground water. In an ordinary year the ground-water table reaches its low point at the end of the growing season and is built up during the winter and early spring, following closely the precipitation. It recedes during the late spring, summer, and fall, unless there is excessive precipitation. Both medium and high stream flow result, in the main, from surface run-off following soon after precipitation. Low stream flow and also the flow in springs and wells largely result from seepage from ground water. Reductions in ground-water yield occur in the main when the ground-water table approaches closer and closer to the level at which the water from it enters a stream, spring, or well. In areas where the topography has a pronounced relief the volume of the terrane above a plane through the outlet affords storage capacity for a considerable supply of water, and the water table in the higher tracts may attain a considerable altitude above the point of outlet. Therefore, in many areas the reductions in ground-water yield over long periods of drought may be comparatively small, as discussed on page 27 with reference to the Potomac River at Shepherdstown, W. Va.

Unfortunately, there are comparatively few long-time records of fluctuations of the water table, and most statements in regard to ground water in hydraulic studies are based more on generalized impressions than on observed data. False impressions of depletion may be gained by the necessity of deepening wells in periods of drought, by increased needs for water which require additional or deeper wells, and by leakage from casings, clogging of intakes, or filling of old wells.

In many sections of the country during the last few years precipitation and water-supply trends have been downward. Similar downward trends in the past have been followed by upward trends, and there is nothing to indicate that this will not apply to the present downward trend.

GROUND WATER

Owing to the deficiency in precipitation during the replenishment period of 1934 there was little or no recharge in the main drought areas, so that the available ground water was in a large measure that carried over from the preceding year. Consequently in large areas the ground-water table fell below the outlets of springs and

the bottoms of streams and wells, thus materially cutting off its contribution to surface waters and to springs and wells.

Adequate data to indicate the extent to which the ground-water table was lowered in 1934 or whether there has been a progressive lowering during the past few years are not available, and any statements in this regard are largely conjecture. Although there may have been a progressive fall in some areas, there are no records to indicate that this is true to any great extent except where there has been heavy pumping for municipal or industrial supplies or for irrigation. The ground-water table in humid areas in general responds very quickly to fluctuations in rainfall (see pp. 22–26), and in most years there is enough rainfall to supply the normal recharge. The lowering of the ground-water table and the shortage in precipitation in the drought areas resulted in a noticeable lowering effect on stream flow, lakes, ponds, and reservoirs.

SURFACE WATER

The effect of the drought on stream flow was most noticeable in the upper Mississippi, Hudson Bay, Missouri, Colorado, and Great Basin drainage areas. In these areas many previous records of minimum flow were broken, both as to total annual flow and as to flow for shorter periods. Shortages in flow were also noticeable in the Great Lakes drainage basin, the Ohio River tributaries from the north, and the lower Mississippi River tributaries from the west, but comparatively few previous minima on these streams were exceeded. In the Atlantic coast and Gulf of Mexico drainage basins and also in the Pacific coast basins with the exception of portions of the Snake River, stream flow was in general normal. A few examples showing the effect of the drought of 1934 on stream flow in the principal drought areas are given in table 12.

TABLE 12.—*Effect of the drought of 1934 on stream flow in the principal drought areas*

Stream and station	Drainage area (square miles)	Period of record (years)	Discharge for year ending Sept. 30				
			Mean for period (second-feet)	1934		Minimum prior to 1934	
				Second-feet	Percent of mean	Second-feet	Year
Miami River, Dayton, Ohio	2,510	21	2,350	789	33.6	744	1931
Hocking River, Athens, Ohio	944	19	988	445	45.0	465	1925
West Fork of White River, Noblesville, Ind	800	15	855	271	31.7	254	1931
Rock River, Lyndon, Ill	9,010	20	5,650	1,800	31.9	2,110	1931
Kaskaskia River, Vandalia, Ill	1,980	20	1,390	400	28.7	123	1931
Menominee River, Koss, Mich	3,790	21	3,140	2,110	67.2	1,640	1931
Milwaukee River, Milwaukee, Wis	661	20	426	126	29.6	123	1931
Rock River, Afton, Wis	3,190	20	1,860	593	31.8	603	1931
Wisconsin River, Muscoda, Wis	10,300	20	8,550	4,450	52.1	4,440	1931
Gasconade River, Waynesville, Mo	1,680	20	1,400	502	35.9	550	1917

TABLE 12.—*Effect of the drought of 1934 on stream flow in the principal drought areas*—Continued

Stream and station	Drainage area (square miles)	Period of record (years)	Discharge for year ending Sept. 30				
			Mean for period (second-feet)	1934		Minimum prior to 1934	
				Second-feet	Percent of mean	Second-feet	Year
Grand River, Gallatin, Mo	2,250	13	1,110	117	10.4	360	1931
Missouri River, Mobridge, S. Dak	208,700	6	19,500	13,700	70.2	13,000	1931
Missouri River, Booneville, Mo	505,700	9	58,000	23,730	40.9	31,800	1931
Minnesota River, Montevideo, Minn	6,300	25	514	4.4	.9	32.7	1933
Minnesota River, Mankato, Minn	14,600	31	2,320	136	5.9	291	1931
Mississippi River, Elk River, Minn	14,500	19	4,270	1,450	33.9	2,160	1933
Mississippi River, St. Paul, Minn	36,800	42	9,210	1,940	21.1	3,190	1931
Mississippi River, Le Claire, Iowa	88,600	61	48,200	18,900	39.2	24,400	1931
Red River, Fargo, N. Dak	6,420	32	468	17.5	3.7	41.7	1933
Red River, Grand Forks, N. Dak	25,500	52	2,260	244	10.8	351	1931
North Platte River, Saratoga, Wyo	2,880	27	1,330	330	24.8	662	1931
Bear River, Evanston, Wyo	645	21	248	50.8	20.5	105	1931
Rio Grande, Del Norte, Colo	1,320	45	978	468	47.9	353	1902
Animas River, Durango, Colo	692	33	933	345	37.0	402	1931
Colorado River, Glenwood Springs, Colo	4,560	35	3,070	1,423	46.4	1,720	1931
Colorado River, Lees Ferry, Ariz	107,900	40	20,000	6,050	30.2	8,600	1931
Weber River, Oakley, Utah	163	28	246	82.7	33.6	108	1931
Humboldt River, Palisade, Nev	5,010	26	334	34.8	10.4	51.1	1931

As Missouri was one of the States in which drought conditions in 1934 were severe, a summary of low-water conditions in this State is indicative of conditions in other major drought areas. At 9 of the 24 river-measurement stations maintained in that section of the State lying north of the Missouri River the flow ceased entirely for the first time since the beginning of records in 1921. New low-water records were established at 10 other stations. In the area south of the Missouri River conditions were not so critical, as the streams are largely spring-fed. Nevertheless, of the 43 stations in this area, 3 became dry, 23 established new minimum records, and at only 17 did the flow remain above the previous minimum.

In Idaho the year 1934 was characterized by the lowest run-off ever recorded on the Snake River. At Heise, above the upper-valley canals, the river run-off was 54 percent of normal, and at Neeley, below the American Falls Reservoir, it was 43 percent of normal. During 1931, when the next lowest flow on record occurred, the run-off was 58 percent of normal at Heise and 55 percent of normal at Neeley. Jackson Lake bottom storage rights were 52.6 percent filled, and American Falls rights 51.5 percent filled exclusive of hold-overs from the previous year and stored normal flow.

Great Salt Lake reached an altitude of 4,194.85 feet on September 30, 1934, the lowest recorded since observations were begun in 1851. The next lowest level was recorded in 1902 and 1905, when the lake stood at 4,195.7 feet. The maximum recorded stage was 4,212.5 feet in 1868.

In the arid and semiarid parts of the country the lowering of lakes, ponds, and reservoirs was so great that in many localities they dried up entirely or were exhausted by excessive demands for irrigation and other uses. During the year 1934 the net reduction in storage in 24 reservoirs of the United States Bureau of Reclamation with an aggregate capacity of 12,000,000 acre-feet was 2,170,000 acre-feet, as indicated in table 13.

TABLE 13.—*Water in storage in 24 reservoirs of U. S. Bureau of Reclamation on Dec. 31, 1929–34*

	Acre-feet in storage	Change from previous year		Acre-feet in storage	Change from previous year
1929	4,590,000		1932	5,160,000	+2,780,000
1930	3,880,000	−710,000	1933	4,640,000	−520,000
1931	2,380,000	−1,500,000	1934	2,470,000	−2,170,000

DAMAGE

The drought of 1934 covered one of the principal agricultural areas of the country, and in the main the damage it caused relates to agriculture. In the area in which the drought was most severe, precipitation and resulting water supplies are meager, and therefore shortages are much more noticeable and their effects more serious than in the humid areas. Much of the drought damage would not have resulted if there had been a proper coordination between available supplies and the activities that depend upon water. Complete information in regard to damages is not available, but the following paragraphs give a general idea of their extent.

VEGETATION

Miscellaneous reports based on personal observation indicate that during 1934 in the major drought area most types of natural vegetation, especially trees that have deep roots and draw their water from levels near the ground-water table, suffered in varying degrees. It was also observed in the semiarid sections that natural perennial grasses, which were the basis for stock raising in the early days, were in considerable measure drought-resistant. This emphasizes the fact that natural vegetation adjusts itself through the centuries to extremes of climate.

The effects of the drought of 1934 on cultivated vegetation were widespread and in many areas were serious.

In the humid areas the sections affected were limited, in the main, to States in the upper Mississippi, Ohio, and Great Lakes drainage basins, and to Arkansas. The effects were very spotted and were most severe in Minnesota, Iowa, Illinois, Missouri, and Arkansas. In many sections there was sufficient precipitation to mature late-planted forage crops, which greatly relieved the shortage of stock feed.

The effects of the drought were most serious in the semiarid States, where all known conditions unfavorable to vegetable growth existed—deficient total precipitation with unfavorable distribution, extremes in temperature, and hot winds. As indicated in table 11, precipitation during the first two quarters of the year was deficient. As a result the growing season started with too little soil moisture for proper crop germination. This was followed in many areas by deficient precipitation during the growing season, which, combined with excessive temperature and hot winds, was disastrous to much vegetation, especially in the Dakotas.

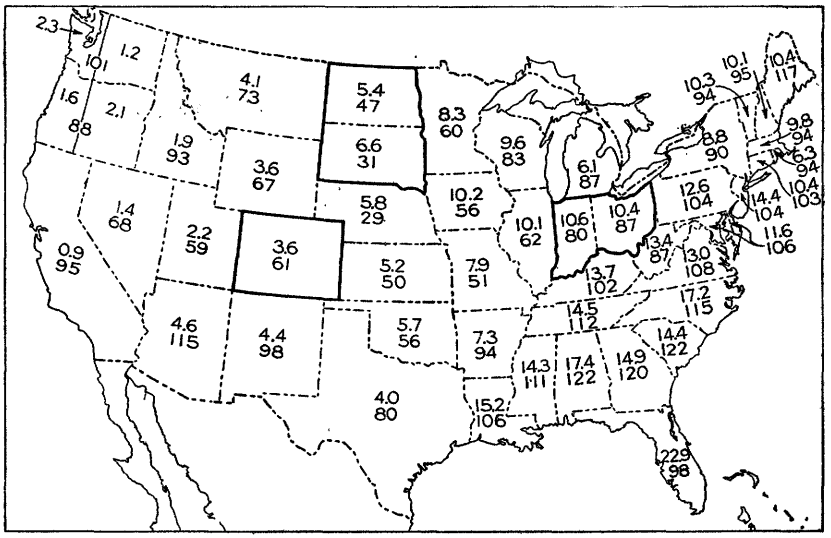

FIGURE 18.—Total precipitation for June, July, and August (upper figures) and composite yields of crops per acre expressed as percentage of average yields (lower figures), 1934. In areas indicated by heavy outline the precipitation in 1934 was the lowest of record.

The conditions that prevailed in the arid sections during 1934 are described in the November report of the Bureau of Reclamation as follows:

The crop results have been surprisingly favorable in view of the widespread shortage of water and the early predictions of crop losses. Well-organized plans of conservation have in a great measure alleviated the threatened losses on projects with limited supplies on hand. On the Carlsbad project, in New Mexico, and in the Imperial Valley, Calif., however, heavy crop losses were experienced by lack of water. Moderate crop losses occurred on the Truckee division of the Newlands project in Nevada, the Strawberry project in Utah, the Minidoka and Boise projects in Idaho, and the North Platte project in Wyoming, where the storage during the past year was very low and summer flows were far below normal. Except on those projects mentioned above, where water has been extremely deficient, crop returns have been excellent.

These results were duplicated on many non-Federal projects and illustrate what can be accomplished with adequate storage and wise

use of water. Many smaller projects that had insufficient storage or did not reduce their acreage or irrigate under the demand system suffered severely in 1934. The areas most affected were in the Great Basin and in areas supplied by water from the Colorado River drainage basin.

Although it is difficult to differentiate the relative magnitude of the effects of the many complex factors entering into the status of agriculture of which drought is only one, crop statistics give an indication of drought effect. The United States general crop report of December 1934 estimated the combined yield per acre of 33 important crops as 81.2 percent of the 10-year average yield (1921–30).

The crop yields by States and the precipitation for the growing months, June, July, and August, are indicated in table 11 and figure 18. The lower numbers in figure 18 show that in 17 States the yield per acre was more than 100 percent of the 10-year average, in 9 between 90 and 100 percent, in 7 between 80 and 90 percent, and in 15 below 80 percent. These figures do not reflect the total loss due to the drought, because acreage entirely abandoned is not included in the computation. Except in Wisconsin, Indiana, and Illinois there were no serious effects on yields in the humid States east of the Mississippi River. Noticeable shortages occurred in the humid States west of the Mississippi except Louisiana and Arkansas and in all the arid and semiarid States except New Mexico, Arizona, Idaho, Washington, Oregon, and California. The lowest yields were in the semiarid States, except Texas, and in Minnesota, Iowa, Missouri, and Illinois on the east, and Montana, Wyoming, Colorado, Utah, and Nevada on the west. The drought area included much of the corn belt, and the yield of corn for the country as a whole was only 60.5 percent of the 10-year average. The other staple crops most affected were small grains and hay. The yield of winter wheat was 83.7 percent of the average, and of spring wheat 79.1 percent, but for cotton, potatoes, and tobacco, three other important money crops, yields were above normal. These figures represent the yields per acre and not the total crop production, which for the more staple crops was unusually low for the country as a whole. The low total production resulted both from low yields due to unfavorable growing conditions and from reduction in acreage, which was about 20 percent less than in 1932 and 12 percent less than in 1933. The shortages, however, were not great enough to have a serious effect on the country's total food supply, and the total returns for crops were the highest since 1929, being estimated at $4,764,507,000, or about 70 percent more than in 1932 and 19 percent more than in 1933.

Attention has been called by the Division of Grazing, Department of the Interior, to the importance of the grass crop in the land eco-

nomics of the country. The value of this crop is not included in the statistics given above, except as a very small percentage is allowed for dry and harvested hay. Reports indicate that in the United States 1,055,000,000 acres, or 55 percent of the entire country, is in grass land. Grass produces half of all the feed for all livestock and is the greatest single crop in area, value, and tonnage. More than half of the above-stated acreage of pasture land is in the arid and semiarid States. Only one-tenth of our pasture land is arable, but that one-tenth has a carrying capacity five times as great as the natural pasture.

The effect of drought on pasture land is threefold—to the grass, to the stock, and to the land itself. Less precipitation means less feed, but as the number of stock is more or less constant, overgrazing is the result and may be carried to a point where the vegetable species most palatable to stock are either partly or wholly destroyed. The drying up of water supplies used by stock means a decreased area of grazing and results in intensified grazing adjacent to the remaining water supplies. This aggravates damage to stock, vegetation, and land.

DOMESTIC AND INDUSTRIAL WATER SUPPLIES

The experience gained during the drought of 1930 and 1931 led to a material extension throughout the country of facilities for conserving and providing water. As a result, the shortages of water for domestic and industrial uses during the drought of 1934 were in most areas much less than during previous droughts.

In the humid regions there were practically no serious shortages except in States bordering on the Mississippi River—especially Missouri and Iowa. The shortages were primarily in the rural section and smaller towns, as most cities and larger towns are now provided with adequate water supplies. In most sections the situation was helped by deepening wells and clearing streams, but in some sections hauling of water was necessary.

In the early stages of the drought the State geologist of Missouri foresaw the possibility of water shortages in the rural sections and directed the necessary geologic surveys for determining the possibilities of the development of underground water throughout the State. These surveys indicated the most favorable locations for wells, and as a result additional supplies were provided throughout the State, so that serious shortages were, in the main, averted. The surveys will also be of great value in the development of adequate water supplies for the future, and they indicate what can be done in other sections.

In the rural portions of the semiarid regions serious shortages were experienced on account of the failure of shallow wells and the drying up of ponds, lakes, and small streams. The urban supplies of these regions, which in the main come from deep wells and the larger streams, were adequate in most localities, although in some areas it

was necessary to curtail consumption and develop additional supplies. Shortages were especially noticeable in the Red River drainage basin of Minnesota and North Dakota.

In the irrigated areas of the arid regions water supplies for domestic, stock, and industrial uses are often developed in connection with irrigation systems. During 1934 shortages of suitable water for these uses were common and caused considerable inconvenience, especially on the smaller irrigation projects. In many localities it was necessary to curtail the use of the water and in some sections to develop supplementary supplies. On most of the larger irrigation projects there were no serious shortages for nonirrigation uses, although supplying the requirements for such uses necessitated an uneconomical operation of the ditches and thus resulted in considerable waste.

The shortage of irrigation water on the Snake River in southern Idaho during 1934 has resulted in a study, now under way, for eliminating winter diversions of water for domestic purposes in that area. It is suggested that wells be drilled to furnish domestic water under all canals, at a cost of $2,250,000. This expenditure will result in adding about 450,000 acre-feet annually to the winter supply available for storage in existing reservoirs that do not fill in the dry years.

Curtailment of the use of water was necessary in most of the larger towns of the arid regions. In some towns deficiencies were overcome by the development of additional supplies. In Salt Lake City, which has a normal summer demand of about 60 second-feet, shortages developed early in the summer. A detailed ground-water investigation under way by the United States Geological Survey in cooperation with the city was utilized to determine the possibilities of obtaining an additional supply, and as a result wells were drilled which yielded 52 second-feet of water. These wells were pumped as needed to take care of exchange agreements by the city and to furnish a direct supply to city consumers. As a result of careful use the city consumption during September amounted to only 44 second-feet, of which 26 second-feet was well water.

HEALTH

According to the following statement of the Surgeon General of the Bureau of Public Health Service,[13] the drought during 1934 had no large effect upon general health.

> It may be that the drought had an effect on the health of persons who were subjected to unusual conditions, but figures that will prove or disprove this are not now available. Even when detailed figures for all States have been compiled it will probably be impossible to separate the effect of the drought from the results of numerous other causes which affect health. Data on deaths for the year 1934 have not yet been collected.

[13] Personal communication.

During the summer of 1934 there was an increase in the reported prevalence of typhoid fever in some of the drought-stricken States. It is probable that some of the increase shown is due to contamination of water supplies, but in some States the apparent increase in number of cases may have been the result of efforts to secure more nearly complete reporting of cases, which have been carried on for several years.

POWER

A comparison of the amount of electricity produced in 1933 and 1934 for public use in the West North Central States (Minnesota, Iowa, North Dakota, South Dakota, Nebraska, and Missouri) indicates that the drought of 1934 had considerable effect on the production of electricity by the use of water power in that area. Although there was an increase of 4 percent in the total production of electricity from 1933 to 1934 in these States, the amount of electricity produced by water power decreased 21 percent.

NAVIGATION

The Chief of Engineers, United States Army,[14] has furnished the following statement in regard to the effect of the drought on navigation:

It would be extremely difficult to evaluate the additional expenditures necessitated by the low-water conditions during the season of 1934, although it is certain that there was some increased dredging necessary in maintaining project depths in the affected region. The low water was particularly felt in the movement of traffic on the upper Mississippi River, as it made it impossible to maintain the project depth of 6 feet at Horse Island, even by release of an additional water supply from pool 15, at Rock Island, Ill.

As a result of the low-water conditions on the upper Mississippi River, the Inland Waterways Corporation, on August 31, 1934, issued an embargo against all freight to and from or via points located on the Mississippi River north of the mouth of the Illinois River, except on cement destined to Guttenberg, Iowa, via Dubuque, Iowa. This embargo was maintained until improved flow conditions permitted its lifting on October 4.

RECREATION AND WILD LIFE

Recreational activities in the drought States were much interfered with during 1934 by the drying up of both natural and artificial lakes. This also had a detrimental effect on wild life, and as a relief measure many lakes ranging in size from about 80 to 10,000 acres were developed in the drought States for recreational use and for bird refuges. The bird refuges were developed on public land entirely at public expense. In the development of the recreational lakes the local people contributed by furnishing the site and all or part of the material and equipment required for the work. Work of this type not only provided effective relief but appealed especially to residents of the semiarid States, where there are few if any bodies of water available for recreational use or for migratory birds.

[14] Personal communication.

RELIEF

For several years there have been demands for relief in many areas due to unfavorable agricultural and other conditions; therefore it is difficult to differentiate the part of the demands in 1934 that were directly traceable to the drought.

In June 1934 Congress made available to the Federal Emergency Relief Administration the sum of $525,000,000 to be expended on drought relief in areas designated by the United States Department of Agriculture as suffering from drought, the funds to remain available until March 31, 1935. The Federal Emergency Relief Administration allotted these funds to the various State emergency relief administrations in the drought area, to be expended by these agencies under general policies established by the Federal Administration.

The program as carried out has included all types of relief, such as direct payment of funds to distressed families, the purchase of livestock that could not be maintained in the drought area because of shortage of feed and water, the furnishing of seed for late forage crops, etc., and work projects, such as the processing and canning of meats for distribution to people on relief rolls and the development of water supplies in the drought areas.

That part of the drought relief program which relates to the development of water supplies included the following items:

Cleaning of springs
Wells for domestic use
Wells for stock water
Wells for municipal water supply
Pumping for stock or domestic use
Pumping for irrigation
Dam for stock water
Dam for irrigation water
Dam for recreational lake
Dam for wild-life refuge
Maintenance ditches
Reservoir outlet
Reservoir repair work
Tapping or lowering a lake
Draining a slough, etc.
Hauling water for stock
Hauling water for domestic use

The work under these items is described in a paper by Lewis A. Jones, staff engineer, F. E. R. A., presented at the meeting of the Engineering Institute of Canada, Toronto, February 7, 1935, in part as follows:

> Because of the comparatively short time the drought relief funds would be available and the urgent need in many areas for immediate water supplies, it was decided in planning the water program to limit the work to projects that would promptly make water available and that could be completed within the limited time during which drought funds would be available. In other words, the object was to meet the existing drought situation rather than to start on a long-time water-conservation program.
>
> On the national-forest ranges and public grazing land the work has been confined largely to the cleaning out and improvement of springs, the digging of wells, the furnishing of windmills and tanks, and the construction of dams to form stock water holes. The improvements are more or less of a permanent nature, and the increased carrying capacity of the range resulting from the work will ultimately pay the cost.

On privately owned land, both in the range and dry-farming areas, the same types of projects have been carried on, but in every case, before construction work has been started, the landowner has been required to sign an easement granting the general public access to the water developed during periods of drought.

In the irrigated areas ditches have been cleaned out and lined to reduce seepage losses, reservoirs and other irrigation structures have been repaired, small reservoirs have been constructed, and pumping from streams has been carried on to furnish supplemental water for crops. This work has resulted in the saving of large areas of crops that would have otherwise been killed by the drought and has enabled the landowners to take care of themselves during this winter instead of being dependent upon the relief rolls. The cost of carrying the benefited people over the winter on the relief rolls would have in most cases exceeded very materially the cost of the work, and the landowners have been able to maintain their self-respect.

In some instances the water supplies for towns and villages have been supplemented by the digging of wells, the improvement of reservoirs, the construction of pipe lines, and the pumping of water from nearby streams, etc. In practically all cases where assistance has been rendered to incorporated towns the local communities have been required to furnish most of the materials required for the work, and the drought funds have been expended in the employment of labor that would otherwise have been on the relief rolls.

In a few of the drought States bird refuges and recreational lakes have been developed as a phase of the relief work, the size of the lakes varying in area from about 80 to 10,000 acres. The bird refuges have been developed on public lands and entirely at public expense. In developing the recreational lakes the local people have been required to furnish the lake site and all or part of the materials and equipment required for the work. The relief funds have been devoted primarily to the employment of labor from the relief rolls. In visiting the field the writer has been impressed with the popularity of such developments. They appeal especially to the residents of the semiarid States, where bodies of water for recreational uses are nonexistent.

In addition to the construction projects outlined above a number of the State relief administrations have conducted ground- and surface-water surveys to determine the extent of such resources. Such projects have furnished employment to engineers and geologists in need, and the results obtained will be of great value in planning long-time programs of water conservation. Several of the States have established water-conservation boards, and the State relief administrations have cooperated with these boards by furnishing technical personnel to assist in developing State-wide plans for water development. If a general public-works program should be undertaken the plans that have been prepared will be of great value in expediting the work.

In Montana the water program has been limited primarily to the development of water supplies on the range lands. Numerous springs have been cleaned out and equipped with suitable water troughs; wells have been dug; and small dams constructed to form stock water ponds. As a result of the work it has been possible to retain a large amount of livestock in the State that would otherwise had to have been sacrificed. In some instances supplemental water has been made available to irrigated lands and repairs made to irrigation systems to reduce seepage losses. Assistance has also been rendered to the State Conservation Board by furnishing employment to technical employees engaged in developing a long-time plan of water development and conservation for the State.

In North Dakota work in the rural region has been limited primarily to the construction of dams for stock water ponds. It is expected that more than 400

such dams will be completed before the end of next March. In addition to the stock water ponds a considerable number of small recreational lakes and municipal reservoirs have been completed ranging in size from 30 to 40 acres up to 600 or 700 acres. Five large bird refuges are also under construction covering a total of more than 150,000 acres. The refuges on the Des Lacs Lakes and the Souris River, located north of Minot, are expected, when completed, to be the most valuable wildlife refuges in the United States. In localities where municipalities and rural communities have suffered from shortage of water, wells have been dug to relieve the situation.

The State has organized a water conservation board, and the Emergency Relief Administration has cooperated with the board by furnishing technical personnel from the unemployed lists to conduct a State-wide survey of ground-water conditions which will be of value in planning a water-development program for the State.

The Federal Emergency Relief Administration feels that the water development and conservation projects carried on under the drought-relief program have not only been of great value in relieving the immediate drought situation but that much of the work is of such permanent character that benefits will continue to be derived for years to come. The value of the crops and livestock saved during the past season have enabled large numbers of farmers to maintain themselves who otherwise would have had to appeal for relief during the present winter. The reduction thus obtained in the relief load will go a long way toward paying the cost of the work. The program has also provided an opportunity for work to large numbers on the relief rolls, thus enabling them to maintain their self-respect by working instead of accepting a dole.

Several projects were undertaken in Idaho by drought-relief agencies set up by the Government. About 17,000 acre-feet of water was made available by the draining of several lakes and by pumping and was distributed by a local committee to water users on Henrys Fork and its tributaries. A section of an old power dam near Woodville was torn out, reducing the size of a ponded area and decreasing losses that were occurring. Several wells were drilled by drought-relief funds in the Blackfoot-Aberdeen section and furnished small supplies for local irrigation. Money from the same source was used to drill wells and build cisterns in the Jerome-Twin Falls area, to assist in providing domestic water, so that use of winter water from irrigation ditches may eventually be abandoned in that area. The Utah Power & Light Co. made available to Henrys Fork canals, without cost, 1,000 acre-feet of water by reducing the operating head in the forebay at its Ashton plant.

The funds allocated to the various States from the $525,000,000 authorized by Congress through March 19, 1935, are indicated below. These amounts include the allocations to the Federal Surplus Relief Corporation for activities in connection with the drought, and in some States they extend to nondrought areas. They do not, however, include allotments to the Farm Credit Association, Civilian Conservation Corps, Agricultural Adjustment Administration, or land purchase program for their activities as related to the drought.

Alabama	$951,250	New Jersey	$1,354,428
Arizona	2,069,000	New Mexico	5,847,000
Arkansas	4,633,000	New York	4,460,000
California	6,800,000	North Carolina	3,050,000
Colorado	8,660,126	North Dakota	13,711,046
Connecticut	225,000	Ohio	1,880,030
Delaware	27,923	Oklahoma	8,576,600
District of Columbia	50,000	Oregon	615,000
Florida	2,285,376	Pennsylvania	1,516,592
Georgia	1,715,600	Rhode Island	108,200
Idaho	3,982,269	South Carolina	3,030,502
Illinois	6,160,000	South Dakota	15,240,675
Indiana	2,025,000	Tennessee	1,255,750
Iowa	4,651,750	Texas	28,014,200
Kansas	13,820,000	Utah	6,388,250
Kentucky	1,061,900	Vermont	20,000
Louisiana	1,208,365	Virginia	1,271,354
Maine	838,152	Washington	650,000
Maryland	1,438,000	West Virginia	699,975
Massachusetts	850,000	Wisconsin	5,925,000
Michigan	2,110,000	Wyoming	3,589,424
Minnesota	10,774,192	Puerto Rico	400,000
Mississippi	1,150,000	Virgin Islands	15,000
Missouri	11,487,450		
Montana	7,286,424		212,220,103
Nebraska	6,860,000	Federal allotment	1,000,000
Nevada	1,401,000		
New Hampshire	79,300		213,220,103

COMPARISON OF DROUGHTS DURING PERIOD 1881 TO 1934

Records of precipitation and stream flow give an index for comparing droughts in their physical aspects and will generally serve to answer questions relative to frequency, duration, extent of area covered, and severity. Additional facts, however, which are usually lacking, are needed in considering the nature and extent of the economic effects.

Precipitation records of the United States Weather Bureau, which are on a comparable basis by States since 1880, are given in tables 1 and 14.

They indicate that in the humid States annual fluctuations are relatively large in amount but comparatively small in percentage of the mean, seldom exceeding 15 percent. In the semiarid and arid States, however, fluctuations in percent of mean are wider and annual deficiencies ranging from 20 to 45 percent are not unusual. Any comparisons based on State annuals for the arid States may be misleading, because of the wide range of precipitation in various parts of the individual States. In the humid and semiarid States, except Texas, the State distribution is more uniform.

The number of years in the period 1881 to 1934 when the precipitation did not exceed 85, 80, 75 and 70 percent of the mean—that is, a deficiency of 15, 20, 25, and 30 percent or more—are given for each State in table 15, which also gives the precipitation for the 6 years during the same period when it was lowest in each State, arranged in order of magnitude of deficiency from lowest to highest. In a few States there were less than 6 years in which precipitation was as low as 85 percent.

Under the criterion that a drought exists when the precipitation falls to 85 percent of the mean, since 1880 there have been 38 drought years in the humid States and 28 in the semiarid States, as indicated in figure 19 and table 14, which also give for the various years in both groups of States the percentage of the area in which there was this deficiency, and the precipitation in percentage of the mean for that area. Table 16 lists for both the humid and semiarid States the 14 worst drought years, arranged both according to magnitude of area affected and chronologically. Plate 1 indicates the States that were affected during the 7 worst drought years for the humid and semiarid States. In some years droughts were common for both groups of States, and in other years only one group was affected.

TABLE 16.—*Years when large areas of the humid and semiarid States had deficiency in precipitation of 15 percent or more*

Humid States

No.	In order of extent			In chronological order		
	Year	Area affected (percent)	Precipitation in area of deficiency (percent of mean)	Year	Interval between deficiency (years)	Order of extent of area affected
1	1930	63	74	1889	----------	5
2	1894	45	80	1894	5	2
3	1901	34	75	1895	1	11
4	1934	32	80	1896	1	13
5	1889	32	77	1901	5	3
6	1910	30	72	1904	3	10
7	1917	30	80	1910	6	6
8	1921	30	84	1917	7	7
9	1925	30	80	1921	4	8
10	1904	29	78	1925	4	9
11	1895	27	77	1930	5	1
12	1933	24	80	1931	1	14
13	1896	18	82	1933	2	12
14	1931	18	79	1934	1	4

Semiarid States*

1	1934	100	65	1887	----------	12
2	1910	100	71	1888	1	8
3	1894	80	70	1890	2	5
4	1917	78	71	1893	3	9
5	1890	68	76	1894	1	3
6	1933	66	77	1895	1	10
7	1931	65	80	1901	6	13
8	1888	57	82	1910	9	2
9	1893	57	74	1913	3	11
10	1895	45	78	1914	1	14
11	1913	44	84	1917	3	4
12	1887	35	85	1931	14	7
13	1901	35	75	1933	2	6
14	1914	35	83	1934	1	1

* North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma.

TABLE 14.—*Annual precipitation in percent of mean, by States, 1881–1934*

[Figures following State names indicate mean annual precipitation in inches. Bold-face figures in table indicate that precipitation was 85 percent of mean or less]

| Year | Humid States | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Semiarid States | | | | | | | | | | Arid States | | | | | | | | | | | | | | | | | | | | Number of States in which precipitation was 85 percent of mean or less | | | Extent and intensity of deficiency in precipitation | | | |
|---|---|---

TABLE 15.—*Number of years when precipitation did not exceed 85, 80, 75, or 70 percent of mean and the precipitation for the 6 years in which the precipitation was lowest, for the period 1881 to 1934, by States*

State	50-year mean,[a] 1881–1930 (inches)	1			2			3			4			5			6			Number of years when precipitation did not exceed the following percentage of mean			
		Date	Precipitation		Date	Precipitation		Date	Precipitation		Date	Precipitation		Date	Precipitation		Date	Precipitation					
			Inches	Percent of mean		Inches	Percent of mean		Inches	Percent of mean		Inches	Percent of mean		Inches	Percent of mean		Inches	Percent of mean	85	80	75	70
Humid States:																							
Maine	41.20	1897	30.60	74	1914	32.98	80	1905	33.23	81	1921	33.55	81	1924	34.37	83	1910	34.51	84	8	2	1	0
New Hampshire	39.52	1908	30.76	78	1894	31.38	79	1899	31.66	80	1897	32.33	82	1914	32.58	82	1910	33.41	85	7	3	0	0
Vermont	37.03	1896	28.78	78	1882	29.67	80	1914	30.16	81	1908	30.24	82	1911	30.54	82	1897	31.18	84	6	2	0	0
Massachusetts	42.39	1897	32.43	77	1930	33.84	80	1910	34.96	82	1883	35.77	84	1908	36.04	85	1924	36.08	85	6	2	0	0
Rhode Island	44.07	1930	32.83	74	1897	34.60	79	1918	36.57	83	1925	37.20	84	1896	37.25	85	1924	37.46	85	8	2	1	0
Connecticut	44.96	1930	32.02	71	1924	34.84	77	1897	37.50	83	1894	38.01	85	1910	38.33	85	1914	38.44	85	5	2	1	0
New York	39.01	1930	32.18	82	1908	33.54	86	1895	33.89	87	1899	34.18	88	1934	34.97	90	1884	35.23	90	1	0	0	0
New Jersey	45.89	1930	35.28	77	1931	37.07	81	1895	37.29	81	1918	37.65	82	1885	37.87	83	1921	38.16	83	8	1	0	0
Pennsylvania	42.47	1930	28.82	68	1895	33.51	79	1922	34.88	82	1900	37.31	88	1931	37.36	88	1909	37.38	88	3	2	1	1
Maryland-Delaware	41.89	1930	23.78	57	1895	34.47	82	1925	34.91	83	1914	35.97	86	1904	36.49	87	1900	36.66	88	3	1	1	1
Virginia	42.18	1930	24.99	59	1925	32.53	77	1921	34.94	83	1881	35.40	84	1894	35.76	85	1904	36.11	86	5	2	1	1
North Carolina	50.44	1925	37.33	74	1930	38.04	75	1933	39.28	73	1911	42.65	85	1921	42.92	85	1904	43.27	86	5	3	2	0
South Carolina	48.21	1925	35.82	74	1933	35.95	75	1931	37.17	77	1911	39.80	82	1930	40.15	83	1904	40.98	85	6	3	2	0
Tennessee	50.30	1930	39.80	79	1925	40.50	81	1904	40.74	81	1894	42.65	85	1895	43.10	86	1931	43.24	86	4	1	0	0
Kentucky	45.81	1930	27.86	61	1894	34.81	76	1904	35.10	77	1901	35.65	78	1889	35.97	79	1934	37.00	81	7	5	1	1
West Virginia	43.83	1930	25.43	58	1895	32.82	75	1904	33.33	76	1894	34.52	79	1887	35.33	81	1885	37.23	85	6	4	2	1
Ohio	38.44	1934	26.60	69	1930	27.00	70	1895	28.46	74	1894	29.75	77	1901	32.36	84	1900	32.82	85	6	4	3	2
Michigan	31.29	1930	22.62	72	1934	25.46	81	1925	25.51	82	1910	25.69	82	1889	26.86	86	1895	26.90	86	4	1	1	0
Indiana	40.17	1934	29.70	74	1930	29.70	74	1901	30.56	76	1895	30.99	77	1914	31.54	79	1894	32.21	80	7	5	2	0
Illinois	37.26	1901	25.72	69	1930	27.89	75	1894	28.89	78	1914	28.99	78	1895	31.89	86	1910	32.09	86	4	4	2	1
Arkansas	48.97	1901	35.27	72	1924	37.03	76	1885	37.55	77	1896	37.72	77	1917	40.72	83	1899	41.49	85	6	4	1	0
Missouri	40.17	1901	25.28	63	1930	31.27	78	1917	32.06	80	1887	32.77	82	1894	33.18	83	1934	34.19	85	6	3	1	1
Iowa	31.48	1910	19.87	63	1894	21.94	70	1901	24.41	78	1886	24.71	78	1933	24.94	79	1889	24.95	79	10	6	2	2
Wisconsin	31.63	1910	21.41	68	1895	22.45	71	1930	25.08	79	1932	25.37	80	1891	26.12	83	1901	26.34	83	8	4	2	1
Minnesota	25.91	1910	14.73	57	1889	19.08	74	1923	19.81	76	1934	20.30	78	1929	20.56	79	1933	20.97	81	9	5	2	1
Florida	52.94	1927	40.71	77	1917	41.36	78	1931	43.97	83	1883	45.17	85	1921	45.24	85	1895	45.50	86	5	2	0	0
Georgia	50.48	1931	36.75	73	1904	37.17	74	1893	40.29	80	1927	40.65	81	1921	40.94	81	1925	41.00	81	7	3	2	0
Alabama	53.11	1904	39.21	74	1931	42.78	81	1889	43.30	82	1914	44.90	85	1925	45.20	85	1910	45.20	85	8	1	1	0
Mississippi	53.32	1889	38.31	72	1924	40.06	75	1904	41.48	78	1896	43.13	81	1899	44.52	83	1887	44.57	84	7	3	2	0
Louisiana	55.64	1924	38.34	69	1889	40.25	72	1917	40.27	72	1899	42.35	76	1904	43.83	79	1896	46.56	84	8	5	3	1
Semiarid States:																							
Oklahoma	32.63	1910	18.92	58	1891	22.31	68	1917	22.39	69	1901	22.78	70	1888	23.40	72	1896	23.78	73	14	10	6	4
Kansas	27.48	1917	19.60	71	1910	19.67	72	1934	19.92	72	1893	20.25	74	1894	20.72	75	1890	21.16	77	12	7	5	0
Nebraska	23.50	1894	13.30	57	1934	14.40	61	1893	16.80	71	1910	17.03	72	1890	17.18	73	1895	18.75	80	9	6	5	2
South Dakota	20.77	1934	13.18	63	1931	14.66	71	1894	15.30	74	1933	15.31	74	1910	15.49	75	1925	15.90	77	12	9	5	1
North Dakota	17.70	1934	9.49	54	1917	10.92	62	1889	11.30	64	1910	12.19	69	1933	13.34	75	1929	14.32	81	10	5	5	4
Texas	30.84	1917	16.21	53	1893	20.47	67	1910	21.46	70	1901	22.23	72	1909	23.45	76	1924	23.50	76	11	7	4	3
Arid States:																							
New Mexico	14.49	1910	9.46	65	1917	9.49	65	1892	9.51	66	1934	9.96	69	1902	9.97	69	1894	10.47	72	12	12	9	5
Colorado	16.79	1934	10.93	65	1890	11.97	71	1888	12.00	71	1893	12.89	77	1889	13.73	82	1924	13.75	82	12	4	3	1
Wyoming	14.05	1886	7.16	51	1887	8.80	62	1902	9.81	70	1919	10.46	74	1893	10.67	76	1889	10.81	77	13	8	4	3
Montana	15.21	1889	9.24	61	1931	10.09	66	1890	10.78	71	1904	11.04	73	1919	11.14	73	1934	11.25	74	10	7	6	2
Idaho	17.17	1888	10.08	59	1889	12.05	70	1924	12.46	73	1929	13.06	76	1928	13.60	79	1895	13.63	79	9	6	3	2
Nevada	9.01	1928	4.87	54	1887	5.18	57	1924	5.49	61	1910	5.53	61	1888	5.76	64	1929	5.83	65	16	16	11	7
Utah	12.67	1887	6.55	52	1883	7.72	61	1900	8.38	66	1890	9.00	71	1902	9.17	72	1934	9.49	75	18	11	6	3
Arizona	13.10	1885	7.12	54	1900	8.17	62	1903	8.43	64	1924	8.68	66	1899	8.70	66	1904	9.24	71	15	13	11	5
California	23.53	1898	10.35	44	1923	14.13	60	1887	14.63	62	1895	14.85	63	1929	15.00	64	1932	15.60	66	19	15	10	7
Eastern Oregon	13.81	1908	9.32	68	1898	9.72	70	1924	10.42	76	1918	10.53	76	1905	10.80	78	1928	11.21	81	10	5	2	2
Western Oregon	54.22	1930	37.11	68	1929	38.66	71	1918	43.28	80	1905	44.11	81	1892	44.25	82	1923	44.89	83	9	3	2	1
Eastern Washington	16.89	1929	10.19	60	1890	12.00	71	1898	12.02	71	1930	12.12	72	1895	12.92	77	1922	13.37	79	11	6	4	1
Western Washington	56.98	1922	43.02	76	1890	43.17	76	1929	44.01	77	1905	46.18	81	1911	46.81	82	1923	47.25	83	9	3	0	0

[a] Means for Oregon and Washington are for period of record, 1890–1934.

In the 31 humid States the time interval between specially noticeable droughts has ranged from 3 to 7 years. During the 7 most severe drought years the area affected ranged from 30 to 63 percent of the total. Deficiencies in precipitation were as high as 28 percent. In extent of the area affected and deficiency of precipitation, 1930 was the most severe drought year of record. The next 2 were 1894 and 1901.

In 5 semiarid States (North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma) the time interval between droughts has

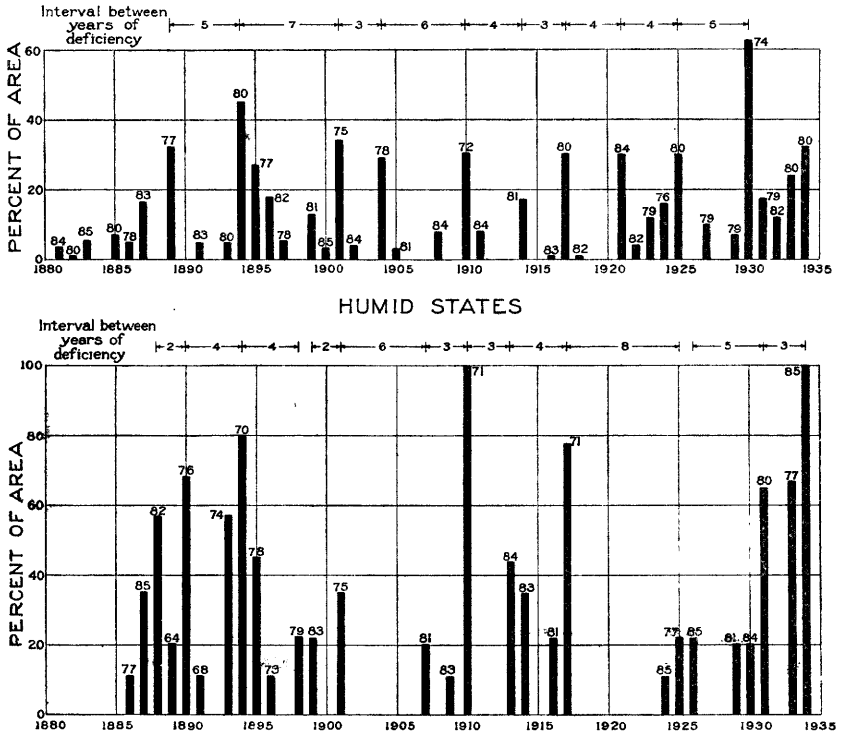

FIGURE 19.—Percentage of area having deficiencies in precipitation of 15 percent or more, 1881–1934, for 31 humid States and 5 semiarid States. Small figures on graph indicate precipitation in percent of mean in the area of deficiency.

ranged from 2 to 8 years. During each of the 7 most severe drought years over 64 percent of their area was affected, and there were 2 years, 1910 and 1934, when the deficiency in precipitation over the whole area was 29 and 35 percent, respectively. In extent of the area affected and deficiency of precipitation, therefore, 1934 was the most severe drought year of record in these States. The next 2 were 1894 and 1910. In general, drought damages in the semiarid States have been more severe than in the humid States.

Although definite data as to damage are not available, 1930 probably ranks highest in humid States, and 1934 in semiarid States.

In 1906 the United States Weather Bureau reported [15] that

> The greatest drought this country has experienced in the last 100 years, both as to intensity and extent of territory covered, culminated in the middle Mississippi and Missouri Valleys in 1894 and in the Lake region and Atlantic coast districts in 1895. * * *
>
> The next serious drought was in 1881. It affected practically the whole of the country east of the Mississippi and lasted from July to September. * * * The most striking characteristic of this drought was its duration and attendant high temperatures. Vegetation and staple crops were seriously damaged, and in the latter stages of the drought there was a scarcity of water for domestic use and for manufacturing purposes. In many places scores of shops and factories were obliged to shut down for lack of water.

Later Weather Bureau reports briefly referred to marked drought conditions during 1910.

The drought of 1881 was evidently of short duration and slight extent. There were but few localities where records indicated precipitation below the mean for more than 2 consecutive months, and these low months, were either preceded or followed by months of excessive precipitation, so that for most States the average precipitation for the year was almost equal to or above the mean. In fact, out of the 36 nonarid States, precipitation for the year was below the mean in only 11. In none of these States was the precipitation below 84 percent of the mean. In the Ohio Valley, July and August were extremely deficient in precipitation, but the Lake region had normal rainfall. Western New York, Pennsylvania, Maryland, Delaware, and Virginia as a whole had only 1 summer month of major deficiency in precipitation. These deficient months, accompanied by high temperatures that severely affected vegetation, probably led to the classification of the drought of 1881, although short in duration, with the major drought period of 1894–95.

An indication of drought conditions since 1769 in southern California is given in the following summary [16] of precipitation trends, taken from statements in letters and reports of the mission padres:

1. There has been no material change in the mean climatic conditions of southern California in the past 162 years.
2. There have been earlier fluctuations from average rainfall conditions, however, both excesses and deficiencies, of greater magnitude than any which have occurred in the past 40 years.
3. The 28-year period of rainfall deficiency which ended in 1810 was about as severe as has been the present one to date, and much more protracted.
4. The period of rainfall surplus from 1810 to 1821 was more intense than anything in the past 40 years. It seems to have been about as intense as was that between 1883 and 1893.

[15] Henry, A. J., Climatology of the United States; U. S. Weather Bur., Bull. Q, p. 51, 1906.

[16] Lynch, H. B., Rainfall and stream run-off in southern California since 1769, Metropolitan Water District of southern California, August 1931.

5. The period of rainfall deficiency which lasted from about 1822 to 1832 was more severe than has been any occurring since.

6. The period of rainfall deficiency which commenced in 1842 and lasted until 1883 was much longer than any other of which we have record. It was not so acute, however, as some others, both earlier and later. It was broken by a period of normal rainfall but was without any period of excess rainfall to balance the deficiency.

7. In comparison with several periods of rainfall shortage which have occurred in past years, the present rainfall deficiency to date cannot be considered a major shortage.

8. For all practical purposes the useful water yield of the areas under consideration closely approximates the run-off from the principal streams of these areas, except in times of heavy floods.

9. The run-off from southern California streams has in general shown fluctuations from the normal similar in character to those of the rainfall, but larger in relative percentage.

10. By reason of these fluctuations, the useful water yield has at various times been reduced from the average by considerably more than one-half for a period of 10 years, and by 30 percent for a period of 28 years.

DROUGHT AND LOW-WATER STREAM FLOW

Figure 20 shows the location of 47 river-measurement stations that have been selected to indicate the relation of droughts to stream flow in various sections of the country. No stations have been included for streams where the regimen appears to have been changed by diversion or storage works. Minimum discharges and other data for these selected stations are given in table 17.

The minimum flows for the various months as determined from the records available indicate that similar low flows may be expected in the future and their combination may be assumed to represent a possible composite (built up) low-water year. A year having even lower flow must also be considered a possibility. For example, such a composite year for the Potomac River at Point of Rocks, Md., indicates that a minimum annual flow of 2,160 second-feet or less is possible and even probable. For the period of record the consecutive 12 months of minimum flow started with April 1930, and during these 12 months the mean flow was 2,450 second-feet, or only 290 second-feet greater than in the composite minimum year. With the exception of February and April, the minimum discharge for all months occurred in the 12-month period beginning May 1930. The minimum for February occurred in 1934; for April, in 1915.

The minimum monthly discharge of many streams for most of the months occurred during the drought periods of 1930–34. The probability of other sequences of so many months of minimum flow is remote, and therefore for the drought areas of 1930–34 these figures will probably serve for some time as a basis for estimating low-water flows. Records of daily and monthly flow in connection with

deficiency tables as given for the Potomac River on pages 29–30 are necessary to determine the frequency of the effects of drought on low-water flows.

CARRY-OVER EFFECT AS RELATED TO DROUGHT

The carry-over effect of water supplies as related to drought periods may pertain to vegetation, to surface water, to soil moisture, and to ground water. On account of the counterbalancing influences that follow drought periods the subject is not readily understood, and a study of available information indicates that some phases of the carry-over effects have probably been overemphasized in hydraulic studies.

In the humid and semiarid States vegetation depends primarily upon the accumulated soil moisture at the time of planting and a

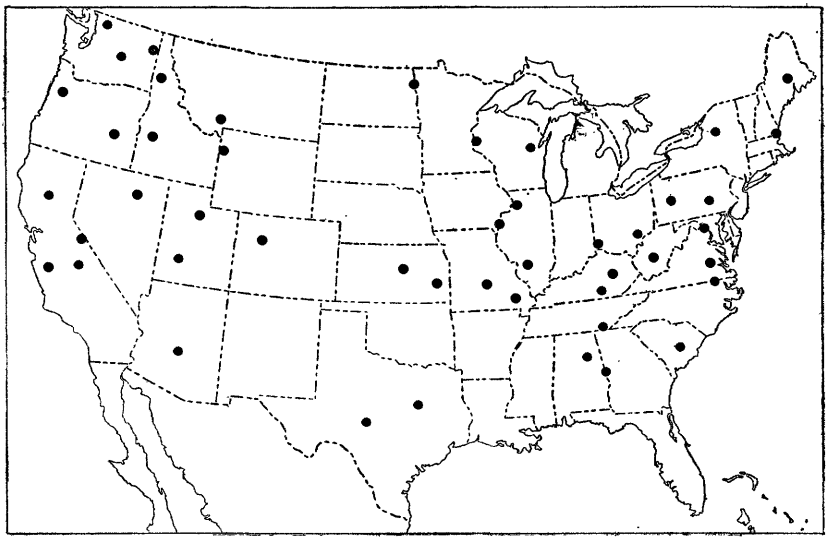

FIGURE 20.—Location of river-measurement stations used to show the relation of drought and stream flow.

favorably distributed precipitation during the growing season. Therefore, the principal carry-over effect on vegetation is in connection with soil moisture. In the arid regions successful agriculture depends in a large measure on stored water. Therefore, if adequate storage facilities are available, shortages of water due to drought may in a large measure be overcome from accumulations in storage of excesses in supplies during previous years.

It has been noted that the vegetable growth in years following droughts is especially vigorous. This may perhaps be accounted for by the fact that during the excessive drought years the land is dormant on account of lack of sufficient moisture to sustain vegetable growth. There is nothing to indicate any large detrimental carry-over effect on vegetation due to drought during the period 1930–34.

TABLE 17.—*Minimum discharge, in second-feet, at selected river-measurement stations for periods of record ending Sept. 30, 1934*

Station	Piscataquis River near Foxcroft, Maine	Merrimack River at Lawrence, Mass.	Susquehanna River at Harrisburg, Pa.	Potomac River at Point of Rocks, Md.	James River at Cartersville, Va.	Roanoke River at Old Gaston, N. C.	Santee River at Ferguson, S. C.	Chattahoochee River at West Point, Ga.	Coosa River at Childersburg, Ala.	Allegheny River at Franklin, Pa.	Hocking River at Athens, Ohio	Kanawha River at Kanawha Falls, W. Va.	Miami River at Hamilton, Ohio	Kentucky River at Lock 10, Winchester, Ky.	Cumberland River at Burnside, Ky.	Tennessee River at Chattanooga, Tenn.	Wolf River at New London, Wis.	West Branch of Oswegatchie River near Harrisville, N. Y.	St. Croix River at St. Croix Falls, Wis.	Red River at Grand Forks, N. Dak.	Mississippi River at La Crosse, Iowa	Rock River at Lyndon, Ill.	Kaskaskia River at Vandalia, Ill.	Yellowstone River at Corwin Springs, Mont.
Drainage area.....sq. miles	286	4,460	24,100	9,650	6,240	8,410	14,800	3,550	8,390	5,980	944	8,300	3,040	3,990	4,890	22,000	2,240	253	5,930	25,500	88,600	9,010	1,980	2,630
Period of record	1904-34	1880-1934	1890-1934	1897-1934	1899-1934	1912-34	1908-34	1897-1910; 1912-34	1917-34	1918-34	1916-34	1877-1934	1910-34	1909-34	1915-34	1875-1934	1913-34	1917-34	1910-34	1882-1934	1874-1934	1915-34	1915-34	1910-34

Minimum monthly discharge

Month	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge
January	1918	61.6	1925	1,590	1931	3,880	1931	2,370	1931	2,440	1934	2,940	1934	8,670	1934	3,000	1934	10,500	1931	2,290	1931	75.5	1931	5,600	1931	580	1931	543	1931	3,010	1914	18,400	1926	601	1918	105	1925	1,170	1933	38.6	1890	11,400	1931	2,120	1931	25.3	1932	646
February	1930	52.3	1931	2,130	1931	9,120	1934	2,600	1934	3,150	1934	9,200	1898	2,220	1934	2,780	1918	7,080	1932	12,000	1931	262	1925	10,200	1931	1,310	1910	3,270	1915	7,390	1931	24,500	1934	949	1930	139	1913	1,540	1933	282	1934	17,000	1934	1,740	1931	37.4	1932	641
March	1926	140	1885	3,370	1915	7,960	1925	27,800	1915	4,370	1925	5,780	1925	5,370	1927	6,400	1914	3,050	1925	9,360	1915	1,210	1915	8,150	1915	1,210	1915	2,010	1915	22,100	1931	57,800	1931	1,160	1927	495	1930	3,200	1913	1,000	1931	26,000	1931	2,850	1931	97.9	1932	747
April	1921	940	1915	7,960	1925	27,800	1915	4,370	1925	5,780	1925	5,370	1927	6,470	1914	2,130	1925	4,910	1934	2,840	1934	174	1930	4,800	1934	602	1934	1,340	1934	2,080	1925	17,800	1931	901	1921	256	1934	2,430	1934	573	1931	23,900	1934	1,400	1934	240	1930	954
May	1921	68.8	1915	2,180	1934	10,100	1930	2,230	1925	3,370	1911	5,900	1898	1,490	1925	3,070	1934	1,110	1930	2,550	1934	77.8	1930	2,550	1934	442	1930	294	1930	689	1925	10,800	1934	861	1920	120	1934	1,490	1934	151	1934	16,400	1934	1,240	1934	184	1912	2,360
June	1921	47.9	1911	1,180	1934	5,140	1930	1,100	1930	967	1932	1,600	1911	6,280	1925	1,770	1925	2,220	1934	555	1930	62.2	1930	1,290	1934	452	1930	48.8	1930	326	1879	8,300	1933	664	1933	71.2	1934	1,010	1933	116	1910	15,900	1931	1,340	1934	122	1934	4,345
July	1921	36.8	1913	1,260	1932	2,600	1930	771	1930	652	1930	1,500	1925	4,620	1925	578	1925	1,990	1930	414	1930	39.6	1925	1,360	1910	376	1930	34.2	1925	149	1925	4,760	1933	443	1934	36.9	1934	839	1934	30.6	1934	13,200	1934	1,030	1931	104	1919	2,030
August	1924	36.8	1913	1,260	1932	2,600	1930	771	1930	634	1930	1,500	1925	4,620	1925	533	1925	1,990	1930	435	1930	44.8	1930	1,310	1934	337	1930	15.8	1925	94	1925	3,960	1933	459	1929	54.4	1930	1,320	1934	30.7	1933	13,800	1925	1,210	1922	25.4	1934	1,020
September	1923	25.9	1883	1,220	1930	3,400	1930	706	1930	528	1930	1,500	1925	3,560	1931	360	1931	1,610	1930	516	1930	36.1	1930	1,130	1925	441	1930	15.0	1927	160	1904	5,610	1933	556	1922	105	1933	1,540	1933	31.7	1933	13,800	1925	1,210	1922	25.4	1934	1,020
October	1910	41.5	1910	1,260	1930	3,300	1930	846	1930	924	1931	1,500	1931	4,320	1931	1,110	1931	2,220	1930	771	1930	50.4	1922	1,310	1930	457	1930	44.0	1931	292	1931	7,040	1933	617	1930	105	1925	1,460	1933	79.0	1933	14,100	1932	1,800	1930	25.2	1932	994
November	1910	39.0	1908	1,580	1930	3,300	1930	846	1930	924	1931	1,500	1931	4,320	1931	1,110	1931	2,220	1930	771	1930	64.5	1930	2,690	1930	509	1930	107	1930	1,460	1917	10,300	1933	555	1922	145	1925	1,300	1933	82.6	1933	11,300	1933	1,740	1930	35.1	1932	851
December	1929	60.6	1910	1,460	1930	3,830	1930	1,420	1910	1,340	1917	2,190	1917	6,880	1933	2,100	1933	3,320	1930	4,220	1930	64.5	1930	2,690	1930	509	1930	107	1930	1,460	1917	10,300	1933	555	1922	145	1925	1,300	1933	82.6	1933	11,300	1933	1,740	1930	35.1	1932	673

Minimum period discharge

Period	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge
7 days	Sept. 26, 1923	15.0	July 18, 1911	847	Sept. 23, 1932	1,080	Oct. 4, 1930	661	Oct. 1, 1930	394	Sept. 19, 1932	521	Sept. 5, 1925	3,120	Aug. 29, 1925	248	Sept. 25, 1925	1,330	Aug. 17, 1930	351	Oct. 11, 1931	24	Oct. 7, 1930	984	Aug. 3, 1934	214	Sept. 18, 1930	10.1	Sept.6,21,1925	65	Sept. 9, 1925	3,480	Sept. 3, 1933	337	Aug. 28, 1934	33.0	Aug. 11, 1934	754	Sept. 14, 1934	17.3	Dec. 24, 1933	7,490	Aug. 27, 1934	687	Sept. 30, 1930	15.3	Feb. 12, 1932	896
1 month	Sept. 1, 1923	23.9	July 1, 1911	1,180	Nov. 1, 1930	2,300	Oct. 1, 1930	706	.....do.....	528	Oct. 1, 1930	940	Sept. 1, 1925	3,430	Sept. 1, 1925	466	Aug. 1, 1925	1,700	.....do.....	424	Sept. 1, 1930	40.4	Sept. 1, 1930	1,220	July 1, 1930	475	Sept. 1, 1930	15.4	Aug. 1, 1925	116	Aug. 1, 1925	4,380	Aug. 1, 1933	436	.....do.....	44.2	July 1, 1934	926	Aug. 1, 1934	20.7	Dec. 1, 1933	11,300	Aug. 1, 1934	870	Nov. 1, 1930	25.1	Feb. 1, 1932	941
2 months	Aug. 1, 1934	38.0	.....do.....	1,320	Oct. 1, 1930	2,300	Sept. 1, 1930	770	Aug. 1, 1930	544	Sept. 1, 1930	1,000	Aug. 1, 1925	4,000	Aug. 1, 1925	466	Aug. 1, 1925	1,700	.....do.....	455	Aug. 1, 1930	40.2	Aug. 1, 1930	1,220	Oct. 1, 1930	488	Aug. 1, 1930	21.7	Aug. 1, 1930	236	July 1, 1925	6,040	Sept. 1, 1933	437	July 1, 1934	57.1	July 1, 1934	1,010	Aug. 1, 1934	34.9	Oct. 1, 1933	13,000	July 1, 1934	1,260	Nov. 1, 1930	27.2	Oct. 1, 1931	644
3 months	.....do.....	40.1	.....do.....	1,320	Sept. 1, 1930	2,600	Aug. 1, 1930	770	Aug. 1, 1930	544	Aug. 1, 1930	1,000	June 1, 1925	5,710	June 1, 1931	700	Sept. 1, 1931	2,200	June 1, 1931	2,880	June 1, 1930	1,040	July 1, 1930	48.0	June 1, 1930	1,590	July 1, 1930	50.1	June 1, 1930	348	June 1, 1930	10,800	July 1, 1933	544	June 1, 1933	120	July 1, 1934	1,320	.....do.....	45.9	Aug. 1, 1933	14,000	Apr. 1, 1934	1,620	Aug. 1, 1930	28.4	Oct. 1, 1931	653
6 months	July 1, 1914	71.0	July 1, 1910	1,740	Aug. 1, 1930	3,110	July 1, 1930	945	July 1, 1930	829	July 1, 1930	1,300	June 1, 1925	7,310	Apr. 1, 1925	2,290	Apr. 1, 1925	2,290	Apr. 1, 1925	5,240	May 1, 1930	2,200	May 1, 1930	68.9	May 1, 1930	2,310	June 1, 1930	279	June 1, 1930	325	May 1, 1930	14,700	.....do.....	609	June 1, 1930	155	July 1, 1933	1,420	July 1, 1933	96	July 1, 1933	16,200	July 1, 1930	1,620	July 1, 1930	60.8	July 1, 1931	749
9 months	July 1, 1910	120	June 1, 1910	2,240	June 1, 1930	3,460	June 1, 1930	1,040	June 1, 1930	1,310	June 1, 1930	1,470	May 1, 1925	8,460	May 1, 1925	2,290	May 1, 1925	2,290	May 1, 1925	5,240	June 1, 1930	2,200	June 1, 1930	68.9	June 1, 1930	2,310	July 1, 1930	279	June 1, 1930	325	June 1, 1930	14,700	.....do.....	609	June 1, 1930	155	July 1, 1933	1,420	July 1, 1933	96	July 1, 1933	16,200	July 1, 1930	1,620	July 1, 1930	60.8	July 1, 1931	902
12 months	Oct. 1, 1910	363	Sept. 1, 1910	3,460	Apr. 1, 1930	13,500	Apr. 1, 1930	2,450	Apr. 1, 1930	2,070	Apr. 1, 1930	3,410	June 1, 1926	9,420	Dec. 1, 1930	2,810	Dec. 1, 1930	7,180	Apr. 1, 1930	4,700	Apr. 1, 1930	165	Apr. 1, 1930	4,300	Apr. 1, 1930	853	Apr. 1, 1930	1,650	Apr. 1, 1930	2,460	Apr. 1, 1930	18,300	Sept. 1, 1930	857	Sept. 1, 1930	344	Sept. 1, 1933	1,730	Oct. 1, 1933	245	Sept. 1, 1933	19,200	Oct. 1, 1933	1,810	Aug. 1, 1930	98.1	Indeterminate	

Discharge for year ending September 30

	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge
Maximum	1908	1,000	1928	10,300	1891	52,600	1902	15,240	1903	11,300	1928	10,900	1912	26,900	1920	10,300	1920	23,600	1928	13,600	1927	1,600	1901	21,100	1927	5,880	1927	8,930	1927	11,900	1932	58,500	1929	2,720	1928	736	1916	6,040	1916	5,580	1882	94,400	1929	9,590	1927	3,610	1918	3,960
Minimum	1911	363	.....	.....	1931	20,200	1931	4,920	1931	5,350	.....	5,230	1927	8,040	.....	2,670	.....	6,300	.....	5,230	1931	6,480	1934	445	1904	13,000	1931	2,291	1933	3,720	1933	7,840	1932	38,400	1931	345	1934	525	.....	3,140	1934	244	1934	48,200	1934	1,800	1931	123	1931	2,000
Mean	.....	656	.....	.....	.....	34,600	.....	6,380	.....	7,100	.....	8,040	.....	18,710	.....	6,300	.....	14,300	.....	9,380	.....	988	.....	14,000	.....	3,720	.....	5,110	.....	2,020	.....	12,400	.....	1,797	.....	166	.....	1,550	.....	192	.....	16,300	.....	1,650	.....	1,360	Not determined	
Composite	.....	163	.....	.....	.....	9,640	.....	2,160	.....	1,900	.....	2,670	.....	6,750	.....	1,740	.....	4,690	.....	3,170	.....	646	.....	3,630	.....	776	.....	2,020	.....	12,400	.....	696	.....	166	.....	1,550	.....	192	.....	16,300	.....	1,650	.....	78.6	.....	1,390

Station	Smoky Hill River near Abilene, Kans.	Gasconade River at Waynesville, Mo.	Current River at Van Buren, Mo.	Neosho River near Iola, Kans.	Brazos River at Waco, Tex.	Llano River near Junction, Tex.	Verde River near McDowell, Ariz.	Colorado River at Glenwood Springs, Colo.	Beaver River near Beaver, Utah	Big Cottonwood Creek near Salt Lake City, Utah	West Walker River near Coleville, Calif.	Humboldt River at Palisade, Nev.	Silvies River near Burns, Oreg.	Sacramento River near Red Bluff, Calif.	Arroyo Seco near Soledad, Calif.	Kings River at Piedra, Calif.	Skagit River at Newhalem, Wash.	Columbia River at Trinidad, Wash.	Spokane River at Spokane, Wash.	Snake River near Moran, Wyo.	Payette River near Horseshoe Bend, Idaho	Clearwater River at Kamiah, Idaho	Willamette River at Albany, Oreg.
Drainage area.....sq. miles	18,700	1,680	1,640	3,800	28,500	1,760	6,240	4,660	82	48.5	243	5,010	940	9,300	238	1,700	1,160	89,700	4,350	820	2,230	4,850	4,840
Period of record	1905-21	1915-34	1913-34	1915-34	1898-1911; 1914-34	1915-34	1899-09; 1904-34	1900-34	1914-34	1904-34	1902-08; 1915-34	1902-06; 1911-34	1903-34	1895-1934	1901-34	1895-1934	1908-34	1913-34	1891-1934	1904-34	1907-15; 1920-34	1911-34	1882-1934

Minimum monthly discharge

Month	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge
January	1912	35	1918	224	1918	700	1922	28	1911	12.3	1918	42.0	1931	229	1932	469	1932	12	1934	16.8	1930	26.9	1932	10.0	1932	10.0	1924	4,750	1904	18	1904	183	1930	675	1930	25,300	1930	1,060	1931	328	1932	690	1930	1,040	1930	9,390
February	1913	40	1917	184	1934	655	1934	30	1909	24.0	1918	42.4	1904	196	1932	731	1920	15.4	1934	17.6	1929	32	1932	30.1	1932, 1933	20.0	1930	4,750	1924	26.3	1924	290	1929	598	1929	25,300	1929	1,720	1931	597	1932	686	1929	1,160	1931	8,500
March	1917	107	1917	417	1918	720	1918	74	1918	21.0	1918	43.8	1904	196	1934	1,230	1933	21.8	1933	56.2	1929	125	1934	29.9	1934	11.7	1924	4,010	1931	15.8	1912	1,230	1929	1,850	1929	40,300	1905	7,720	1922	422	1934	2,460	1924	1,820	1934	9,040
April	1907	109	1934	275	1913	800	1920	312	1911	187	1917	52.8	1934	139	1908	3,880	1934	48.9	1934	79.6	1933	316	1934	11.3	1934	5.62	1924	3,250	1931	5.4	1934	2,320	1915	4,790	1929	122,000	1926	6,810	1905	1,270	1931	5,140	1915	15,300	1926	7,070
May	1933	162	1934	177	1934	1,040	1933	126	1911	33.3	1917	34.0	1934	62.9	1934	2,760	1934	24.1	1934	25.1	1924	105	1931	6.3	1934	2.54	1924	2,970	1924	.66	1924	523	1915	4,090	1926	146,000	1926	2,120	1934	1,280	1934	1,770	1934	6,400	1926	5,070
June	1933	94	1934	84.8	1934	584	1934	27	1934	18.6	1918	23.7	1913	119	1934	930	1934	18.5	1934	14.2	1924	26.9	1931	5.7	1924	.45	1931	2,620	1924	0	1924	211	1926	3,500	1926	140,000	1931	922	1934	967	1934	1,520	1926	3,320
July	1913	18	1930	120	1913	600	1918	6	1918	2.7	1918	20.0	1934	105	1934	921	1934	14.1	1934	13.3	1934	17.4	1931	3.7	1934	0	1931	2,900	Several	0	1924	166	1931	2,310	1926	95,500	1931	625	1934	355	1931	530	1924	853	1931	2,500
August	1913	44	1922	276	1913	600	1918	36	1899	90.1	1934	30.2	1901	93	1934	714	1934	11.1	1934	11.6	1924	16.1	1931	6.5	1934	.84	1934	2,650	Several	0	1924	76	1926	1,460	1927	75,300	1930	911	1934	276	1931	471	1934	806	1931	2,350
September	1913	46	1917	107	1932	649	1931	36	1926	83.6	1917	35.1	1901	134	1931	824	1931	16.6	1931	20.5	1924	25.5	1931	10.3	1931	3.88	1932	2,850	Several	0	1934	108	1926	863	1931	45,000	1931	1,060	1932	320	1931	607	1922	1,040	1929	2,150
October	1913	22	1917	107	1933	1,040	1931	16	1917	41.7	1917	41.2	1898	195	1931	647	1931	13.6	1931	19.5	1931	29.7	1931	10.3	1931	5.17	1933	3,360	1929	29	1922	112	1929	667	1929	34,600	1929	1,070	1929	240	1931	635	1922 and 1929	1,110	1929	2,560
November	1912	50	1916	186	1912	690	1921	21	1917	52.3	1917	41.8	1903	227	1931	490	1931	13.6	1933	17.6	1928	28.8	1931	10.6	1931	10.0	1930	3,690	1930	10.1	1929	135	1929	836	1929	27,600	1930	1,110	1911	280	1932	632	1919	713	1930	6,080

Minimum period discharge

Period	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge	Beginning	Discharge
7 days	Aug. 14, 1913	10.4	Aug. 9, 1934	62.1	Aug. 5, 1934	556	Aug. 18, 1934	0.9	Aug. 16, 1918	0.19	Aug. 27, 1918	13.6	July 14, 1904	35.9	Dec. 13, 1931	413	Sept. 1, 1924	10.1	Sept. 16, 1934	10.6	Sept. 1, 1924	14.0	Aug. 25, 1931	2.4	July 19, 1934	0	Aug. 10, 1931	2,470	.....	0	Sept. 27, 1924	68	Indeterminate		Indeterminate		Indeterminate		Sept. 15, 1934	176	(Sept. 11, 1931	420	Nov. 30, 1919	500	Sept. 21, 1870	1,870
1 month	Aug. 1, 1913	18	July 1, 1934	84.8	July 1, 1934	584	Aug. 1, 1934	1.8	July 1, 1934	2.7	Aug. 1, 1918	20.0	June 1, 1904	62.9	Jan. 1, 1932	469	.....do.....	11.1	Sept. 1, 1934	11.6	.....do.....	15.1	Aug. 1, 1931	3.7	Aug. 1, 1934	0	Aug. 1, 1931	2,500	.....	0	Sept. 1, 1924	76	Feb. 1, 1929	598	Jan. 1, 1930	23,300	Aug. 1, 1931	625	Nov. 1, 1929	239	Sept. 1, 1931	} 471	Dec. 1, 1919	713	Sept. 1, 1931	2,150
2 months	.....do.....	31	Oct. 1, 1917	106	Aug. 1, 1913	600	July 1, 1934	7	July 1, 1934	16.1	July 1, 1918	21.8	May 1, 1904	94.4	Dec. 1, 1931	479	Dec. 1, 1931	12.5	Aug. 1, 1934	12.4	Aug. 1, 1924	16.8	July 1, 1931	4.7	July 1, 1924	.22	.....do.....	2,540	.....	0	.....do.....	90	Jan. 1, 1929	684	.....do.....	24,400	July 1, 1931	798	Oct. 1, 1922	302	Aug. 1, 1931	504	Aug. 1, 1934	830	Aug. 1, 1931	2,220
3 months	.....do.....	36	Aug. 1, 1922	124	July 1, 1913	633	June 1, 1934	24	Feb. 1, 1909	26.9	June 1, 1917	28.6	Apr. 1, 1904	103	.....do.....	644	Nov. 1, 1931	12.9	July 1, 1934	13.0	.....do.....	19.7	June 1, 1931	5.2	.....do.....	.43	July 1, 1931	2,570	.....	0	.....do.....	102	Nov. 1, 1929	713	Dec. 1, 1929	25,500	.....do.....	858	Dec. 1, 1930	318	.....do.....	538	Aug. 1, 1931	1,000	Sept. 1, 1929	2,400
6 months	Oct. 1, 1916	69	July 1, 1922	170	May 1, 1913	731	Sept. 1, 1919	46	Oct. 1, 1917	60.1	.....do.....	33.4	Jan. 1, 1904	136	Oct. 1, 1931	846	July 1, 1931	14.2	Aug. 1, 1933	27.5	June 1, 1924	25.7	.....do.....	7.1	June 1, 1931	3.41	May 1, 1931	2,900	June 1, 1931	43	Aug. 1, 1930	102	Aug. 1, 1916	1,240	Aug. 1, 1929	51,600	.....do.....	1,160	Oct. 1, 1933	388	.....do.....	594	.....do.....	1,200	May 1, 1926	3,360
9 months	Aug. 1, 1916	162	July 1, 1916	300	.....do.....	784	Aug. 1, 1919	127	July 1, 1921	202	Apr. 1, 1917	40.9	Aug. 1, 1933	204	Oct. 1, 1933	1,420	Oct. 1, 1933	22.8	Oct. 1, 1933	34.8	Oct. 1, 1933	27.6	Feb. 1, 1924	84.9	Oct. 1, 1933	34.8	Oct. 1, 1933	15.0	Nov. 1, 1923	519	Oct. 1, 1925	2,650	Oct. 1, 1925	80,200	Mar. 1, 1930	3,250	Dec. 1, 1930	758	Mar. 1, 1931	1,400	July 1, 1931	1,930	Apr. 1, 1930	5,200
12 months	Dec. 1, 1912	160	Aug. 1, 1933	438	Feb. 1, 1913	1,030	July 1, 1919	179	July 1, 1910	270	.....do.....	48.2	.....do.....	293	.....do.....	1,420	.....do.....	22.8	Oct. 1, 1933	34.8	.....do.....	27.6	Feb. 1, 1924	84.9	Oct. 1, 1933	34.8	.....do.....	15.0	Nov. 1, 1923	519	Oct. 1, 1925	2,650	Oct. 1, 1925	80,200	Mar. 1, 1930	3,250	Dec. 1, 1930	758	Mar. 1, 1931	1,400	Mar. 1, 1931	4,980	Mar. 1, 1930	6,420

Discharge for year ending September 30

	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge	Year	Discharge
Maximum	1915	2,380	1927	3,590	1927	3,640	1927	3,600	1920	6,580	1924	544	1904	2,170	1907	4,160	1922	80.1	1909	131	1907	694	1921	862	1904	415	1904	22,600	1907	421	1906	5,300	1934	6,280	1928	156,000	1934	10,300	1909	2,680	1907	5,140	1928	12,700	1904	19,000
Minimum	1913	214	1917	563	1932	1,050	1918	215	1917	572	1917	53	1934	227	1934	1,420	1934	54.5	1934	27.9	1924	81.0	1933	34.8	1924	135	1924	4,160	1931	167	1924	859	1925	2,650	1926	80,200	1930	3,370	1931	796	1931	1,470	1931	5,200	1931	7,980
Mean	.....	.....	.....	1,440	.....	1,870	.....	1,150	.....	2,550	.....	203	.....	791	.....	3,070	.....	67.3	.....	278	.....	278	.....	338	.....	8.32	.....	11,300	.....	2.61	.....	2,270	.....	4,450	.....	121,000	.....	6,710	.....	1,460	.....	3,010	.....	8,440	.....	13,740
Composite	.....	67	.....	.....	.....	680	.....	73	.....	1,180	.....	38.4	.....	151	.....	2,070	.....	46.1	.....	66.0	.....	66.0	.....	16.8	.....	.....	.....	3,480	.....	.....	.....	469	.....	1,870	.....	68,400	.....	2,270	.....	522	.....	1,300	.....	3,260	.....	5,200

NOTE.—Discharge records for 1934 are provisional and may be subject to slight change.

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During drought periods surface waters stored in lakes, ponds, and reservoirs are usually heavily drawn upon and may be depleted entirely. The replenishment of these stored supplies in years following drought may draw so heavily on the precipitation as to cause noticeable shortages for various uses. Replenishment of ground-water storage may result in the same effect.

ALLEVIATION OF DROUGHT DAMAGE

Droughts are natural phenomena brought about by deficient and poorly distributed precipitation, high temperatures, and hot winds, which in turn depend upon other natural phenomena over which man has no control. There is nothing, therefore, that man can do to modify their occurrence. However, the economic losses resulting from shortages of water caused by droughts relate to activities that man can control, and it is possible for man to do much toward the alleviation of such losses by the conservation of available water supplies by storage, by efficiency in all uses of water, and by the adjustment of activities that depend upon water to available supplies and to variations in supplies.

In order to exercise either of these three controls, it is necessary to have complete information in regard to all available supplies, their fluctuations, and the possibilities for their conservation. This information should include climatic records, especially of precipitation; records of stream flow from which both the total flow and the distribution of flow that may be expected can be estimated; and records of fluctuations of the ground-water table, with other information relative to ground-water supplies. Topographic maps of watercourses, indicating reservoir sites and possibilities for diversion, will also be required.

Drought damages depend in a large measure on the climate of the area affected—that is, whether it is humid, semiarid, or arid—and on the type of activities in the area. Therefore, a full knowledge of the water requirements for agriculture and other activities in each area is also important in combating drought damages.

Although far from adequate, records of precipitation, temperature, stream flow, and other natural phenomena relating to water supplies are now of sufficient length to give an indication as to how far activities depending upon water can be extended without serious loss on account of deficient supplies. The extent to which economic losses due to droughts are eliminated will depend on the continuation and extension of these records and their use both in planning and in operation.

The humid areas in general have adequate precipitation to meet the needs of vegetation, both natural and agricultural, to supply adequate surface and ground waters to meet present demands for various other

needs, and also in most sections for additional demands if expansion is wisely planned. In any year there may be small areas that have shortages of water, and at intervals varying from 15 to 20 years there may be major shortages. In general, however, if due consideration is given to the character and extent of development, there should be no serious inconvenience due to water shortages in the humid areas, except at long intervals. If agriculture and other activities are properly planned and the facilities for utilizing available supplies are provided, damage due to these shortages can be minimized.

In the arid sections special caution should be exercised in the expansion of activities that will increase water-supply demands, until more information is available in regard to the amount of water that can reasonably be depended upon. Although there have been shortages of supply in many localities during drought years, the indications are that these shortages can, in the main, be overcome if all available sources are developed and if facilities are provided for their economic use. If, however, the present climatic trends in the arid sections continue, the development of additional water needs in many localities may result in serious loss.

The most pressing water-supply problems of the country are in the semiarid areas, which since their early settlement have had more or less trouble on account of deficient water supplies, especially as related to agriculture, the principal activity in these areas. The indications are that much readjustment must be made in these areas before they can be placed upon a secure basis in respect to water demands, and this will require much careful study not only of the available supplies that can be expected but of the types of agriculture and other activities that can be successfully carried on as limited by these supplies.

At the present time much water is made unavailable for use, especially in the vicinity of centers of population, by pollution from sewage and other wastes, and the conditions may eventually become so acute that large expenditures for elimination of pollution will be justified. Governmental agencies, Federal, State, and local, should give this question careful study with the idea of setting up sufficient regulatory measures to avoid disaster from pollution in times of drought. No section of the country is free from this danger.

The people who live on the land may be divided into three groups—first, the agricultural industrialist, who is primarily interested in money crops and does not attempt to supply his own food needs; second, the farmer who raises both food for his subsistence needs and money crops and who is thus self-contained on the farm; third, the subsistence agriculturist, who raises only food crops and depends on outside work for his money.

As a large percentage of the people who live on the land fall in the last two classes, the bulk of the food supply that enters into the commerce of the country is produced by a comparatively small percentage of the rural population. Drought effects are more serious to the group of agricultural industrialists than to the subsistence groups, as it is an exceptional drought in which there is not sufficient production of crops for subsistence, although supplies may at times be meager. In fact, during all drought years suffering has been largely confined to areas which have been devoted primarily to commercial agriculture and in which no special attention is given to subsistence needs. One of the outstanding results of the drought of 1930 was the large extension of subsistence agriculture in areas that had heretofore depended wholly upon money crops.

The Arkansas "live-at-home program" [17] developed as a result of the drought of 1930 indicates that a real solution to the problem of the alleviation of drought damages in rural sections is to eliminate the marginal producer and to insure that each farm unit raise sufficient food for its own needs. Under this program Arkansas officials are working to lift the one-crop curse and persuade farmers to plant food as well as money crops, so that they may be at least partly self-sustaining in time of drought. The principles of this constructive program are as follows:

To raise enough grain and hay to feed all livestock.

To produce enough meat to supply the family's needs.

To keep enough milk cows to supply the family with an abundance of milk and butter.

To provide health insurance in the form of a year-round garden, and to preserve any surplus of home-raised vegetables.

To maintain a flock of at least 30 laying hens.

To give increased care to home orchards, and in areas where no fruit is grown at present to plant enough fruit trees to supply the family's needs.

To rebuild soil fertility by planting at least half the present corn and cotton acreage to legumes and pasture crops.

To reduce tilled acreage and apply the surplus labor to terracing and drainage.

To install at least one home convenience and to beautify each homestead by painting all buildings, improving farm lawns, and planting flowering trees and shrubs.

One of the obstacles in the alleviation of drought damages is conservatism and the difficulty in changing established practices. This applies especially to the arid West and is illustrated by conditions outlined in the annual report dated March 4, 1935 (unpublished), of the committee of nine to the water users of district 36, Idaho, which comprises the Snake River drainage basin, as follows:

During a long series of years up to 1923 Snake River had an abundant run-off during 4 out of every 5 years. The streams remained at high stage until well

[17] How to live at home: Arkansas Univ. Coll. Agr. Extension Circ. 255, 1931.

into July and discharged in ordinary years 5,000,000 acre-feet annually past Milner to the ocean. During the past decade, however, the stream flow has greatly decreased. During the past 6 years, for example, the amount of water discharged past American Falls was only 50 percent of the amount during the 6 years from 1909 to 1914. The continuation of the present low discharge for so long a period, taken in conjunction with tree-ring and geologic studies, indicates that it is not unlikely that the period from the early settlement of the valley up to 1923 was one of overabundant water supply and that the present situation more nearly represents the normal condition.

If this proves to be the case, the water users on Snake River will be forced by necessity to eliminate certain pioneer habits and practices in the use of water that they acquired during the years of abundance and learn to adopt all available methods of conservation or else abandon part of the acreage now irrigated.

As a practical matter, however, in view of the established rights, viewpoint, and habits of the various water users, it is difficult to propose any plan to improve the present water supply that does not meet with the opposition of some section which feels that its rights and needs, either real or imaginary, are being infringed upon. As one studies the situation and comes to appreciate the difficulties involved in accomplishing the full conservation and efficient use of the waters of Snake River he feels a certain sympathy with that Persian poet who, 500 years ago, was moved to exclaim:

> "Ah! would that I could grasp
> This sorry scheme of things entire
> And mold a world anew
> Nearer to my heart's desire!"

In all countries and at all times water has been the limiting factor in social and other development. We have now reached a time in the development of this country when much more careful consideration must be given to water supply than has been given in the past, or serious consequences will result. The disastrous effects of recent droughts in the arid and semiarid States have in a large measure been due to failure to give adequate study to the relation of water supply to development. With the growth of the country detrimental effects of droughts increase, and they will continue to increase unless a proper relation between water supplies and requirements is established and maintained. It is not safe to assume that droughts of greater severity than those which have been recorded will not occur, and even if they are not more severe, as measured by deficiency in water and length, their economic effects will be greater as utilization of and demands for water are increased. The maximum development and successful use of all natural resources can be accomplished only on the basis of full and reliable information as to water supplies, with special emphasis on drought periods, and, in order that this information may be available, it is essential that adequate provision be made for the collection of systematic records of the Nation's water resources on a continuing basis.

PRECIPITATION DIAGRAMS

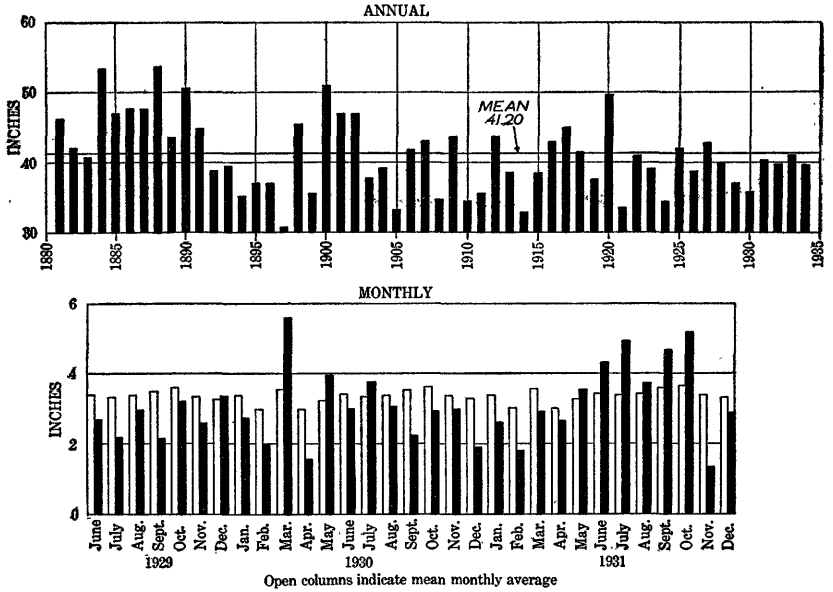


FIGURE 21.—Annual precipitation in Maine, 1881–1934, and monthly precipitation, June 1929 to December 1931.

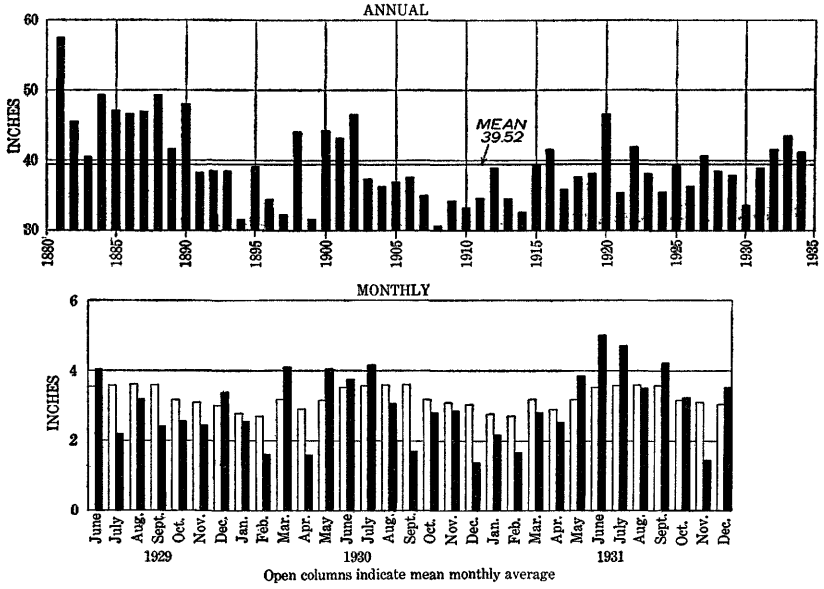


FIGURE 22.—Annual precipitation in New Hampshire, 1881–1934, and monthly precipitation, June 1929 to December 1931.

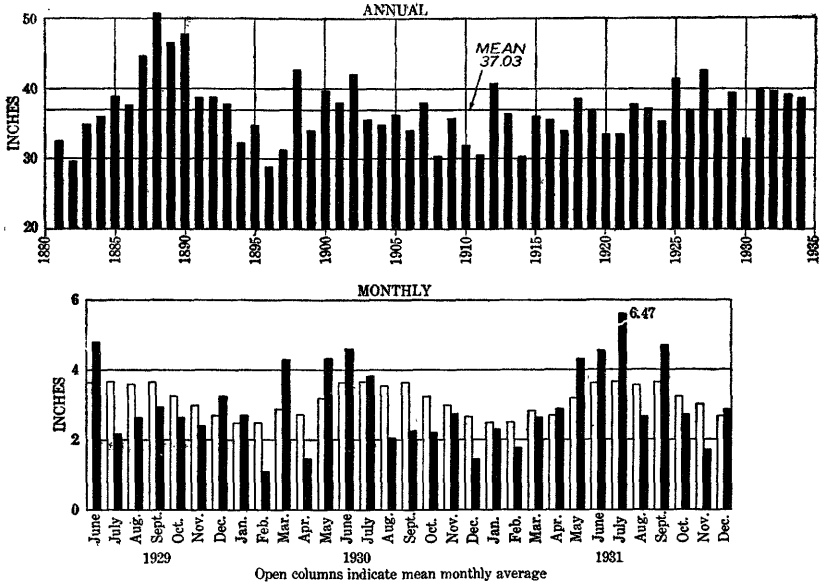


FIGURE 23.—Annual precipitation in Vermont, 1881–1934, and monthly precipitation, June 1929 to December 1931.

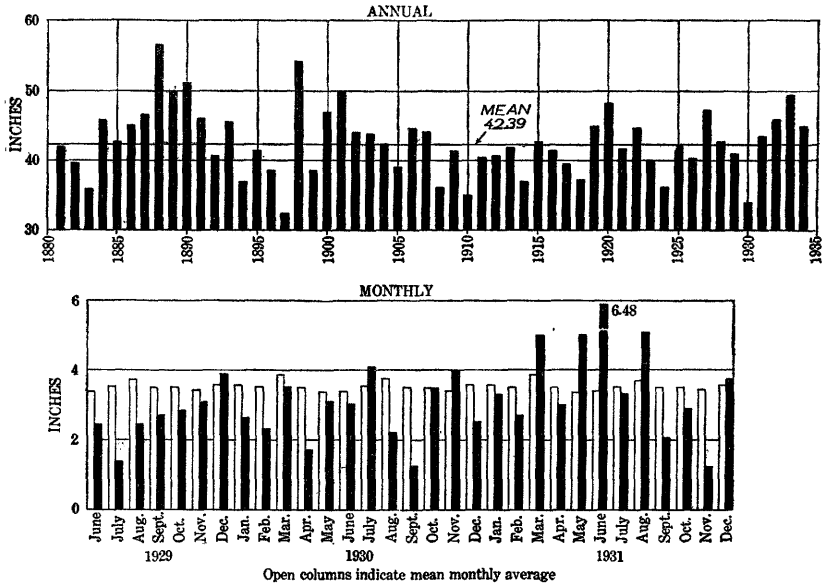


FIGURE 24.—Annual precipitation in Massachusetts, 1881–1934, and monthly precipitation, June 1929 to December 1931.

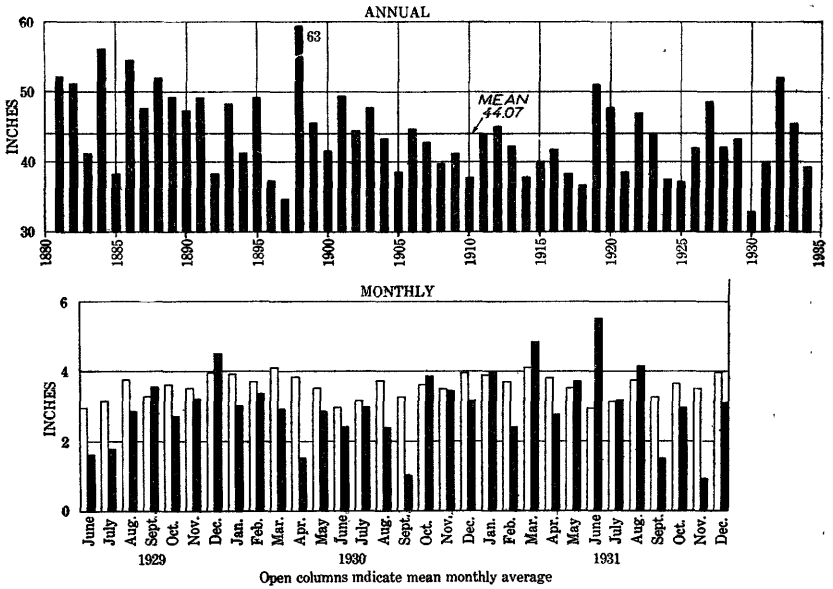


FIGURE 25.—Annual precipitation in Rhode Island, 1881–1934, and monthly precipitation, June 1929 to December 1931.

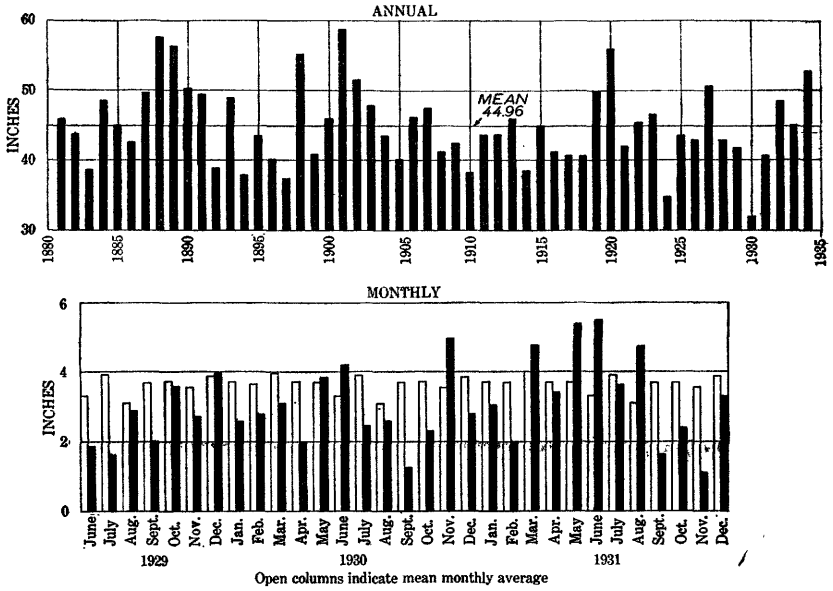


FIGURE 26.—Annual precipitation in Connecticut, 1881–1934, and monthly precipitation, June 1929 to December 1931.

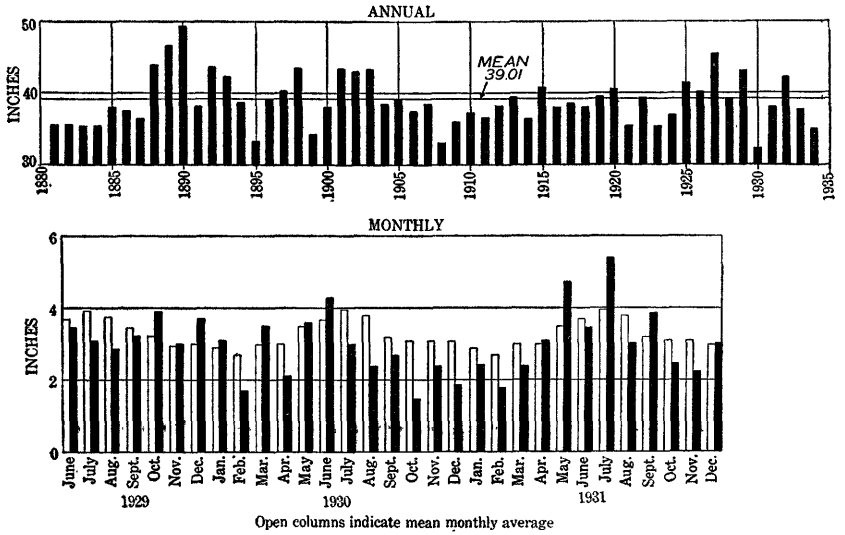


FIGURE 27.—Annual precipitation in New York, 1881–1934, and monthly precipitation, June 1929 to December 1931.

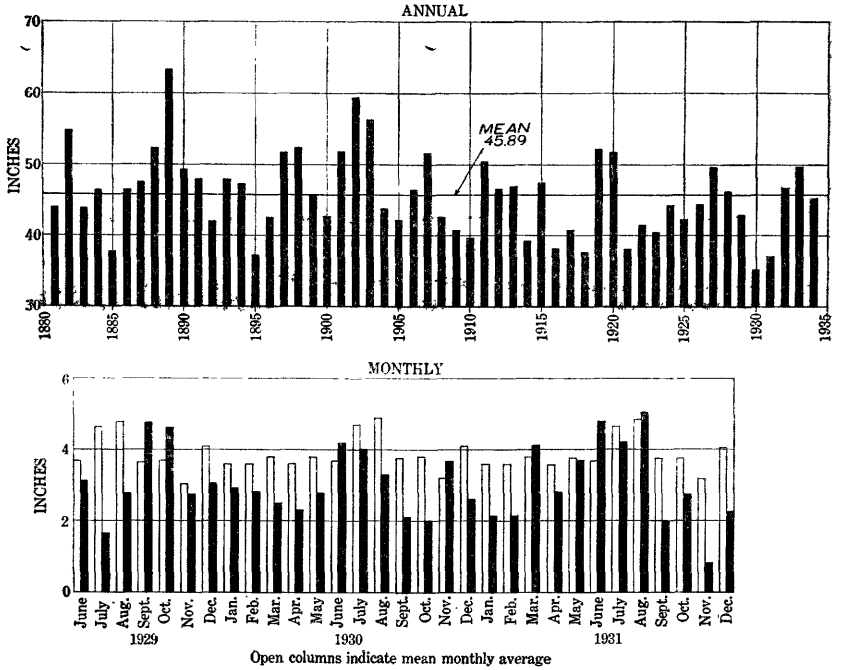


FIGURE 28.—Annual precipitation in New Jersey, 1881–1934, and monthly precipitation, June 1929 to December 1931.

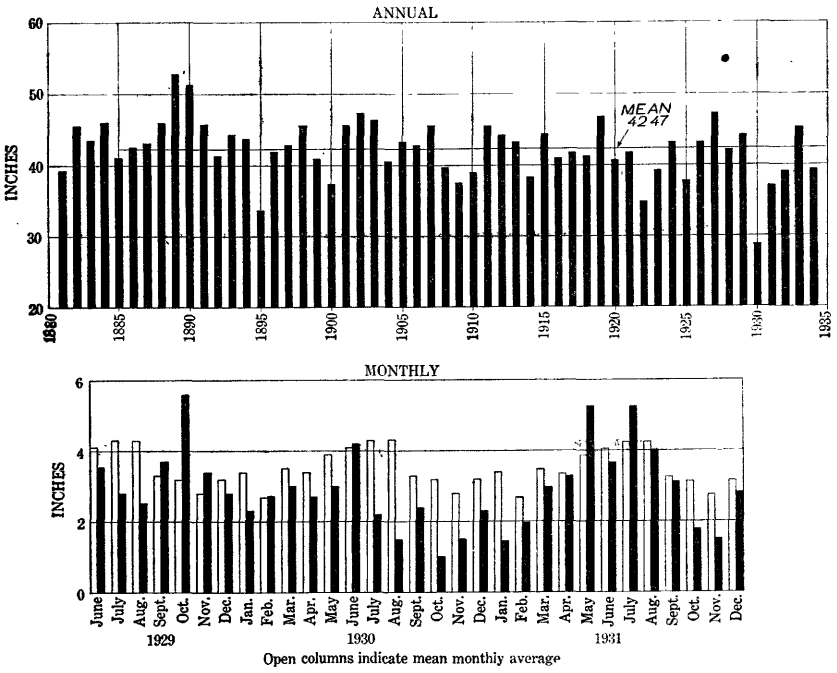


FIGURE 29.—Annual precipitation in Pennsylvania, 1881–1934, and monthly precipitation, June 1929 to December 1931.

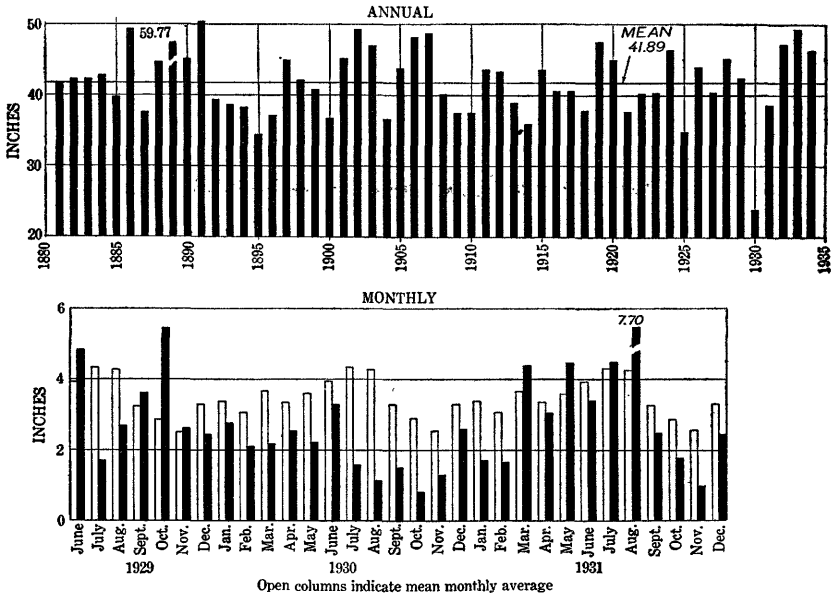


FIGURE 30.—Annual precipitation in Maryland-Delaware, 1881–1934, and monthly precipitation, June 1929 to December 1931.

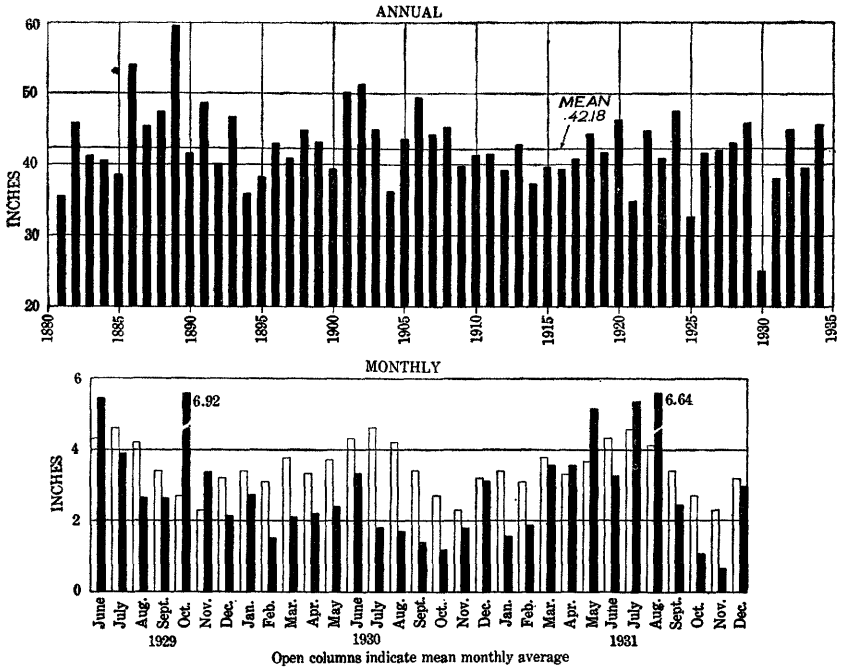


FIGURE 31.—Annual precipitation in Virginia, 1881–1934, and monthly precipitation, June 1929 to December 1931.

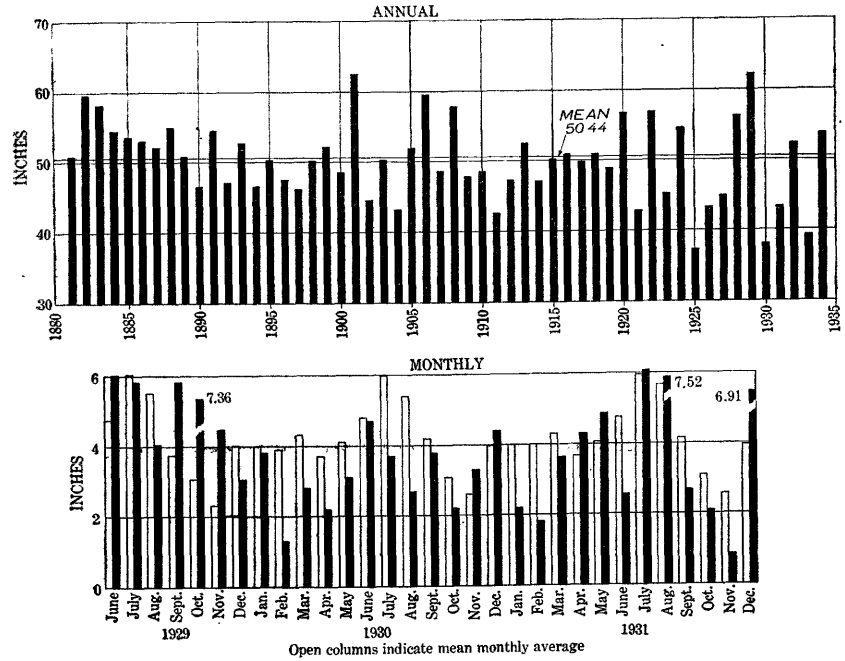


FIGURE 32.—Annual precipitation in North Carolina, 1881–1934, and monthly precipitation, June 1929 to December 1931.

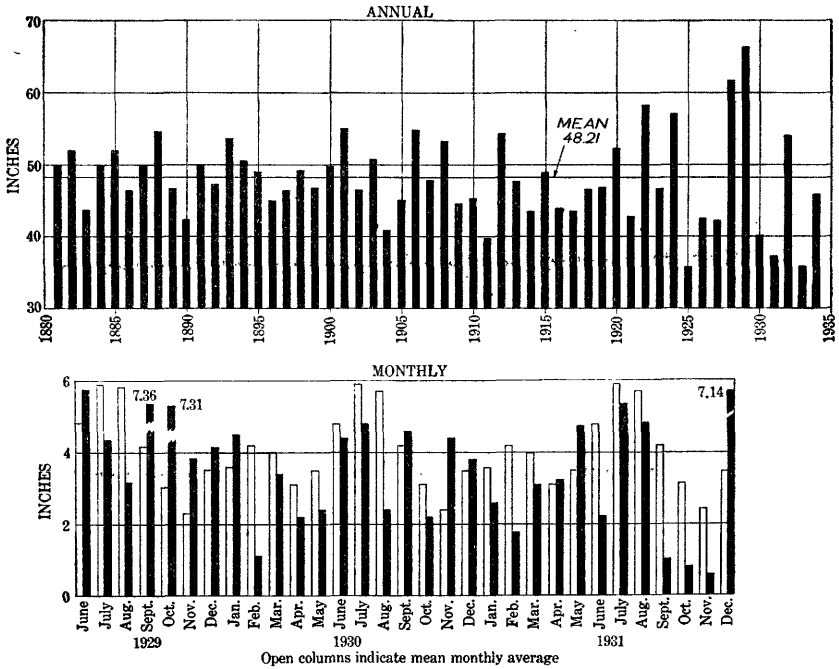


FIGURE 33.—Annual precipitation in South Carolina, 1881–1934, and monthly precipitation, June 1929 to December 1931.

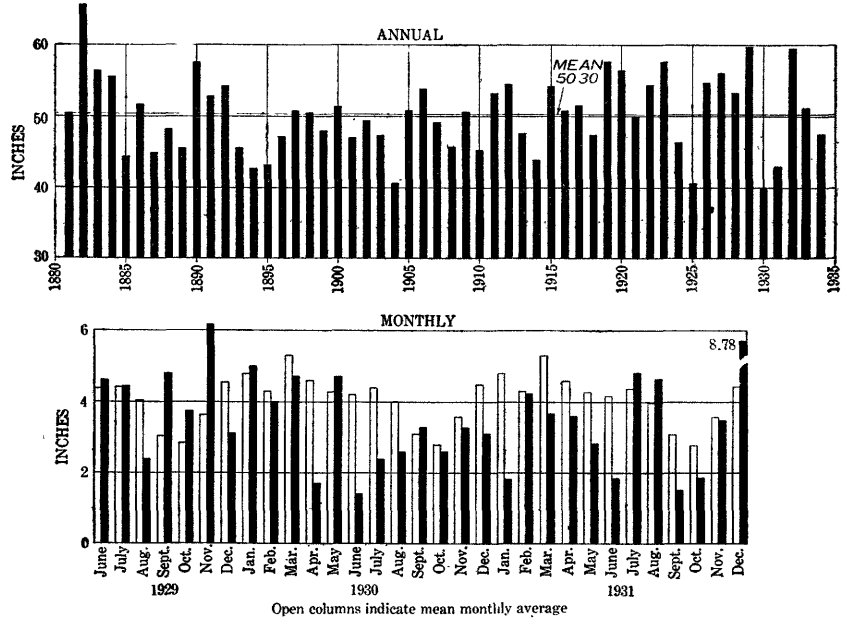


FIGURE 34.—Annual precipitation in Tennessee, 1881–1934, and monthly precipitation, June 1929 to December 1931.

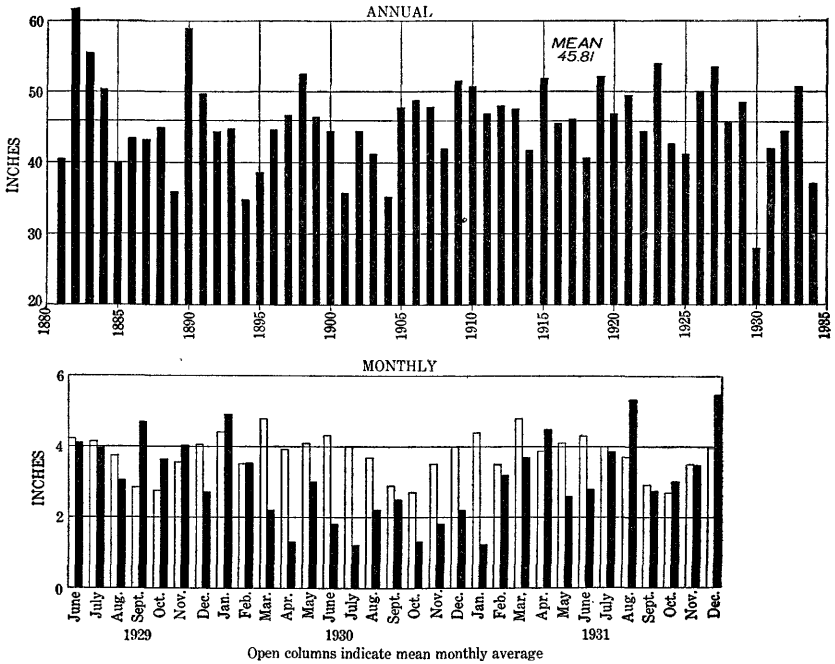


FIGURE 35.—Annual precipitation in Kentucky, 1881–1934, and monthly precipitation, June 1929 to December 1931.

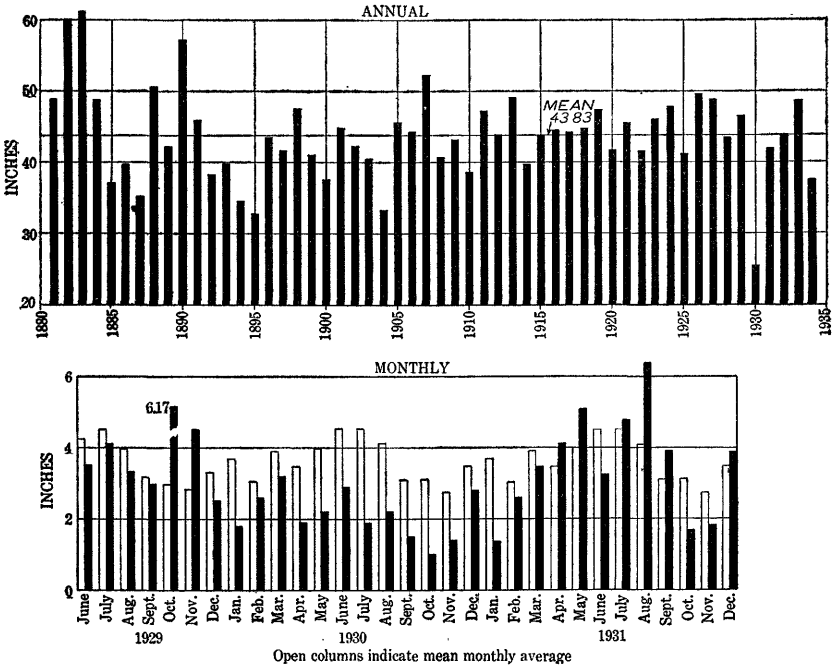


FIGURE 36.—Annual precipitation in West Virginia, 1881–1934, and monthly precipitation, June 1929 to December 1931.

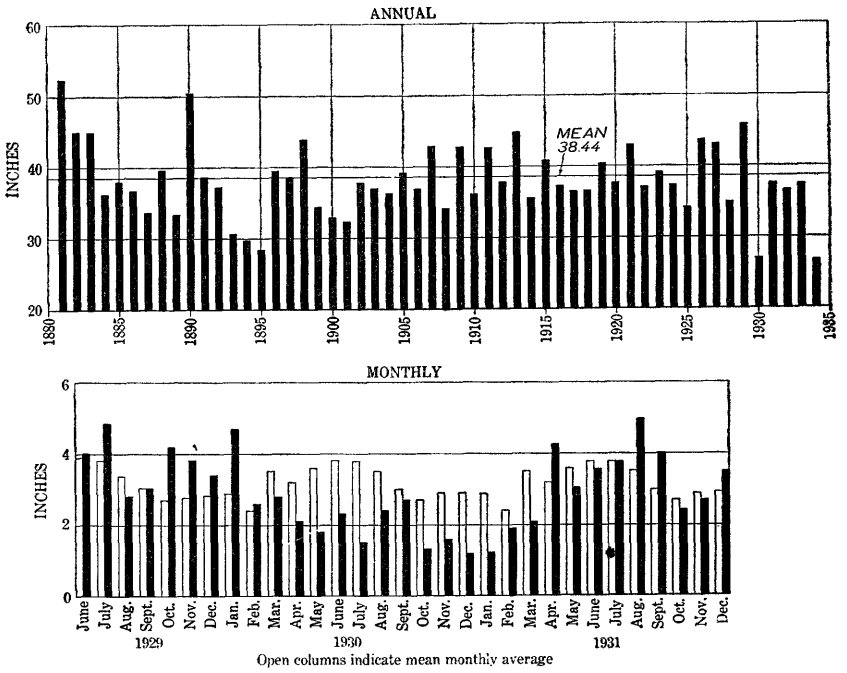


FIGURE 37.—Annual precipitation in Ohio, 1881–1934, and monthly precipitation, June 1929 to December 1931.

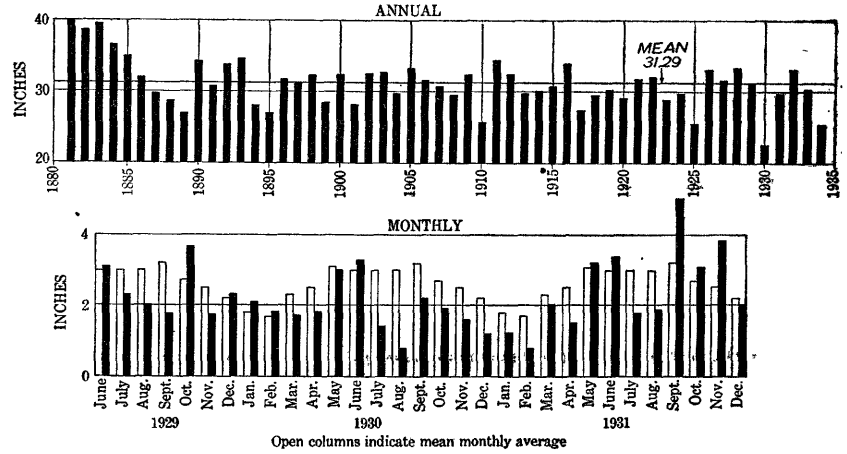


FIGURE 38.—Annual precipitation in Michigan, 1881–1934, and monthly precipitation, June 1929 to December 1931.

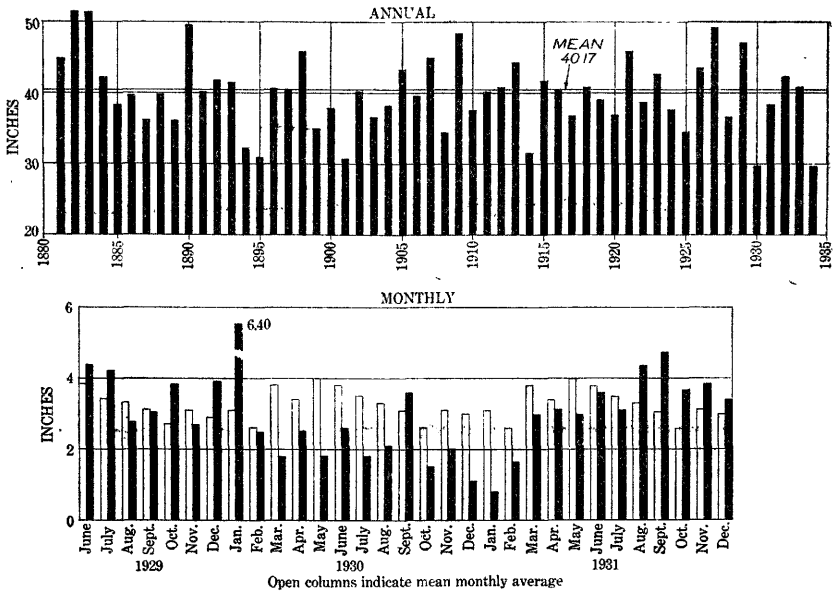


FIGURE 39.—Annual precipitation in Indiana, 1881–1934, and monthly precipitation, June 1929 to December 1931.

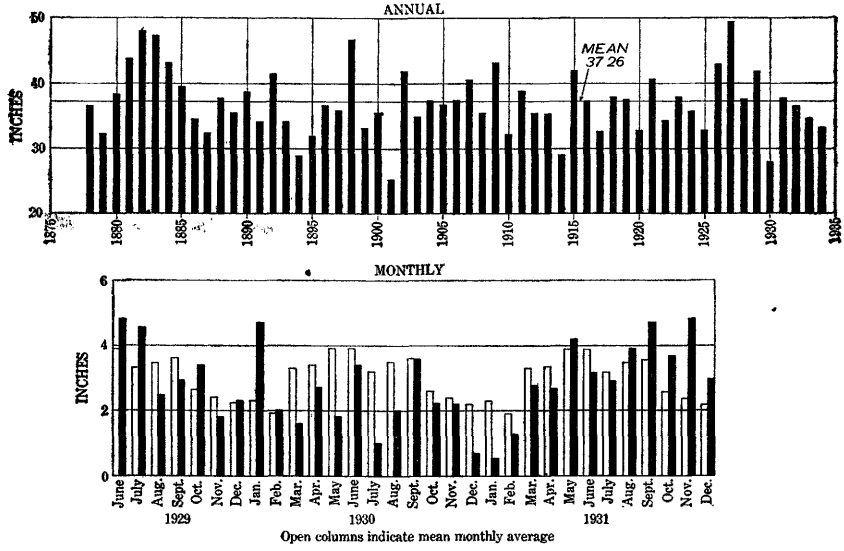


FIGURE 40.—Annual precipitation in Illinois, 1878–1934, and monthly precipitation, June 1929 to December 1931.

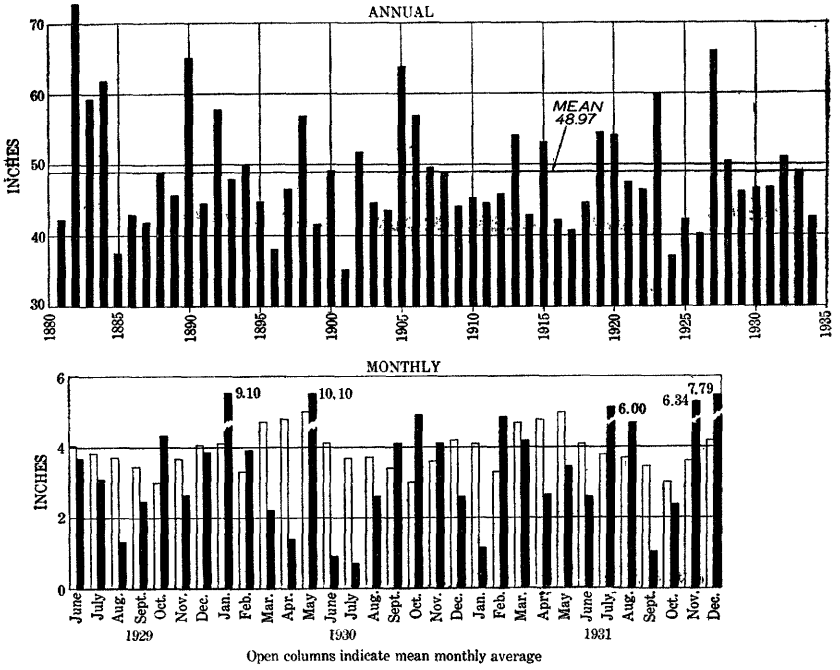


FIGURE 41.—Annual precipitation in Arkansas, 1881–1934, and monthly precipitation, June 1929 to December 1931.

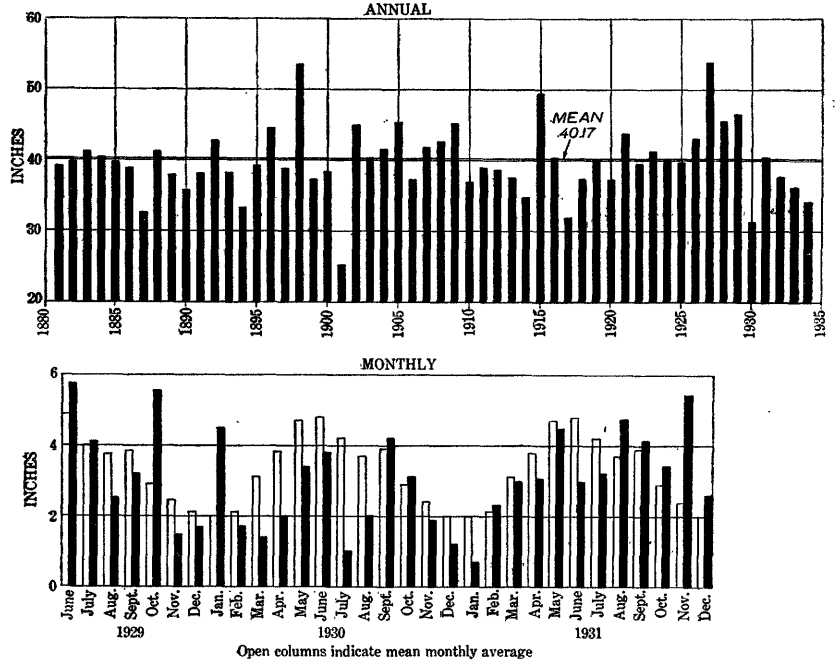


FIGURE 42.—Annual precipitation in Missouri, 1881–1934, and monthly precipitation, June 1929 to December 1931.

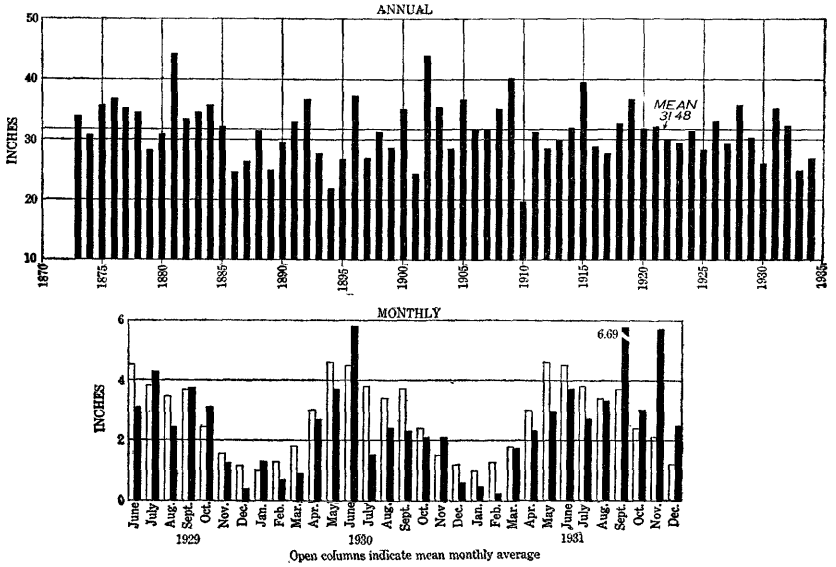


FIGURE 43.—Annual precipitation in Iowa, 1873–1934, and monthly precipitation, June 1929 to December 1931.

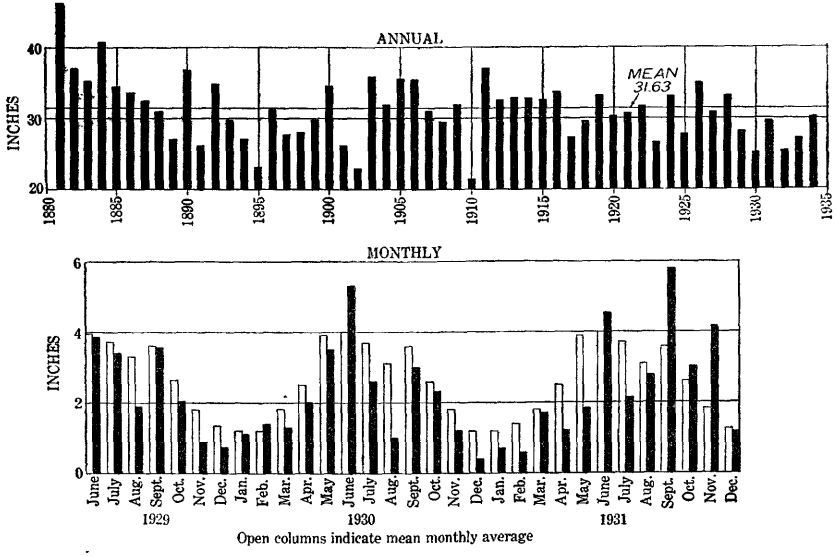


FIGURE 44.—Annual precipitation in Wisconsin, 1881–1934, and monthly precipitation, June 1929 to December 1931.

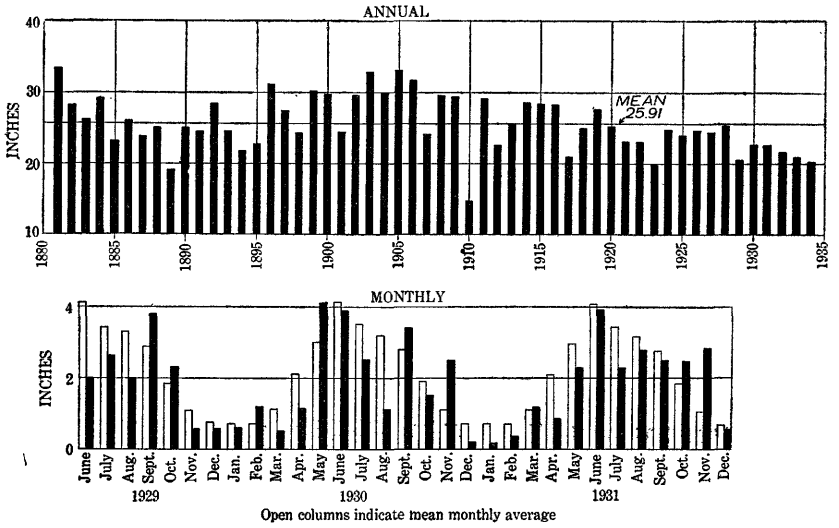


FIGURE 45.—Annual precipitation in Minnesota, 1881–1934, and monthly precipitation, June 1929 to December 1931.

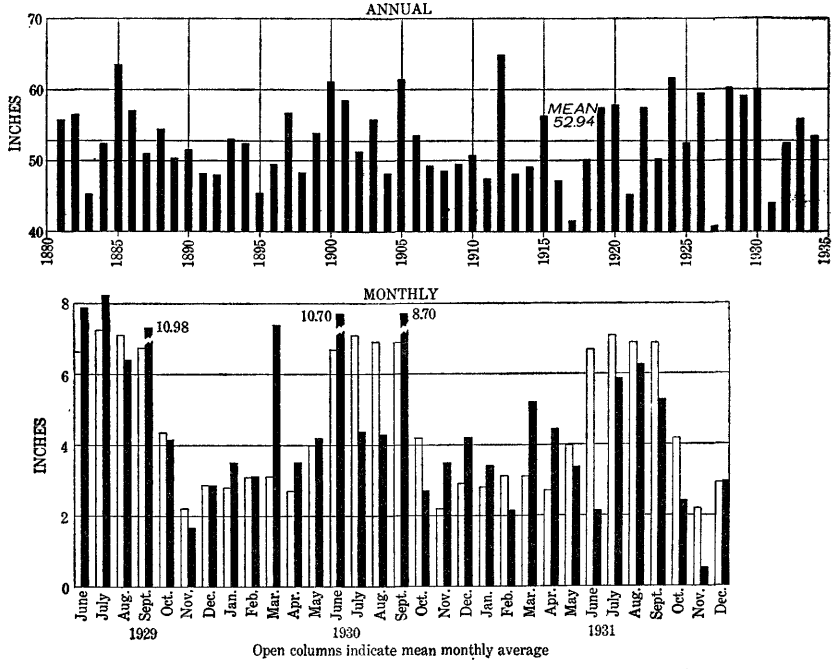


FIGURE 46.—Annual precipitation in Florida, 1881–1934, and monthly precipitation, June 1929 to December 1931.

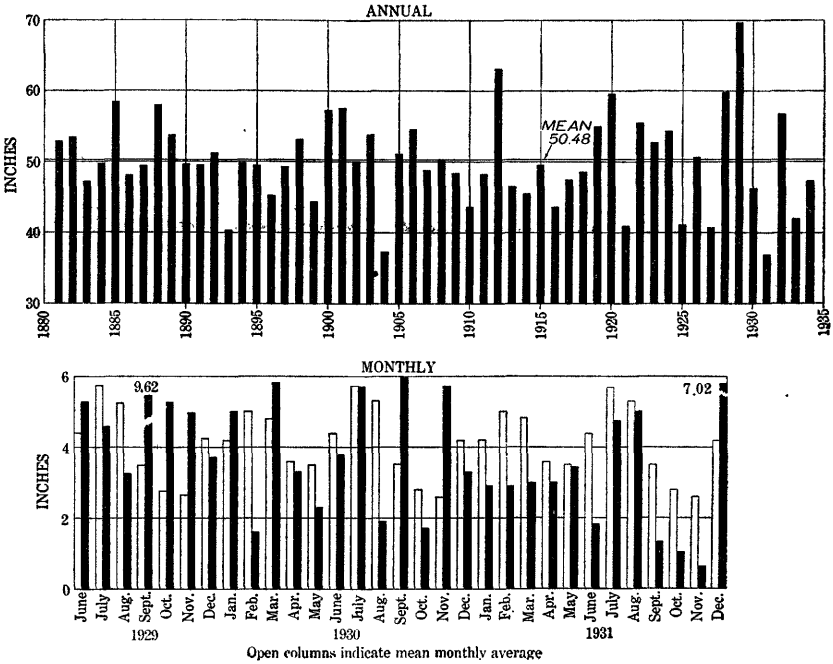


FIGURE 47.—Annual precipitation in Georgia, 1881–1934, and monthly precipitation, June 1929 to December 1931.

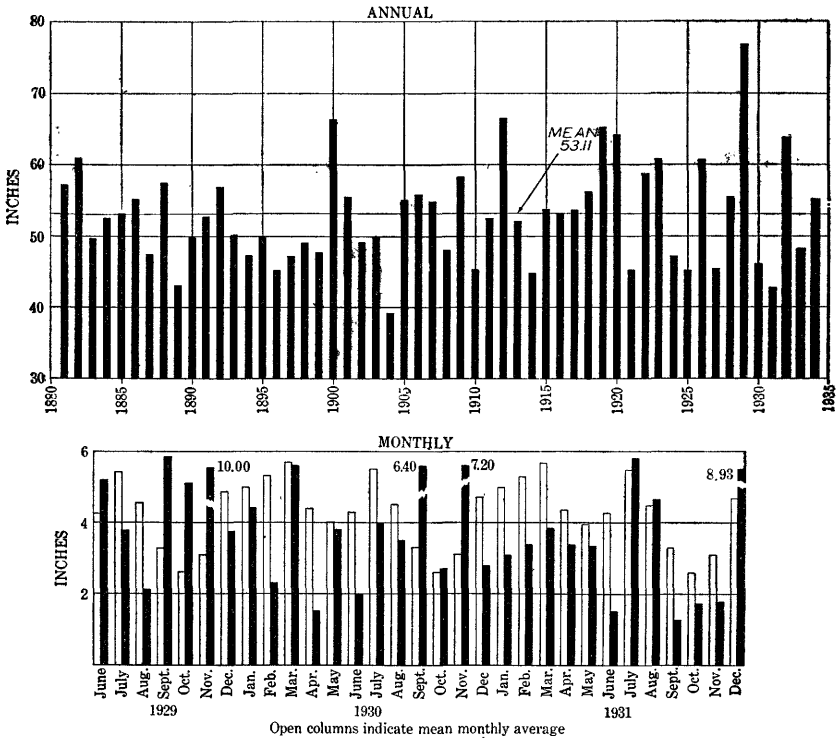


FIGURE 48.—Annual precipitation in Alabama, 1881–1934, and monthly precipitation, June 1929 to December 1931.

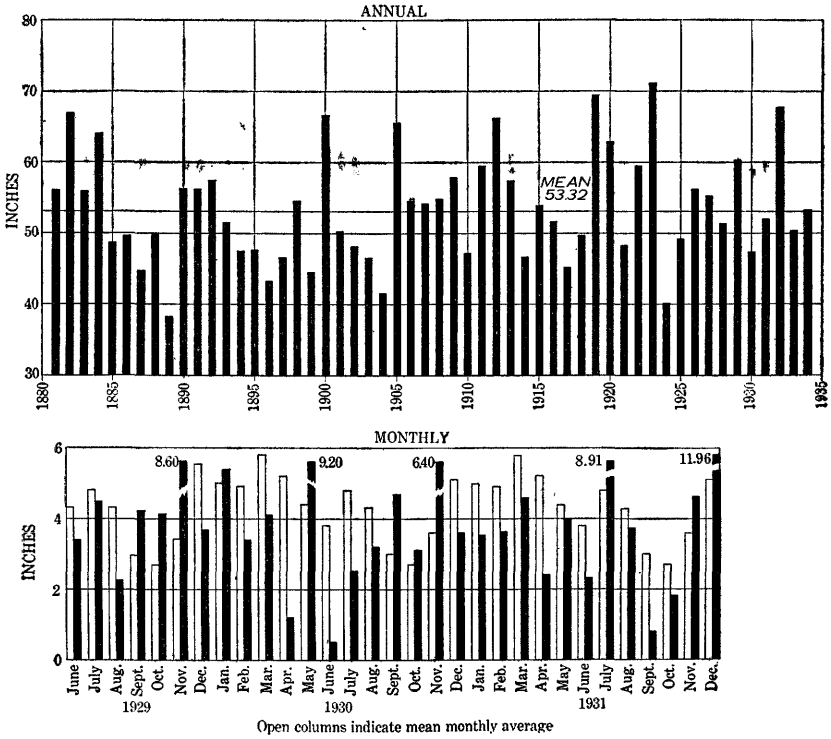


FIGURE 49.—Annual precipitation in Mississippi, 1881–1934, and monthly precipitation, June 1929 to December 1931.

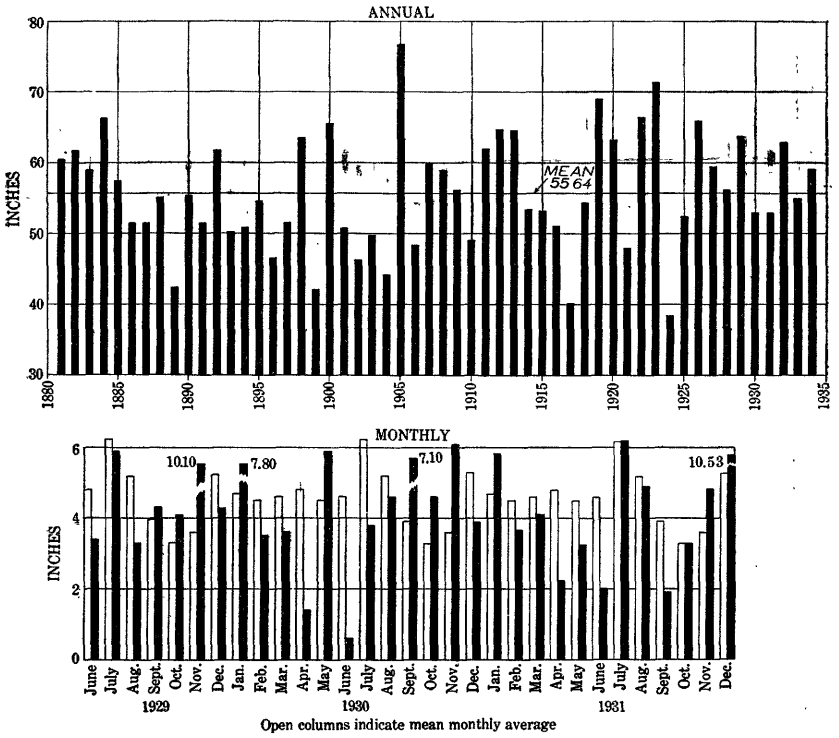


FIGURE 50.—Annual precipitation in Louisiana, 1881–1934, and monthly precipitation, June 1929 to December 1931.

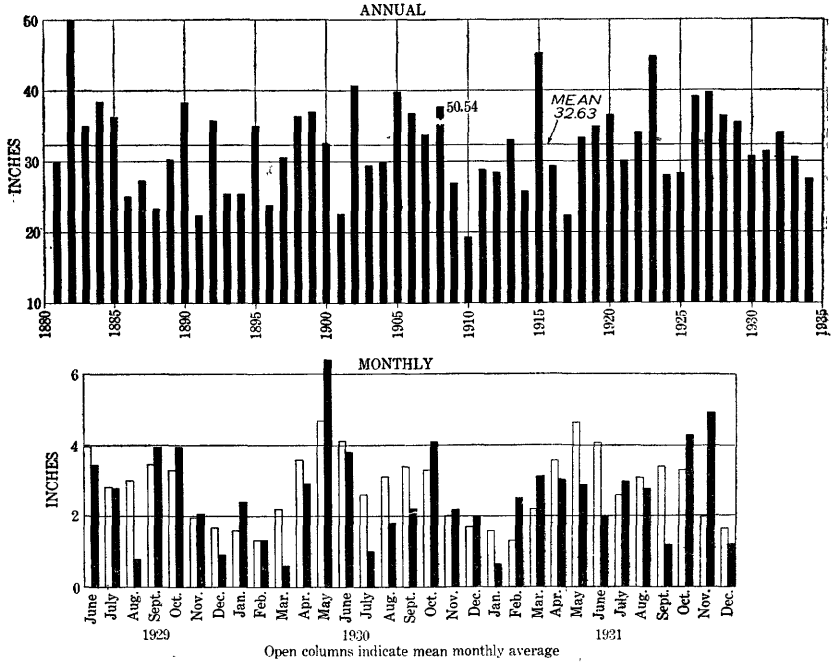


FIGURE 51.—Annual precipitation in Oklahoma, 1881–1934, and monthly precipitation, June 1929 to December 1931.

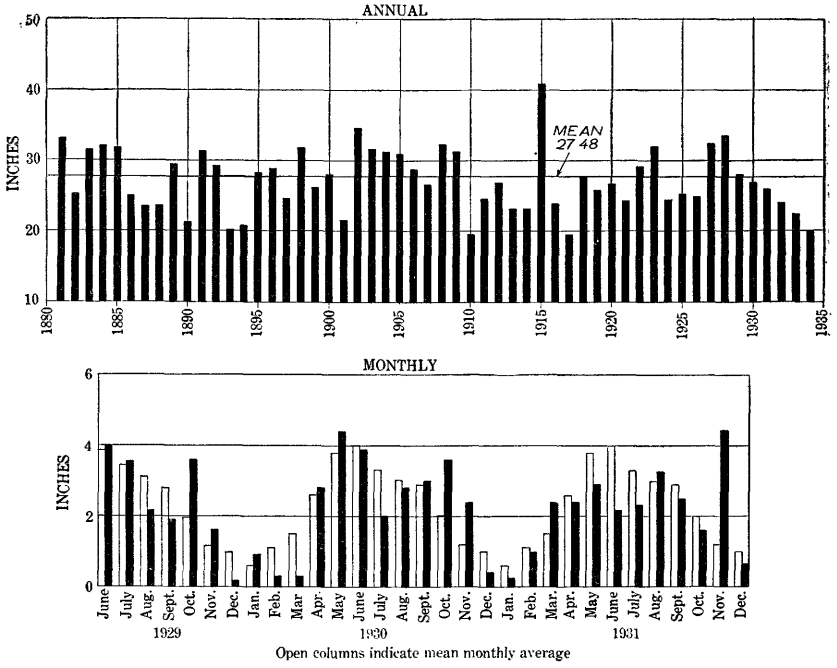


FIGURE 52.—Annual precipitation in Kansas, 1881–1934, and monthly precipitation, June 1929 to December 1931.

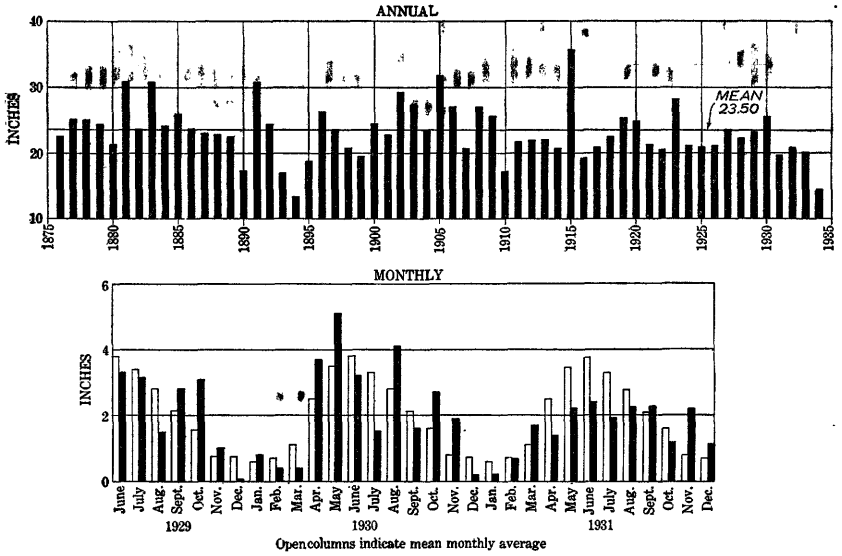


FIGURE 53.—Annual precipitation in Nebraska, 1876–1934, and monthly precipitation, June 1929 to December 1931.

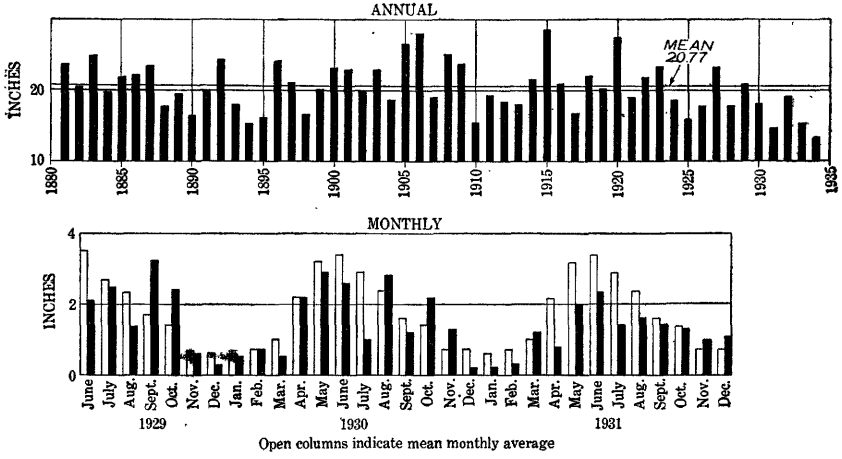


FIGURE 54.—Annual precipitation in South Dakota, 1881–1934, and monthly precipitation, June 1929 to December 1931.

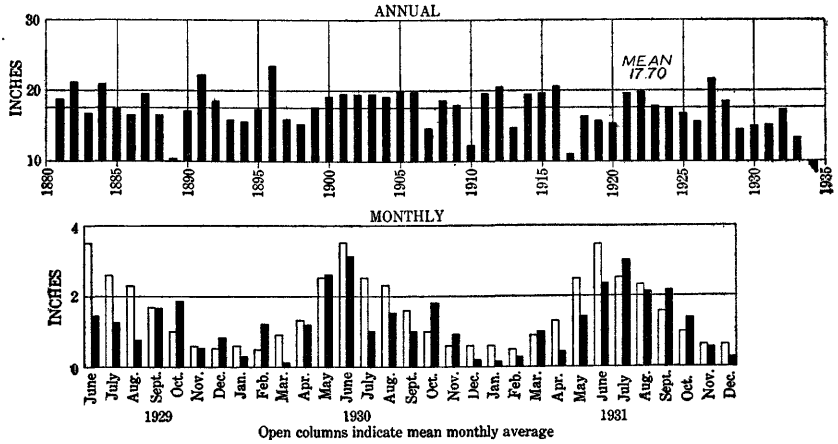


FIGURE 55.—Annual precipitation in North Dakota, 1881–1934, and monthly precipitation, June 1929 to December 1931.

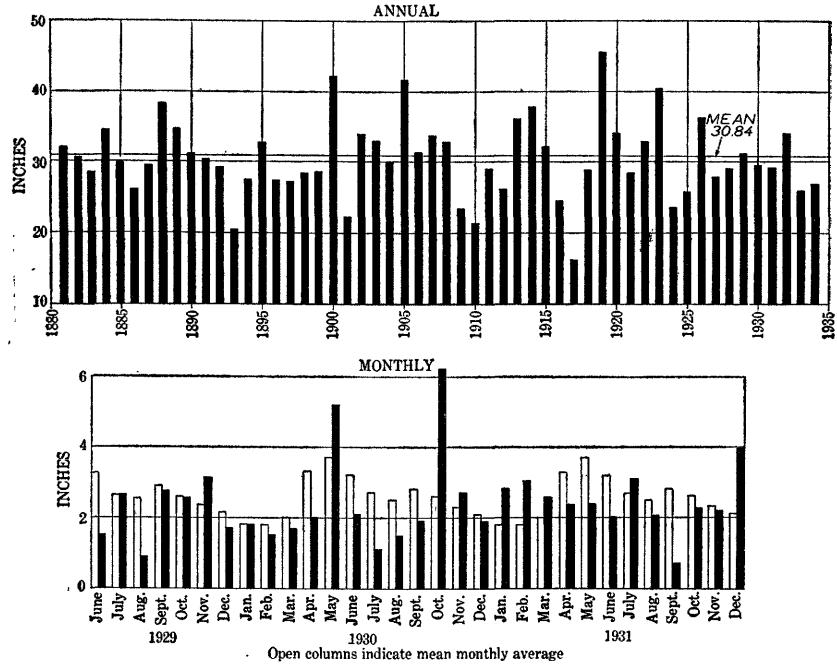


FIGURE 56.—Annual precipitation in Texas, 1881–1934, and monthly precipitation, June 1929 to December 1931.

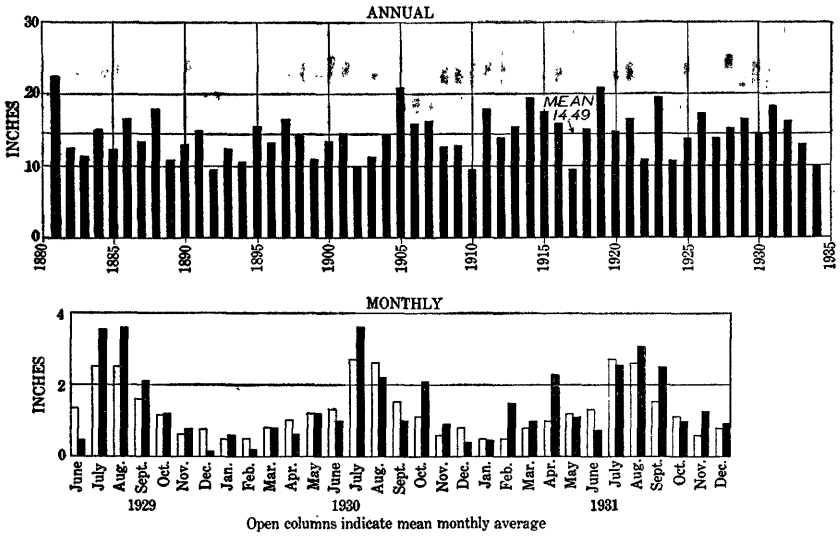


FIGURE 57.—Annual precipitation in New Mexico, 1881–1934, and monthly precipitation, June 1929 to December 1931.

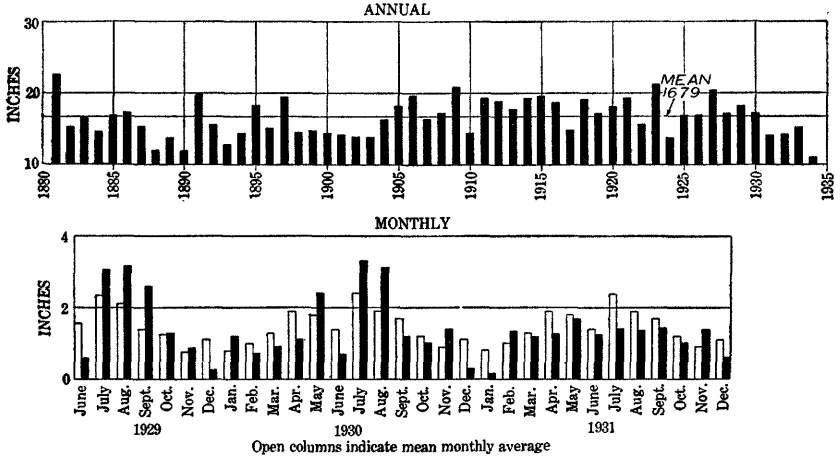


FIGURE 58.—Annual precipitation in Colorado, 1881–1934, and monthly precipitation, June 1929 to December 1931.

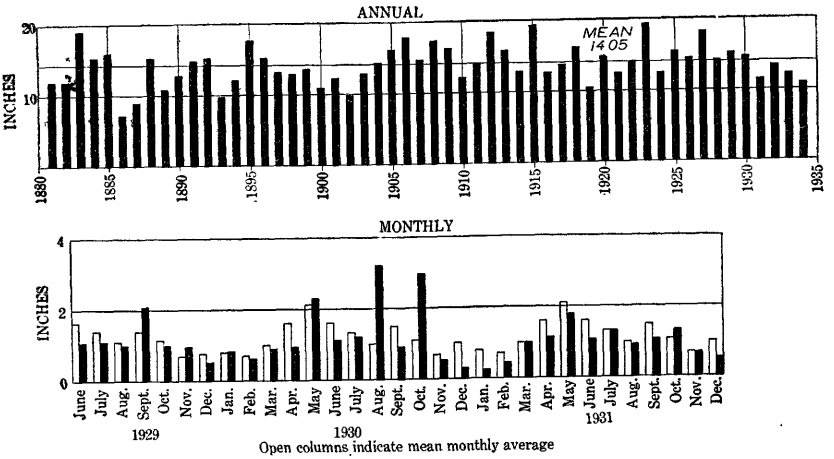


FIGURE 59.—Annual precipitation in Wyoming, 1881–1934, and monthly precipitation, June 1929 to December 1931.

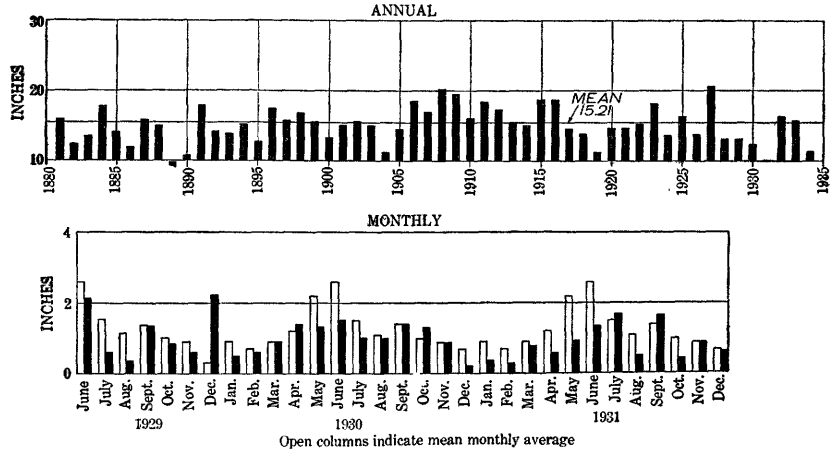


FIGURE 60.—Annual precipitation in Montana, 1881–1934, and monthly precipitation, June 1929 to December 1931.

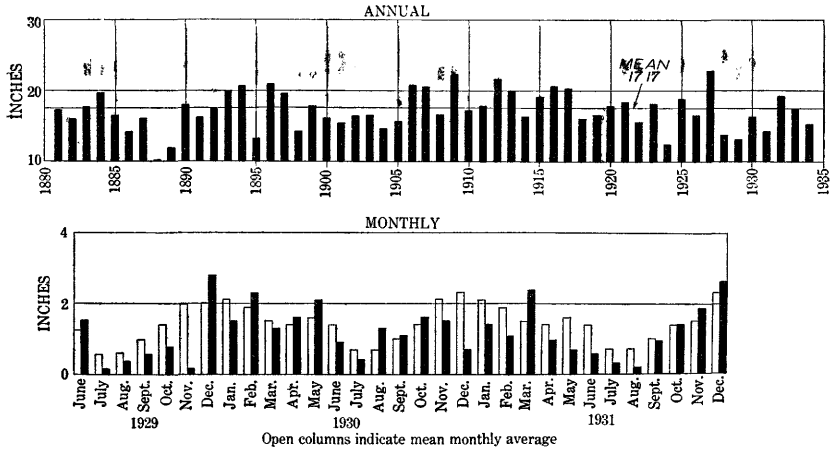


FIGURE 61.—Annual precipitation in Idaho, 1881–1934, and monthly precipitation, June 1929 to December 1931.

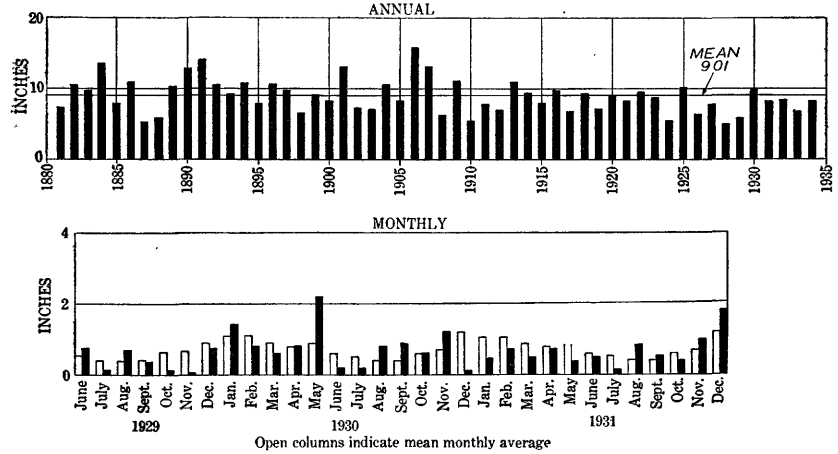
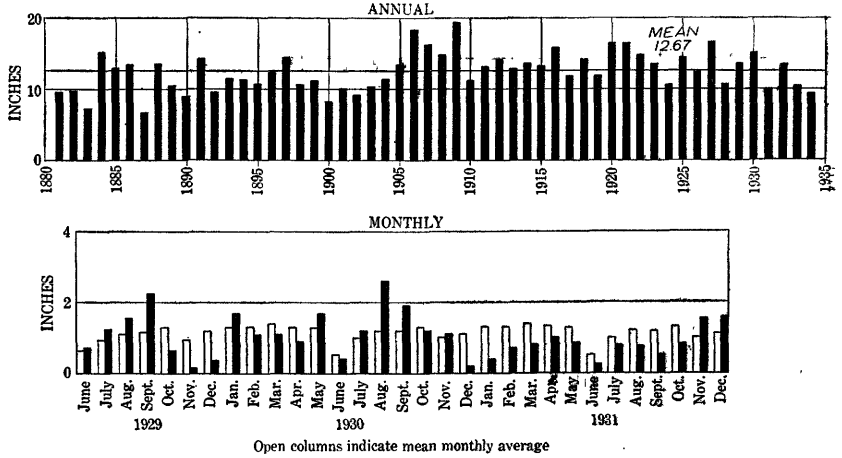
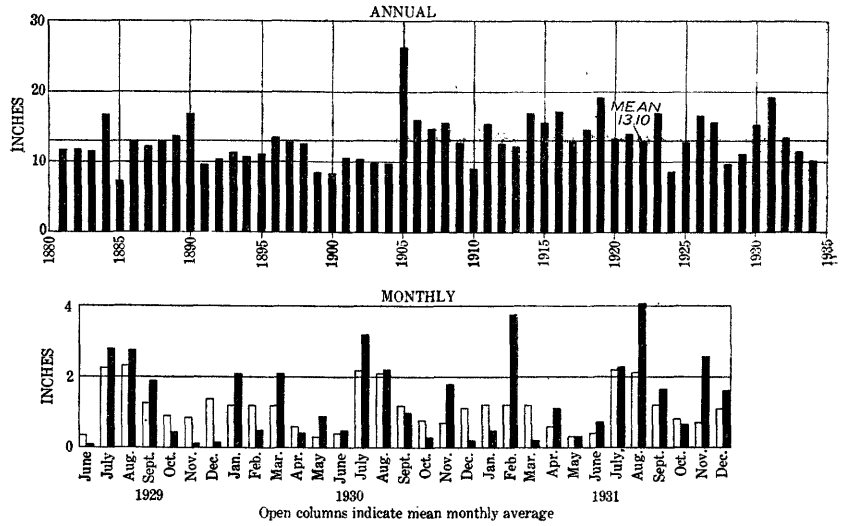


FIGURE 62.—Annual precipitation in Nevada, 1881–1934, and monthly precipitation, June 1929 to December 1931.



Open columns indicate mean monthly average

FIGURE 63.—Annual precipitation in Utah, 1881–1934, and monthly precipitation, June 1929 to December 1931.



Open columns indicate mean monthly average

FIGURE 64.—Annual precipitation in Arizona, 1881–1934, and monthly precipitation, June 1929 to December 1931.

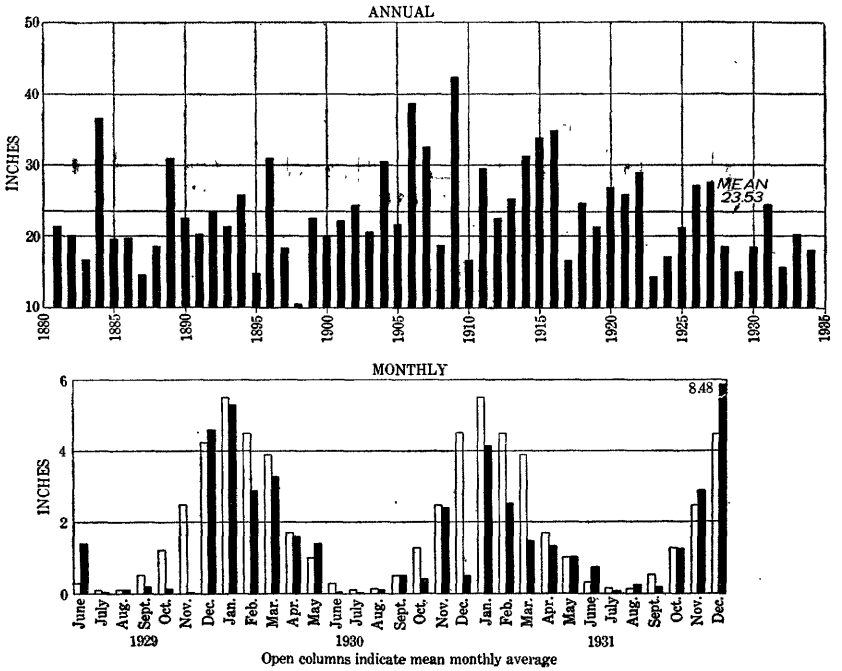


FIGURE 65.—Annual precipitation in California, 1881-1934, and monthly precipitation, June 1929 to December 1931.

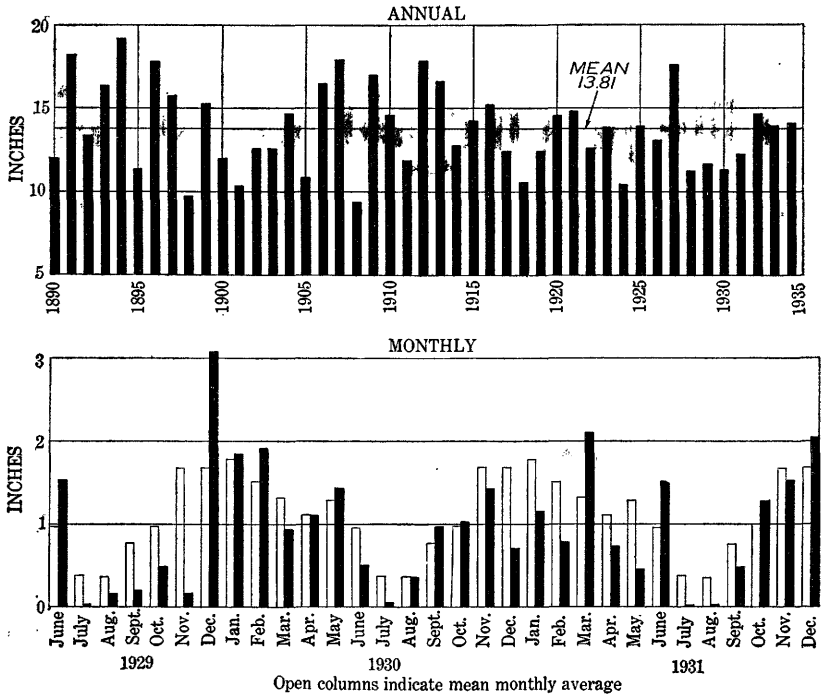


FIGURE 66.—Annual precipitation in eastern Oregon, 1890–1934, and monthly precipitation, June 1929 to December 1931.

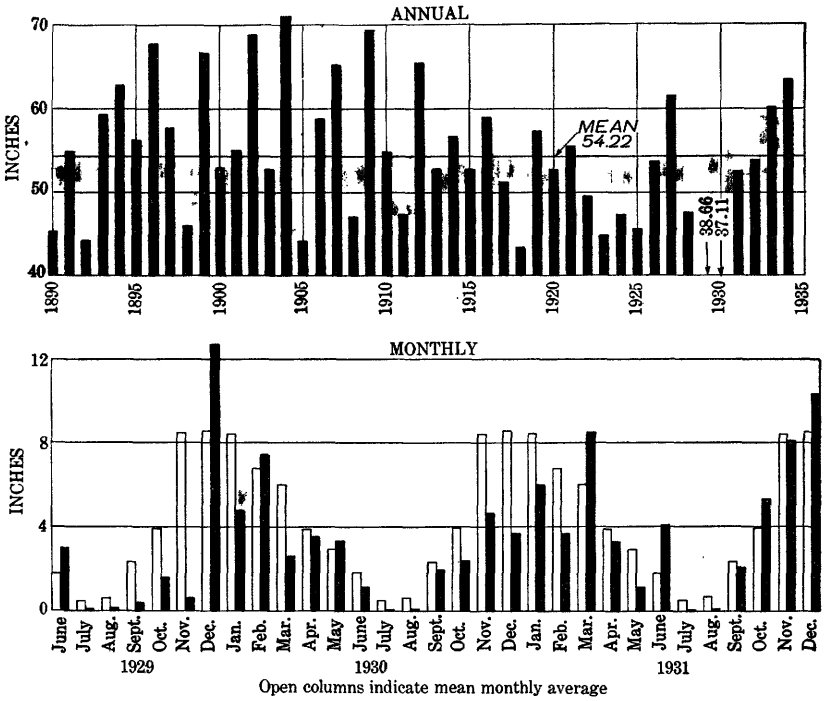
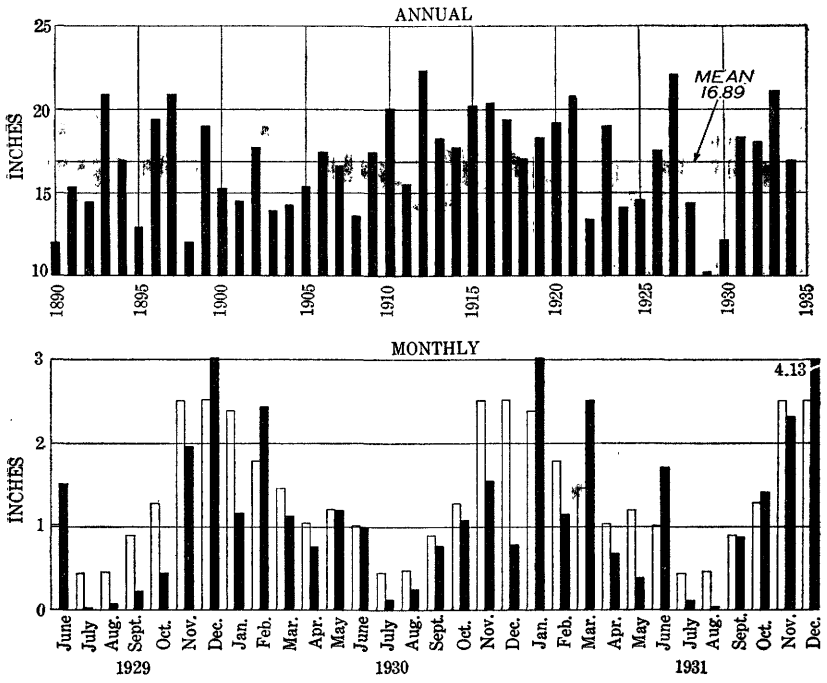


FIGURE 67.—Annual precipitation in western Oregon, 1890–1934, and monthly precipitation, June 1929 to December 1931.



Open columns indicate mean monthly average

FIGURE 68.—Annual precipitation in eastern Washington, 1890–1934, and monthly precipitation, June 1929 to December 1931.

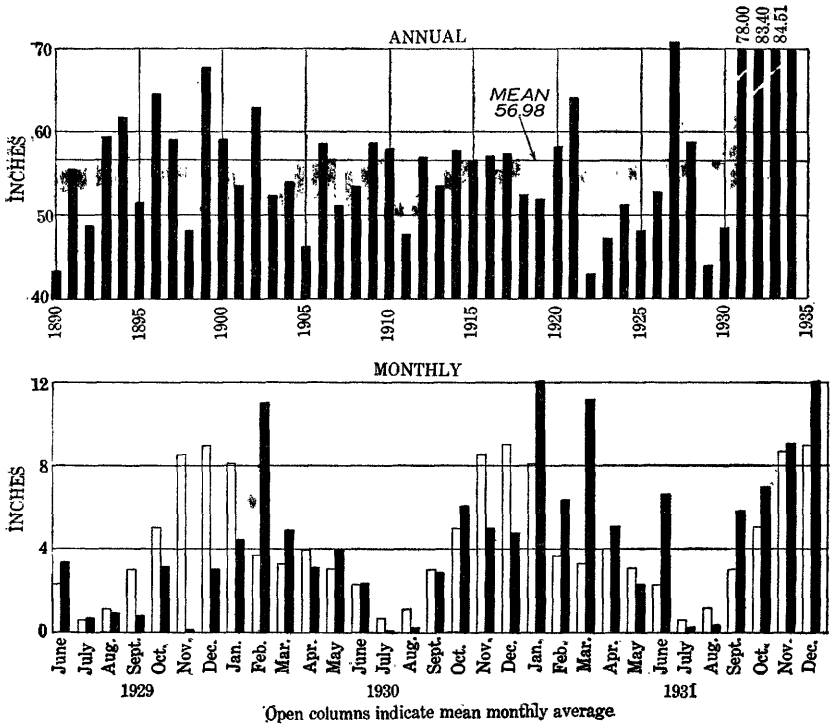


FIGURE 69.—Annual precipitation in western Washington, 1890–1934, and monthly precipitation, June 1929 to December 1931.

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RG 0037
STATE ENGINEER
UPPER COLORADO RIVER COMMISSION
Hearings
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HOOVER DAM FLOOD CONTROL
BOX 11

UPPER COLORADO RIVER COMMISSION
Upper Colorado River Compact
1930, 1944-49, 1956

NOT FOR RELEASE

Vernal, Utah
July 7, 1948

To Upper Colorado River Basin Compact Commission

Gentlemen:

On December 1, 1947, there was submitted to you a progress report of the Engineering Advisory Committee. Since that time the Committee has completed the work assigned to it on September 17, 1946, at the Santa Fe meeting of the Commission. The purpose of this letter is to present a brief summary of the results and conclusions of the work of the Engineering Advisory Committee.

Assignment

The work assigned to the Engineering Committee was:

(a) Preparation of base maps to show the locations of present and potential irrigation developments within the limit of the Colorado River system upstream from Lee Ferry and stream gaging stations and drainage areas.

(b) Determination of water contributions by States, involving the tabulation of stream flow records at key gaging stations, the extension of records by estimates, and estimation of runoff from unmeasured areas.

(c) Estimation of present depletions above key gaging stations, State Lines and Lee Ferry.

(d) Estimation of channel losses along the main Colorado River and principal tributaries above Lee Ferry.

(e) Determination of the extent to which the Upper Basin can make its apportioned water uses during drought cycles and still meet its compact obligation at Lee Ferry.

Maps

The progress report transmitted to you on December 1, 1947 contains copies of maps of the states of Arizona, Colorado, New Mexico, Utah and Wyoming prepared by the Bureau of Reclamation and published as part of the report on "The Colorado River" (House Document 419, 80th Congress, first session). These maps show the locations of present irrigated areas and potential irrigation projects, as envisioned by the Bureau of Reclamation, within the Colorado River Basin. The progress report of the Engineering Advisory Committee also contains a general map, prepared by the Colorado Water Conservation Board, showing drainage areas and the locations of gaging stations.

Drainage Areas

The table of drainage areas previously submitted has been revised to correct a few minor errors. The total drainage area above the Lee Ferry compact point is 109,889 square miles (instead of 108,989 square miles, previously reported). The drainage areas are shown on the attached Table 1.

Historic Stream Flows

The progress report of December 1947 contains tables showing the recorded and estimated stream flows at key gaging stations for the years 1914-1945, inclusive. That report also contains an explanation of the methods used to estimate stream flows at the various gaging stations during the period of non-record. The average annual stream flows at key gaging stations for the period 1914-1945, inclusive, are shown on the attached Table 1.

Historic Runoff at State Lines

The runoff per square mile from ungaged drainage areas within each state was determined by computing the net gain between gaging stations, adding the estimated channel losses and dividing by the drainage areas. The average annual flows (period 1914 to 1945, inclusive) at State Lines are estimated to be as follows:

AVERAGE ANNUAL HISTORIC FLOWS
AT STATE LINES (1914-1945, incl.)

Arizona	1000 A.F.
Ungaged area tributary to San Juan River	86.5
Ungaged area tributary to Colorado River	46.8
Arizona share of main stem channel losses within State	-0.1
Net flow at State Line	133.2

Colorado	
Little Snake River (at mouth)	226.9
Yampa River (exclusive of Little Snake River)	1,172.5
White River	576.2
Ungaged area tributary to Green River	27.4
Colorado River including Gunnison River	5,469.9
Dolores River	762.3
San Juan River above Rosa	929.9
Pine River	294.7
Animas River	807.2
LaPlata River	30.9
Mancos River	48.2
McElmo Creek	51.1
Ungaged area tributary to San Juan River	13.5
Colorado share of main stem channel losses within State	-2.3
Net Flow at State Line	10,408.4

New Mexico	1000 A.F.
Ungaged area tributary to San Juan River	192.1
New Mexico share of main stem channel losses within State	-6.0
Net Flow at State Line	186.1
Utah	
Tributaries of Green River above Linwood	158.8
Henry's Fork	66.8
Brush Creek near Jensen	36.0
Ashley Creek near Vernal	78.0
Duchesne River near Randlett	653.3
Price River at Mouth	87.6
Ungaged area tributary to Green River	127.4
Dolores River	23.2
Ungaged area tributary to Colorado River above Cisco	17.7
Paria River	18.1
Ungaged area tributary to Colorado River below Green River, Bluff and Cisco	777.3
Ungaged area tributary to San Juan River at Bluff	29.2
Utah share of main stem channel losses within State	-50.6
Net Flow at State Line	2,022.8
Wyoming	
Green River above Linwood	1,364.4
Little Snake River (at State Line)	249.8
Ungaged area tributary to Green River below Linwood	15.1
Wyoming share of main stem channel losses within State	-18.7
Net Flow at State Line	1,610.6
Sum of Flows at State Lines	14,361.1

Channel Losses

Average annual channel losses used in the studies reported herein were estimated by the application of appropriate evaporation and consumptive use rates to areas of channel exposed, such areas being estimated from available maps. Channel losses were computed for reaches from Lees Ferry, Arizona, to Granby, Colorado, on the Colorado River; from the mouth to Rosa, New Mexico, on the San Juan River; from the mouth to Green River, Wyoming, on the Green River; and on major tributaries to state lines or to headwater areas. This method of computing channel losses was deviated from only on the Colorado River between the gaging stations at Cisco, Utah, and Cameo, Colorado. These gaging stations indicate a depletion of the river greater than the sum of the calculated irrigation depletions and evaporation channel losses reduced by a nominal inflow from the intervening drainage area. Since the records of

streamflow, calculated irrigation depletions, and inflow estimates are believed to be reasonable, the additional depletion was charged to channel loss in that reach of river.

The channel losses adopted by the Committee were compared with those calculated by hydrographic analysis and other methods were applicable, and are believed to be reasonable.

A comparison of the annual streamflows, with the annual channel losses, estimated by means of differential hydrographs at Lees Ferry and the combined flows of Colorado River at Cisco, Utah; Green River at Green River, Utah, and San Juan River at Bluff, Utah, shows that the channel losses are not uniform each year, but that they vary with the streamflow, being smaller than average in years of less than average streamflows. Similar variations in annual channel losses were found in the studies of the various reaches of the San Juan River. It is assumed that on the other tributaries annual channel losses similarly will vary with the annual runoff.

Historic Contributions at Lee Ferry

Estimated channel losses and unmeasured inflows between state lines and key gaging stations were used to compute the contributions at state lines. The channel losses on water conveyed out of the state to Lee Ferry were proportioned to the state on the basis of the proportionate part of the total quantities of water carried through the channels. The aggregate amounts of such out-of-state channel losses and the estimated contributions by states of the historic flow (average 1914-45, inclusive) at Lee Ferry are as follows:

State	Historic Flow at State Lines acre-feet	Out of state losses acre-feet	Historic Contribution to Flow at Lee Ferry Acre-Feet	% of total
Arizona	133,200	1,000	132,200	0.96
Colorado	10,408,400	455,600	9,952,800	72.18
New Mexico	186,100	7,700	178,400	1.29
Utah	2,022,800	6,000	2,016,800	14.63
Wyoming	1,610,600	102,200	1,508,400	10.94
Total	14,361,100	572,500	13,788,600	100.00

Streamflow depletions

To determine the virgin (or reconstructed) streamflow at state lines and at Lee Ferry, it is necessary to add to the historic flows the effect at these points of the past upstream depletions caused by the activities of man. The principal cause of such past depletions is irrigation development within the

Colorado River Basin. Other causes of streamflow depletion are transmountain diversions outside of the basin, evaporation losses from reservoirs, and consumptive use of water by cities, towns, etc.

The depletion at Lee Ferry was estimated as follows:

(1) The man-made depletions at the sites of use were estimated. For irrigation this involved the determination of (a) the irrigated area; (b) the crop distribution; (c) the areas and character of lands in addition to crop lands, such as canals, drainage ways and incidental seeped areas adjacent to irrigated crop lands which consume water because of man's activities; (d) the estimation from climatic data, irrigation practices and experimental data of rates of consumptive use of irrigation water.

(2) The man-made depletions at the sites of use by cropped land and by incidental water consuming areas were routed downstream through the appropriate channel sections to determine the reduction in channel losses which have taken place due to the decrease in streamflow caused by such depletions between the sites of use and Lee Ferry.

Irrigated Areas

The following tabulation shows the average irrigated areas for the study period, 1914-1945, inclusive, and the present irrigated areas adopted by the Engineering Committee. The figures presented herein supersede those shown in the progress report of December 1, 1947.

State	Irrigated Areas - Acres: Average for 1914-1945, incl.	Present
Arizona	3,770	9,840
Colorado	790,606	790,600*
New Mexico	39,000	43,620
Utah	288,520	303,977
Wyoming	228,700	236,675
Total	1,350,596	1,384,712

*Assumed to be same as average for period, 1914-1945.

Incidental Areas

The areas of non-cropped land adjacent to and consuming irrigation water incidental to the irrigation of the crop lands were estimated by inspection of the Bureau of Reclamation land classification sheets, field inspection,

available aerial surveys and other detail and general maps of the irrigated areas. The incidental areas adopted by the Committee are as follows:

(Average for Study Period, 1914-1945, inclusive)

Arizona	Negligible
Colorado	106,812 Acres
New Mexico	6,482 "
Utah	48,625 "
Wyoming	28,600 "
Total	190,519 "

Rates of Depletion

Field experimental data within the Colorado River Basin to determine unit rates of consumptive use are available for the New Fork Area, Wyoming, and Uncompahgre Project, Colorado. Similar data are available at other experimental plots outside of the Colorado River Basin. To transfer the consumptive use data to various sites of use within the Colorado River Basin, empirical relationships between the experimental data and climatological data were used. The method developed by H. F. Blaney of the Department of Agriculture, who is an authority on consumptive use, was adopted. Arrangements were made to secure the services of Mr. Blaney and Wayne Criddle of the Department of Agriculture to study the problem. A field inspection trip over the Colorado River Basin was arranged so they could inspect the various areas and interview local water masters, water commissioners, water users, personnel of the Soil Conservation Service and the Bureau of Reclamation, and others regarding data on irrigation practices and adequacy of water supply in the various areas of the basin. With these data appropriate rates of consumptive use of irrigation water at the sites of use were selected.

Past Man-made Depletions at Sites of Use

The rates of consumptive use of irrigation water for various crops and types of native vegetation were applied by the Engineering Advisory Committee to the irrigated and incidental areas to secure the past man-made depletions at sites of use. The past man-made depletions at sites of use are summarized in the following table:

Man-made Depletions at Sites of Use
Averages for 1914-1945, incl.
Acre-Feet

Type of Use	Arizona	Colorado	New Mex.	Utah	Wyoming
Cropped Lands	3,790	821,378	56,174	384,043	183,620
Incidental Areas	--	178,662	14,993	81,001	40,750
Transmountain Diversion	--	43,713	--	79,000	
Res. Evap. Losses	200	10,000	--	13,500	2,200
Domestic Use	--	9,000	1,000	3,000	1,100
Less Water Supplied from Importations	--	--	--	4,000	--
Totals at Sites of Use	3,990	1,062,753	72,167	556,544	227,670
Total for Basin					1,923,124

"Salvaged" Channel Losses

The depletions at the sites of use were routed downstream to Lee Ferry to determine the change in channel losses resulting from man-made depletions. The differences between average past channel losses and the channel losses as they would have been had the depletions not been made represent "salvaged" channel losses as follows:

Average 1914-1945

State	Salvaged Channel Losses (acre-feet)		
	Within state	Out of state	Total
Arizona	0	0	0
Colorado	20,000	26,700	46,700
New Mexico	900	1,800	2,700
Utah	11,700	500	12,200
Wyoming	1,300	10,400	11,700
Totals	33,900	39,400	73,300

Estimate of Man-made Depletions at State Lines and at Lee Ferry

Deducting the salvaged channel losses from the man-made depletions at the sites of use results in depletions at state lines and at Lee Ferry as shown in the following table. For convenience this table also shows the estimated depletions at the sites of use.

Man-made Depletions
(Units Acre-feet) Rounded to Nearest 100 AF
Averages for 1914-1945, incl.

State	At Sites of Use	At State Lines	At Lee Ferry
Arizona	4,000	4,000	4,000
Colorado	1,062,800	1,042,800	1,016,100
New Mexico	72,200	71,300	69,500
Utah	556,500	544,800	544,300
Wyoming	227,700	226,400	216,000
Total	1,923,200	1,889,300	1,849,900

For convenient reference there is attached hereto a tabulation showing the past depletions at state lines by tributaries.

Virgin Flow at Lee Ferry

Virgin streamflow contributions at state lines and at Lee Ferry were obtained by adding to the historic contributions the man-made stream depletions estimated at these sites. The following table shows the virgin contributions at state lines and Lee Ferry and also the out of state channel losses which were estimated for average undepleted flow conditions.

Virgin Flows at State Lines and Lee Ferry

State	Virgin flow at state lines acre-feet	Out of state losses acre-feet	Contribution to virgin flow at Lee Ferry acre-feet	Contribution to virgin flow at Lee Ferry % of total
Arizona	137,200	1,000	136,200	0.87
Colorado	11,451,200	482,300	10,968,900	70.14
New Mexico	257,400	9,500	247,900	1.58
Utah	2,567,600	6,500	2,561,100	16.38
Wyoming	1,837,000	112,600	1,724,400	11.03
Total	16,250,400	611,900	15,638,500	100.00

Main Stem Reservoir Operations

The flow of the Colorado River is not uniform but varies from year to year. At Lee Ferry the historic flow has ranged between a minimum of about 4,400,000 acre-feet in 1934 to a maximum of about 21,900,000 acre-feet in 1917. The average historic flow for 1914-1945, inclusive, was 13,788,600 acre-feet. In the 10-year period of lowest historic flow, 1931-40, inclusive, the average annual flow at Lee Ferry was 10,151,000 acre-feet.

In the absence of replacement reservoirs the Upper Basin, under the terms of the Colorado River Compact, during such a period as 1931 to 1940, inclusive, could deplete the virgin flow of the Colorado River at Lee Ferry by only about 4,300,000 acre-feet. To permit full use of the Upper Basin allocation of 7,500,000 acre-feet annually during drought cycles, holdover reservoirs must be constructed in the Upper Colorado River Basin to impound water in years of high runoff and to release such stored water in critical periods of low runoff, such as 1931-40, to help meet the Upper Basin obligation at Lee Ferry.

Such reservoirs will deplete the flow at Lee Ferry by reason of evaporation losses. The amount of holdover storage capacity required to regulate the streamflow and the depletion of flows at Lee Ferry due to reservoir evaporation losses can only be approximated until alternative storage sites have been studied in detail and the locations and capacities of reservoirs selected. One important factor, which cannot now be precisely evaluated, but which will have a marked influence on the holdover storage capacity

needed is the effect of upstream development of future irrigation projects and storage reservoirs. Such projects will furnish some equation of stream-flows and will decrease the storage capacity needed in the holdover reservoirs, shown in the studies reported herein.

Operation studies were made, assuming that all holdover storage would be provided at the Glen Canyon site on the Colorado River. For simplification in operation it was assumed that the flow at Lee Ferry would be maintained at an annual rate of 7,500,000 acre-feet during the period of drawdown and refilling of the reservoir and that increased upstream depletions would be at a uniform rate of 5,174,100 (7,500,000 minus 1,849,900 minus 476,000) acre-feet annually. It was also assumed that 5,000,000 acre-feet of storage capacity would be reserved as dead storage for power head and sediment.

These studies show a required storage capacity of 34,200,000 acre-feet (live capacity 29,200,000 acre-feet) to regulate the flow of the Colorado River in the manner indicated. The average annual stream depletions due to reservoir losses are estimated to be about 476,000 acre-feet.

During a closed cycle operation for the 32-year period such a reservoir would perform in the following manner:

(a) Be at dead storage level at the end of 1940.
(b) Refill during the period from 1941 to 1945 and from 1914 to 1920.
(c) Be generally full and spilling from 1920 to 1929, inclusive.
(d) Be drawn down during the period, 1930 to 1940, inclusive.

The reservoir operation studies described herein show the average annual use of the virgin flow at Lee Ferry as follows: (average 1914-1945)

Depletion of flow at Lee Ferry by irrigation, etc. in Upper Colorado River Basin	7,024,000 AF
Depletion of flow at Lee Ferry by evaporation losses from holdover reservoirs	476,000 AF
Sustained flow at Lee Ferry for Lower Basin	7,500,000 AF
Spill from reservoir (would largely occur in 7 years)	638,500 AF
Total average virgin flow	15,638,500 AF

Respectfully submitted,
Engineering Advisory Committee

(signed)	J. R. Riter	Chairman
(signed)	R. I. Meeker	Arizona
(signed)	R. J. Tipton	Colorado
	F. C. Merriell	Colorado
(signed)	R. M. Gildersleeve	Colorado
	J. H. Bliss	New Mexico
(signed)	J. R. Erickson	New Mexico
(signed)	C. O. Roskelley	Utah
	H. T. Person	Wyoming
(signed)	R. D. Goodrich	Wyoming
(signed)	H. P. Dugan	U. S. B. R.

TABLE 1
UPPER COLORADO RIVER BASIN KEY GAGING STATIONS

	Streamflow Station	Mean Historic Flow Water Years 1914-1945 1000 A.F.	Drainage Areas Square Miles
1.	Green River at Green River, Wyoming	1260.5	7670
2.	Blacks Fork near Millburne, Wyoming	113.2	156
3.	East Fork of Smith Fork near Robertson, Wyo.	32.5	53
4.	West Fork of Smith Fork near Robertson, Wyo.	16.3	37
5.	Green River near Linwood, Utah	1501.6	14300
6.	Burnt Fork near Burnt Fork, Wyoming	25.1	53
7.	Henrys Fork near Lonetree, Wyoming	32.4	55
8.	Henrys Fork at Linwood, Utah	66.8	530
9.	Little Snake River near Dixon, Wyoming	423.5	1028
10.	Little Snake River near Lily, Colorado	472.4	3680
11.	Yampa River at Steamboat Springs, Colorado	345.1	604
12.	Yampa River near Maybell, Colorado	1189.5	3410
13.	Brush Creek near Jensen, Utah	36.0	255
14.	Ashley Creek near Vernal, Utah	78.0	101
15.	Duchesne River at Myton, Utah	439.5	2705
16.	Duchesne River near Randlett, Utah	653.3	3820
17.	White River near Meeker, Colorado	461.7	762
18.	White River near Watson, Utah	582.0	4020
19.	Price River near Heiner, Utah	92.6	430
20.	Green River at Green River, Utah	4658.4	40920
21.	Colorado River at Hot Sulphur Springs, Colo.	*	782
22.	Colorado River at Glenwood Springs, Colorado	2080.4	4560
23.	Roaring Fork at Glenwood Springs, Colorado	1028.0	1460
24.	Colorado River near Cameo, Colorado	3505.0	8055
25.	Plateau Creek near Cameo, Colorado	186.3	604
26.	Gunnison River near Grand Junction, Colorado	2054.9	8020
27.	Dolores River at Gateway, Colorado	788.1	4350
28.	Colorado River near Cisco, Utah	6186.0	24100
29.	Sum of San Juan, Rio Blanco and Rito Blanco Rivers at Pagosa Springs, Colo.	399.5	379
30.	Navajo River at Edith, Colorado	131.8	165
31.	Piedra River at Arboles, Colorado	380.6	650
32.	San Juan River at Rosa, New Mexico	956.6	1990
33.	Pine River at Ignacio, Colorado	256.4	448
34.	San Juan River near Blanco, New Mexico	1260.2	3558
35.	Animas River at Durango, Colorado	654.7	692
36.	Animas River near Cedar Hill, New Mexico	806.7	1092
37.	Animas River at Farmington, New Mexico	753.8	1360
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40.	San Juan River at Shiprock, New Mexico	*	12876
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43	San Juan River near Bluff, Utah	2275.6	23010
44.	Paria River at Lees Ferry, Arizona	25.3	1550
45.	Colorado River at Lees Ferry, Arizona	13763.3	108335
46.	Colorado River at Lee Ferry, Arizona	13788.6	109889

*Mean for Water Years 1914-1945 not computed.

TABLE 2

Averages for 1914-1945, Inclusive

Depletions at State Lines by Principal Streams - Acre-feet (rounded)

State	Stream	Depletion
Arizona	All	4,000
Colorado	Little Snake	11,300
	Yampa River	52,100
	White River	33,700
	Colorado River	723,000
	Dolores River	39,200
	San Juan above Rosa	13,600
	Pine River	41,500
	Animas River	30,000
	LaPlata River	20,400
	Mancos River	11,400
	McElmo Creek	65,500
	Miscellaneous, small	1,100
	Subtotal Colorado	1,042,800
New Mexico	San Juan Basin	71,300
Utah	Green above Linwood	0
	Henry's Fork	11,300
	Other tributaries above Green River, Utah	415,200
	Colorado River & tributaries above Cisco, Utah	0
	San Juan above Bluff	9,000
	Remainder of State	105,300
	Import	- 4,000
	Subtotal Utah	544,800
Wyoming	Green River above Linwood	193,500
	Little Snake River	19,300
	Miscellaneous areas	13,600
	Subtotal Wyoming	226,400
	Total for Upper Basin	1,889,300

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	**U-1_pgs i-60**	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

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RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Arizona - Colorado - New Mexico - Utah - Wyoming

●

NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

●

SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

WATER RESOURCES
CENTER ARCHIVES
MAR 1966
UNIVERSITY OF CALIFORNIA
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UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME II

Record of Commission Meetings No. 6-11, inclusive

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD OF MEETING NO. 6

February 17 , 18, 19, 20 and 21, 1948

Shirley-Savoy Hotel

Denver, Colorado

MEETING NO. 6
Denver, Colorado
Feb. 17-18-19-20 and 21, 1948

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February 18, 1948
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Vote taken; carried.	2	6	134
Motion by Com. Stone to Adjourn; Seconded	2	6	134
Vote taken; carried.	2	6	134

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Francis Feltch	State Representative, Vernal, Utah.
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Norman W. Barlow	Assist. Compact Commissioner, Cora, Wyoming.
Joe L. Budd	Assist. Compact Commissioner, Big Piney, Wyoming.

Ernest B. Hitchcock	Assist. Compact Commissioner, Rock Springs, Wyoming.
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UNITED STATES GEOLOGICAL SURVEY:

M. T. Wilson	District Engineer, Salt Lake City, Utah.

PROCEEDINGS

The meeting was called to order by Chairman Bashore at ten o'clock a.m., Tuesday, February 17, 1948, in the Colorado Room of the Shirley-Savoy Hotel, Denver, Colorado.

THE CHAIRMAN: Gentlemen, the meeting will come to order. The Chair observes that the members of the Arizona Interstate Stream Commission are present with us and as it is my understanding that it is a relatively new group, I would like Mr. Carson to introduce these gentlemen.

COM. CARSON: Mr. Chairman, Arizona has recently created an Interstate Stream Commission composed of seven members. Four of them are here. I want to introduce Mr. Wayne M. Akin, Chairman; Mr. R. H. McElhaney, Vice-Chairman; Mr. Barry M. Goldwater, Member; and Mr. Jay M. Gates, Member.

THE CHAIRMAN: Thanks, Mr. Carson.

(Com. Stone distributes, "Suggested Agenda, Meeting No. 6, Upper Colorado River Basin Compact Commission," which is as follows:)

1. Determination of schedule of session of Commission for Meeting No. 6.

2. Consideration of agenda for Meeting No. 6.

3. Consideration of report of Engineering Committee.

4. Consideration of report of Legal Advisory Committee.
   (a) Administrative provisions.

(b) Provisions relative to projects constructed in one state for the benefit of another state or for the common benefit of all states.

(c) Provisions relative to apportionment of losses of water incidental to reservoir operations.

(d) Provisions relative to preferential uses of water.

(e) Method of treatment of water uses by Indians.

5. Consideration of factors suggested by states at Meeting No. 5 and not heretofore discussed by Commission.

Group I.

(a) Shall the compact operate for a fixed term of years or for perpetuity.

(b) Shall the allocation of beneficial consumptive use be subject to future adjustment in the event that any state does not make full beneficial consumptive use of its allotted share within a stated period.

(c) Provisions for periodic review of compact terms and conditions.

Group II.

(a) What provisions shall be incorporated in the compact to define the rights and obligations of the United States.

(b) How shall water uses made by the United States or any of its agencies be charged.

(c) Provisions relative to uses of water by Indians.

(d) Provisions relative to navigation.

(e) Provisions relative to flood control.

(f) Provisions relative to silt control.

(g) Provisions relative to cooperation with such United States agencies as Bureau of Reclamation, United States Geological Survey, International Boundary and Water Commission, and possibly others.

Group III.

(a) Shall compact contain any provision relating to the delivery of water at Lee Ferry for the use of Mexico in the event there is not sufficient surplus water to supply the Mexican share.

(b) Should the compact contain any provision relative to extraordinary drought in order to take advantage of the applicable provisions of the Mexican Water Treaty.

Group IV.

(a) What general provision should be incorporated in the

Upper Basin Compact to recognize the validity and applicability of the Colorado River Compact.

(b) Should the definitions contained in Article II of the Colorado River Compact be incorporated without change in the Upper Basin Compact.

(c) Should paragraphs (f) and (g) of Article III of the Colorado River Compact relating to the apportionment of unapportioned water be carried over into the Upper Basin Compact.

(d) What if anything, should be done with relation to Article VI of the Colorado River Compact pertaining to controversies between two or more states.

. . . . . .

Group V.

(a) Should the compact endeavor to encompass rights and obligations arising out of or affecting interstate tributaries.

(b) What provision shall be made with relation to the existing La Plata River Compact.

(c) What adjustment must be made between Colorado and New Mexico in connection with the use of San Juan River water.

(d) What adjustment must be made between Colorado and Wyoming with relation to the uses of the water of Little Snake River.

(e) What adjustment must be made between Wyoming and Utah with respect to the uses of the water of Green River tributaries arising in Utah.

(f) What adjustment must be made between Colorado and Utah with respect to uses of water on the main stream of the Colorado River, the Yampa River, the White River and the Dolores River, and other interstate streams tributary to either the Green River or the Colorado River.

(g) In the allocation of beneficial consumptive use of water shall there be specific allocations to tributary drainage basins in each state.

(h) Shall an upper state be required to deliver to a lower state any specific amount of water from any tributary.

Group VI.

(a) Definition of the term "beneficial consumptive use".

(b) Method of measuring beneficial consumptive use.

(c) Consideration of the method of treatment of conveyance losses.

(d) Consideration of the method of treatment of so-called salvage water.

(e) The determination of general type of formula for defining obligations of states to make Lee Ferry deliveries.

6. Discussion of means of correlating the work of the Engineering and Legal Committees.

7. Discussion of a time schedule for the preparation and completion of a draft of the compact.

8. Determination of time and place of next meeting.

THE CHAIRMAN: We shall first take up Item No. 4 on the agenda as laid before the Chairman and that is, "Consideration of report of Legal Advisory Committee." Is the Chairman of that Committee prepared to report?

COM. CARSON: Yes, Mr. Chairman. The Legal Advisory Committee met all day Sunday and Monday of this week and arrived at a report which will be mimeographed today and ready for presentation to this Compact Commission as soon as it is completed. We have prepared a report on all matters referred to the Legal Advisory Committee but we prefer to wait until that mimeographed copy is available to all Commissioners and its being offered for consideration of the Commission.

THE CHAIRMAN: Thank you, Mr. Carson. We are glad to hear that the Legal Advisory Committee has made progress, and of course in the absence of the written report we will have to pass over that matter.

At the last meeting the Commission instructed the Chairman to communicate with the various Federal agencies and ascertain the answers to two questions. The Chairman carried out those instructions and communicated with the various interested agencies and has received replies from the International Boundary and Water Commission, the Federal Power Commission, the Bureau of the Budget, and an acknowledgment from the Department of the Interior. Those letters have been turned over to Mr. Ray E. Peterson of the Colorado Water Conservation Board and he is now having copies prepared--about 35 copies I believe--and they will be distributed when they become available so that you may study them.

Generally speaking, the communication from the International Boundary and Water Commission I think is quite satisfactory, and the communication from the Federal Power Commission was rather helpful.

I mention that at this time so you may know that the matter will receive attention before we get through here with this Meeting No. 6.

Judge Stone, at this juncture would you like to make a statement in regard to Item No. 5 on the agenda, which is: "Consideration of factors suggested by states at Meeting No. 5 and not heretofore discussed by Commission."

COM. STONE: Mr. Chairman, Colorado in anticipation of what might be considered at this meeting, prepared a suggested agenda. We have copies available for all members of the Commission and their advisers. It is a mere suggestion and designed to expedite the work of the Commission and to bring to the attention of the Commission many matters which in our judgment will have to be considered. It is Colorado's position that pending a final engineering report, we should dispose of many questions which in the judgment of Colorado must be considered

before a compact is negotiated. If it is agreeable with the Chairman and the members of the Commission we are prepared to pass out this suggested agenda.

THE CHAIRMAN: Please do that, Judge.

(Suggested Agenda distributed generally to advisers and others present.)

THE CHAIRMAN: Does Colorado wish to make an opening statement in regard to the question of whether the compact shall operate for a fixed term of years or for perpetuity? Item (a) under Group I.

COM. STONE: Do I understand that this agenda is acceptable to the Commission, that we proceed under it?

THE CHAIRMAN: I haven't heard any objection. Is this agenda satisfactory to the members of the Commission?

COM. STONE: I might make this explanation, Mr. Chairman: We have made an attempt on page 1 under Paragraph 5 to pick up from the statements of all of the states items which were submitted by the various states but which were not discussed at the last Compact meeting. We reviewed the statements submitted by each and all of the states at Meeting No. 5 and incorporated here those items which had not been discussed at Meeting No. 5, placing them here on the proposed agenda for discussion. There have been added other items which were not submitted at the last meeting.

It is evident that there are items toward the last of the suggested agenda which cannot be discussed, fully at least, until the engineering report is in; but there is a big program of work here if the Commission wishes to proceed with these items or any other items which any state may have to suggest in addition to those suggested by the states at the last meeting. Colorado does not wish to be in the position of proceeding with any agenda that isn't acceptable to all of the states.

THE CHAIRMAN: Well, it seems to the Chairman, Judge Stone, that Colorado has done exactly what you relate and that it was to bring all these factors that have been thrown into the hopper together here and placed them on the agenda. They have been talked about and it is time to make some disposition of them, either decide they have a place in the compact or not, and why not or why they should be in. Is there any objection from any member of the Commission in regard to proceeding on the basis of the agenda prepared by Colorado? The Chair hears no objection.

COM. WATSON: This outline should be followed, we should complete it as soon as we can within reason, and that will lead to the main question we are here for, namely, dividing the water.

THE CHAIRMAN: Very well. Thank you, Mr. Watson. Are there any further remarks on this agenda? (No response.) Are we ready to proceed with the discussion of the items on the agenda? (No response.) Apparently there are no fixed opinions on this matter one way or the other. Do I hear a motion to proceed with the agenda?

COM. CARSON: I move we proceed with the agenda.

COM. WILSON: Second the motion.

THE CHAIRMAN: You have heard the motion and the second. Is there

further discussion? (No response.) (Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

Now, will Colorado discuss subitem (a) of Item 5, Group I: "Shall the compact operate for a fixed term of years or for perpetuity."

COM. STONE: In accordance with the method followed at the last meeting I shall call upon Mr. Breitenstein to open the discussion on behalf of Colorado on subitem (a) of Item 5, Group I, of the agenda.

MR. BREITENSTEIN: Mr. Chairman, that raises a question of the length of term of the compact. Shall it be a compact which operates in perpetuity? Or shall it have a fixed term of years? We feel that that is a problem which should be decided now rather than to wait until the end of the compact negotiations. We have at times run up against the proposition that after everything else is determined, somebody has the idea that perhaps the compact should operate for a fixed term of years rather than perpetuity.

Speaking personally, it seems to me that what we are trying to do here is to make a permanent allocation of the waters of the Colorado River between the Upper Basin States which shall be good for all times.

We have had presented to us a plan or a report of the Bureau of Reclamation. As I understand it the Bureau says that carrying out that plan or that report is dependent upon the allocation of water between the states. It would seem obvious to me that if that allocation is not permanent but is one which is good for only a fixed term, then further questions can be raised as to whether or not a water supply is available for particular projects.

The only argument that I can think of in favor of having it operative for a fixed term of years is that none of us can foresee what will happen in the future and conditions might change so as to make the allocation unwise under future conditions. It would seem to me that can be taken care of by some provisions of the compact which would not disturb its permanent character.

THE CHAIRMAN: Thank you, Mr. Breitenstein.

COM. STONE: Supplementing what Mr. Breitenstein has said and as Colorado's Compact Commissioner, it is the view of Colorado that this compact should operate in perpetuity.

COM. WATSON: I move that this compact shall operate in perpetuity

COM. BISHOP: I second the motion.

THE CHAIRMAN: Are there any remarks on the motion as made and seconded? (No response.) Question is called for. Thereupon a vote is taken on Com. Watson's motion.)

THE CHAIRMAN: It seems everyone is very reluctant about raising his voice this morning on these votes so the Chair, in order to make sure he hasn't failed to hear the vote, is going to call the roll by states on this motion on Item (a). Utah?

COM. WATSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: I vote yes on the motion. I would like to make this explanation: I think it is obvious that any compact that is negotiated should be in perpetuity; but there will be suggestions made, as has been discussed in the Legal Advisory Committee, that provision should be inserted that on the request of two or more states signatory to the compact, they may either make a new one or amend an old one to iron out any inequities that may be found to exist. On that basis I would like to have a final, perpetual compact.

COM. STONE: I might say that the suggestion made by Mr. Wilson is well taken and that item is covered under subsection (c) in this list.

THE CHAIRMAN: Colorado?

COM. STONE: Aye.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Aye.

THE CHAIRMAN: Will Colorado now open the discussion on subitem (b), Article 5, Group I: "Shall the allocation of beneficial consumptive use be subject to future adjustment in the event that any state does not make full beneficial consumptive use of its allotted share within a stated period."

COM. STONE: I again ask Mr. Breitenstein to open the discussion on subitem (b) of Item 5, Group I.

MR. BREITENSTEIN: Of course that is tied in with (a) on which the Commission has just acted. While it is well for the compact to operate in perpetuity, nevertheless there may be a situation whereby or wherein it is necessary to change some of the allocations of water. We do not know whether or not any one of the states may in the future completely use the water which is allocated to it. Now, in the event conditions arise which result in a state being unable for some reason to utilize its full share of the water, then it would seem reasonable that that water be available for use in some other Upper Basin State.

You all recall that in the Colorado River Compact there is a provision that the Upper Basin shall not withhold and the Lower Basin shall not demand water which cannot be beneficially used in the Basin. It seems to me that we should take advantage of that here and if within a fixed time or whatever condition you want to place on it, it is found that the water allocated to one state is not going to be used in that state, then the water ought to be available for another state because there is no need of letting this water run down to the Gulf of California unused. We want to utilize every bit of it that we can.

It would seem to me that there should be some flexible provision in the compact which would take care of a situation resulting from the failure or inability of one state to utilize its share of the water. We do not know now in whose favor such a provision might operate or to the detriment of what state it might operate. But it seems to me, having regard to the complete utilization of the water, it is essential that there be some such provision in the compact.

Judge Stone suggests that in considering (b) we might at the same time

consider (c). That is a provision for periodic review of compact terms and conditions.

In the Rio Grande Compact there is a provision for periodic review of compact terms and conditions which are not of a substantive nature. That provision permits review at the end of each five-year period after the effective date of the compact. At the end of the first five-year period, New Mexico made a request for review of the provision of the compact relating to the schedule of water deliveries at San Marcial, New Mexico. That matter has been considered for a year and a half or two years by an engineering committee. They made a report and their report is going to be considered by the Rio Grande Commission at its meeting this month. What will come of that I do not know. But that illustrates the method in which the Rio Grande Compact provision has operated.

It is possible, as we all realize I am sure, that no matter how hard we work on this, some inequities may develop in the passage of the years. Now we all want to iron out those inequities I am sure. We don't want one state to have an unfair advantage over another state. It would seem to me that careful consideration should be given to some compact provision which would take care of the matters referred to in (b) and (c).

COM. WATSON: Mr. Chairman, wouldn't it be well to refer to the Colorado River Compact and see what language is used in the Colorado River Compact and ascertain whether we can go along with that language or whether we have to modify it, because the same idea is covered in the Colorado River Compact.

MR. BREITENSTEIN: May I answer that, Mr. Chairman?

THE CHAIRMAN: Certainly.

MR. BREITENSTEIN: I have given that consideration and it is my judgment at the present time that we cannot utilize the same scheme as is found in the Colorado River Compact.

COM. STONE: I should like to make the further remark that we ought to use experience and not necessarily be bound by provisions made over twenty years ago. Conditions have changed. I think we ought to apply to this subject a fresh outlook and not permit ourselves merely to fall back on conclusions of twenty years ago.

I should like to add one other thing which I believe ought to be kept in mind in considering (b) and (c). I believe there would be no difference of opinion on this proposition that provisions of a substantive nature in a compact cannot be changed except that such changes are effectuated in the same manner that the original compact is made, that is, by ratification of the states and approval by Congress. Provisions under (c) contemplate terms and conditions which are not of a substantive nature and which may be reviewed and adjustments made by an administrative body set up under the compact.

That general principle it seems to me must be kept in mind in considering (b) and (c). We must recognize that there is a distinction there which is fundamental. Yet the mere fact that substantive provisions can be changed only in the same manner that the compact is made does not foreclose this Commission from incorporating flexible provisions for adjustment to meet conditions in the future which we do not foresee now.

MR. BREITENSTEIN: The matter covered by subdivision (c) here was

discussed by the Legal Advisory Committee. My view of the work of the Legal Advisory Committee is that it merely puts down in appropriate language decisions which are made by the Compact Commission. I think it is not proper for the Legal Advisory Committee to make the decisions. The lawyers are just the working boys who prepare the language to carry out the wishes of your Commission.

Now, when we discussed a matter, which is the same as (c) here, I believe we all came to the conclusion that it would be presumptive on our part to try to work out anything in advance of having a specific direction from the Commission itself. In my mind it is not proper to merely refer a matter such as (b) and (c) to the Legal Advisory Committee and say, "You come in here and show us something to cover these items." I think that the policy decisions as to what will be encompassed by a compact provision must be made in the first instance, not in the second instance, by the Commission itself.

Referring specifically to (c), in the Rio Grande Compact the provisions for periodic review are strictly confined to those that are not of a substantive nature. One thing that has arisen to cause differences of opinion is, what is meant by a substantive provision? What provisions are substantive and what are not?

Now it seemed to me that the Commission should decide in the first instance whether or not it wants to confine periodic review to substantive provisions or nonsubstantive provisions or both and you should tell the Legal Committee what you want to say on that, and of course the same remarks are applicable to (b). In other words, I think it is unfair to the Legal Committee to expect it in the first instance to make the decisions for subsequent criticism by the Commission.

MR. GILES: Mr. Chairman, I am not a member of the Commission but I would like to make this observation, that it is rather difficult for me to conceive of a state binding itself at this time in this compact to release any of its allocated water within a stated period. It is rather difficult to foresee conditions that would make a state come to that conclusion. It seems to me it would be a dangerous procedure to bind yourself to a re-allocation of water to another state if you don't use it within a stated period yourself. If it can be done it would probably be a good thing to do but I wouldn't want to be a party to that myself.

COM. STONE: I think Mr. Giles raises a very pertinent question here. The question is: In making allocations do you want to make those permanent so that they could not be changed except in the same way the original compact is made? Or, do you want to put into the compact agreements whereby under such conditions it could be made?

That raises the question of policy which Mr. Breitenstein refers to. That points up the question. There could be put into this compact provisions which would initiate procedure whereby recommendations could be made to the respective legislatures and for the approval of Congress for any change; or we could make it more flexible and permit future adjustments as to allocations of water. Mr. Giles points up the question and says that that should not be done. Well, that is just one of the questions which this Commission should decide here.

MR. GILES: Well, Judge, I don't go that far. I think it is possible to make your compact flexible enough to re-allocate under conditions that point the way for re-allocation. But what I had in mind was, at this time to have a provision in your compact that within a given number of years if a state hasn't used its allocated water it shall give it up--

COM. STONE: You can always re-allocate under a compact, under another compact that could be made the same as this one.

MR. GILES: That is right.

COM. STONE: The point is whether we shall lay the basis for review and the procedure for that.

MR. ROLLINS: Mr. Chairman, may I say a word?

THE CHAIRMAN: Yes, sir.

MR. ROLLINS: What I say may not be the opinion of our Commissioner and may not be the opinion of his advisers but it seems to me that inasmuch as the 7,500,000 acre feet is allocated to the Upper Basin States in perpetuity, that this Commission should take a similar stand and all allocations that are made in this compact should be in perpetuity. If we do determine here that a review can be taken at some future date, it should be so far ahead that it would give every state ample opportunity to get all of its projects completed.

I can remember back a long time and we in Wyoming have been talking about projects for the last fifty years and yet we haven't any. It may be fifty years before we will have all our projects; it may be longer than that. I for one certainly wouldn't want to bind Wyoming to any compact which could be reviewed again in a few years even if it was done in the manner in which we are negotiating at this particular time. I would want a hundred years if we are going to make any decision on it.

COM. BISHOP: Mr. Chairman, we would like to see the allocation in perpetuity the same as the allocation to the Upper Basin is in perpetuity. We are at a higher elevation than the states lower down and naturally will be longer developing our water resources. I would like to have all the time that is necessary. I wouldn't want any change ever to be made except with our consent.

COM. WATSON: Do you mean, Mr. Bishop, by that that the entire 7,500,000 acre feet will be divided, or a major portion of the 7,500,000 and a surplus left to allocate at some future date as was provided for in the Colorado River Compact?

COM. BISHOP: I believe, Mr. Watson, we agreed at the last meeting that we would make the division of 7,500,000 acre feet of water on a percentage basis, in which case if there isn't that much available we will get our percentage. If there is more than that, of course we will come under the terms of the Colorado River Compact which provides at a certain time we can ask for allocation of the surplus water. I don't think we should try to divide the surplus in this compact.

MR. BLISS: Mr. Chairman, it would seem to me that Mr. Bishop has more or less answered his own question. Any action that the Commission would take would necessarily have to be unanimous and no state would have to give up any right unless they were convinced in their own mind they could not use their allocated share of the water. It seems to me that would take care of itself in any substantial change in the compact.

COM. CARSON: Mr. Chairman, it seems to me it should be in perpetuity and that this (b) and (c) are not necessary now to go into any compact but should be covered by a provision that we discussed in the Legal Advisory Committee--but we didn't feel justified in proceeding with it--and that would

simply be a provision that on the request, as Judge Wilson said, of two states, or some other number, whatever the Commission should decide, the governors of the signatory states would appoint members of the Commission to review, and let it go at that. Then it would be decided in the light of the then condition instead of now as to all of these readjustments.

COM. WATSON: Mr. Chairman, may I ask Mr. Carson a question? That review would have to be unanimous?

COM. CARSON: That would have to be made in the same way this compact would be made. In other words, the same power that made it could alter it, ratified by the legislatures of the various states and approved by the Congress.

MR. CLYDE: I would like to make just one comment. Under Article III, Section (e), of the Colorado River Compact, the Upper Division has already bound itself not to withhold water that it cannot use, using the word "cannot." If the Upper Basin in dividing the water among the states of the Upper Basin allocated water to one state in a quantity above that which it can use, then under our already existing contract with the Lower Basin they are going to get that water because we say we will not withhold it if we cannot use it.

I think that the Upper Basin States ought to leave--and I think the method ought to be somewhat as Mr. Carson suggests--should leave the matter open so that if we do through insufficient data now make allocation beyond that which can be used by any Upper Basin States, it can be reconsidered. Otherwise, under Article III, Section (e), of the existing compact, it is going to go to the Lower Basin because all that we cannot use we agree we will not withhold. And if we allocate to Utah more than it can use, then under the existing compact it will go to the Lower Basin unless we have some method of readjusting it and letting the Upper Basin come into the picture. The method I think, however, ought to be that suggested by Mr. Carson, which is, leave the matter open for renegotiation when that fact becomes known.

COM. STONE: Mr. Chairman, all of the other states have commented; Mr. Breitenstein merely presented the problem. Colorado's position on (b) and (c) is this: First I shall take up (c). We believe that the compact should contain a clause which would permit under the conditions set forth, whatever they may be, a periodic review of nonsubstantive terms, that is, matters which do not affect the substance of the compact, matters which do not change or affect the apportionment to the states, but nonsubstantive terms which are designed and will be helpful in making the compact more effective and operative. We believe in that connection the clause specifying a review should define what constitutes substantive provisions.

As to (b), "Shall the allocation of beneficial consumptive use be subject to future adjustment in the event that any state does not make full beneficial consumptive use of its allotted share within a stated period," Colorado is not in favor of such a provision. Our reason is this: We should make the apportionment in an equitable fashion under the conditions as we know them today. If in the future it appears that some state cannot use its portion of the water, there is nothing to prevent the making of a supplemental compact under the conditions as we shall know them in that day. I am inclined to believe that Grover Giles and Mr. Rollins are right in saying that we cannot now appraise that condition and no state in the interest of future generations would want to appraise it, and there really is no need of doing it because if the thing should happen for Colorado which Mr. Watson mentions, the door is open for the making of a supplemental compact.

So to sum up, Colorado favors a provision suggested by Subsection (c) with the suggestion that that provision must be carefully drawn and should

clearly define what constitutes nonsubstantive matters. Colorado is opposed to anything being included in the compact as suggested under Subsection (b).

MR. CLYDE: Mr. Chairman, may I ask Judge Stone a question?

THE CHAIRMAN: Yes, sir.

MR. CLYDE: Do you, Judge Stone, fear legally that California might be able to argue that we have relinquished our rights to readjust our apportionment if we at this time in perpetuity and with no reservation whatsoever in the compact, allocate more water to an Upper Basin State than it can use and then California come forward and say, "Well, by that now you under Article III, Subsection (e), of the Colorado River Compact have relinquished that water to the Lower Basin"?

COM. STONE: You have raised I think an important question and one I haven't thought of; but offhand I believe we should incorporate in the compact an appropriate reservation to make it clear that the Upper Basin proposes to use its water even though it may require some future reapportionment among the states of the Upper Basin.

MR. CLYDE: That was the point of my comments before, that we ought to reserve that some way so that by an allocation today on the basis of existing data we don't allocate to one state more than it can use.

COM. STONE: I think you have a very important point there and I agree with your thinking; however, that is a different point from that raised by these two suggestions.

MR. CLYDE: It is different but it is related.

COM. STONE: It is related. I do think we must be very careful that we do not leave the door open for a lower basin state to make a claim such as you mention. I believe that can be done and still carry out sound principles as to (b) and (c). That is a different but a related subject to the one raised by (b) and (c).

THE CHAIRMAN: Well, the Chairman hopes that in the drafting of this compact there will be no provision written into it which will invite competition between the Upper Basin States in the furtherance of their development. You might in the future have a division of opinion between the Upper Basin States and two or three states gang up on another one and get right in the way of their appropriations and delay their work.

Of course we are all talking about this compact in good faith but we will all pass out of the picture one of these days, new faces will appear. How they will look at it remains to be seen. But I would advise extreme caution in leaving the matter open so there would be competition invited between the Upper Basin States themselves in the development.

COM. STONE: I believe, Mr. Chairman, we recognize that and that is one of the reasons why we believe there should be no provision as to (b) but I think that in the interest of the most effective compact there should be some carefully phrased provision under (c), and we will tentatively go along with the suggestion made by Utah that we must have that reservation.

MR. WEHRLI: Mr. Chairman, may I make a comment?

THE CHAIRMAN: Mr. Wehrli.

MR. WEHRLI: It seems to me unimportant whether provisions of this character are included in the compact because the compact can be changed only by the making of a new compact, which would require the concurrence of all of the states, and with or without provisions of this kind the states certainly would have the right at any time in the future to make a new compact. So as far as we are concerned, we think that these matters are unimportant and I am inclined to agree with Mr. Carson in the matter. I am also a little bit apprehensive about the extending of an invitation, which provisions of this kind impliedly do.

COM. STONE: May I reply to that, Mr. Chairman?

THE CHAIRMAN: Certainly.

COM. STONE: I agree with Mr. Wehrli as to (b), but as to (c), he says we can change the compact. Yes, we can change the compact as to nonsubstantive matters, but we all know the turmoils that the machinery of negotiating a new compact mean. We know it means delay even though we are all in agreement. As to nonsubstantive matters which do not affect a state's apportionment of water or which do not affect a state's obligation to deliver water at Lee Ferry but which go to mere details of administration, we shouldn't lose the opportunity of leaving some flexibility on administration if it is properly surrounded with conditions which will protect a state's substantive rights. I believe that that provision in the Rio Grande Compact was carefully considered and experience has demonstrated that it was wise.

COM. WATSON: Can you, Judge Stone, as a lawyer define what is substantive and what is not substantive?

COM. STONE: I believe it can be defined. I wouldn't want to attempt it right at the moment. The question was raised in this state and with other states in connection with compacts which we have had under consideration as to what constitutes substantive matters and what are nonsubstantive matters, and the principles I think are pretty well understood. You cannot change substantive matters without the consent of all of the states and without a compact being made in the same manner as the original compact was made, that is, by ratification of the legislatures and approved by Congress. But I don't believe we should put ourselves in a straightjacket with respect to nonsubstantive matters and that we ought to explore the possibilities of writing a clause under (c) which would be satisfactory to all of the states. I believe that is what Mr. Carson suggested.

THE CHAIRMAN: Judge, just to bring the point out, what is meant by "periodic review of compact terms"? Does that mean every five years, every ten years, every fifty years or every one hundred years, or what does it mean?

COM. STONE: We don't say there. That is a matter for the Commission to agree upon if we have a clause of that kind. You may wish to approach it in a different manner. You may not want to have periodic reviews. You may want to leave it up to a review at the instance or suggestion of, let us say, two states, and such nonsubstantive changes would have to be agreed upon by all of the states.

THE CHAIRMAN: Well, would it be your idea that the year after this compact is written somebody could have a review of it?

COM. STONE: The Rio Grande Compact fixed it at every five years.

THE CHAIRMAN: Was that done on a percentage basis of allocation or actual acre feet?

COM. STONE: It didn't have anything to do with allocation because allocation is a substantive matter; it had to do with nonsubstantive matters. I will ask Mr. Breitenstein, who has had this matter before him, to give some suggestion as to what has been considered substantive and matters which are of nonsubstantive nature.

THE CHAIRMAN: Mr. Breitenstein.

MR. BREITENSTEIN: I can give a curbstone opinion in answer to Mr. Watson's inquiry and probably none of the other lawyers present would agree with me.

THE CHAIRMAN: We appreciate that.

MR. BREITENSTEIN: A substantive matter goes to a right or the definition of a right. A nonsubstantive matter is one which goes entirely to procedure. That is over-simplified but I think it gets the overall idea.

On the periodic review my thought was that it should be permissible to review nonsubstantive matters at fixed intervals and I am inclined to think the five-year period set up in the Rio Grande Compact is as fair as you can get. That is five years after the compact is effective and every five years thereafter. I believe the experience of New Mexico has shown the wisdom of such a provision.

THE CHAIRMAN: Mr. Breitenstein, it is your idea then that this provision (c) would not relate to re-allocation of water?

MR. BREITENSTEIN: Absolutely not.

COM. STONE: It is our position that that could not be done without ratification by the legislatures and approval by Congress.

MR. HOWELL: May I ask you this question? Assuming now you do attempt to define what shall be nonsubstantive matters, who will have the determination as to whether it is of nonsubstantive matter or whether it is not.

COM. STONE: It is my suggestion, Judge, that we should define what constitutes nonsubstantive matters so it would be clear in the compact and it wouldn't be necessary for anybody to determine it except this Commission in making the compact.

MR. HOWELL: The only difficulty about that that I have in mind is that my experience teaches me that two lawyers having desires in opposite ways can very plausibly argue no matter how you define it, the matter is a substantive matter or is a nonsubstantive matter according to what you want.

MR. BREITENSTEIN: May I make a suggestion?

MR. HOWELL: Yes.

MR. BREITENSTEIN: Your definition as to what is nonsubstantive might be by specific reference to paragraphs in the compact.

MR. WEHRLI: May I ask a couple of questions?

THE CHAIRMAN: Surely.

MR. WEHRLI: Did I understand you to say, Judge Stone, that you

were opposed to (b) and favored (c)?

COM. STONE: That is correct. Colorado opposes (b) for the very reason which you gave, that if we want to make any changes of a substantive nature the door is open to renegotiate a compact, or, to put it the other way, to negotiate a supplemental compact. We believe that we are not in a position today to commit any state to a different apportionment from that which is made by this compact and that each state must reserve that for the future.

But as to (c), we sincerely believe we should attempt to draft a clause which will permit some flexibility in the administration of the compact and in the handling of nonsubstantive matters without having to go through the process of negotiating a supplemental compact.

So we oppose (b). We do not submit at this time the exact provision as to (c) but we believe that the Commission should consider (c) and some of the terms that might be set up under (c) and submit it to the Legal Advisory Committee to draft.

MR. WEHRLI: My second question is this: Under (c) if you have such provision in the compact, wouldn't it nevertheless require the action of all the states to make any change?

COM. STONE: The answer to that is this: that if you have periodic review you could not change nonsubstantive matters without the consent and agreement of all the states.

MR. WEHRLI: Well, could you make any change except as to matters of administration, which after all are not defined particularly in the compact, without the concurrence of all of the states?

COM. STONE: If I understand your question right, our position is that you could not change any substantive matter without a supplemental compact. You could change a nonsubstantive matter under an appropriate clause in the compact with the consent of all of the states.

MR. CLYDE: Expressed how, Judge Stone? By the legislature ratifying it or just by the Commission?

COM. STONE: Under the Rio Grande Compact the administrative commission is authorized to make periodic reviews and there are representatives on that commission of all the states. They cannot review and suggest changes of a substantive nature because that requires the action of the states.

MR. HOWELL: Under your view would it require unanimous action on the part of the commission?

COM. STONE: Why certainly. We don't think you can change anything without unanimous action. You can't change nonsubstantive matters without an agreement of all the members, let us say, of the administrative commission. You certainly can't change substantive matters without a new or supplemental compact ratified by the legislatures of the states and approved by Congress.

THE CHAIRMAN: Gentlemen, we have had considerable discussion on subitem (b) of Article 5, Group I. Will somebody submit a motion in regard to it?

COM. BISHOP: I will make a motion that we go on record as against (b).

THE CHAIRMAN: Do I hear a second to Mr. Bishop's motion?

COM. WILSON: Mr. Chairman, I would like to speak on that motion but it has no second.

COM. WATSON: I will second the motion.

THE CHAIRMAN: Mr. Watson has seconded Mr. Bishop's motion. It is now open for discussion.

COM. WILSON: In the first place I would like to say, Mr. Chairman, I don't see what we are accomplishing by voting yes or no on some of these sentences. Reference has been made in discussing points (b) and (c) to the provisions of the Rio Grande Compact, to which Colorado, Texas, and New Mexico are parties, and it does have a provision in Article 13 which provides for a review. What do you mean by providing in a compact for a review? A review by whom? By the commission or the administrative body to be created by the compact?

In the Rio Grande Compact there is authorization for a review by the Commissioners themselves of any matter that is not substantive. I take it that the compact commission that is set up in the compact cannot review a substantive matter. In other words, they can't talk about it. It would do no good. So that would leave only nonsubstantive matters for the commission to review. If there are any nonsubstantive matters in the compact and you have a clause like this in it, the commission presumably can review those nonsubstantive matters. They are precluded, however, from reviewing substantive matters.

Now what is the purpose of permitting the commission to review nonsubstantive matters unless it is to make recommendations that they be changed or unless they have the power to change them themselves? Are you going to give the body that you create here the power to change nonsubstant matters without going back to the state legislatures?

I think some provision for review ought to be put in the compact but it should be made to mean something. If you are going to give a body the right to review, give them a right to act on the thing or make recommendations. I see no objection to giving them the right to review substantive or nonsubstantive matters even if they can't do anything about either one, except to make recommendations to the legislatures. It seems to me that we can't decide anything by voting yes or no on either one of these, (b) or (c).

As far as (b) is concerned I will say this, that I think we all recognize the principle that if any state does have allotted to it water that it cannot use consumptively and beneficially, that state ought to give some of the other states the opportunity of using it.

THE CHAIRMAN: When?

COM. WILSON: We can't say now.

THE CHAIRMAN: When?

COM. WILSON: That is it. I would be opposed to saying now any stated period of time even though we put it one hundred years. So I think everybody is opposed to (b). But as to (c), it depends a great deal upon the administrative body that you create and the power you confer upon it whether the review amounts to anything or not.

COM. STONE: I understand, Mr. Chairman, that the motion goes only to (b).

THE CHAIRMAN: That is correct, Judge Stone. Are there any further comments on the motion as made and seconded?

COM. STONE: May I ask Mr. Bishop and Mr. Watson if we are correct in our interpretation of the motion that the motion goes only to (b)?

COM. BISHOP: That is right.

COM. WATSON: That is right.

THE CHAIRMAN: That is correct.

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Now we have before us the disposition of subitem (c) under Article 5, Group I. Is there further discussion of subitem (c)? The two subitems (b) and (c) have been considered together and some of the comments refer to (c); (b) has been disposed of.

COM. CARSON: Mr. Chairman, I think it would be well if we passed (c) without any action until we see what terms are in this compact. To my mind it is not very likely there will be any nonsubstantive terms in this compact and the action of whatever commission is here set up will be in the matter of interpretation, which can not vary the language of the compact itself.

THE CHAIRMAN: The Chair is not sure he understands your thought there, Com. Carson. We must assume that somebody is going to attempt to put into this draft of the compact, the wishes of the Commission; and whether something is in or out on Item (c), the boys that draft it, and I presume that will be the lawyers, will have to have some indication as to what the Commission wants.

COM. CARSON: I move we defer consideration of Subsection (c) of this agenda to a later time.

COM. BISHOP: I will second that motion.

THE CHAIRMAN: The motion is seconded. Is there a discussion of the motion?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. Arizona?

COM. CARSON: Aye.

THE CHAIRMAN: New Mexico?

COM. WILSON: Aye.

THE CHAIRMAN: Colorado?

COM. STONE: Aye.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Aye.

THE CHAIRMAN: Utah?

COM. WATSON: Aye.

THE CHAIRMAN: The motion is carried. The next item on the agenda is a consideration of the subitems under Group II on page 2. Now it occurs to your Chairman that in connection with the discussion of the subitems under Group II you should have before you the views of the Federal Power Commission and the International Boundary and Water Commission, but as those copies are not available before you perhaps we may go ahead in a consideration of that item and await final disposition of it to the time when you can consider the views which have been expressed by the Federal agencies. Mr. Watson?

COM. WATSON: What shall we do with the reservation suggested by Mr. Clyde? Shall we refer that to the Legal Advisory Committee so that they may draw the appropriate language as to that reservation made protecting the rights of the Upper Basin against the Lower Basin on water that might go down?

MR. BREITENSTEIN: Group IV, which is set up here on page 2 of the suggested agenda, contains matters referring to the Colorado River Compact. As I understand the suggestion it is to have in the Upper Basin Compact some provision which would take care of the Colorado River Compact as Mr. Clyde has suggested. If that is correct it seems to me the discussion properly comes up under Group IV.

COM. WATSON: That is right.

COM. STONE: Mr. Chairman, I move that we defer consideration of Group II on page 2 until the statements from the Federal agencies to which you have referred are before the Commission.

THE CHAIRMAN: Is there a second to that motion?

COM. CARSON: I will second the motion.

THE CHAIRMAN: Any discussion of the motion? (No response. Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

COM. STONE: Now, Mr. Chairman, we get to Group III, which will precipitate considerable discussion. It is about twelve o'clock. It seems to me we ought to start in there tomorrow with either Group II if those Federal matters are before us, or Group III if they are not.

THE CHAIRMAN: Off the record. (Discussion off the record.)

COM. WATSON: Mr. Chairman, I move we adjourn until tomorrow afternoon at a time to be determined by the adjournment of the Colorado River Basin States Committee.

COM. STONE: The meeting this afternoon is at the Cosmopolitan Hotel at two o'clock.

THE CHAIRMAN: Is there a second to the motion to adjourn?

COM. WILSON: Second the motion.

(Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

(12:00 noon, Recess.)

Denver, Colorado
February 18, 1948
4:00 o'clock p.m.

(All Commissioners present.)

THE CHAIRMAN: Gentlemen, we had gotten down to Group II of the agenda and then decided to pass it up in view of the non-availability of the letters from the Federal agencies. Now those letters have been mimeographed and are available here and we will pass them out to the members of the Commission and others. Mr. Giles, will you take care of that? Then if there is no objection the communications from the Federal agencies will be incorporated in the minutes.

(Mr. Giles distributes copies of communications from Federal agencies.)

THE CHAIRMAN: Gentlemen, is it your desire now to have these made a part of the record or incorporated in the minutes? Apparently the first communications that were received by your Chairman were made a part of your record but were not incorporated in the minutes. You may express your ideas on how you want these handled.

COM. STONE: Mr. Chairman, I move that in accordance with the procedure followed with respect to the other communications from the Federal agencies, these letters be made a part of the record.

COM. WATSON: Second the motion.

THE CHAIRMAN: Any discussion? (No response. Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

(The communications above referred to are as follows:)

"INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO
FIRST NATIONAL BANK BUILDING
EL PASO, TEXAS

Office of the Commissioner
United States Section

December 18, 1947

My dear Mr. Bashore:

This will acknowledge receipt of your letter of December 15, 1947, in which you request a statement in response to the questions propounded by the Upper Colorado River Basin Compact Commission at its meeting in Denver, Colorado, on December 2, 1947. These questions are: 'What right if any, to the use of Upper Colorado River water does the agency have or claim on behalf of the United States? What particular provision and what particular language should be incorporated in any Upper Colorado River Basin Compact to protect the right, if any, to the use of Upper Colorado River water held or claimed by an agency on behalf of the United States?'

This agency, representing the United States in boundary and water treaty matters with Mexico, claims only such right in waters of the Colorado River system as may be necessary to satisfy the provisions of the Mexican Water Treaty of February 3, 1944, with which you are familiar.

In response to the second question I believe that the rights of the United States, in so far as the particular interests of this agency are concerned, will be adequately protected by a provision in any Upper Colorado River Basin Compact substantially as follows:

> 'Nothing in this Compact shall be construed as affecting the obligations of the United States of America to the United Mexican States under existing treaties.'

This provision is substantially taken from Article XVI of the Rio Grande Basin Compact.

Sincerely yours,

(Signed) L. M. Lawson
Commissioner

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Honorable Harry W. Bashore
Federal Representative and Chairman
Upper Colorado River Basin Compact Commission
Mitchell, Nebraska."

"THE SECRETARY OF THE INTERIOR
WASHINGTON 25, D. C.

January 9, 1948

My dear Mr. Bashore:

I have received your letter of December 15.

The questions raised in your letter will be duly considered and responses thereto will be forthcoming as soon as possible. Your invitation to the Office of Indian Affairs will be transmitted to that agency.

No doubt the Office of Indian Affairs will contact you directly.

Sincerely yours,

(Signed) William E. Warne
Assistant Secretary of the
Interior

Hon. Harry W. Bashore
Federal Representative and Chairman
Upper Colorado River Basin Compact Commission
Mitchell, Nebraska."

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"FEDERAL POWER COMMISSION
Washington 25

Upper Colorado River
Basin Compact Commission January 30, 1948

Mr. Harry W. Bashore
Federal Representative and Chairman
Upper Colorado River Basin Compact Commission
Mitchell, Nebraska

Dear Mr. Bashore:

In your letter of December 15 you ask two questions on behalf of the Upper Colorado River Basin Compact Commission with regard to the proposed compact for distribution of the waters of the Upper Colorado River Basin.

The first question is: What right, if any, to the use of the Upper Colorado River water does the Federal Power Commission have or claim on behalf of the United States?

If this question has reference to appropriation rights to the use of the Upper Colorado River Basin water, the answer is that the Federal Power Commission does not have or claim any such rights on behalf of the United States to the use of the Upper Colorado River Basin water. Under the Federal Power Act this Commission is not an operating agency, exercising, on behalf of the United States, any proprietary rights. It is authorized to issue and supervise licenses under that Act for non-Federal water power projects. Licenses have been issued for water power developments having an installed capacity of more than 100 horsepower on the following streams within the Upper Colorado River Basin:

Project No. 190,	Uinta River and Pole Creek, Utah;
Project No. 400,	Animas and Lake Fork on San Miguel River, Colorado;
Project No. 662,	Pine Creek, Wyoming;
Project No. 1773,	East Fork of Lake Fork of Duchesne River (Yellowstone Creek), Utah;
Project No. 1901,	Cunningham Creek, Colorado.

There are also a number of water power plants having less than 100 horsepower capacity in this river basin which are operating under Federal Power Commission licenses. Presumably, all of the projects operated under such licenses have acquired water power rights under State law and would not be affected by the proposed compact. However, it is felt that the proposed compact should not contain any provisions which would inequitably

deprive any of these licenses of their water power rights or prevent the acquisition of such projects by the United States in accordance with the terms of the Federal Power Act. If the compact follows the usual form of other interstate river compacts, it is believed that such rights will not be prejudiced.

However, the United States has other rights and responsibilities with respect to water use than those of a proprietary nature, and Congress has entrusted some of those other rights and responsibilities to the Federal Power Commission. In the Federal Power Act Congress requires that licenses for projects of over 100 horsepower capacity shall be issued only for projects which are best adapted to comprehensive plans for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water power development, and for other beneficial public uses, including recreational purposes. This requirement of conformance by non-Federal water power projects with comprehensive plans represents a policy of long standing and of fundamental importance and has been made equally applicabl to Federal developments authorized under other statutes.

Therefore, the compact should recognize the desirability of comprehensive development of water resources in the Upper Colorado River Basin, including power development, to the end that the economic conditions of the area may be improved and the wealth of the nation increased. The rights and responsibilities of the United States should be recognized and the compact should not prevent full development of water power in accordance with State and Federal laws relative to beneficial consumptive use of the waters.

The second question which you ask reads: What particular provision and what particular language should be incorporated in any Upper Colorado River Basin compact in order to protect the rights, if any, to the use of Upper Colorado River water held or claimed by an agency on behalf of the United States?

The following language is suggested for the Upper Colorado River Basin compact:

Article _____

Nothing in this compact shall be deemed:

(a) To impair or affect any rights, powers, or jurisdiction of the United States, or those acting by or under its authority, in, over and to the waters of the Upper Colorado and its tributaries, as now provided by law; nor to impair or affect the right of the United States or those acting by or under its authority, to acquire rights in and to the use of waters of said river and its tributaries, as now provided by law;

(b) To subject any property of the United States, its agencies or instrumentalities, to taxation by any State, or subdivision thereof, nor to create an obligation on the part of the Unite States, its agencies or instrumentalities, by reason of the acquisition, construction, or operation of any property or works of whatsoever kind, to make any payments to any State or political subdivision thereof, state agency, municipality, or entity whatsoever in reimbursement for the loss of taxes;

(c) To subject any property of the United States, its agencies or

instrumentalities, to the laws of any State to any extent other than the extent these laws would apply without regard to this compact.

When other specific provisions of the compact have been formulated, it will be appreciated if the Federal Power Commission may have an opportunity of studying and commenting upon them before they are finally adopted by the Compact Commission.

Sincerely yours,

(Signed) Nelson Lee Smith,
Chairman."

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"EXECUTIVE OFFICE OF THE PRESIDENT
BUREAU OF THE BUDGET
WASHINGTON 25, D. C.

Jaunary 21, 1948

Mr. Harry W. Bashore
Federal Representative and Chairman
of the Upper Colorado River Basin
Compact Commission
Mitchell, Nebraska

Dear Mr. Bashore:

This will acknowledge receipt of your letter dated December 15, 1947, setting forth two questions which you have submitted to various Federal agencies concerning the rights of the United States to the waters of the Upper Colorado River.

I appreciate your advising me of these requests and am sure that the agencies concerned will consider the matter and make appropriate replies directly to you. I am requesting these agencies to furnish us with copies of their replies for the information of the Executive Offices.

Sincerely yours,

(Signed) James E. Webb
Director."

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THE CHAIRMAN: You will recall at our meeting yesterday morning the Legal Advisory Committee indicated that it wasn't ready to report but today there is available the mimeographed report and perhaps Mr. Carson, the chairman of that committee, wishes to submit the report. There are plenty of copies of the report available and perhaps they should be passed around for the perusal of those who haven't seen it.

COM. CARSON: I think everybody has a copy who is a member of the Commission.

("Report of Legal Advisory Committee on Matters referred by Compact Commission at Meeting No. 5" distributed.)

COM. CARSON: The mimeographed copy of the report of the Legal Advisory Committee I think is self-explanatory and I don't know whether there is any desire that the provisions of it be read or not. The Committee considered all the questions that have been submitted to it by the Compact Commission and here in the report detailed the questions that were submitted and the Committee's suggestion of the provision referred to for the consideration of the Compact Commission.

We found that there were some matters that we have tentatively reported on that are of substance rather than mere phraseology. There are some other matters which we think should be decided by the Commission rather than recommended by the Legal Advisory Committee. There were two matters in which there was a divergence of views among the Committee itself, so all of the Committee does not wish--I am sure that is true of each member of the Committee--to be considered as committed to this and this only. We are the servant of this Commission and if anything in here is not acceptable or wrong and if you desire to change the base, we will try to put it in appropriate language.

There are two matters of policy which really require consideration by the Commission, one relating to the administrative provision as to whether or not that should be, as we have here reported, the minimum requirement of an administrative agency to construe reports in the light of this compact and make findings of fact. One school of thought was that perhaps it should be in the nature of an authority set up by compact among the states. The Legal Committee was of the opinion that that was neither necessary nor desirable. So this is explanatory in its terms as to our recommendations of the composition and the powers of the commission and the effect of its findings.

One other question related to that matter which is a matter for the Commission itself, as well as the consideration of the whole thing, but one particular matter is how the expenses of the commission here proposed to administer the compact should be paid. One idea was that it should be borne equally by the four states of the Upper Division; the other was that it should be according to the percentage of water allocated to each. And I might add as a Commissioner now, that in my view this commission here set up should not be participated in by Arizona, both from the Arizona viewpoint and from the viewpoint of the States of the Upper Division, but should be composed of one member from each of the States of the Upper Division and one Federal Representative.

On the matter of the facilities in one state for the benefit of another, which is the second question referred on page 5 of the report, we have there gone into the question of eminent domain and payment in lieu of taxes and other things which seemed to us to be proper for the consideration of the Commission.

On the third question which was presented to us on the charging of reservoir losses, appearing on page 8 of the report, we have suggested langua which it seems to us properly handles that proposition but that again for the consideration of the Commission.

On the question of preferential uses of water, we have gone into it and recommend that the language of the Colorado River Compact in that respect be incorporated in this compact.

You also referred to this committee the question of what should be done concerning Indian rights and we recommend that a similar clause to that in the Colorado River Compact be incorporated herein. We did not believe

that this Commission or this compact could authoritatively settle or attempt to settle the question of Indian rights as may be raised by the United States Government or the Indian Service. We do believe that the question of Indian rights should be kept in mind by this Commission whenever it goes to apportioning the water under the belief that the water apportioned to each state must be utilized to satisfy the rights of Indians and whites alike, and that should be taken into account in the apportionments made. We did not believe that any specific language other than that suggested relating to Indians should be incorporated in the compact but we did think that some general clause to the effect that all uses of water within the borders of the state should be charged against the apportionment of that state.

We got along very well and the members of the Committee worked diligently to prepare this report. We suggest it for your consideration.

THE CHAIRMAN: Thank you.

REPORT OF LEGAL ADVISORY COMMITTEE ON MATTERS REFERRED BY COMPACT COMMISSION AT MEETING NO. 5

The Upper Colorado River Compact Commission at its meeting No. 5 referred five matters to the Legal Advisory Committee. In this report the committee sets forth its recommendations in regard to each of the matters so referred.

In considering this report the Commission must realize that the compact provisions proposed are necessarily in tentative form. Decisions yet to be made by the Commission on both substantive and procedural matters will affect the proposals here made. It must be understood that the committee and the individual members thereof may desire to make further or different recommendations after further progress has been made in forming a compact.

I.
ADMINISTRATIVE PROVISIONS

Motion of Commission

The principle of creating an administrative agency is accepted by the Commission and a clause shall be incorporated in the compact adopting the principle. The matter is referred to the Legal Advisory Committee to work out the details and report back to the Commission.

Recommendation

ARTICLE _____
ADMINISTRATIVE PROVISIONS

There is hereby created an interstate administrative agency to be known as "Upper Colorado River Commission."

The Commission shall be composed of one representative of each of the states of the Upper Division, namely, Colorado, New Mexico, Utah and Wyoming, and if designated by the President of the United States, one representative of the United States. The Commissioner for Colorado shall be appointed by the Governor of Colorado with the advice and consent of the Colorado Water Conservation Board. The State Engineer of New Mexico shall be ex-officio commissioner for New Mexico. The commissioner for Utah shall be appointed

by the Governor of Utah with the advice and consent of the State Water and Power Board. The State Engineer of Wyoming shall be ex-officio commissioner for Wyoming. If any state desires to provide for the selection of its commissioner in a different manner, the commissioner, selected as so determined by such state, shall be the commissioner for such state. The President of the United States shall be requested to designate a commissioner for the United States. If a commissioner is so designated for the United States he shall be the presiding officer of the Commission and shall be entitled to the same powers and rights as the commissioner of any state.

Any four members of the Commission shall constitute a quorum.

Expenses. The salaries and personal expenses of each commissioner shall be paid by the government which he represents. All other expenses which are incident to the administration of this compact and which are not paid by the United States shall be borne (equally by the four states) (prorata by the four states according to the percentage of water allocated to each). On or before November 1st of each year the Commission shall adopt and transmit to the governors of the four states and to the President a budget covering an estimate of its expenses for the following year and of the amount thereof payable by each state. Each state shall pay the amount due by it to the Commission on or before April 1st of the year following. The payment of the expenses of the Commission and of its employees shall not be subject to the audit and accounting procedure of any of the four states or of the United States.

Employees. The Commission shall appoint a secretary who shall not be a member of the Commission and who shall serve for such term and receive such salary and perform such duties as the Commission may direct. The Commission may employ such engineering, legal, clerical and other aid as may in its judgment be necessary for the performance of its functions under this compact. In the hiring of employees the Commission shall not be bound by the civil service laws of any state or of the Federal Government.

Powers. The Commission shall have the power to

1. Adopt rules and regulations not inconsistent with this compact.

2. Locate, establish, construct, abandon, operate and maintain water gaging stations;

3. Make estimates to forecast water run-off on the Colorado River or any of its tributaries;

4. Engage in cooperative studies of water supplies of the Colorado River and its tributaries;

5. Collect, analyze, correlate, preserve and report on data as to stream flows, water storage, water diversions and water use of the waters of Colorado River or any of its tributaries;

6. Make findings as to the amount of and report on the beneficial consumptive use of water each year in the Upper Colorado River Basin and in that portion of each state lying within this basin.

7. Make findings as to the amount of and report on the water deliveries at Lee Ferry each year and the amount of such water supplied by

each state of the Upper division;

8. Make findings as to the amount of and report on the share of reservoir losses chargeable against the apportionment made to each of the four states;

9. Make findings as to the amount of and report on the obligation of each state to make water deliveries at Lee Ferry;

10. Perform all functions and do all things required of it by this compact and do all things proper and convenient in the performance of its duties hereunder. Provided, however, that the concurrence of four members of the Commission shall be necessary in any action taken by the Commission;

11. Make and transmit annually to the Governors of each of the four states and the President of the United States with the estimated budget a report covering the activities of the Commission for the preceding year.

Records Open to Inspection. The Commission and its secretary shall make available to the Governor of each of the signatory states any information within its possession at any time and shall always provide free access to its records by the governors of each of the states or their representatives or authorized representatives of the Federal Government.

Findings of fact. Findings of fact made by the Commission shall not be conclusive in any court or before any agency or tribunal but shall be admissible and shall constitute prima facie evidence of the facts found.

Comments.

1. The committee considered that the apportionment of the expenses of administering the compact is a substantive matter for determination by the Commission. Two methods of apportionment were suggested in meetings of the committee, viz., an equal division by the states or a division proportional to the percentage of water allocated to each state. These alternative methods are set out in brackets in provision on expenses.

2. The Commission is not given the express power to own real and personal property. The committee believes that under paragraph 10 of the powers the Commission would have the right to acquire, hold and dispose of any property, real or personal, necessary to the performance of any of the powers granted. This would mean, by way of example, that the Commission could acquire land necessary for gaging stations.

3. The committee directs the attention of the Commission to the fact that consideration might as well be given to the matter of tort liability of the Commission, its members and employees.

4. The proposal permits action upon a vote of four commissioners. Findings of fact by the Commission are not conclusive and may be rebutted by a dissatisfied state.

II.

FACILITIES IN ONE STATE FOR THE USE OR BENEFIT OF ANOTHER STATE

Motion of Commission.

There is referred to the Legal Advisory Committee consideration of compact provisions relative to the use of eminent domain, reimbursement of

taxes, control of diversions, storage and release of water, compliance with state requirements as to the filing of maps and plans, all in connection with the construction of a project in one state for the benefit of another state or states.

Recommendation

ARTICLE ____

FACILITIES IN ONE STATE FOR THE USE OR BENEFIT OF ANOTHER STATE

No state shall deny the right of the United States, another signatory state, any person or entity to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one state for the purpose of diverting conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the state of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper state for beneficial consumptive use in a lower signatory state when such is within the allocation of such lower state herein made. Such rights shall be subject to the rights in a state in which such reservoir or works are located to have and receive the water allocated to it herein for beneficial consumptive use.

Any signatory state, any person or any entity of any signatory state shall have the right to acquire necessary property rights in any other signatory state by donation, purchase or through the exercise of the power of eminent domain.

Any signatory state upon the written request of the Governor of another signatory state for the benefit of whose water-users property is to be acquired in the state to which such written request is made shall proceed expeditiously to acquire the desired property through the exercise of its power of eminent domain, and shall convey such property to the requesting state or such entity as may be designated by the requesting state. Provided however, that all costs and expenses of every kind and nature whatsoever incurred in the acquisition of the requested property shall be paid by the requesting state at the time and in the manner prescribed by the state requested to acquire the property.

Should any facility be constructed in a signatory state for the benefit of another state or states or the water users thereof as above provided, the construction, repair, replacement, maintenance and operation of such facility shall be subject to the laws of the state in which the facility is located, except that in the case of a reservoir constructed in one state for the benefit of another state the water administration officials of the state in which the facility is located shall permit the storage and release of any water which, as determined by the finding of the Commission, falls within the share of the state for whose benefit the facility is constructed, and in the case of a regulating reservoir for the joint benefit of all states in making Lee Ferry deliveries the water administration officials of the state in which the facility is located shall in permitting the storage and release of water, comply with the findings and orders of the Upper Colorado River Commission.

In the event property is acquired in one state for the use and benefit of another the users of water made available by such facilities shall pay to the political subdivisions of the state in which such works

are located each and every year during which such rights are enjoyed for such purposes a sum of money equivalent to the average amount of taxes levied and assessed against the land and improvements during the ten years preceding the acquisition of such land in full reimbursement for the loss of taxes in such political subdivisions of the state, said payments to be in lieu of any and all taxes on said property, improvements and rights.

The signatory states further agree to recommend to the President and to the Congress that in the event the United States shall acquire property in one of the signatory states for the benefit of another signatory state or its water users, provision be made for like payment in reimbursement of loss of taxes.

Comments.

1. The point was raised in the committee that there are constitutional questions as to whether a state or water user of that state could go into another state and exercise the right of eminent domain. Attention is directed to Grover Irrigation Company v. Lovella District, 21 Wyoming 204, 255. To take care of this situation provision has been made for condemnation by the state in which the facility is located.

2. In subjecting a facility in one state to the laws in the state in which the facility is located, it is not the intent to subject the United States to the police regulations of a state to an extent greater than that provided for in Section 8 of the Reclamation Act of 1902.

3. In the provision on reimbursement for loss of taxes the point was raised that the United States could not be compelled to make the required payments. For this reason a provision was added that a recommendation be made to the United States that when it acquired such property provision be made for reimbursement of taxes.

4. No provision is made for the potential loss of taxes.

III.
CHARGING OF RESERVOIR LOSSES

Motion of Commission.

The Legal Advisory Committee is requested to draft a provision to effectuate the principle that losses of water incidental to reservoir operations be apportioned between the states upon the basis of the benefits received from such reservoir operations.

Recommendation.

"Water losses resulting from reservoir operations shall be charged to the state or states receiving benefit from such reservoir operations in proportion to the beneficial consumptive use of water made available to each state by the reservoir except that in the case of regulating reservoirs for the joint benefit of all states in making Lee Ferry deliveries the charge shall be proportionate to the beneficial consumptive use of water in each state during the year for which the charge is made."

Comments.

1. The formula for charging reservoir operation losses should be carefully worked out by a joint engineering and legal committee after the Commission has determined the substantive provisions of the compact.

2. The committee felt that no consideration should be given to power benefits for the reasons that (1) power uses are subordinate to domestic and irrigation uses, (2) any formula based on power uses is impossible of ascertainment at this time, (3) power uses would probably be through a transmission grid which will make it difficult to determine the source or place of use of the power, and (4) some of the power may be used outside of the basin.

IV.
PREFERENTIAL USES OF WATER

Motion of Commission.

The Upper Colorado River Basin Compact shall contain provisions relative to the preferential use of water in conformity with such provisions of the Colorado River Compact and the Legal Advisory Committee is requested to draft the necessary language.

Recommendation.

"Inasmuch as the Upper Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of the Upper Colorado River basin, the use of its waters for the purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding.

Subject to the provisions of this compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

The provisions of this article shall not apply to or interfere with the regulation and control by any state within its boundaries of the appropriation, use, and distribution of water."

Comments.

The committee thought that the provision on preferential uses of water should be taken word for word from the Colorado River Compact except for the change to "Upper Colorado River."

V.
INDIAN RIGHTS

Motion of Commission.

The legal question of the rights and interests of the Indians in

Colorado River water is referred to the Legal Advisory Committee for study and recommendations.

Recommendation.

ARTICLE ____

INDIANS

Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes.

Comments.

The committee felt that the wise procedure in regard to the Indian subject is to incorporate in the Upper Basin Compact the same language as is contained in the Colorado River Compact. The question of the charging of Indian uses against the basin or against the state in which the uses occur is a substantive matter for the Commission. The Legal Advisory Committee feels that the charge should be against the state in which the uses occur.

Respectuflly submitted,

LEGAL ADVISORY COMMITTEE

By: Charles A. Carson, Chairman.

COM. CARSON: If there is any other member of the Committee who has anything to add to that I wish they would be given an opportunity.

THE CHAIRMAN: Thank you.

COM. STONE: May I ask a question, Mr. Carson? You said there were two matters on which the Committee disagreed. Did I understand those two matters were, first, the policy relating to the provision for the administration of the compact; and, second, the question of the apportionment of the expense? Is that correct?

COM. CARSON: Except I didn't want to be understood as saying there was any particular disagreement among the members of the Committee in what we are now submitting. There were two schools of thought: one that it should be authoritative like a river authority; the other that it should be administrative. This Commission had made no indication of its desire although, as you will recall, I asked you to do so. We concluded the best thing to do at this point was to recommend the minimum administrative body and then if you desire to change that in any way, we would try to put whatever the decision was in the appropriate language. But from our viewpoint the administrative provisions of this compact are preferable to any authoritative body.

The other was on the apportionment of the expense and on that there were two schools of thought so we didn't think we should attempt to resolve that but rather, as you will note in the report on page 2 relating to expenses, we put them both in there in parentheses so the Commission could strike out whichever one it wanted.

THE CHAIRMAN: Are there further comments or questions or suggestions in regard to the report of the Legal Advisory Committee?

MR. WALLACE: Mr. Chairman--

COM. CARSON: I believe if you would call on the other members of the

Legal Advisory Committee they might want to add to what I have said before the questions.

THE CHAIRMAN: Very well. Judge Wilson, you were on that Committee.

COM. WILSON: Yes, Mr. Chairman, I was on the Legal Committee and also a member of the Commission, and it was understood that in making this report, no member of the Commission was necessarily bound by these recommendations. In other words, as I understand the report it is merely a suggestion to the Commission so that the Commission may determine these questions upon which there may be a difference of opinion.

As Mr. Carson stated, when we began it wasn't known what the Commission desired as to the administrative body that would administer and carry out the functions of a compact when one is made. We had to consider that the Commission might desire purely an administrative body with no judicial or quasi-judicial functions whatever, simply to carry out the administrative features of the compact that might be agreed to.

On the other hand it was suggested that the administrative body should be given more power, quasi-judicial functions or even judicial functions. There was even a suggestion by some that the Commission might desire to create a corporation and empower it with many powers and duties, not only to administer the compact but to make binding conclusions of fact. The majority of the Committee seemed to believe an administrative body with no judicial function should be created, and I think you will find that is what has been done in this instance. We did not want to foreclose the Commission from going back behind this and setting up a real corporation if that is what the Commission wants.

Now with that understanding, as a member of the Legal Committee, we make this report as suggested. As a member of the Commission, I reserve the right to vote on any controversial subject that may arise as and when it does arise.

THE CHAIRMAN: Do the legal advisers for Wyoming have anything to say?

MR. WEHRLI: Mr. Chairman, I want first to refer to a couple of formal matters that I have observed in this draft that escaped my attention and perhaps the attention of others in its preparation.

On the first page there is set up:

"ARTICLE _____

ADMINISTRATIVE PROVISIONS"

What is dealt with in that article is the administrative agency. I assume there may and probably will be other administrative provisions in the compact aside from those that appear in this article. I am inclined to think that through inadvertence that heading came in that way and probably should be "ADMINISTRATIVE AGENCY" rather than "ADMINISTRATIVE PROVISIONS." It is just a formal matter but I think the heading is a little bit misleading because there will be no doubt some other administrative provisions in the compact.

Then on page 5 there is an "ARTICLE" and a place for a number, and I am inclined to think that heading ought to be, "FACILITIES IN ONE STATE FOR THE USE OR BENEFIT OF ANOTHER STATE OR STATES." We had some

discussion about that but I believe the matter was lost in the arduous duties that we attempted to perform in a comparatively short time because as I understand it, that article does relate not only to the construction of a reservoir in one state for the benefit of another state but the construction of a reservoir in one state that might benefit two or perhaps more than two states. Those are merely formal matters that I think should be given some consideration.

With reference to the voting power on the commission, Judge Wilson I believe has correctly said that the Commissioners may disagree with the Committee that prepared this. I find myself in that position so far as Wyoming is concerned. Our Wyoming Commissioner is not entirely agreed upon the question of the voting power. That is a matter of course that probably will come up at a later time.

There is one other point that I would like to refer to and that's the recommendation on page 8 under III about the charging of reservoir losses. I am not sure that I understand exactly what was meant in the last part of that and maybe if I understood I would agree with it, but it says--I am referring to the recommendation:

> ". .in making Lee Ferry deliveries the charge shall be proportionate to the beneficial consumptive use of water in each state during the year for which the charge is made."

I am wondering if the Committee meant that or whether the Committee meant that the charge should be in proportion to the beneficial consumptive use of water allotted to each state under the compact regardless of the amount that might be used in a particular year. I am in doubt about the matter. I think something might be considered there too as to whether that charge should be related to the consumptive use of water allocated to each state under the compact or whether it should be related to the respective obligations of the Upper States to supply the delivery at Lee Ferry. At least I wish to point out that we are not entirely satisfied with the phraseology used which relates it to the consumptive use of water that is made in each year regardless of the apportionment by the compact, and I think that is a matter that we would want to have given some consideration before passing on it.

I believe those are the only things that we have in mind at this time that we wish to call to the attention of the Commissioners.

THE CHAIRMAN: Thank you, Mr. Wehrli. General Gray, do you have any further comments?

MR. GRAY: No, Mr. Chairman, I do not. Thank you.

THE CHAIRMAN: The member of the committee from Utah. Mr. Clyde.

MR. CLYDE: In attempting to write an administrative provision to administer a compact not yet written we are somewhat handicapped because we are working in the abstract; and we are handicapped somewhat in knowing what administrative provisions to put in because we do not and did not know what would be administered. And for that reason I at least feel that after the compact itself is written and many of the substantive decisions are made, there will of necessity be additions and changes in the administrative provision that we have set up. You can't completely cover the administration of something when you don't know what it is that you are administering. And so the report as far as I am concerned ought to be submitted with the idea that as those substantive decisions are made, changes and additions may of necessity have to be made in what has been submitted.

I think Mr. Carson and Judge Wilson correctly reflect the attitude of the various schools of thought that came forward in the meeting and I concur in their statements of it.

In addition I would like to point out that, in addition to the administrative provisions that are contained in the report denominated subdivision I, there are administrative provisions also contained in that part which is denominated subdivision II, "Facilities in one state for the use or benefit of another state." It is that provision that I interpret to provide the watermaster for the stream. On page 6, releases from reservoirs, both main stem and reservoirs in one state for the use and benefit of another--the release and storage of water in those reservoirs are to be governed by the decisions of the commission and the findings it makes. I think those are equally related to the administrative part as those we have classified in paragraph I and that that is an additional administrative provision and ought to be read together with it.

THE CHAIRMAN: Thank you, Mr. Clyde. Judge Howell.

MR. HOWELL: I don't think I have anything to add to what has been said except perhaps I should say that I was the one I think that was willing to go as far as anybody, perhaps even further, in creating an administrative body which would be vested with full power and authority to carry out the provisions of this compact whether it involved the exercise by the commission of what we commonly call quasi-judicial powers. I think Mr. Clyde was inclined to favor such provisions, perhaps not going as far as I did in the draft which I proposed which created the body politic of this commission or corporation, but substantially I think he was in agreement with me that the commission should be vested with complete power to administer the compact in the same way as a watermaster would be under judicial decree. However, the other members of the Committee were inclined to the view that such provisions could not be finally ratified by the various states and for that reason we acquiesced in giving the commission less power so that it only has the right to make findings of fact, which are prima facie but not conclusive evidence before any court and therefore gives to any state that is dissatisfied with the findings of the commission the right to go into court and have them reviewed.

It does not go so far as I should like to have seen it go but at the same time I would like to say as far as I am personally concerned, I am reasonably satisfied with the administrative provisions.

THE CHAIRMAN: Thank you, Judge Howell. Mr. Breitenstein.

MR. BREITENSTEIN: It seems to me, Mr. Chairman, that what has been said already illustrates the danger, and what I have pointed out on numerous occasions, of the Commission referring to the Legal Advisory Committee the drafting of certain language without telling that Committee what principles you have in mind. It seems to me it is unfair to the Legal Advisory Committee and unfair to the Commission itself to expect your Legal Advisory Committee to draw up any provisions unless you tell us first what general principles you have in mind. Now I think what has been said this afternoon illustrates that point.

The next thing I want to say is this: I disagree one hundred percent with both Mr. Clyde and Judge Howell that anything in the administrative provisions sets up a watermaster on a stream.

MR. HOWELL: I didn't say it did.

MR. BREITENSTEIN: Mr. Clyde did.

MR. HOWELL: I know but I didn't say that. In your present provisions I don't think it does.

MR. BREITENSTEIN: I said during meetings of the Legal Advisory Committee Colorado would not agree to any provisions which had the effect of setting up a watermaster on the stream; and I requested, I thought, so it was understood that that matter would not be brought up at the Commission meeting. As I construe the administrative provisions they do not in any way set up a watermaster on the stream. The commission is given powers solely with regard to facilities in one state for use of water in another state, or for facilities in one state for the common benefit of another state.

The next thing I went to say is in regard to what Mr. Wehrli said on page 8, Article III, "Charging of Reservoir Losses." Now I prepared that recommendation myself. Before it went around to the Legal Advisory Committee I submitted it to lawyers and engineers in Colorado and I got no suggestions of a change. I submitted it to the Legal Advisory Committee and brought it up several times and no one suggested a change.

Now perhaps my language isn't clear--I thought it was--but speaking only personally, my intent in the language which Mr. Wehrli read--and I believe it is as clearly stated as it can be--is that the charge is proportionate to the beneficial consumptive use of water during the year in which the charge is made and that is not proportionate to the allocation of each state, and if it can be said any more clearly I would like to know how it should be said.

THE CHAIRMAN: Thank you, Mr. Breitenstein.

MR. WEHRLI: Mr. Chairman, I will enter my apologies to Mr. Breitenstein. I misread Mr. Breitenstein's language on page 8 or read it with the assumption in my mind that it related to the allocation of beneficial consumptive use in the compact. I still have the question whether that is a proper provision because it would make a determination each year necessary and in addition to that it occurs to me that perhaps the correct thing or the right thing would be to relate it to the right of the state even though the state had not fully exercised its right.

MR. CLYDE: Mr. Chairman, may I clear the record on my remark?

THE CHAIRMAN: Yes.

MR. CLYDE: I didn't mean to imply--and if I said it it was a mischoice of words--that this set up a watermaster. What I did mean was that the subject matter in this dealing with that problem is contained in the joint facilities and I agree with Mr. Breitenstein's interpretation. The facility for one state located in another is under the control of the administrative officer of that state to release or store water according to the findings of the commission. I didn't mean to imply that it was a watermaster we had attempted to create here but the subject matter of how these reservoirs would function was not covered in the administrative part, part I, but in the facilities part in part II.

MR. HOWELL: I would like to say this too because there was sort of an implication in what Mr. Breitenstein said of some sort of bad faith on my part. What I said or what I thought I was saying was that I was in favor of creating a watermaster.

MR. BREITENSTEIN: Yes, I concede that, Judge.

MR. HOWELL: And the majority of you didn't agree with me.

MR. BREITENSTEIN: Yes, sir.

MR. HOWELL: And I gave way on it. So I don't say this creates any watermaster. I don't think it does.

MR. WALLACE: Doesn't it create a watermaster and some sort of commission?

MR. HOWELL: A fact finding board.

MR. WALLACE: A fact finding board. And he reports to the officer in the various states what is going on on the river?

MR. BREITENSTEIN: In two cases: in case of a facility in one state for use in another state; or a facility in one state for the common benefit of all states--in only those two instances.

MR. WALLACE: So if there is a shortage of water at Lee Ferry, what is the action?

MR. BREITENSTEIN: Neither the Commission nor the Legal Advisory Committee has reached that point yet.

THE CHAIRMAN: Apparently we have heard from the lawyers. Are there any further questions or comments on the report of the Legal Advisory Committee?

COM. STONE: Mr. Chairman, I should like to make a suggestion. I anticipate that the action of the Commission on this report will require considerable discussion and I am of the opinion that each Commissioner ought to very carefully study this report before speaking or taking a position. I should like to suggest since it is nearly five o'clock, that we have the evening or some time between now and the convening of the Commission tomorrow to study this report a little more carefully.

THE CHAIRMAN: Judge Stone, would you also suggest that the report of the Committee be studied in connection with the communications received from the Federal agencies which are available?

COM. STONE: Yes.

THE CHAIRMAN: I think that is a pretty good idea.

COM. CARSON: Mr. Chairman, speaking for myself now, I don't belie that this Commission should undertake to adopt these specific provisions her stated until we have gone further in the drafting of the compact as a whole. I think we should just keep these and study them for reference and keep them in mind. But I don't think any formal action should be taken approving them at this time.

COM. STONE: Mr. Carson, perhaps you misunderstood my statement. I don't think so either. Someone suggested--I believe it was Mr. Clyde--the fact that the administration provision or the provision for the creation of an administrative commission should be left open for review when other provisions of the compact are agreed upon, and yet I do believe we ought to make some progress in discussing this report, and I believe that it's been the policy of this Commission to adopt other measures for incorporation in the compact on a tentative basis.

COM. CARSON: I didn't read this first part of this report but that is what I am speaking of now:

"In considering this report the Commission must realize that the compact provisions proposed are necessarily in tentative form. Decisions yet to be made by the Commission on both substantive and procedural matters will affect the proposals here made. It must be understood that the committee and the individual members thereof may desire to make further or different recommendations after further progress has been made in forming a compact."

COM. STONE: That is correct, I understand that, and yet we ought to attempt to make some decisions as far as we can make them on a tentative basis.

MR. HOWELL: I would like to ask you a question, Mr. Carson, and the other members of the Committee, if they would be willing to have the report amended in the particulars suggested by Mr. Wehrli with reference to the designation of the articles.

COM. CARSON: I would.

MR. HOWELL: So far as I am concerned I think they should be.

COM. STONE: I would too except instead of "agency", "commission". Administrative Commission.

COM. CARSON: Administrative Commission would be better.

MR. WEHRLI: That would be agreeable.

COM. CARSON: I would agree. The other members of the Committee are here and if any of the other members of the Committee disagree they had better speak up.

MR. WEHRLI: Judge Stone, the reason I used that word was because it was used down here.

MR. BREITENSTEIN: I would just call it "Administration" if I was doing it.

THE CHAIRMAN: Gentlemen, it seems to the Chairman that it is evident that changes will have to be made as you proceed along. What you are trying to do at this time is fit a suit of clothes on a ghost. You don't know anything about the body of the matter, and then as you determine that, this will have to be fit to it. I think the lawyers did an excellent job in the work that was assigned to them but I believe they would have had more heart in the thing if they knew the shape of the body they were going to put these clothes on. That is my view of the situation. Of course you will have to make changes as you go along.

COM. WATSON: Mr. Chairman, inasmuch as there will be a lot of changes made I move that we accept this report of the Legal Advisory Committee and file it for further study and consideration.

COM. STONE: Mr. Chairman, I would oppose that motion for the reason that that means no progress, that simply accepts it and files it. There are decisions which we can possibly make at this time and we should make them, but we should leave it open for review as to all provisions which should be changed when other measures in the compact are agreed upon.

THE CHAIRMAN: Gentlemen, your Chairman likes to proceed somewhat in order. The motion has received no second. Is there a second to the motion? If there is it is open for discussion. Is there a second to Mr. Watson's motion?

COM. WATSON: Mr. Chairman, since I am in the unfortunate position of not getting a second to my motion, I will comment on my own motion if I may.

THE CHAIRMAN: You may do that.

COM. WATSON: We have so many details here, we can't see the forest for the trees. All of us are confused in a mass of detail.

COM. WILSON: May I interrupt?

COM. WATSON: Yes, sir.

COM. WILSON: I would like to second the motion for this reason: I don't believe there is any conflict in his motion and what Judge Stone has in mind. If this board will accept it and file it for study, if Judge Stone wants to call it up in the morning for discussion, there is nothing inappropriate about that.

COM. STONE: That is all right, Judge, if that is understood. I got the impression from Mr. Watson's motion that we would not consider it any further at this time.

COM. WILSON: I don't think he intended that. Let it be filed for study and we will call it up in the morning and discuss it.

COM. STONE: That is all right. I would agree if that is understood.

THE CHAIRMAN: You heard the motion that the report of the Legal Advisory Committee be accepted and that it can be taken up at any time for further consideration. Any further discussion? (No response. Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

THE CHAIRMAN: Mr. Wehrli.

MR. WEHRLI: Mr. Chairman, we are of the opinion that some tentative decisions at least will have to be made as we go along and in that regard I agree with Judge Stone. I believe that it is understood that any decision that is made now is tentative and that before any compact is finally arrived at would be subject to change.

In order to make easier progress than we otherwise might, and having in mind the agenda that Colorado has presented and the matters that are included in the report of the Legal Advisory Committee, Wyoming has prepared a motion which is written and which we will present at some appropriate time tomorrow, and I would like to give copies of it to the Commissioners for their consideration along with this report.

The main purpose of it is to obviate, as far as we can, the difficulty that Mr. Breitenstein mentions of not having very specific instructions for this Legal Advisory Committee. We think this will be a start along that line. In this motion we have attempted to deal with matters that we think are not of the extremely controversial type, matters upon which we may be able to reach tentative agreements at this session.

I would like at this time to give each of the Commissioners a copy of the motion and also the Chairman for such consideration as they may want to give it and we will bring it up at some time tomorrow if it is believed that it will serve any purpose in expediting the proceedings of this Commission.

THE CHAIRMAN: Very well, Mr. Wehrli.

("Motion by L. C. Bishop, Commissioner for Wyoming," distributed.)

THE CHAIRMAN: Gentlemen, is there a motion for adjournment? It is now ten minutes to five. Or do you wish to continue?

COM. STONE: I move we adjourn to reconvene at 9:30 tomorrow morning.

MR. GILES: Before that motion is put, Judge Stone, I find it necessary to ask for leave of absence from the rest of this meeting.

MR. WALLACE: Mr. Chairman, let Mr. Clyde act in his place.

THE CHAIRMAN: Very well. That is Utah's prerogative. Gentlemen, you have heard Mr. Giles' statement that he must leave tomorrow morning and will not be present at the Commission meeting. I am sure we all regret his departure but we will submit to his wishes.

MR. GILES: Thank you, Mr. Chairman.

THE CHAIRMAN: Is there a second to Judge Stone's motion for adjournment?

COM. WATSON: Second the motion.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

THE CHAIRMAN: We are now adjourned.

(4:55 p.m., Wednesday, February 18, 1948, recess until 9:30 a.m., Thursday, February 19, 1948.)

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Denver, Colorado
February 19, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The Commission will please come to order. The Chairman observes that the Chairman of the Engineering Advisory Committee is present and on page 1 of the suggested agenda is a place for consideration of the report of the Engineering Advisory Committee. Mr. Riter, are you ready to render your report?

MR. RITER: Mr. Chairman, the Engineering Committee has no formal report to present at this time. I would like to report however, verbally, that the Engineering Committee are still active. We have held two meetings since the December 1st, 1947 meeting of the Compact Commission, and at these meetings we have discussed remaining engineering problems to be studied by the Engineering Committee.

We find that before we can make further progress on determination of streamflows originating from various states, it is necessary for us to determine the present depletions of streamflows at state lines and at Lee Ferry. You will

recall that this is one of the items we were unable to report on on December 1st, 1947 because there isn't unanimous agreement among the members of this Committee on what the present uses are in the Colorado River Basin. Progress is being made. Studies are being conducted to determine the present depletion

We have taken advantage of the action by the Commission at the last meeting volunteering to pay the expenses of Harry Blaney, who is with the Department of Agriculture and who has performed considerable work determining irrigation uses. He attended our meeting in Cheyenne during the month of January and then late in January and early in February we had a special meeting of a subcommittee in Mr. Blaney's office to further study the subject of present uses.

I don't know exactly when we will be prepared to report our conclusions or recommendations on this subject to the Commission. I feel in my own mind, however, in view of the important nature and the controversial nature of present stream uses, the Engineering Advisory Committee is not going to be satisfied until we ourselves make an inspection tour of the whole Colorado River Basin in company with Mr. Blaney. So I can't look for any conclusive determination of this problem before the end of June.

There are a few members of the Engineering Advisory Committee here, Mr. Merriell--I don't see John Bliss.

COM. WILSON: He left this morning.

MR. RITER: Mr. Baker. They may wish to supplement what I have to say.

THE CHAIRMAN: Before calling on these other men, Mr. Riter, is your Committee able at this time to furnish the Commission an estimate which might be considered 85 or 95 percent correct, of the yield of the tributary streams entering the Colorado from the various states either at the state line or at Lee Ferry?

MR. RITER: If the Commission desires me to, I think I could sit down and from the information we have in the progress report give you an estimate within the indicated percentage that you wish for. I do not know, however, that that estimate would be accepted by all members of the Engineering Advisory Committee.

THE CHAIRMAN: Thank you for the answer, Mr. Riter. I think you have answered my question. Now, Mr. Baker, do you have anything to add?

MR. BAKER: No, I have nothing of value to add.

THE CHAIRMAN: Mr. Merriell?

MR. MERRIELL: Mr. Chairman, I hesitate somewhat to say what I am about to say but I believe it is needed. The Engineering Committee embarked on the job of finding out what is the water resource of the Upper Colorado River. What I now say is not said in derogation of the Bureau of Reclamation but I will say that everything that the Engineering Committee has so far derived is not in the report of the Bureau of Reclamation. That report was properly, as itself says, not intended to operate as a solution of the problems of the division of water in the Upper Basin. There are still to be derived very large amounts of information which I feel are essential to the solution of this problem.

I should like to point out that we people in Western Colorado--and

I am speaking now primarily as a Western Colorado man--have never been under any illusions as to what is involved in a compact between the States of the Upper Basin or Division. It is water that arises in Colorado that is going to pay the bill. The people in New Mexico will agree with me I think that their desires for water exceed the yield of water from New Mexico. The plans for the State of Utah included in the Colorado River Basin report indicate that we can't look for a proportional delivery of water by the State of Utah at Lee Ferry. Our friends in Wyoming are in the same case we are in in Colorado. No matter what is done in Wyoming there will be water continue to flow out of that state for the purpose of making deliveries at Lee Ferry. But what the gentlemen of this Commission are doing is dividing up the water that comes from about twenty thousand square miles in Western Colorado.

Now speaking again as a person from Western Colorado, when we undertake in the final language of this compact to pay that bill for delivery of water at Lee Ferry, we want to be very sure what the bill is going to be. I think it is desirable to say this, although as I say, I say it with some hesitation. I think it is desirable to say this because Colorado has been accused of a desire to prolong this thing, to evade it and to avoid it. It isn't that at all, gentlemen. You are about to get up from the table and leave a check for us to pick up and we would like to know just as nearly as we can know about any future thing, just what the size of that check is going to be.

That is all I have to say, Mr. Chairman.

THE CHAIRMAN: Thank you, Mr. Merriell.

MR. WALLACE: Mr. Merriell, what additional information are you now seeking and in your opinion how much time will it require?

MR. MERRIELL: I hesitate to take over the functions of the Engineering Advisory Committee but my understanding, Mr. Wallace, is this: We have still to get through the services of Mr. Blaney a final figure upon which we can agree as to the present depletions.

MR. WALLACE: Does that mean an analysis of the consumptive use in the various sections of the entire Upper Basin?

MR. MERRIELL: That is well along, Mr. Wallace. That will not take too much longer. Then we have one other matter which enters into this thing and that is the determination of the channel losses which have occurred in the past and will occur in the future in the conveyance of the water from the various states, principally through Eastern Utah, to Lee Ferry. When we have determined those two things we shall be in a position I take it to say definitely what each state contributes not only at its state border but at Lee Ferry.

Then we have been under the necessity of considering the desires of states for future ultimate development, and that of course will involve the extension of the process we have already worked out for past uses to those future uses. And I can say--speaking again for Western Colorado--that our principal desire all through these years has been that the original Colorado River Compact be strictly carried out and that the deliveries at Lee Ferry should never become a matter of controversy with the Lower Basin.

Now then, if the Upper Basin is going to make a compact for the division of water among its states, the primary consideration in my mind is that that thing that we believed in all these years in Western Colorado should be as definitely determined and as definitely assured as it is possible for humans to do it.

MR. WALLACE: What is your opinion of the duty of the entire Upper Basin to deliver water at Lee Ferry?

MR. MERRIELL: With the information we have at present it appears, Mr. Wallace, that we should not be able to deliver that water consistently according to the terms of the original Colorado River Compact without the middle river reservoirs in Eastern Utah to produce regulation and long carryover.

MR. WALLACE: The point I am trying to get is this: Are you permitted under the compact to store water for purposes of equalization and limit your delivery to 75,000,000 acre feet over a period of ten years, or must you deliver there all of the water that is not under the 7,500,000 acre feet consumptive use limitation?

MR. MERRIELL: The only consideration that moves me in that matter at all is the requirement of the original Colorado River Compact that we shall deliver in consecutive ten-year periods 75,000,000 acre feet of water at Lee Ferry.

MR. WALLACE: Then you have a right to use everything in excess of that in the Upper Basin?

MR. MERRIELL: That is a question that I have never given any consideration to at all, what we had a right to use. Whatever is left we do have a right to use if we can substantiate the use above 7,500,000 acre feet.

MR. WALLACE: In other words you are claiming that you have a right to use a part of the surplus?

MR. MERRIELL: Certainly if we can substantiate that use and if there is any surplus.

THE CHAIRMAN: Are there any further remarks or questions in regard to the report of the Engineering Advisory Committee?

COM. WATSON: Mr. Riter, what were the results of your recent visit with Mr. Blaney in Los Angeles in regard to the question of determining the consumptive use of water?

MR. RITER: I think Mr. Roskelley from your state, Mr. Erickson from New Mexico, Mr. Patterson from Colorado, Mr. Dugan from the Bureau of Reclamation, were selected as a special subcommittee to meet with Harry Blaney at Los Angeles and to work out unit rates of depletion using a method devised by Mr. Blaney, based on tank experiments and information on various types of vegetation, unit rates of depletion. The committee met with Mr. Blaney, furnished him with all of the available information that we had compiled regarding types of crops grown in various portions of the Upper Basin, and climatic conditions. By climatic conditions I mean average monthly temperatures and information on percentage of possible sunlight, and information on length of growing season. The committee worked with Mr. Blaney and derived some tentative figures for unit rates of consumptive use for various portions of the Basin.

Now, after the committee returned we examined the data and we have some supplemental information. We have found some unpublished Weather Bureau data that were not available to us previously. We had a brief meeting of the available members of the Engineering Committee here in Denver yesterday morning and we decided we would resubmit the new climatic data to Harry Blaney and then ask him if there are any changes he wishes to recommend to us in the consumptive rates that he had tentatively derived.

Bearing in mind that the information Harry Blaney will furnish us

is consumptive use at various points within the Basin for various types of vegetation, then the Engineering Committee will have to apply that to the information we have on crops to arrive at the final answer on consumptive uses. Does that fully answer your question, Mr. Watson?

MR. WALLACE: Wherein does your study with Mr. Blaney differ from the study on the Lowry-Johnson method?

MR. RITER: The Lowry-Johnson formula is a different approach. We used some of the results that Mr. Blaney gave us on four of the field test areas used in deriving the Lowry-Johnson approach and we found a very close check. Three of the areas I think checked within one or two percent; one of them there was a difference of ten percent. I think that difference of ten percent can be rationalized in that we had an unusually high water table. The tank experiments by Blaney were average water table conditions. When we get the information from Blaney and coordinate it with the Lowry-Johnson approach, we will apply it and we will determine the consumptive use at the point of use.

Now I don't think there will be too much controversy on that item. The principal criticism of the studies made by the Bureau of Reclamation is that the Bureau failed to allow for salvage of water. The Bureau failed to deduct natural consumptive uses on certain areas of land before they were irrigated. I can cite you some examples.

Mr. Merriell in Colorado pointed to some areas along the Gunnison River which were naturally irrigated by Nature before man came; and after man came in and constructed a ditch on that land, the lands received a small amount of additional irrigation. In the studies made by the Bureau of Reclamation we took the total area under the ditch and applied a unit rate of use to it; we called that consumptive use.

The Bureau was criticized by the members of the Engineering Committee because in determining the depletion, caused by irrigation, the Bureau should have deducted the natural consumptive use that took place before the activities of man. Some of us call it salvage and some of us call it natural depletion which should have been subtracted from the total present use.

The net result is that it indicates we may be--I think I gave you a figure at the last meeting--as much as 30 percent too high on our estimate of present depletions.

Of course there are other factors, factors on the high side and factors on the low side. One example: When you irrigate a piece of land you also irrigate additional land besides the particular tract to which you apply water. You irrigate the barrow pits, you irrigate adjacent lands, drainage channels, etc. To allow for such uses the Bureau of Reclamation adopted rates of use high enough to make allowances for these so-called incidental uses.

Is that correct, Mr. Merriell? Do you care to supplement what I said on that particular point?

MR. MERRIELL: I think, Mr. Riter, you covered it except possibly to mention this: People who customarily work with the questions of the consumptive use of water or depletion are accustomed to thinking of a long growing season and a median altitude and conditions which are more or less uniform in the various areas considered. I should like to point out that one thing that has cost us time is the fact that in Colorado irrigation is practiced over a vertical interval of 4,000 feet and with growing seasons which extend from only a few weeks to 200 days; and that in Wyoming and in Utah, to a certain extent, the same condition exists. So that it is a case of tearing the area apart and

getting it into its component parts where conditions can be set up as they actually are.

MR. WALLACE: Mr. Merriell, is it your opinion that you have got to have a definition of consumptive use as the term occurs in the Compact in its relationship to the virgin conditions of the Basin, both land and water? In other words, there was a lot of irrigation going on in the Basin before the white-man came here.

MR. MERRIELL: Oh, yes.

MR. WALLACE: Have you got to establish that relationship before you are satisfied?

MR. MERRIELL: That is one of the things we are attempting to establish along with the general question of consumptive use.

COM. WATSON: Mr. Merriell, did some of that land referred to by Mr. Riter that was partially irrigated by Nature, when it had water applied to it, go out of production because of becoming sour and having too much water applied to it?

MR. MERRIELL: The pre-irrigated land in the Colorado River Basin--and I think this statement can safely be made not only for such land in Colorado but in Wyoming and Utah as well--the pre-irrigated land seldom sours. It is land which almost universally is at high altitudes and is now devoted to the raising of grass hay. And I am hopeful--and I would recommend to any of you so you may understand what is involved--but I am hopeful that when Mr. Blaney makes a trip here this spring I can take him into some of those areas when the melt of the snow is occurring. I think he will see quite clearly and quite quickly that the pre-irrigation is an actual fact.

MR. RITER: May I supplement the question, Mr. Chairman? If I understood Mr. Wallace's question correctly it may have some legal implications. We in the Engineering Advisory Committee are trying to stay with engineering matters and not trying to determine legal matters. I think it may be necessary to have a legal definition of beneficial consumptive use. The Engineering Committee is trying to determine the engineering facts with regard to streamflow depletion.

I observe that Mr. Roskelley has come in since I made my verbal report. I don't know whether he cares to make any comments.

MR. ROSKELLEY: From what I have heard I would say no, Mr. Riter.

THE CHAIRMAN: Mr. Riter, it seems evident to the Chairman that the work of your Committee is now handicapped by the resignation on account of ill health by Mr. Patterson, a very able, intelligent and painstaking engineer. It is the hope of the Chairman that Mr. Patterson will be able to resume his work with your Committee and with the Colorado River Board at an early date. But in the interim, what arrangements are being made to fill the gap caused by Mr. Patterson's resignation?

COM. STONE: Mr. Chairman, is that a question Mr. Riter should answer? Isn't that Colorado's problem?

THE CHAIRMAN: I don't know that it is entirely but it is certainly a question interesting to the Commission--it certainly is interesting to the Chairman.

COM. STONE: Colorado will say we are not going to delay any of the work of the Engineering Committee because of the resignation of Mr. Patterson. Mr. Patterson has resigned as Chief Engineer of the Colorado Water Conservation Board and has resigned as a member of this Committee, is leaving Colorado on the 28th of this month as I am informed, but Colorado is not helpless because of this situation. Mr. Patterson was a very able engineer and did a splendid job, not only on this Committee but on other matters. We regret his resignation. It is a situation which we must face but we don't propose to delay this work because of that unfortunate occurrence.

THE CHAIRMAN: In other words then, Judge, steps will be taken by Colorado to see that the absence of Mr. Patterson will not handicap the work of the Committee?

COM. STONE: I wish to remind you too, Mr. Chairman, that Colorado had three engineers on that Engineering Committee, Mr. Patterson, Mr. Tipton, and Mr. Merriell. Both Mr. Merriell and Mr. Tipton are still with us and expect to function. It is going to be difficult for our state to replace Charlie Patterson. A man like that is not easily replaced. But we are taking every step to secure a man to take his place.

In the meantime, Mr. Tipton and Mr. Merriell will carry on and I don't believe there will be any delay whatsoever because of that occurrence. We just lose the services of a very capable and well-informed engineer, that is true; but that can't be helped.

COM. WATSON: Mr. Chairman, may I ask if these studies that are being made by the Engineering Committee are necessary as prerequisites to writing a compact or could they go on contemporaneously with negotiating the compact.

COM. STONE: I will answer that "no" so far as Colorado is concerned.

COM. WATSON: What do you think, Mr. Riter?

MR. RITER: Well, I prefer not to answer the question. I feel this: The studies are absolutely necessary. Now after all I am only an engineer. I am not a lawyer. I do know that compacts have been negotiated with less engineering information than we now have before you. Whether those compacts are desirable compacts will have to be the responsibility of the Commission to decide. We are just an engineering advisory committee. We can advise you what studies you have to have. Certainly before a compact can be operated you will certainly want information on the water. The water is the thing you are dividing.

Now it may be that some smart lawyer can write some language without knowing what the facts are. I don't know. They did a pretty good job here yesterday writing some language without knowing anything about the nature of the compact. Maybe they can do the same thing without any engineering information. I really don't know.

MR. BREITENSTEIN: Mr. Riter, do you think the Engineering Committee or any member of it can furnish to the Legal Committee now a formula for measuring beneficial consumptive use of water?

MR. RITER: I don't think it is up to the engineers to do that.

MR. WALLACE: Mr. Chairman, off the record.

(Discussion off the record.)

COM. WATSON: Mr. Chairman, do these facts go merely to the administration of the water after a compact shall have been written or are they necessary to a division of the water and consequently a part of the compact?

MR. RITER: Now, Mr. Watson, let's get back and find out what these facts are that we are supposed to report on. What the Engineering Committee is attempting to ascertain is how much of the undepleted flow of the Colorado River originates in each of the five Upper Basin States. That is one of the facts we are attempting to ascertain. When we presented our report to you a year ago it was the opinion of the Commission that those facts were necessary for negotiation of a compact. I presume the Commission is still of that opinion.

One other important study we are making is to analyze the extent of channel losses. We are trying also to analyze the amount of reservoir capacity needed to equate the streamflow.

Now let's keep this fact in mind--I am sure that you have it well in mind--historically in a period from 1931 to 1940, the flow at Lee Ferry averaged about 10,000,000 acre feet per year. Over a longer period of time from 1914 to 1945, the average flow at Lee Ferry was in the neighborhood of 14,000,000 acre feet per year. Of course that is only part of the story.

The present uses are an unknown quantity precisely. For the purpose of illustration let us say they amount to 2,000,000 acre feet per year. That means then that over a long period of time the undepleted flow at Lee Ferry is approximately 16,000,000 acre feet annually. On a short period of time the undepleted flow is approximately 12,000,000 acre feet annually.

The Lower Basin has a bottom right--we might as well say a bottom right because that is exactly what it is--to 7,500,000 acre feet. The Mexican Treaty is an obligation that must be met. The Upper Basin has to meet part of that obligation. There isn't uniform opinion among engineers and lawyers as to how much the Upper Basin will have to release at Lee Ferry for the benefit of the Mexican Treaty. Opinions differ on that. It is my personal opinion that in a critical year of low runoff the Upper Basin is going to have to release at least half of a million and a half acre feet. Other engineers don't agree with me. There are other engineers who say that the Upper Basin will not have to release anything. But in any event if we are going to restrict the Upper Basin development by the flow that is available in a low ten-year period, there will be something less than 5,000,000 acre feet for use in the Upper Basin--probably 4,000,000 acre feet. That is only half of the water that is allocated to the Upper Basin on a long-term basis. On a long-term basis there is approximately 7,500,000 acre feet available. So it seems to me that we have got to make studies of reservoir operation to know and decide how much water can be actually applied to the land.

We do know this, that reservoir losses are going to be charged against the Basin. We do know it is physically possible to put in so many reservoirs that they might use up 1,000,000 acre feet of water just in reservoir losses. It may not be economical to do that. If we can put in another capacity of reservoirs that only evaporate 500,000 acre feet and still meet our obligation at Lee Ferry, then we can get that much more additional water to apply to the land.

Then of course, Mr. Watson, there is also the question of power development and the question of financing these projects. Power development is absolutely essential in my opinion to secure revenues to finance the irrigation developments.

Now these are problems that must be considered. Whether they are problems which should be deferred to the future or whether they are problems that should be looked into at this time, I say the Commission has to determine what should be done. We are engineers. Our primary job is to serve you, to bring to your attention all the facts we can assemble.

MR. ROLLINS: You say that up to date it has been impossible for the engineers to agree on these various items?

MR. RITER: No, we have partial agreement. We have a progress report. The information contained in the progress report was agreed upon.

MR. ROLLINS: I understood you to say you had recently been disillusioned because you couldn't get together on these things. The question I want to ask you is this: After you are through with your studies in your opinion how nearly 100 percent accurate will you be?

MR. RITER: We will be just as accurate as it is humanly possible to do it. There is one matter of principle involved, not only facts, but the principle of salvage of water, that we must resolve. Various states have criticized the Bureau for not allowing for salvage of water. At our last meeting in Cheyenne, Mr. Tipton, a very competent engineer who represents Colorado, who has done a lot of thinking on this matter and has made more studies on this matter than I have, presented some illustrations based on other streams which he studied. Those streams were the Rio Grande, the South Platte, and the Arkansas Rivers. Mr. Tipton demonstrated from those streams that the formula used by the Bureau of Reclamation of consumptive use times area irrigated is not the proper rate of depletion. He demonstrated from those streams that some of the depletion was met from salvage of natural losses.

The members of the Engineering Committee do not know to date how much water can be salvaged from the Colorado River. It is our intention, however, to give the matter further study and to try to arrive at a satisfactory answer.

As to the magnitude of the error, it now appears from the tentative studies we have that the Bureau of Reclamation estimates may be off as much as a half million acre feet. Now that is not a final figure but I will say that is just an indication of what we are running into. If the Commission feels we are wasting our time by trying to eliminate an error of half a million acre feet, all you have to do is tell us so and we will cease work.

COM. WATSON: Mr. Chairman, I think these studies are all very important. Many of them will pertain to the administration of the River after a compact has been written, but whether or not we are precluded from dividing the water until these studies shall have been made is another question. The writing of a compact will include the administration of the River, the dividing of the water, and other factors.

MR. RITER: Well, Mr. Watson, I would hesitate to pass judgment on your opinion. You are a Commissioner and if you are very strong in your opinion I would suggest you get the Commission together and present that matter to the Commission for discussion.

As I said before, compacts have been made with less information than we now have. That is a matter that I know can be proven because we have records of other compacts. Take for example the 1922 compact on the Colorado River. We did not even have a gaging station at Lee Ferry when that compact was negotiated. Now then, whether or not you want to repeat a compact on that basis is for you to say, not for me to tell you.

COM. WATSON: Mr. Riter, I am not intending to put you on the spot. I think the Commission is on the spot.

COM. BISHOP: Mr. Chairman, I am glad to see Mr. Watson finally come over to the stand that has been maintained by Wyoming all along. And I am going to repeat for the benefit of some of those that haven't been here before that it seems to me it doesn't make very much difference whether it is a half million more or less. We will divide the water on a percentage basis--we have agreed to that already--and if there is less and we have to take less, we will take our percentage.

I have great appreciation for the work the Engineering Committee has done and I think we ought to have them do that work and get all the information they can. I don't think it is anything we should hold the compact up for.

MR. BREITENSTEIN: Mr. Chairman, the Colorado Commissioner has gone out of the room but I think the statements of Mr. Watson and Mr. Bishop should be answered by Colorado. I should just like to say two things:

First, Colorado deems it necessary both to allocate the water, the beneficial consumptive use of water; and, second, to determine the obligation to maintain the flows at Lee Ferry. I feel confident in asserting that Colorado would not do one without the other. I would like to know if anybody has any suggestions to make now or tomorrow or the next day on two things: First, what sort of a formula or a method or whatever you want to call it, can be devised so that each state knows its obligations to maintain the Lee Ferry flows; and, second, how you are going to measure beneficial consumptive use.

It doesn't do any good to divide between these states the beneficial consumptive use of any amount of water unless and until you know how you are going to measure that beneficial consumptive use.

COM. WATSON: Mr. Chairman, certainly the obligations at Lee Ferry will not be determined by the amount of water that any state produces. In other words, the amount of water that that state should have in the division is certainly not based on the amount of water that it contributes to the river. There are other factors to be considered and the obligation at Lee Ferry will be determined by them.

MR. WALLACE: Of course I am not a lawyer--I am following the suggestion by Mr. Riter--I am not a lawyer but I can't see a bit of difficulty in the matter of delivery of water at Lee Ferry.

In the first place, Mr. Breitenstein, we need a watermaster. The 7,500,000 acre feet allocated to the Upper Basin States are in common ownership. The priority of use of that water attaches to every acre foot of water. As a result they are all on the same priority excepting those projects that were builded prior to the ratification of the compact. All of the other projects will be built having an equal priority. And it is up to the states if they want to change that priority within the state, they may do so; but so far as the watermaster is concerned, the delivery at Lee Ferry will be in proportion to the water they use in those projects that are built after the ratification of the compact--repeating again that those buil prior to the ratification of the compact have a priority that cannot be disturbed.

Now if there is any difficulty about that, all you have got to do-

well, there is no difficulty so far as I can see. I thought I was intelligent enough to understand it and the only problem about that is, Mr. Breitenstein, you have got to have a watermaster who will tell you in Colorado what your share is.

MR. BREITENSTEIN: Well, Mr. Wallace, if that is the only solution I am afraid that we are just wasting our time here talking about this because we in Colorado are not going to have a watermaster that is going to come up to our state and tell us what diversions to shut down. That is a state obligation.

MR. WALLACE: Your state will be told what your share of the water delivery at Lee Ferry is by the watermaster.

MR. BREITENSTEIN: We will not be told by the watermaster; we will be told by the compact that is entered into here.

MR. WALLACE: I will go a step further. If you are going to have the privilege of storing the water in the Upper Basin States, you have got to so insist upon the priority of irrigation and municipal use above power that you control by a watermaster the operation of every reservoir on the whole river from source to mouth.

COM. WATSON: Mr. Breitenstein, inasmuch as you asked for a formula to determine these things, wouldn't it be well for us to talk about the formula? Wouldn't it be well for us to have an agenda that would contain matters that are germane to the issue and are substantive and not be shadow-boxing on a lot of issues that are not germane?

MR. BREITENSTEIN: We are willing to consider any formula, any scheme, any device, which any state, the Federal Government, any engineer or any lawyer of any of the states or the Federal Government, has to suggest. We do not have sufficient facts in Colorado to submit such a formula ourselves. We will consider any one that anybody else suggests.

We are not willing to proceed on the basis of allocating so much beneficial consumptive use of water for two reasons: First, that does not define our obligations at Lee Ferry; and, second, that furnishes no method whatsoever of measuring beneficial consumptive use, and if you cannot measure something, what good does it do you to divide it?

COM. WATSON: I take it then that Colorado is not able or willing at the present time to say how much water she thinks she is entitled to in the Upper Basin?

MR. BREITENSTEIN: Oh, I am not going to go that far, Mr. Watson. But I am going to say that any figure which we might give would be utterly valueless unless you have some method of measuring it.

MR. RITER: Mr. Chairman, may I be permitted to indulge a legal question?

THE CHAIRMAN: At your own risk.

MR. RITER: Mr. Breitenstein, I fully understand the implication you made to Mr. Watson when you say if you can't measure beneficial consumptive use, you can't divide it. Of course I am ignorant on legal matters but it seemed kind of funny to me that we already have a compact for beneficial consumptive use, the measure of use between the Upper Basin and Lower Basin despite the fact that you and I personally do not know the formula for measuring it.

MR. BREITENSTEIN: One of the weaknesses of your Colorado River Compact is that there is no method of measurement. There is no standard set up. That is one of the weaknesses. Why should we make another compact with the same weakness. You say you give us the beneficial consumptive use of any amount of water, say 1,000,000 acre feet; what good does that do us unless we know how you are going to measure that million acre feet?

MR. RITER: May I call your attention to this fact: That was apparently good enough in 1922 to permit some of our competitiors to go ahead and use that water.

MR. BREITENSTEIN: They are down at the bottom of the stream where they get everything the law of gravitation takes down to them.

MR. RITER: Of course maybe I don't fully appreciate the implication there. I will admit that I can't measure it; I don't know what it means. I have my own personal opinion of it. There are lawyers who tell me I am wrong. Now is it necessary to know that precisely before you try to make another compact? That is the only question I am asking you.

MR. WALLACE: These gentlemen have just advised you they have the Lowry-Johnson report. They have worked over that formula and in many instances it doesn't differ more than one percent and the maximum it differs is 10 percent. When they coordinate the studies of the Lowry-Johnson report together with the studies they are now making and give you a report that the consumptive use is so and so, are you prepared to accept it?

MR. BREITENSTEIN: I can't answer that question, Mr. Wallace.

MR. WALLACE: You are making a very strong plea you don't know what consumptive use is and here you have a proposition where these gentlemen are going to present it to you in a little while.

MR. BREITENSTEIN: I didn't say I didn't know what consumptive use was; I said I didn't know how to measure beneficial consumptive use.

MR. WALLACE: I assume that you include in that difficulty the question of salvage?

MR. BREITENSTEIN: Well, I include a number of things.

MR. WALLACE: Repeat them for us so we may understand them.

MR. BREITENSTEIN: Studies of beneficial consumptive use have been made many times. Maybe you know of a definition of beneficial consumptive use. I don't right now. And if I knew of a definition of beneficial consumptive use I wouldn't as a lawyer know how to prepare a definition which I would expect an engineer to go out in the field and put to practical application. Maybe somebody else does. And I say we are willing to consider any suggestions any of you have to make along that line. The mere inability of Colorado to do that should not prevent the rest of you from coming up with whatever ideas you have.

We are not measuring consumptive use; we are measuring beneficial consumptive use. That brings in another term. And how are we going to measure it?

MR. WALLACE: What I am trying to learn are the factors that are necessary on which to base that conclusion. Now we have the Lowry-Johnson report. We have the study of the engineers. You have a study going on as

to salvage. Now what else do you want?

MR. BREITENSTEIN: Well, I want some concrete recommendation. We are talking about generalities here. We are engaging in the most glittering generalities there ever were. Let's get done with sparring. If somebody has something to suggest in black and white let's bring it out and see it.

MR. WALLACE: What I am trying to find out is what you want to know before we can base this conclusion.

MR. BREITENSTEIN: I would like to know two things: First, a definition of beneficial consumptive use; and, second, a method of measuring it.

COM. WATSON: Mr. Breitenstein, if you divide the water on a percentage basis, which has been passed upon by this Commission, would not the variable be not in the percentage but in the amount; and therefore if the amount were small or large it wouldn't make any difference if the percentage were the same.

MR. BREITENSTEIN: It doesn't mean anything because you don't know against what your percentage applies.

MR. WEHRLI: Mr. Chairman, may I ask a question? You have a definition of beneficial consumptive use in the Republican River Compact.

MR. BREITENSTEIN: That is consumptive use as I recall. I am not sure.

MR. WEHRLI: I believe it says beneficial consumptive use. I want to be clear in making reference to that I do not believe that definition would be adequate for the purposes of this compact------ because of a different factor in our determination here relating to transmountain diversions, which was not involved in the Republican River Compact.

COM. STONE: I think Mr. Wehrli's remarks are apropos. It demonstrates the difficulties. Mr. Chairman, I was out when this discussion was going on.

Somebody yesterday joked about my using the word "realistic"; I am going to use it again. I think we have got to get out of the realm of speculation and look at the situation realistically.

I want to announce here and now that it is Colorado's fervent hope and expectation that we shall arrive at a compact for submission at the next session of the legislatures in January. We have a very deep appreciation in this State because of the topographical condition of the State, because of the large amount of water supplies which arise in this State, because of obligations which may be placed on this State for deliveries at Lee Ferry, that we must negotiate a compact which we can recommend to our leglislature and have a reasonable chance of having it ratified. When we make a compact we expect to do everything possible to get it ratified by the legislature. A compact which we make cutting the pattern for future generations must be one which we can support, not on the basis of a lot of wild guesses or speculation over formulas, but one which we can support on the basis of the facts.

Let us assume you could drive Colorado into a position of taking hasty action. That doesn't mean you have got a compact. We have sincerely approached this matter on the basis, not of obtaining all of the engineering refinements that engineers might quarrel about for the next fifty years, but on the basis of getting certain salient facts which we believe are necessary for making a compact which we have a reasonable chance of getting ratified.

We have always proceeded on the basis that there were two elements involved here: one, the determination of the respective obligations of the states to make deliveries at Lee Ferry; and, second, the apportionment of water. And unless I change my ideas through the engineering studies or the expression of wisdom on the part of you gentlemen, I think that it is reasonable that a state in the position of Colorado should not agree upon apportionment without a concurrent agreement upon a determination of respective obligations. Those things run concurrently.

This Commission has appointed by unanimous consent an Engineering Advisory Committee. I sincerely believe that that Engineering Committee is doing a good job. I anticipate that there will be a report here in ample time for us to approach with intelligence and with the facts in mind, a consideration of the apportionment of the water and the determination of the deliveries at Lee Ferry, and do that well in advance of the next sessions of the legislatures.

In the meantime, it has been our hope that we would consider other matters which must be considered and agreed upon and made a part of any compact, and we have been proceeding as diligently as we could to present to you gentlemen some of those factors which we believe should be considered. I thought we were making progress last time and if we would get at it, I think we could make progress this time. We can be doing that and get that behind us so there will be no delay on the meat and cocoanut of the compact when this Engineering Committee reports, we hope, sometime this spring or early summer.

COM. WATSON: Judge Stone, wouldn't it be well to have a group, appointed by this Commission, studying some of these fundamental factors that will be the basis of making a compact?

In other words, we are studying certain factors here but we have persistently evaded the main things that will determine the apportionment of the water. Wouldn't it be well for us to have a committee from the Commission that should make these studies concurrently and be able to come to a conclusion at an early date rather than wait for the Engineering Committee to make its report?

MR. WALLACE: I will say this much, Judge, we are now wandering all over the place. We have one subject we are discussing now; that is beneficial consumptive use. If we will stick to one thing at a time we will make progress. We compliment all the things you have done. You have done the greatest job in the world, we appreciate that. But the subject before us at this moment is beneficial consumptive use and what I would like to ask Colorado for is--you are the experienced people in this business, you have made many compacts. We have made none except we agreed to the Colorado River Compact. We have Judge Howell with us and I don't believe he has ever worked on a compact in his life, but he is certainly a very capable man. But we can't understand why with all of your experience you are not willing to say just exactly what you want, what the facts are you want to know before you will agree on the definition of beneficial consumptive use. I confess I am puzzled.

Let me get out of Mr. Breitenstein why he can't tell us what he wants to know before we can agree on a definition of beneficial consumptive use and apply that definition.

COM. STONE: Thank you, Mr. Wallace, and I will answer Mr. Watson's question and I want to reciprocate your statement about Judge Howell. We certainly think you have got a very able man advising you on the legal side

together with Mr. Clyde.

Mr. Watson, we assumed that we were doing just what you suggest in this agenda which we have submitted to you here. We believed we were submitting some of those fundamental questions. I think as we go through them you will finally agree that we have submitted some of those fundamental questions which we can be working on while the engineers are completing their studies.

Now Mr. Wallace brings up the question of a suggestion about this factor of beneficial consumptive use or what is the definition of it. I should like to reiterate what Mr. Breitenstein has said that it is not limited to a mere definition of beneficial consumptive use. A very important factor is the measure of that beneficial consumptive use and that is in my judgment--for what it is worth--a factor which must be determined before we make a compact.

Now Mr. Blaney has been brought in and a very able subcommittee has been established to study and make recommendations from an engineering viewpoint on what should be the basis of this Commission's consideration in determining and agreeing upon the measure of beneficial consumptive use. My point was--and this is partly in answer to Mr. Wallace--that if we do have a committee made up of as competent men as there is in the western half of the United States or anywhere, attempting to arrive at engineering factors upon which we can determine that, is it not wise before anyone attempts to deal with generalities on the subject for us to have the benefit of that? And in the meantime there are other important factors which as you suggest we should be working on and that was our program--I mean--that was our suggested program. That is mere suggestion from one state.

Mr. Wallace, that may not be a full answer but Mr. Wehrli brought out something here which I think demonstrates the situation. He points out a thing which I have always thought, that the definition in the Republican River Compact would not be applicable to the Colorado River because of its situation and because of the potential developments on that River, uses within the Basin and uses without the Basin. Now the difference between two rivers is a factual matter, and it is the factual matter which this committee is studying. It seems to me that we can--and I want to say for Colorado we will meet just as often and as long every time as you want to--and I think we can put in our time in studying this basic material which has been submitted to the Commission. By that time the Engineering Committee can come out.

MR. BREITENSTEIN: Judge, Mr. Wallace made reference to some of the things I have said and I hate to use up any time of the Commission in making a speech but if you would like to have a lawyer talk for a few minutes on engineering matters I will be glad to tell Mr. Wallace what bothers me.

MR. WALLACE: All I am trying to find out is what are the factors to be considered in the definition of the words, beneficial consumptive use; and when that definition is agreed upon, some explanation of the application thereof. Now if that has been referred to this Committee and we are going to wait for this Committee and you are going to wait for the report of this Committee, I personally don't see anything else to do.

MR. BREITENSTEIN: It seems to me there is a lack of understanding of a problem around here. There is either a lack of understanding or we are completely off base in Colorado, one or the other. You have said, Mr. Wallace, that we in Colorado have had perhaps more experience in making compacts--and also in interstate litigation--than the other states. Unfortunately that is true. I am not so concerned with a definition of beneficial consumptive use as I am concerned with the method of measuring beneficial consumptive use. The Colorado River Compact does not divide water; it divides the beneficial

consumptive use of water.

Now when you get into a dispute like this, what are the methods which have been used for measuring it? At times the method employed has been headgate measurements. The Laramie River decision of the United States Supreme Court is an example of that and I think we all know enough of that decision and of the facts there to agree--and I think even Wyoming will agree--that measuring on the basis of headgate diversions is utterly unfair.

Another method which has been employed is to determine beneficial consumptive use by the extent of irrigated acreage. That just does not work and the thing that Mr. Riter referred to when he told of Mr. Tipton's explanation, is the best example of that.

Along the Arkansas River we have had a lot of litigation with Kansas. Kansas claimed in a suit brought in 1928 that Colorado was injuring her because the irrigated acreage had increased almost double since the decree of the Supreme Court in 1907, and we were able to establish by engineering testimony, which was accepted without qualifications by the United States Supreme Court, that that increase in irrigated acreage had not resulted in any increase in consumptive use of water. We showed that the usable state-line flows had increased in the thirty years that had elapsed. So acreage is not a measure.

If there is any doubt on that Mr. Wehrli's experience on the North Platte should be indicative. There the engineers testified without contradiction that when an area is opened up to irrigation, considerable amounts of water are used to fill up the ground water table, and when your water table comes in balance, then the return flows from the project increase and more water is available downstream. We here in Colorado have had the same experience on the South Platte.

Now, with those factors, things that we know about that cannot be denied, what method--and I say it is an engineering rather than a legal question, Randy, with all due regard--what engineering formula are we going to devise to measure this beneficial consumptive use?

And I say you cannot charge Colorado with any neglect or any dilatoriness in that matter. I venture to say that long before any of the other states thought of this we in Colorado requested our engineering advisers to try to work out some formula for doing this. I know myself I talked to engineers about it in the summer of 1945 when this thing first came up, and I have had numerous schemes advanced to me as to the system which might be followed. I didn't see why we couldn't write them out in language and use them. But unfortunately in each instance when the engineers made further investigations they found that each scheme, each plan, whatever you want to call it, was unworkable and thus far no engineer has come to either Judge Stone or me with a workable method of measuring beneficial consumptive use of water.

Now we are not all-wise; we are just working boys like the rest of you. And if anybody, anybody at all, has a plan for doing this, we are most ready, willing and able to consider it.

THE CHAIRMAN: The Chair recognizes Mr. Wehrli.

MR. WEHRLI: Wyoming will offer to give you a definition of beneficial consumptive use and we will do that this afternoon in writing.

Now that will not be a formula for dividing the water between

these states but it will represent at least our conception of how beneficial consumptive use ought to be defined as it relates to the use to be allocated to each of the states, not as it relates to the amount of beneficial consumptive use that may be available to the Upper Basin States under the terms of the Colorado River Compact. The two are not the same. But if it will make anyone happy or accomplish any good purpose, I have worked on that problem a little bit and I will be glad to present it in writing this afternoon.

I recognize what Mr. Breitenstein so clearly brings out about the difficulty of making an allocation of water. You at first think that perhaps an amount of diversions in acre feet would be the better plan. I am inclined to agree with Mr. Breitenstein that that has its very serious objections.

In the North Platte case to which Mr. Breitenstein has referred some allocation was made upon the basis of acreage irrigated. I doubt if that could be applied in making a compact here as it was in the North Platte case because here we have some rather complicating factors which we didn't have in the particular areas there where that sort of formula was used.

I observe that in the Republican River Compact, with which I am not familiar except having read it, and of course it is Colorado's compact, a division was made on the basis of beneficial consumptive use.

We do have confronting us in this case the fact that in the Colorado River Compact the term, beneficial consumptive use, is employed. It seems to me that the greatest difficulty that will arise if you base a division of water upon percentage and beneficial consumptive use--and if I read the record of the proceedings of the last meeting of this Commission correctly, which I did not attend of course, there was a motion to that effect--the greatest difficulty you are going to be confronted with is finding out every year how much each state used under a definition of that kind. Obviously it is easier each year to measure the amount of headgate diversions in a particular state. It is likewise easier to measure the amount of acreage irrigated, and of course some other diversions, let us say, for power and the amount of reservoir losses, and so forth.

But when you come to a determination under whatever definition you employ--let's assume we get the best definition we can--when you come to a determination each year, as you may have to ultimately under the administration of a compact, of the amount of water that the state has beneficially consumptively used, I think it is a very difficult problem. That in my mind does not preclude the making of such an allocation because that may be--and I am inclined to think it is--the best method that can be employed.

So much for that. As I say, we will be glad to present something for the consideration of the other states on a definition of beneficial consumptive use as it relates only to the use that may be made in the respective states and with the assumption that the compact ultimately will apportion the water in terms of beneficial consumptive use. Of course if it doesn't then the definition is unimportant.

COM. STONE: Mr. Wehrli, may I ask you a question at that point?

MR. WEHRLI: Yes, sir.

COM. STONE: As I understand that merely goes to the definition of beneficial consumptive use and you don't propose at this time--of course you have a right to do it and if you have a formula we certainly would like to have it--but I assume that doesn't go to the measurement of the beneficial consumptive use, merely the definition of it.

MR. WEHRLI: Well, when we get through defining it we might find a way to measure it. As long as we don't know what it is I don't know that we can.

By "formula" do you mean some percentage allocation between the states?

COM. STONE: No, where and how the beneficial consumptive use is to be measured, whether by depletions or by beneficial consumptive use at the point of use.

MR. WEHRLI: My definition will have some bearing upon that question, Judge Stone, and might answer your question. I am not sure as to that.

We came here this morning rather with the assumption that we were going to pick up where we left off yesterday in consideration of the Legal Advisory Committee report, and of course we had the engineering report, which I think was entirely appropriate. We did not expect to have before us at this time this question of beneficial consumptive use although it is on the agenda. We would suggest that orderly procedure at this time would be to return to the consideration of the Legal Advisory Committee's report and take up this other subject of beneficial consumptive use at whatever time someone desires to take it up.

THE CHAIRMAN: We will convene at two o'clock.

(2:00 p.m. Meeting resumed.)

THE CHAIRMAN: The Commission will please come to order.

MR. WALLACE: Mr. Breitenstein, what is the difference between facts and factors?

MR. BREITENSTEIN: Well, you want me to get into a discussion now of the differences between findings of facts and conclusions of law? You have got the same thing there. I take it a fact is a fact. A factor is something in which an element of judgment is involved. It isn't the ultimate fact.

MR. WALLACE: I have been trying to get you to name the factor concerning which we seem to be puzzled.

MR. BREITENSTEIN: I don't know what you are all trying to get out of me because I do not have the ability to devise this formula. I will say that flatly. I haven't the training or the experience to do it.

But now just start up at the headwaters of the stream, if we are going to continue the discussion, you have got the Green River in Wyoming into which flow some tributaries from Utah. On those tributaries is Utah going to be required to deliver any water to the Wyoming Line and if so, how much and how is that amount of water to be measured? The Green River then flows down into Utah, back into Colorado, and then out into Utah. Now simplifying it to some extent, when it gets down to the Colorado-Utah Line, are Wyoming and Colorado because the Yampa River comes in ahead of that going to be required to maintain any flows at that point and if so how much and how are they to be determined?

Next downstream is the White River rising in Colorado. Is Colorado going to be required to deliver any specific amount of water at the

Utah Line, and if so, how much and how is it to be determined? And the same, going on downstream, is true for the main stem of the Colorado River, the Dolores, the San Juan and all of its tributaries.

I do not see how we can enter into a fair compact unless all those situations are considered.

Judge Stone suggests that I have left out one thing in my attempt to simplify it, and that is that we must consider the losses in Utah in transporting the water from the Colorado Boundary down to Lee Ferry. I believe that you in Utah will agree that it would not be fair to charge Utah with all those losses. If you are willing to assume them, why, just tell us so and we will deal on that basis, but it does not seem to me that Utah in fairness should be charged with those.

When the water gets to the Utah Line it flows for a considerable distance before it passes into Arizona. Going down those hundreds of miles, water is lost through evaporation, bank storage, and all those things. How are those losses to be charged? Does Colorado's obligation end when it delivers the water at the Utah Line? Are we to have no concern over those transportation losses or over the evaporation losses in the main stem reservoirs? Is Utah going to bear the entire burden of those? From the standpoint of fairness it seems to me that Colorado and Wyoming should bear part of that because the mere fact that we deliver the water to the Utah Line doesn't mean it gets down to Lee Ferry.

Frankly, rather than overstating the problem I have understated it. I have been guilty of oversimplification. It seems to me that the physical facts should be so apparent to all of you that you should recognize that we are not here concerned merely with cutting the pie.

COM. WATSON: Mr. Breitenstein, am I correct in saying that the Engineering Advisory Committee have been properly authorized by this Commission to make these studies in our assignment to them?

MR. BREITENSTEIN: I am not going to answer that one, no, sir. I am not on the Commission and I am not on the Engineering Advisory Committee and I am not going to construe your authorization to them.

COM. STONE: I didn't get that question.

COM. WATSON: Am I correct in assuming that the Engineering Advisory Committee has been properly authorized by this Commission to make these studies and report back?

COM. STONE: I think all we have to do is look back at the minutes of this Commission to ascertain what they have been authorized to do.

COM. WATSON: As I remember it, Judge Stone, the Engineering Advisory Committee was given a very limited assignment that would not involve many of the problems that will come up in this matter that are fundamental in negotiating a compact. And one of the objections that some of us have had is that the assignment for study of these various fundamental problems was not extensive enough.

COM. STONE: Mr. Watson, the only comment I would have to make on that--and I think it is in line with the constructive procedure you have in mind--is that if the assignment to the Engineering Advisory Committee is not broad enough and any state feels it should be broadened it would be perfectly proper for that state to suggest such broadening of the assignment. It has

been our thought in Colorado that the broadening of such an assignment may become necessary as we proceed but that the Engineering Committee had a sufficient assignment at the moment. But we would not resist the wishes of any state that desired to suggest a broadening of the assignment at this or any other time.

MR. CLYDE: Mr. Chairman, it seems to me in listening to the discussion that there is a certain amount of buck-passing going around between the Commission, the Legal Advisory Committee and the Engineering Advisory Committee. Utah has indicated that it feels that the data now available is sufficient to permit a division of water on a percentage basis. If I correctly interpret Colorado, they indicate that they don't think so, that they have to have some more engineering facts.

I haven't clear in my mind what additional engineering facts they have got to have and whether or not the Engineering Committee understands what additional engineering facts they have got to get. If somebody could specifically state what is lacking and what is yet needed so that we can get to that subject, then the Engineering Committee could be told to get them, those specific things, and could concentrate on getting them. Then as soon as they are here we would be in a position to turn to the discussion of the particular thing that Utah has been urging that we turn the discussion to, that is, to-wit, the division of the water.

I don't think it has been stated what additional engineering facts are necessary so the Engineering Committee can get them for us, and in talking to individual Committee members I am convinced that they don't know exactly what it is the Commission wants them to get.

COM. STONE: Mr. Clyde, were you through?

MR. CLYDE: Yes.

COM. STONE: There is one thing that worries me a lot and your statement just made indicates or points up that matter. You refer in your statement to necessary information regarding the division of the water---as Mr. Breitenstein put it a few moments ago, the division of the pie. None of you seem to be concerned and apparently never mention that engineering facts are probably needed more to determine the respective obligations to deliver water under the Colorado River Compact than for the apportionment of the water granted to the Upper Basin under the Colorado River Compact.

It was, I think, quite pointedly stated here by Mr. Merriell this morning that because of Colorado's position, our topographic position as a state, we will be compelled to assume, probably justly so, a large measure of obligation. Colorado does not propose to end up these compact negotiations and have the obligations of the Colorado River Compact to deliver water placed solely on her shoulders and have only such water for use in our state as remains after that obligation is met by Colorado for all the other states. That is a joint obligation. That is not an obligation of one state.

We can never forget that we have two jobs to do here: one, to determine the respective obligations to deliver water at Lee Ferry; and, secondly, to apportion the water allotted to the Upper Basin for Upper beneficial consumptive use. And we cannot confine this discussion with respect to engineering facts to the mere matter of securing the necessary data to apportion the water.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	**U-2_pgs 61-134**	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

MR. CLYDE: I appreciate, Judge Stone, the position of Colorado and speaking personally I think the position is reasonable that Colorado should desire to tie in the division of the water with the division of the obligation at Lee Ferry. If I were representing the State of Colorado I would insist that those two things be decided and discussed together.

I wasn't attempting to give a solution to the problem, I was attempting to state it as it appears to me. We had it in the Legal Committee when we were attempting to function. In talking to some individual members of the Engineering Committee I think I see the same problem. I am willing to take it for granted that Colorado on the present basis of existing facts is not willing to discuss either of those two questions. We are confronted then with a theory. We are confronted with a situation where you feel that the protection of your state requires more inquiry and more facts than you have at your disposal this morning.

COM. STONE: That is a very fair statement, Mr. Clyde.

MR. CLYDE: Now, that being so, it would seem to me taking that as the position with which we are confronted, can we not clarify for the Legal Committee and the Engineering Committee and others who might be working on this, the line or the lines along which you feel further inquiry is necessary so that the further study by the peoples working on it can be concentrated to the end of getting for you the data which you feel is yet necessary for you to have.

Maybe the Engineering Committee sees clearly where it is supposed to go and what the Commission wants, but I have gathered from the comments of those who have spoken that they don't clearly understand what the Commission yet wants so we can get to a discussion of that. And I think our work would be greatly facilitated if that could be spelled out better for those who are working on it.

MR. RITER: Mr. Chairman, the Engineering Committee has a specific task to do. Briefly the assignment given us consists of the following elements:

1. Preparation of base maps for use by the Commission in its deliberations. We have completed that assignment. We have made available to each state, maps prepared by the Bureau of Reclamation--

THE CHAIRMAN: Mr. Riter, pardon me. I would suggest that you are repeating what you have told this Commission three or four times before. Let's get more to the point on this thing.

MR. RITER: I am trying to be helpful by trying to reiterate briefly the assignment the Engineering Committee has and with that assignment in front of it, the Commission can decide if they want to give us more assignment.

THE CHAIRMAN: Very well.

MR. RITER: Item No. 2 is determine the water supply available from each state. That assignment has not been completed. It is partially complete but it is not completed.

Item No. 3 concerns studies of river and reservoir operations to determine the extent to which the Upper Basin can make use of its allocated water supply during drought cycles and still meet its compact obligations at Lee Ferry. That assignment has not been completed.

Those three items constitute our present assignment.

COM. WATSON: Mr. Chairman.

THE CHAIRMAN: The Chair recognizes Mr. Watson.

COM. WATSON: In defense of Mr. Riter I wish to say that his statement was very definite. I was present at that Engineering Advisory Committee meeting in Cheyenne, September 1946, and that Committee was definitely assigned the work Mr. Riter and his Committee performed.

Now, as far as I can remember there has been no other definite assignment by this Commission to that Engineering Advisory Committee. Therefore, I think it is the duty of this Commission to state definitely and emphatically what other factors the Commission should take up for study.

The objection that some of us have had to the procedure is that many of these problems that should be considered contemporaneously with the study that the Engineering Committee has made.

I therefore think that this Commission should make assignments to Mr. Riter's Committee. I think he has done a fine job. I don't think he is in any way subject to criticism from this Commission.

COM. STONE: I don't imply criticism. I am speaking plainly. But, Mr. Watson, you have those ideas and they are no doubt appropriate, and there are certain matters which you say are worrying you; can you put down and submit under the a, b, c, the further assignments which should be given to this Committee? If you can, Colorado is not going to stand in the way of any reasonable assignment.

COM. WATSON: Judge Stone, I would be glad to do that and will give it to this Commission tomorrow morning.

MR. CLYDE: The discussion that has just ensued since my last remarks demonstrates to me that perhaps each is waiting for someone else to go forward. The Engineering Committee is waiting for a further assignment from the Commission. It is proceeding with all its energies to study the things assigned to it but it hasn't gone into some of the things that Colorado has indicated she feels are indispensable to reaching a discussion of this. The Legal Committee had the same problem.

I haven't sufficient information and knowledge and experience in these things so that I can say what we now need and haven't got so I can tell anybody how to do it. But I certainly feel that it might be very helpful if the group could get together informally, the engineers, the lawyers, and the Commission, and discuss what they haven't got yet that they need so that each can then start upon an enterprise of getting it. Maybe we can't set it down definitely but it would seem to me we could do it more definitely than we have given anybody the word yet on it.

MR. RITER: Mr. Chairman, Mr. Watson is correct. He and Mr. Bishop were both present when the engineers discussed our assignment. There was a great deal of controversy over one item, namely, potential uses. Some of us on the Engineering Committee felt that that was the most important single factor to be used as the basis for negotiating a compact. After discussing the matter pro and con we felt it was entirely beyond the capacity of the Engineering Committee to determine potential uses.

The Bureau of Reclamation spent close to a million and a half dollars preparing the report that discusses project potentialities. The Engineering Committee recognizes the potentialities are a very important

factor. It is so stated in our report. But we did not recommend that we be given the job of studying the project potentialities. We felt that was a job that should be reserved for the Commissioner of each state. The Engineering Committee stands ready to serve in any way the Commission sees fit that we can help serve to advance this cause.

COM. WATSON: Mr. Chairman, at that meeting these various factors explained by Mr. Riter were approved by the Engineering Advisory Committee. The representative from Colorado, for whom I have a very great deal of respect, stated that he would not be able under his commission as agent to go any further than the assignment described by Mr. Riter. For that reason nothing else was done.

COM. STONE: Who was that made that statement?

COM. WATSON: Mr. Patterson.

MR. RITER: This report was signed by the representative of each state: Riter, Baker, Patterson, Bliss, Cottrell, and Person.

COM. STONE: I would suggest that as a help on this situation, in addition to Mr. Watson attempting to set down some matters which he thinks should be further studies by the Engineering Committee, it might be helpful if Mr. Riter would aid in that and make a suggestion as to further assignments that should be given to them.

COM. WATSON: I suggest also, Mr. Chairman, that Colorado do the same thing, along with each of the other states.

THE CHAIRMAN: Well, gentlemen, it seems to your Chairman that we have had rather an exhaustive discussion of the report of the Engineering Advisory Committee, and the Chair is a little bit hopeful that we may proceed. However, if the discussion has not been completed, I don't want to appear arbitrary about the matter, but these matters are all inter-related and unless you have an objection and further discussion, we might take up again, if any of the Commission members so desire, a further consideration of the report of the Legal Advisory Committee, particularly since mimeographed copies of the report of the Legal Advisory Committee were furnished all members last evening, together with the letters which your Chairman received from the Federal agencies.

Does anyone have anything further to suggest in regard to a more detailed consideration of the report of the Legal Advisory Committee?

MR. HOWELL: At the expense of being criticized for prolonging this matter it appears to me that this is the situation now that confronts us. The Governor of Colorado last night in a very good speech as I thought, said that he hoped certainly that we would be able to present this compact to the next meeting of the legislature. I don't know when your legislature meets but I know ours meets in January.

Now it is indicated so far that until June, at least, we can't expect a final report from the engineers' assignment as they construe it at the present moment. It is indicated that there are other matters which will also be necessary to refer to them. Judge Stone says that probably that can't be done until the next meeting, which it certainly wouldn't be any use to have before June as I figure it when the final report upon what has been assigned to the Engineering Committee is ready. If at that time and waiting until that time you make these other suggestions, being now only seven months away at least from our legislature, you will then be still nearer to it and you diminish the

possibility of presenting this matter to the next legislature, at least as far as our state is concerned.

So it seems to me--and of course I am not a member of this Commission, I am merely making the suggestion--that it would be a good idea if a motion were made that each state designate a representative to meet with Mr. Riter and determine as far as they are able at this time at least, the matters which should be referred to this Engineering Committee and have a report.

COM. WATSON: Mr. Chairman, I so move.

COM. STONE: Wait a minute. You so move what?

COM. WATSON: I move that this Commission appoint one member from each state to meet with Mr. Riter to discuss any additional factors that should be considered now in order to acquire data that will lead to the making of a compact.

THE CHAIRMAN: The Chairman is not clear as to when these appointees are to meet with Mr. Riter.

MR. HOWELL: Right now.

THE CHAIRMAN: Very well.

COM. BISHOP: Second the motion.

THE CHAIRMAN: You have heard the motion and the second. Now, Judge Stone, it is up for discussion. The Chair recognizes Judge Stone.

COM. STONE: I am not prepared to discuss that motion now. I wish to clarify a statement made by Mr. Howell.

THE CHAIRMAN: Let's dispose of the motion and then you can clarify the statement.

COM. STONE: We will be compelled to vote "no" on the motion--

THE CHAIRMAN: That is certain.

COM. WATSON: Question.

COM. STONE: --if we are not permitted to clarify that statement, and we dislike doing that because we do have some belief that the motion is well taken. But if this is arbitrary and we are not permitted to keep this record straight on the part of a state that is compacting here, we must take a position of that kind.

MR. HOWELL: I ask as a matter of personal privilege, Mr. Chairman, that Judge Stone, if I have made any statement that he thinks misrepresents him, be permitted to state what it is.

THE CHAIRMAN: Very well. We will now hear from Judge Stone on the matter of clarifying the motion.

COM. STONE: Not to clarify the motion, no.

THE CHAIRMAN: Very well, anything you want to say. Let's have a little harmony.

COM. STONE: The statement was made that Colorado suggested that this whole matter be deferred to June, Mr. Howell.

MR. HOWELL: No, no.

COM. STONE: I wanted you to know that I said perhaps we could do this better at the next meeting. I hope we are not going to wait until June to have another meeting. I also wish to say that what the Governor stated yesterday is my position. I do want to get this compact done for the next legislature.

MR. HOWELL: Well, but the only reason I said there probably wouldn't be any use for you to have a meeting until June was because as I understood--I might be wrong--the Chairman of the Engineering Advisory Committee stated that they wouldn't be ready to make their final report on what has already been assigned to them until June. Now, if you can't go ahead without that report and then you indicate that there are certain other things you want to know, what would be the use of having a meeting before they are able to make that report?

COM. STONE: I have never gone that far in any statement I have made. Furthermore, I think there is some substance in the agenda which Colorado suggested and it does include matters which Colorado will insist upon being settled before a compact is written, and I think we can be making more time than has been made here today if we go to those matters. That is all.

MR. HOWELL: Mr. Chairman, it won't interfere with the agenda as far as that is concerned if we do have this meeting.

COM. STONE: I am not opposing that meeting.

THE CHAIRMAN: The Chairman has proceeded in a very unparliamentary manner and we are now ready for discussion of the motion. (Question is called for.) (Thereupon a vote was taken and Com. Watson's motion carries unanimously.)

THE CHAIRMAN: Now do you at this time wish to appoint in accordance with the motion?

COM. WATSON: Mr. Chairman, may I suggest one other matter and that is that when this committee has been appointed, they proceed immediately to go to work.

THE CHAIRMAN: That was incorporated in your motion, I think. I understood it that way.

COM. STONE: May I make this inquiry: The motion is limited to one person from each state?

COM. WATSON: I would yield to that, Judge.

COM. STONE: It involves legal and engineering matters and it seems to me that perhaps no state is prepared to fully set forth its suggestions by the attendance of only one person.

COM. WATSON: I think your objection is well taken.

THE CHAIRMAN: As the Chair understands it then, each state can designate any number to confer with the Chairman of the Engineering Advisory Committee.

COM. WATSON: At least one engineer and one lawyer.

THE CHAIRMAN: Oh, that is the understanding. Very well, the Chair stands corrected. The Chair will now ask the State of Arizona to designate its representatives if you will.

COM. CARSON: R. Gail Baker.

COM. WATSON: What lawyer?

COM. CARSON: We don't need a lawyer on that. He is both.

THE CHAIRMAN: Colorado?

COM. STONE: Designate Jean Breitenstein and Frank Merriell.

THE CHAIRMAN: New Mexico?

COM. WILSON: Designate Rufus Carter and I. J. Coury.

THE CHAIRMAN: Utah?

COM. WATSON: C. R. Roskelley and J. A. Howell.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Mr. Wehrli and Mr. Rollins for Wyoming.

COM. STONE: Mr. Chairman, I move the Commission adjourn to reconvene this evening in order that this special committee that has been appointed may proceed with its work.

THE CHAIRMAN: Is there a second to Judge Stone's motion?

COM. BISHOP: Second.

THE CHAIRMAN: Is there a discussion of the motion?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

(3:05 p.m. Recess.)

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(7:30 p.m. Meeting resumed.)

THE CHAIRMAN: Will the Commission please come to order. In line with the wishes of the Commission prior to recess, the states appointed their advisers to confer and consult with the Chairman of the Engineering Advisory Committee for the purpose of determining what if any additional studies should be undertaken in order to assist the Commission in writing a compact.

Mr. Riter, as Chairman of the Committee are you ready to submit a report?

MR. RITER: Yes, sir.

THE CHAIRMAN: Mr. Riter, you may proceed to make your report.

MR. RITER: The special committee assumed that its function was to determine whether it was necessary to vest in the Engineering Advisory Committee any additional authority to that already given it to furnish any additional factual data to enable the Commission to make a division of the water of the Upper Basin and to fix the obligation of the respective states at Lee Ferry.

Opportunity was therefore given by the committee to the representatives of each state to suggest what additional factual data those representatives deemed necessary. No state suggested any additional factual data that was deemed necessary, although the committee has not yet completed its present assignment.

Accordingly, the committee decided unanimously that it was not necessary to vest the Engineering Advisory Committee with any additional authority and that it was for the Commission to determine whether it could make a hypothetical division of the water to which it is entitled under the Colorado River Compact among the respective states and to determine whether it should make any hypothetical determination of the obligation of the respective states at Lee Ferry prior to the final report of the Engineering Advisory Committee; that if and when such hypothetical decisions are made, either prior to or after such final report, it may be necessary to have the Engineering Advisory Committee make additional studies to determine how such tentative decisions of the Commission will operate.

COM. BISHOP: I move the adoption of the report.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion is now open for discussion.

COM. STONE: May I inquire, does an adoption of that report mean that a vote in favor of it is in agreement to a hypothetical division or a hypothetical determination of obligations at Lee Ferry agreed upon--does that carry that implication?

MR. WEHRLI: Mr. Chairman, I would think not. I would think that the report of the committee simply means that if a hypothetical situation is presented to the Engineering Committee and there is further action desired, then a further report would be made without obligation to present such hypothetical situation.

COM. STONE: Thank you, Mr. Wehrli. I assumed that was it but I wanted to be clear on it.

MR. WEHRLI: I think we ought to be clear on it and I think that is the purpose of it and the intent of it.

THE CHAIRMAN: As the Chairman understands it, it is not incumbent upon the Commission or any member of the Commission to make a hypothetical or tentative allocation until the original assignment of this Committee has been completed. Then at that time I believe the report of the Committee implies that before it can continue and make further studies, a hypothetical allocation should be made and then they will proceed to see how that allocation works out and will present that then to the Commission for further consideration of any member. If he feels that it is not acceptable to his state he can raise his objection. Is that correct, Mr. Riter?

MR. RITER: That is my understanding.

COM. WILSON: Mr. Chairman, would it be understood also that any hypothetical allocation or determination would not be binding on anybody and be merely for the purposes of demonstration?

THE CHAIRMAN: Yes, Judge Wilson. That is my understanding of it because the Engineering Committee will have to study any assumed allocation to determine if the Commission has gotten its foot in it here and there and done an injustice to any particular state. That is the purpose of this study after the assumption is made.

COM. CARSON: Mr. Chairman, what was that motion, to adopt or to accept?

(Motion read as follows: COM. BISHOP: I move the adoption of the report.)

COM. CARSON: Mr. Chairman, I would like to make an amendment to that motion, that the report be accepted for the consideration of the Commission, or a substitute motion.

THE CHAIRMAN: Is the amendment accepted?

MR. WEHRLI: We have no objection to the change in terminology.

THE CHAIRMAN: Is that satisfactory to the second to the motion?

COM. WATSON: Yes.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

THE CHAIRMAN: The question has been called for. (Thereupon a vote was taken and Com. Bishop's motion as amended carried unanimously.)

MR. CLYDE: Mr. Chairman, I would like to ask Mr. Riter a question. If I correctly heard the report it contemplated that this Commission might either before the engineers complete the report or after it, depending on what they decide--

MR. RITER: That is right.

MR. CLYDE: --make this hypothetical allocation.

MR. RITER: That is right.

MR. CLYDE: And that the question would be for the Commission perhaps now to decide whether they want to try it now or after.

MR. RITER: It is entirely up to the Commission, yes.

THE CHAIRMAN: Are there further remarks on the subject mentioned by Mr. Clyde?

COM. STONE: I might say, Mr. Chairman, Colorado voted favorably on the motion on the explanation that was made before the vote was taken. The explanation now made is not the explanation that was made by Mr. Riter or the Chairman when the motion was put.

MR. HOWELL: The report itself definitely stated either before or after the final report of the Engineering Advisory Committee.

COM. WILSON: It can't be made after unless the Commission so votes.

COM. STONE: I might say, gentlemen, that Mr. Breitenstein tells me that the explanation now made by Riter is the correct intention of the committee. If it is, although I misunderstood the interpretation of that report or the intent of it as put by the Chairman and concurred in by Mr. Riter, we shall not quarrel about that. If that is the intent of the committee we are willing to abide by the intent even though I as Colorado's Commissioner voted upon a different interpretation of the report.

MR. WEHRLI: Mr. Chairman, I don't believe there can be any misunderstanding that would have any serious consequences, because if any one state represented on this Commission is opposed to presenting a hypothetical situation prior to obtaining the report of the Engineering Committee, I can't very well see how such a hypothetical situation could be presented. Consequently I think there is no substantial disagreement about it. And if Colorado objects, as I understand it does, to the presentation of any hypothetical or tentative formula until after receiving the report, it seems to me that such a situation cannot be presented until after the report is received.

I think that is the situation we are in and that there isn't any real disagreement about it or can be any real disagreement about it because as I understand it Colorado says they are not prepared to enter into the presentation of a hypothetical or tentative figure until after the report is received.

COM. STONE: Mr. Wehrli's statement I think is entirely correct. There is no reason to delay this matter because the outcome would be the same apparently.

COM. WILSON: Mr. Chairman, I would like to say this, that I attended the meeting of the engineering committee and I thought this would be a very splendid idea. In fact, I think the committee agreed that there is a great deal of information that they have been asked to furnish that they can't furnish unless they do assume an allocation of water and I believe that is the situation. However, in view of Colorado's position I don't want to be put in the position of trying to force this on Colorado, since they have expressed themselves as they have, and I am not going to press the point. I still think it would be a good idea and wouldn't hurt anybody and would facilitate the work of the Engineering Committee. But I am not going to insist and I don't think the Commission should force Colorado into accepting this plan. Let's wait until the report is in and then determine it.

COM. WATSON: The solution is hypothetical.

COM. WILSON: That was my idea. You could take two or three hypothetical figures assuming each state got this much and assuming each state got that much. If we don't authorize the Committee to do that I don't see why they can not on their own motion juggle some figures around so they can tell us what this obligation at Lee Ferry spells.

THE CHAIRMAN: Mr. Riter, since we have come to an agreement in regard to the work that your Committee is to do, the Chairman would like to ask you how long in your opinion will it take to complete your work? By that I don't mean to include a study of a hypothetical allocation of benefits and responsibilities.

MR. RITER: Mr. Chairman, I think the record will show this morning I

stated we could have a final report before June. My reason for saying that is that the subject we are having the most difficulty reconciling is the matter of present uses. I feel from the studies that we have made and the discussions we have had that the Engineering Committee will not agree upon final figures on present use until we have had an opportunity to go in the field with Mr. Blaney and inspect typical areas in various states in order to verify the judgment of the representatives of the various states regarding type and character of agricultural practice and to visualize areas of pre-irrigated land.

COM. CARSON: Mr. Chairman, I would like to move that we proceed with this agenda.

COM. STONE: I second the motion. (No vote taken.)

COM. BISHOP: Mr. Chairman, if we are ready to consider this report I would like to move that this under "Expenses" on the second page where it says in parenthesis, "(equally by the four states)" and then in parenthesis, "(prorata by the four states according to the percentage of water allocated to each)", that the last one be approved by this group, "prorata by the four states according to the percentage of water allocated to each."

COM. WATSON: Second the motion.

THE CHAIRMAN: Any discussion of the motion as made and seconded?

COM. STONE: Mr. Chairman, just a moment and I will have a comment to make. (Confers.) Mr. Chairman, I understand that any vote at this time on this or other matters is in accordance with the agreement at the last meeting that all favorable or unfavorable votes are tentative until the final vote is taken on all of the terms of the compact.

THE CHAIRMAN: The Chair would feel that that is a reasonable interpretation because some of these matters I think need a little consideration more than we can afford to give at these meetings by the individual states.

COM. STONE: That is our understanding. I just wanted to be sure that that was the understanding of the Commission. It was at the last meeting.

MR. WEHRLI: Mr. Chairman, as far as Wyoming is concerned that is our understanding that these matters are approved tentatively.

COM. STONE: Colorado has no comments to make on the motion at this time.

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. Those in favor of the motion will please say "Aye."

COM. WILSON: I suggest you call it by states.

THE CHAIRMAN: That is the procedure we followed the other day. Perhaps we should do that. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: I will pass on that. We are not concerned with that.

THE CHAIRMAN: New Mexico?

COM. WILSON: New Mexico declines to vote on that until there has been an allocation.

COM. BISHOP: Mr. Chairman, on page 3, Item 10, I would like to amend the third line where it says "that the concurrence of four members of the Commission shall be necessary"--I would like to amend that to read "that the concurrence of a majority of the members of the Commission shall be necessary in any action taken by the Commission."

COM. WATSON: You make that as a motion, Mr. Bishop?

COM. BISHOP: Yes.

COM. WATSON: I second the motion.

THE CHAIRMAN: Is there a discussion of the motion as made by Com. Bishop? It would occur to the Chairman at this point that one of the members of the Legal Advisory Committee should give his reason for stating four members.

COM. CARSON: Mr. Chairman, in the beginning in the Legal Advisory Committee there was an opinion expressed that all actions taken by the Commission should be by unanimous vote, but it was also the suggestion that it be made by majority vote. The Legal Advisory Committee discussed the matter pro and con and then set up this provision for the five members, one from each of the four states of the Upper Division and a Federal Representative, and in order to not completely stymie the action of the commission by the veto power of any one state, we finally worked out a compromise of ideas sufficiently to report to this Commission on the basis here set up. That is a four-fifths vote.

Then we made these other provisions limited to the findings of fact and provided that those findings should "not be conclusive in any court or before any agency or tribunal but shall be admissible and shall constitute prima facie evidence of the facts found."

It seemed to us that that was about as good as you could go here and it would make it then so that if four members of the commission agreed on a finding of fact it would be prima facie evidence of the facts found but still if one state disagreed it could contest it and go into the matter before any court or tribunal it desired. That was our best judgment as to the possibility of working out a compromise in view of the contrasting points of view.

But here again I want to point out that Arizona is not directly concerned in this because we don't participate on this commission.

THE CHAIRMAN: Is it understood that the Federal member of this board

would have voting power?

COM. CARSON: Yes, sir. That is, it is set up in this report that he would have voting power.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

THE CHAIRMAN: Those in favor of the motion will say "Aye."

COM. STONE: May I suggest you call the roll of states.

THE CHAIRMAN: Oh, yes, thank you. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: No.

THE CHAIRMAN: Arizona?

COM. CARSON: I think I should vote "No" on that because I want to assist in arriving at a compact and if it is made that way you won't get a compact, so I vote "No."

THE CHAIRMAN: New Mexico?

COM. WILSON: No.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: The motion fails to carry by three to two. Gentlemen, let's stick to the agenda. Have you finished with page 3 under the item of "Powers"? If so, we will proceed to page 4. Are there any comments or objections to the paragraph entitled, "Records Open to Inspection"?

COM. STONE: Mr. Chairman, if there are no further motions with respect to particular sections of the article, "Administrative Commission", I move, subject to the rule that a vote at this time is tentative, that the article as amended and changed be approved.

COM. BISHOP: Second the motion.

THE CHAIRMAN: That would include, then, Judge, bottom of page 1, all of page 2, page 3, and part of page 4 as amended and corrected. All of page 4?

COM. STONE: Down to the word, "Comments".

THE CHAIRMAN: Yes. Ready for the question? (Question is called for.) Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

(The article, "Administrative Commission", as amended and corrected, above referred to, is as follows:)

"ADMINISTRATIVE COMMISSION

"There is hereby created an interstate administrative agency to be known as 'Upper Colorado River Commission.'

"The Commission shall be composed of one representative of each of the states of the Upper Division, namely, Colorado, New Mexico, Utah and Wyoming, and if designated by the President of the United States, one representative of the United States. The Commissioner for Colorado shall be appointed by the Governor of Colorado with the advice and consent of the Colorado Water Conservation Board. The State Engineer of New Mexico shall be ex-officio commissioner for New Mexico. The State Engineer of Utah shall be ex-officio commissioner for Utah. The State Engineer of Wyoming shall be ex-officio commissioner for Wyoming. If any state desires to provide for the selection of its commissioner in a different manner, the commissioner, selected as so determined by such state, shall be the commissioner for such state. The President of the United States shall be requested to designate a commissioner for the United States. If a commissioner is so designated for the United States he shall be the presiding officer of the Commission and shall be entitled to the same powers and rights as the commissioner of any state.

"Any four members of the Commission shall constitute a quorum.

"Expenses. The salaries and personal expenses of each commissioner shall be paid by the government which he represents. All other expenses which are incident to the administration of this compact and which are not paid by the United States shall be borne prorata by the four states according to the percentage of water allocated to each. On or before November 1st of each year the Commission shall adopt and transmit to the governors of the four states and to the President a budget covering an estimate of its expenses for the following year and of the amount thereof payable by each state. Each state shall pay the amount due by it to the Commission on or before April 1st of the year following. The payment of the expenses of the Commission and of its employees shall not be subject to the audit and accounting procedure of any of the four states or of the United States.

"Employees. The Commission shall appoint a secretary who shall not be a member of the Commission and who shall serve for such term and receive such salary and perform such duties as the Commission may direct. The Commission may employ such engineering, legal, clerical and other aid as may in its judgment be necessary for the performance of its functions under this

compact. In the hiring of employees the Commission shall not be bound by the civil service laws of any state or of the Federal Government.

"Powers. The Commission shall have the power to:

"1. Adopt rules and regulations not inconsistent with this compact;

"2. Locate, establish, construct, abandon, operate and maintain water gaging stations;

"3. Make estimates to forecast water run-off on the Colorado River or any of its tributaries;

"4. Engage in cooperative studies of water supplies of the Colorado River and its tributaries;

"5. Collect, analyze, correlate, preserve and report on data as to stream flows, water storage, water diversions and water use of the waters of Colorado River or any of its tributaries;

"6. Make findings as to the amount of and report on the beneficial consumptive use of water each year in the Upper Colorado River Basin and in that portion of each state lying within this basin;

"7. Make findings as to the amount of and report on the water deliveries at Lee Ferry each year and the amount of such water supplied by each state of the Upper Division;

"8. Make findings as to the amount of and report on the share of reservoir losses chargeable against the apportionment made to each of the four states;

"9. Make findings as to the amount of and report on the obligation of each state to make water deliveries at Lee Ferry;

"10. Perform all functions and do all things required of it by this compact and do all things proper and convenient in the performance of its duties hereunder. Provided, however, that the concurrence of four members of the Commission shall be necessary in any action taken by the Commission;

"11. Make and transmit annually to the Governors of each of the four states and the President of the United States with the estimated budget a report covering the activities of the Commission for the preceding year.

"Records Open to Inspection. The Commission and its secretary shall make available to the Governor of each of the signatory states any information within its possession at any time and shall always provide free access to its records by the governors of each of the states or their representatives or authorized representatives of the Federal Government.

"Findings of Fact. Findings of fact made by the Commission shall not be conclusive in any court or before any agency or tribunal but shall be admissible and shall constitute prima facie evidence of the facts found."

THE CHAIRMAN: It appears now we are ready to consider Article II.

COM. WILSON: Mr. Chairman, before you go to Article II I would just like to suggest that the matter under "Comments" through this report should probably be taken by the members of the Commission and their legal advisers and considered. I don't think it is necessary to discuss them now but there are some things there that ought to be given some thought. That is why the comments were put in there, to call it to the attention of the Commission.

THE CHAIRMAN: The Chair is assuming that the comments are there for the benefit of the present consideration. They certainly should be used for what they are worth and presumably have been read and considered prior to the adoption of the motion.

Are you ready now for the consideration of Article II? And in line with Judge Wilson's suggestion, it is assumed that on page 7 the comments have been studied by the members of the Commission.

MR. BREITENSTEIN: I think it should show in the record that the interpretation placed on the article which you have just adopted is that the commission, the agency you set up, may acquire, hold and dispose of any property, either real or personal, necessary for the performance of any of its powers. I think the record should show that is the intent of the Commission in adopting it.

THE CHAIRMAN: Without objection, the record will so show.

COM. STONE: Mr. Chairman, may I make a further suggestion? It appears to me that it would be good practice if the article be read here rather than rely on our previous reading of it or hasty reading here.

THE CHAIRMAN: That might be a very good suggestion, Judge Stone, and assuming that there is no objection, we will impose on Mr. Breitenstein to read the article.

MR. BREITENSTEIN:

"No state shall deny the right of the United States, another signatory state, any person or entity to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one state for the purpose of diverting, conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the states of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper state for beneficial consumptive use in a lower signatory state when such use is within the allocation of such lower state herein made. Such rights shall be subject to the rights in a state in which such reservoir or works are located to have and receive the water allocated to it herein for beneficial consumptive use.

"Any signatory state, any person or any entity of any signatory state shall have the right to acquire necessary property rights in any other signatory state by donation, purchase or through the exercise of the power of eminent domain.

"Any signatory state upon the written request of the Governor of any other signatory state for the benefit of whose water users property is to be acquired in the state to which such written request is made shall proceed expeditiously to acquire the desired property through the exercise of its power of eminent domain, and shall convey such property to the requesting state or such entity as may be designated by the requesting state. Provided

however, that all costs and expenses of every kind and nature whatsoever incurred in the acquisition of the requested property shall be paid by the requesting state at the time and in the manner prescribed by the state requested to acquire the property.

"Should any facility be constructed in a signatory state for the benefit of another state or states or the water users thereof as above provided, the construction, repair, replacement, maintenance and operation of such facility shall be subject to the laws of the state in which the facility is located, except that in the case of a reservoir constructed in one state for the benefit of another state the water administration officials of the state in which the facility is located shall permit the storage and release of any water which, as determined by the finding of the Commission, falls within the share of the state for whose benefit the facility is constructed, and in the case of a regulating reservoir for the joint benefit of all states in making Lee Ferry deliveries the water administration officials of the state in which the facility is located shall, in permitting the storage and release of water, comply with the findings and orders of the Upper Colorado River Commission.

"In the event property is acquired in one state for the use and benefit of another the users of water made available by such facilities shall pay to the political subdivisions of the state in which such works are located each and every year during which such rights are enjoyed for such purposes a sum of money equivalent to the average amount of taxes levied and assessed against the land and improvements during the ten years preceding the acquisition of such land in full reimbursement for the loss of taxes in such political subdivisions of the state, said payments to be in lieu of any and all taxes on said property, improvements and rights.

"The signatory states further agree to recommend to the President and to the Congress that in the event the United States shall acquire property in one of the signatory states for the benefit of another signatory state or its water users, provision be made for like payment in reimbursement of loss of taxes."

THE CHAIRMAN: Now, gentlemen, the Chair would like to call your attention to the letter from the Federal Power Commission which has been handed to you and I believe that perhaps you should consider that in connection with Article II. Mr. Breitenstein, will you read the letter?

MR. BREITENSTEIN: "Dear Mr. Bashore"--it is dated January 30, 1948.

THE CHAIRMAN: Pardon me, just a moment. I am just wondering if you need to read the entire letter.

MR. RITER: It is Item (b) on page 2.

MR. BREITENSTEIN: Here is what you want:

"The following language is suggested for the Upper Colorado River Basin Compact:

"Article _____

"Nothing in this compact shall be deemed:

"(a) To impair or affect any rights, powers, or jurisdiction of the United States, or those acting by or under its authority, in, over, and to the waters of the Upper Colorado River and its tributaries, as now provided by law; nor to impair or affect the right of the United States or those acting by or under its authority, to acquire rights in and to the use of waters of said river and its tributaries, as now provided by law;"

The next one I think is the one the Chairman thought was important:

"(b) To subject any property of the United States, it agencies or instrumentalities, to taxation by any State, or subdivision thereof, nor to create any obligation on the part of the United States, its agencies or instrumentalities, by reason of the acquisition, construction, or operation of any property or works of whatsoever kind, to make any payments to any State or political subdivision thereof, state agency, municipality, or entity whatsoever in reimbursement for the loss of taxes;

"(c) To subject any property of the United States, its agencies or instrumentalities, to the laws of any State to any extent other than the extent these laws would apply without regard to this compact."

COM. STONE: As I understand this provision, the last paragraph of the proposed article is not in conflict with that statement made by the Federal Power Commission. It simply says the signatory states agree to recommend to the President and to the Congress in the event the United States shall acquire property in one state and so forth. The Congress may not be willing to carry out that provision. All we say here is that the states agree to attempt to induce the Congress to recognize that provision in the event of the building of any of these works.

MR. WEHRLI: Mr. Chairman, I would like to point out that in the mimeographed copy of the 9th line of the first paragraph after the word "such", which is the second word appearing in that line, the word "use" doesn't appear. I think it is intended to be in there and it was read that way by Mr. Breitenstein, and I believe it should be in.

MR. BREITENSTEIN: I wasn't reading from the mimeographed copy; I was reading from my copy of the copy I gave to the girls to copy.

COM. STONE: The word "use" is eliminated and should be inserted.

COM. CARSON: That is on page 5 of the Legal Advisory Committee report.

COM. STONE: Mr. Chairman, at the risk of being accused of being too technical I should like to raise a point, I don't insist on it, and yet it seems to me that the first paragraph of this article is somewhat in conflict with the following paragraphs. The first paragraph says that, "No state shall deny the right of the United States, another signatory state, any person or entity to construct or participate in the construction and use of diversion works"--and so forth; and the remaining part of the article sets forth the conditions under which another state may acquire and use property in one state for use in another.

Now it seems to me that there is a semblance of a denial by the subsequent provisions. There is a denial unless those provisions are complied with. It seems to me that "no state shall deny" is the intent but it is not

entirely clear--that there shall be no denial--but if a state fails to comply with subsequent provisions, then it seems to me that a denial would follow.

MR. BREITENSTEIN: Judge, you thought of a new one that wasn't suggested in the Legal Advisory Committee meetings.

COM. STONE: Isn't that good?

MR. BREITENSTEIN: I think that is highly technical because I think the rights are fully protected. If you want to grant any validity to that technicality, you can of course put a qualifying phrase in your first couple lines of your opening paragraph.

COM. STONE: That is my suggestion, that for fear some lawyer in the future may also be highly technical or some state I think it would be well to insert that.

MR. BREITENSTEIN: "Upon the compliance with this article no state shall deny the right"--something like that. That wouldn't quite do it. Something like that would take care of what you have in mind. "Subject to the conditions hereinafter stated"--begin that way.

COM. STONE: To get this matter before the Commission, I move at the beginning of the first paragraph of the article on page 5 there be inserted the words, "Subject to the conditions hereinafter stated".

COM. WATSON: Second the motion.

THE CHAIRMAN: Is there discussion of the motion: Are you ready for the question?

COM. WATSON: Question.

MR. SAUNDERS: One thing I would like to ask, in the second sentence of the same paragraph, "Such rights shall be subject to the rights in a state in which such reservoir or works are located to have and receive the water allocated to it herein for beneficial consumptive use"--don't you mean, "shall be limited by" rather than "subject to"?

MR. BREITENSTEIN: No, I didn't mean that, Mr. Saunders. The idea is that the exercise of these rights, whatever they are, shall be subject--just the plain meaning of the word "subject"--to the rights of the state in which the reservoir is located--inferior and superior, paramount and subordinate, primary and secondary, "a" and "b", one and two.

MR. SAUNDERS: You have just nullified all the rest of your section.

MR. BREITENSTEIN: No. It was not the intent to nullify it, but it was an attempt to make it subordinate.

MR. SAUNDERS: I will have to sleep over it to see that you haven't just practically abolished the rest of the language of that section.

MR. BREITENSTEIN: All right, how would you suggest we change it?

MR. SAUNDERS: As I say, I will sleep over it. I want to see what I think about it tomorrow morning. I stumbled over that language when I read it first and I stumbled again.

MR. BREITENSTEIN: That language there is not new to the Legal

Advisory Committee. That is from the Republican River Compact. Maybe for that reason it should be changed.

MR. SAUNDERS: That hasn't gone very far yet either.

MR. BREITENSTEIN: I just wanted to show you the source of the language.

THE CHAIRMAN: We will call the roll. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

MR. WEHRLI: Mr. Chairman, the matter I have in mind, which may be hypertechnical, relates to the last sentence in that first paragraph where it says that, "Such rights shall be subject to the rights in a state in which such reservoir or works are located to have and receive the water allocated to it herein for beneficial consumptive use." I believe a better use of language would be to say that "are located to receive and use the water." Of course, the language used may mean that but it may not.

MR. BREITENSTEIN: I would agree with you on that.

MR. WEHRLI: I think it would be a better use of language--"are located to receive and use the water."

COM. STONE: That is unquestionably better. I think we ought to have a motion and make the correction.

COM. BISHOP: I move the correction be made as has just been stated by Mr. Wehrli.

COM. WATSON: Second the motion.

COM. CARSON: Let's get it exact. Which one do you mean?

MR. WEHRLI: I would strike out "have and" just before "receive" and say, "receive and use."

MR. HOWELL: Would you mind repeating that once more? I didn't get it yet.

MR. WEHRLI: In the next to the last line of that first paragraph of that article, strike out the words, "have and", and after the word "receive" insert the words "and use".

MR. HOWELL: So it now reads, ". .or works are located to receive and use the water allocated to it. ."

MR. WEHRLI: That is right.

THE CHAIRMAN: Is there further discussion of the motion?

COM. STONE: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Motion carries unanimously.

COM. BISHOP: Mr. Chairman, I move that the article as amended be approved.

COM. WATSON: Second the motion.

MR. CLYDE: Mr. Chairman, before you vote on that motion I have one other comment to make that was raised by the Federal Representative to the Legal Advisory Committee. On page 6 of the mimeographed report, second paragraph, beginning, "Should any facility be constructed in a signatory state for the benefit of another state. .", as you go on with that language it subjects such construction in another state to the laws of the state in which the project is constructed.

I think that, unless the United States is excepted from it by a later provision, is inconsistent with the letter of the Federal Power Commission; and we discussed that pro and con in the Legal Committee. Some were of the opinion that if it is inconsistent with their position it could be taken care of by a later general provision excluding the United States. I think if that were not done it would be inconsistent with the letter written by the Federal Power Commission and that the Commission in voting on it should have that fact in mind and be aware of the necessity for some general language in addition to this to cover the thing covered by the Federal Power Commission letter.

MR. BREITENSTEIN: The matter which Mr. Clyde has just mentioned is the reason for the inclusion of Comment No. 2. If Comment No. 2 is put in as the interpretation of the clause of the Commission in adopting it, it seems to me you have the matter taken care of.

MR. HOWELL: Does the motion now made include the adoption of the comments under this article?

COM. STONE: I do not believe it does and for the sake of making the legislative history clear, it might be well in moving the tentative adoption of this article that particular attention be called to Comment No. 2 and that it be written into the record here as a part of the motion.

COM. WATSON: Do you make that in the form of a motion?

MR. WEHRLI: I think that Wyoming made the motion. We will accept that, Judge Stone.

COM. STONE: Very well. May we ask then that Mr. Wehrli restate the motion carrying out that idea so the record will be clear.

MR. WEHRLI: Well, the motion made then is that the article proposed by the Legal Advisory Committee entitled, "Facilities in one State for the Use or Benefit of Another State or States," be approved as amended and carrying with it the comments of Paragraph 2 on page 7 of the report wherein it is stated: "In subjecting a facility in one state to the laws in the state in which the facility is located, it is not the intent to subject the United States to the police regulations of a state to an extent greater than that provided for in Section 8 of the Reclamation Act of 1902."

THE CHAIRMAN: Is that agreeable to the second?

COM. WATSON: I will accept that and second the motion.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for and we will vote on the motion. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

(The article above referred to reads as follows as amended:)

"FACILITIES IN ONE STATE FOR THE USE OR
BENEFIT OF ANOTHER STATE OR STATES

"Subject to the conditions hereinafter stated no state shall deny the

right of the United States, another signatory state, any person or entity to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one state for the purpose of diverting, conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the states of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper state for beneficial consumptive use in a lower signatory state when such use is within the allocation of such lower state herein made. Such rights shall be subject to the rights in a state in which such reservoir or works are located to receive and use the water allocated to it herein for beneficial consumptive use."

(The remaining five paragraphs of the above article were not amended.)

THE CHAIRMAN: Apparently the Commission is now ready for the consideration of Article III entitled, "Charging of Reservoir Losses."

The Chairman requests that Mr. Breitenstein read Article III.

MR. BREITENSTEIN:

"Water losses resulting from reservoir operations shall be charged to the state or states receiving benefit from such reservoir operations in proportion to the beneficial consumptive use of water made available to each state by the reservoir except that in the case of regulating reservoirs for the joint benefit of all states in making Lee Ferry deliveries the charge shall be proportionate to the beneficial consumptive use of water in each state during the year for which the charge is made."

COM. BISHOP: I make a motion that Article III on page 8 be adopted.

THE CHAIRMAN: Does the Chair hear a second to the motion?

COM. WATSON: Second the motion.

THE CHAIRMAN: Are there comments or discussion of the motion as made and seconded?

MR. BREITENSTEIN: I want to warn you against that. I think that is one that may cause you difficulty when you come finally to apportion the consumptive use of water and obligations at Lee Ferry among the states, but nobody yet has come up with a better idea than this. This is certainly a case where your adoption should be tentative and the formula should be given careful consideration both by the engineers and lawyers.

MR. HOWELL: In any event, the adoption is only tentative here at this time, or hypothetical.

THE CHAIRMAN: The Chairman would like to ask Mr. Carson if he sees any embarrassment arising in the interpretation of the original Compact if this motion is adopted?

COM. CARSON: No. No, I don't see any embarrassment but I agree that this should be tentative. My own engineer just suggested to me he didn't know whether this would work. So we have to consider this tentative and have engineers and lawyers go over it again before it is finally written

into the final compact. But I think it does embody in that the principle that reservoir losses should be charged in proportion to the benefits received from storage in the reservoir, which I think is not in any way inconsistent with or in dereliction of the original Compact.

MR. WALLACE: Would you begin the paragraph with the words, "Within the Upper Basin"?

MR. BREITENSTEIN: My thought in connection with that is that if you are going to preface this paragraph with any such language you are going to have to preface pretty nearly every paragraph in your compact with the same language and it is unnecessary to do that. There should be a clear, general statement near the front of the compact which should take care of not only this provision but every provision of the compact and it shouldn't be necessary to repeat or reassert that language when you write the compact.

COM. STONE: Mr. Chairman, I think Mr. Breitenstein's suggestion there would take care of this and other matters more appropriately. It carries out the same idea. It would be better to make that clear right at the beginning of the compact.

COM. CARSON: That is what I thought.

Well, Mr. Chairman, I think both of those points of view can be reconciled by inserting this language, after the words "reservoir operations" in the first line, the words, "in the Upper Basin".

MR. WEHRLI: I think that is a good suggestion.

MR. BREITENSTEIN: I won't object to that, Charlie.

COM. CARSON: But then wait a minute, I have got another one. I don't want to be charged with them either as a Lower Basin State. (Laughter.)

MR. BREITENSTEIN: I thought you wouldn't bring that up.

COM. CARSON: Then also after the word "states" in the second line, you would say "of the Upper Basin".

THE CHAIRMAN: Gentlemen, we will recess for five minutes in order to give our reporter a chance to stretch her arm.

(9:45 p.m. Recess.)

(9:55 p.m. Meeting resumed.)

THE CHAIRMAN: Will you come to order.

COM. STONE: Mr. Chairman, I offer a substitute motion. It appearing that the clause dealing with charging of reservoir losses involves engineering as well as legal considerations, I move that action on that clause be deferred at this time and that the clause be referred to the Engineering Advisory Committee, who shall consult with the Legal Advisory Committee, and advise the Commission which will consider the clause at a later time.

COM. CARSON: I second the motion.

THE CHAIRMAN: Are there any comments on the substitute motion?

COM. WATSON: Question.

THE CHAIRMAN: We will now vote on the substitute motion. Those in favor will say "Aye" and I will call on Wyoming first.

COM. BISHOP: Aye.

THE CHAIRMAN: Colorado?

COM. STONE: Aye.

THE CHAIRMAN: Utah?

COM. WATSON: Aye.

THE CHAIRMAN: New Mexico?

COM. WILSON: Aye.

THE CHAIRMAN: Arizona?

COM. CARSON: Aye.

COM. STONE: Mr. Chairman, I move we adjourn to reconvene at ten o'clock in the morning.

COM. WATSON: Second the motion.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

(10:00 p.m., Thursday, February 19, 1948, recess until 10:00 a.m., Friday, February 20, 1948.)

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Denver, Colorado
February 20, 1948
10:00 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The Commission will come to order. Apparently the Commission is now ready to consider Article IV of the report of the Legal Advisory Committee, and following the procedure of yesterday, we will request Mr. Breitenstein to read the Article.

MR. BREITENSTEIN:

"Inasmuch as the Upper Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of the Upper Colorado River basin, the use of its waters for the purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding.

"Subject to the provisions of this compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

"The provisions of this article shall not apply to or interfere with the regulation and control by any state within its boundaries of the appropriation, use, and distribution of water."

THE CHAIRMAN: Thank you, sir.

COM. STONE: Mr. Chairman, in order that we carefully consider this article and not for the purpose of necessarily expressing an opinion at this time, I should like to raise a question with respect to Paragraph 1 of this article.

There has been a lot of history on this question of navigation as it relates to utilization of waters since the Colorado River Compact was adopted. The matter has received considerable attention in Congress. It has also been the subject of much controversy in making other compacts between the states and such agencies as the Federal Power Commission. The Federal Power Commission Act of 1936 delegated certain powers to the Federal Power Commission by the Congress.

Fortunately, the Congress in 1938 when it approved the Colorado River Compact was not subject to pressures on that question which exist today. The Upper Basin even after the negotiation of this compact will still be subject to all of the provisions of the Colorado River Compact. On this particular subject the Colorado River Compact is the law of the river and will continue to be the law of the river. Then, too, the physical conditions, the construction of many dams, the existence of such dams as Hoover Dam, eliminate any fear on this subject. Some of the great projects have been authorized and others will be authorized and built among other things for the production of power, which stems back to the commerce clause. Since the question is covered by the Colorado River Compact I suggest we eliminate the first paragraph of this Article.

Colorado moves that the question which has been raised regarding Article IV be re-referred to the Legal Committee for further consideration.

COM. WATSON: Second the motion.

THE CHAIRMAN: Any discussion of the motion? (Question is called for.) Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.
THE CHAIRMAN: New Mexico?
COM. WILSON: Yes.
THE CHAIRMAN: Arizona?
COM. CARSON: Yes.
THE CHAIRMAN: Motion carries.

COM. STONE: Mr. Chairman, Mr. Merriell has a point on that article which I should like to have him state for the benefit of the Legal Committee when it reconsiders this motion.

MR. MERRIELL: In the second paragraph of Article IV that appears

here, there is no reference to the use to which certain large reservoirs in the middle river are going to be put. It strikes me that the Legal Committee ought to give consideration to the regulatory effect of the reservoirs, so that the latter part of that paragraph should read, "subservient to the use and consumption of such water for agricultural and domestic purposes"--and then a statement--"as to the regulating reservoirs." Otherwise there is no recognition of the regulatory effect of those reservoirs.

THE CHAIRMAN: Well, does Colorado have some language which it is proposed to insert or substitute?

COM. STONE: We have Mr. Breitenstein, and we would possibly have language to suggest when the matter comes up before the Legal Advisory Committee.

THE CHAIRMAN: Gentlemen, are you ready for the consideration of Article V? Mr. Breitenstein, will you please read Article V so we may have it before us for consideration?

MR. BREITENSTEIN:

"Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes."

That is all there is.

COM. BISHOP: Mr. Chairman, I move the adoption of that article.

COM. WATSON: Second the motion.

THE CHAIRMAN: Is there any discussion of that motion? Ready for the question? (Question is called for.) Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: It occurs to me that before we get through we will have to include pretty near the entire transcript because as we go along with this discussion there are going to be more things referred. Isn't it going to be the entire transcript? Am I wrong?

COM. STONE: No.

Colorado moves that the reporter be asked to prepare: 1. Copies

of all articles contained in the report of the Legal Advisory Committee which have been tentatively approved by the Commission; 2. Copies of Article III relating to reservoir evaporation losses which has been referred for consideration by the Engineering Advisory Committee; 3. Copies of Article IV which has been re-referred to the Legal Advisory Committee; and that such copies be made available to the members of the Commission, the members of the Legal Advisory Committee, and the members of the Engineering Advisory Committee.

Does that now cover all the suggestions?

COM. WATSON: Second the motion.

MR. WEHRLI: I presume that the reporter in preparing that would reflect whatever changes have been made, I don't recall very many, or what would be the thought on that?

COM. STONE: I thought that would carry the changes and that was the principal reason for doing it. You might put that in there. Instead of saying the articles that have been tentatively approved, the articles as revised and tentatively approved. That was the purpose, some here wanted to get these articles as revised.

MR. WEHRLI: Very well.

COM. STONE: Otherwise there would be no need. We would just make extra copies of this.

THE CHAIRMAN: Do you have any further comments? (No response. Question is called for.) Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

(Discussion off the record.)

THE CHAIRMAN: Judge Stone, yesterday you indicated that you had a matter which you wished to lay before the Commission in regard to the services of Mr. Blaney, I believe.

COM. STONE: I can bring that up now.

THE CHAIRMAN: It occurs to the Chairman that now is a good time for that because it will fit in anywhere and we have completed consideration of the Legal Advisory Committee report.

COM. STONE: I am sorry Mr. Giles is not here. I made that suggestion because of the fact that Mr. Giles, Secretary of the Commission, reminded me that we had voted to make a fund available in his hands to pay the expense vouchers of Mr. Blaney. He now has a bill for $135.00. He suggested that appropriate action be taken to make funds available in his hands to comply with previous action of the Commission in that matter.

MR. WALLACE: Off the record. (Discussion off the record.)

COM. STONE: Mr. Chairman, I move that pursuant to resolution adopted at the last meeting of the Commission, the Secretary of the Commission bill each of the four states, Colorado, New Mexico, Utah, and Wyoming for $250.00 each.

COM. WATSON: Second the motion.

THE CHAIRMAN: Are there any comments on the motion as made and seconded?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

COM. CARSON: Arizona can't vote.

THE CHAIRMAN: Arizona declines to vote. The motion carries.

We may now proceed with the consideration of the remaining articles on the agenda, which are somewhat numerous.

COM. CARSON: I move that it be deferred for later consideration.

COM. WILSON: And the Legal Advisory Committee can give such further consideration to it as is desired.

COM. STONE: I second the motion.

THE CHAIRMAN: Any discussion of the motion as made by Mr. Carson and seconded by Judge Stone? Are you ready for the question?

COM. BISHOP: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: It appears the Commission is ready to consider the items in Group II on page 2 of the mimeographed copy of the agenda, subitem (a): "What provisions shall be incorporated in the compact to define the rights and obligations of the United States."

COM. STONE: Mr. Chairman, may I inquire, don't you have a letter from the Federal Power Commission that makes suggestions on the provisions?

THE CHAIRMAN: Yes, indeed, and the letter was passed out to the members of the Commission and are available for consideration.

THE CHAIRMAN: We don't like to impose on Mr. Breitenstein but we would be very glad to have him read it.

MR. BREITENSTEIN: This is a letter from the Federal Power Commission dated January 30, 1948, to Mr. Bashore.

(Letter referred to and read.)

COM. STONE: Mr. Chairman, this clause has been considered by Colorado as one state, no doubt by other states. I happen to know that it has been considered by Wyoming in some other compacts, and this has come to be rather common language on this particular subject. We do not see any objection to it. It leaves the rights and the jurisdictions of the Federal and State Governments just where they are, and those rights are not changed by the compact.

In considering this subject I believe we should keep in mind that the Federal Government is not a party to the compact in the absence of ancillary administration. I don't believe we are trying to define the rights between the Federal and State Governments in this compact. We leave them just where they are and that is all this clause does. We don't attempt or could we legally impose any taxation or claims against the Federal Government to pay money in lieu of taxes. Colorado would approve tentatively acceptance of this suggested language.

THE CHAIRMAN: The Chair wonders if the Commission wants to take any action whatsoever on these suggestions by the Federal agencies until you get them all before us. We haven't heard from the Interior Department or the Department of Agriculture. That is merely a suggestion for consideration.

COM. STONE: I have not moved for its tentative acceptance.

THE CHAIRMAN: I understand that.

COM. STONE: I say we would have no objection to it and experience has demonstrated that probably all the Federal agencies will ask for such language.

COM. BISHOP: Judge Stone, if we don't have it in there we will have an argument with the Federal Power Commission and will have to put it in before we can get it through Congress.

COM. STONE: Mr. Chairman, to dispose of this matter without delay, and in view of the fact that suggested language by other Federal agencies has not yet been received, Colorado moves that this matter be deferred for future consideration.

COM. WATSON: Second the motion.

THE CHAIRMAN: Are there any remarks or discussion of the motion made and seconded?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Perhaps we are now ready for the consideration of subitem (b) of Group II which reads: "How shall water uses made by the United States or any of its agencies be charged."

MR. BREITENSTEIN: Mr. Chairman, since Colorado prepared this agenda, may I say what we had in mind there?

THE CHAIRMAN: Yes.

MR. BREITENSTEIN: That is tied in, of course, with subdivisions (c), (d), (e) and (f) under Group II. Those relate to the Indians, navigation, flood control and silt control, and the question is whether or not it is desirable to have in the compact any provision relative to the charging of water uses by the United States. It would seem to me that unless there are specific provisions relating to that matter, the water uses would then be charged against the state in which the use is made of the water.

Consider first the question of the Indians; I apprehend that unless

there is some particular provision taking care of the Indians, the uses by the Indians would be a charge against the allocation made to the state in which the uses occur. Now, is there any reason for incorporating in the compact any provision which would make charges for any of these Federal uses, requiring charges to be made in any different way than are other uses of water?

I might say that the question of the charging of Indian uses was considered to some extent by the Legal Advisory Committee and as I understand it, the consensus of opinion in that Committee was that the uses should be charged against the share of the state in which the uses occur. So far as the Indians are concerned, the point was raised that it would be very difficult from an administrative standpoint to differentiate between Indian uses and white uses, and that any provision which attempted to charge Indian uses against the Basin as a whole would not be possible of practical operation.

THE CHAIRMAN: Gentlemen, you have heard Mr. Breitenstein's explanation. Are there further comments?

MR. WEHRLI: Mr. Chairman, it appears to us at this time that no provision should be incorporated in the compact upon the subject designated under subparagraph (b) of Group II. I don't know hardly how you could frame a provision properly in any event without the states recognizing at least impliedly, some rights that I presume most of the states, if not all of them, deny that the United States has. In other words, I think the position of the states probably is that whatever use is made by any agency of the United States is only as an appropriator of the particular state in which the use is made.

COM. STONE: This question of Indian rights came up before and there was submitted in accordance with the request of the Commission, a brief prepared by Mr. Breitenstein on that subject. I assume that the Legal Committee studied that brief.

MR. WEHRLI: We have partially disposed of the item under (c), not completely, however. It seems to me that (b) and (c) ought to be disposed of together by a general provision in the compact to the effect, generally, that all beneficial use of waters in any state shall be supplied from the water apportioned to that state. That is roughly the language in Article VIII of the Colorado River Compact. I refer more particularly to the second paragraph of Article VIII.

MR. RITER: Mr. Chairman, I note all the Federal agencies have not submitted reports on what rights they might claim. May I suggest that maybe the Commission will probably have to defer action on (b) till they find out what claims, if any, are going to be submitted under (a).

I know we have given quite a little thought to that in the Bureau. We haven't made up our mind fully what rights if any we should claim. We recognize that under Section 8 of the Reclamation Act, the United States gets its water rights through the states; however, it is possible that there may be other rights that might be claimed.

For example, I refer you to Commissioner Lawson's letter of the International Boundary and Water Commission of December 18th, and he suggests brief language to allow for the Mexican Treaty obligation. Then I would like to raise at this time also a possible question about power reservoirs the Federal Government may build, recognizing of course that the Commission has already indicated that power should be subservient to other uses; but none the less, there is also a question about evaporation losses from power reservoirs.

In view of all these complications and in view of the fact that we

don't know what other rights might be claimed--it might be conceivable, for example, that there might be some right claimed for Fish and Wildlife purposes --I am merely throwing that out as a possibility--in view of the uncertainty it just seems to me that as a suggestion to the Commission, you might want to defer action on (b) until you have in front of you the rest of the claims the Federal agencies may wish to make.

MR. CLYDE: Mr. Chairman, it seems to me that in view of the discussion that the Legal Committee had, for example, about Indian rights and the difficulties that will be encountered if they are attempted to be fixed on a basin rather than a state basis, and that if they are fixed on a state basis, that that factor will be one of the factors that will have to be considered in allocating the water, those states having large Indian rights, if they also have the obligation of taking care of the Indians from their allocated share, must have that factor considered in allocating the water; and therefore it seems to me undesirable to attempt to dispose of the basis upon which you are going to divide Indian rights until you allocate the water, find out what weight you give to that factor in the allocation. If you disregard that factor in allocation, it would seem to me you would have to put it on a basin basis. If you give states credit because they have got Indian rights, then that determination it would seem to me would dictate that you go on a state basis. It seems premature to try to dispose of it now.

COM. WATSON: Mr. Chairman, I think that subdivision (c) should be treated similarly to subdivision (b), that we are not ready to make a decision and we should defer action on it. Speaking for Utah, there are about 70,000 acres in the Uinta Basin that are watered from the Uinta Mountains. Three acre-feet per acre are diverted to those 70,000 acres.

I don't think we are ready to make any decision on that one way or the other, so I suggest that Item (c) be deferred for further consideration.

COM. STONE: Why pick out one item? If you are going to defer it, defer them all because they are all related.

THE CHAIRMAN: It occurs to your Chairman that the War Department hasn't notified the Commission in regard to navigation except in its first letter and we have asked the War Department for a reply to those two questions propounded by the Commission. In the absence of that information today it appears doubtful whether you can take intelligent action on subitem (d).

COM. WILSON: I move that action on Group II, page 2, of the agenda, designated as Paragraphs (a), (b), (c), (d), (e), (f), and (g), be deferred with this provision, that as to subdivisions (d), (e), (f), and (g), it does not foreclose discussion at this time.

COM. BISHOP: Second the motion.

THE CHAIRMAN: Are there comments on the motion as made by Judge Wilson and seconded by Mr. Bishop?

COM. WATSON: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: We have now reached Group III on the agenda and are ready for the consideration of the subitems under Group III. Subitem (a) reads: "Shall compact contain any provision relating to the delivery of water at Lee Ferry for the use of Mexico in the event there is not sufficient surplus water to supply the Mexican share."

MR. WEHRLI: Mr. Chairman, I think that it is obvious that some provision will have to be made to recognize the potential obligation in the Colorado River Compact, and I hope it is only potential, and to apportion that obligation among the States of the Upper Basin, that is to say, to apportion such obligation as may arise against the States of the Upper Basin between or among those States. We would be of the opinion that that obligation, whatever it may be, ought to be apportioned upon the same basis as the obligation to make the required deliveries at Lee Ferry. It hardly seems possible that you can deal in terms of quantities of water in connection with this potential obligation and that we will likely have to deal with the distribution of it among the states upon a percentage basis. And as I say, we would be of the opinion that that obligation should be borne percentage-wise in the same way as the obligation to make deliveries at Lee Ferry.

THE CHAIRMAN: Well, let's have a free discussion of that item and then dispose of the matter with a motion.

COM. WILSON: Mr. Chairman, I am inclined to agree with what Wyoming said but we have already deferred action on determining the exact obligation at Lee Ferry among the states. It seems to me that the two go together and we couldn't make any actual determination of any provision in the compact relative to the Mexican Treaty or otherwise until that question has also been considered.

MR. RITER: Mr. Chairman, with regard to Mr. Wehrli's comments may I suggest this, that the Mexican Treaty obligation is a real obligation. Under the original 1922 compact, we did not know what the obligation would be to Mexico. In the meantime, however, a Treaty has been consummated and the Mexican obligation is now known and is real.

THE CHAIRMAN: Mr. Riter, I think maybe you misunderstood Mr. Wehrli. I think he recognizes that part of it but his remarks were directed to the occasion of an extraordinary drought.

MR. BREITENSTEIN: No.

THE CHAIRMAN: Isn't that true?

COM. STONE: No, his remarks went to (a).

MR. WEHRLI: My thought about it was that it is a real obligation,

Mr. Riter; but I merely was trying to express the hope that while it was a real obligation, the water supplies would be such that the Upper Basin would not be called upon to have to supply any water. That is the thought I had in mind.

MR. RITER: Well, of course, we can all live in hopes.

MR. WEHRLI: I don't disagree with you. It is an obligation that is placed on the Upper States.

MR. RITER: I may have misunderstood your remarks. I rather gathered from your remarks that it wasn't a definite obligation, potential obligation.

MR. WEHRLI: It provides that we must respond to the supplying of a deficiency. I was merely trying to express the hope that there wouldn' be a deficiency.

THE CHAIRMAN: Mr. Riter, you were interrupted. Have you complete your statement?

MR. RITER: Yes. Apparently I misunderstood the intent of Mr. Wehrli's remarks.

COM. STONE: This liability might be better described as a contingent liability and it certainly is one which the states cannot overlook, particularly because of the provision of the Colorado River Compact and because of the fact that the total obligation of the United States has been determined.

COM. WATSON: Mr. Chairman, I move that we defer this Group III, Items (a) and (b), until the obligation is determined and further action concerning our obligation at Lee Ferry is decided.

COM. STONE: Mr. Chairman, has that motion been seconded?

THE CHAIRMAN: No, it has not. You have heard Com. Watson's motion. Is there a second?

COM. WILSON: To get it before the house I will second it.

THE CHAIRMAN: The motion has been made and seconded by Judge Wilson. Is there discussion on the motion?

COM. WATSON: Mr. Chairman, I would like to modify my motion. I intended to include (b) also.

THE CHAIRMAN: You did.

COM. STONE: Mr. Chairman, I would like to make a substitute motion. I don't know why we should just defer everything. Some things we must defer but why can't we make some progress here.

My remarks go solely to Subsection (a) and for that reason I move that the Commission recognizes the contingent liability for deliveries of water at Lee Ferry in the event there is not sufficient water supply to comply with the obligations of the United States under the Mexican Treaty, and that the matter be referred to the Legal Advisory Committee.

COM. BISHOP: I second the motion.

THE CHAIRMAN: Substitute motion has been made by Judge Stone and seconded. Com. Watson, do you care to withdraw your motion?

COM. WATSON: If it is necessary. I would like to comment.

I think that what Judge Stone stated is already the law of the river and we all understand it so we are just simply stating something that is self-evident. Therefore we refer something that is selfevident to the Legal Committee.

COM. STONE: My purpose, Mr. Watson, is this: The Legal Committee is a drafting committee and we could make some progress by an instruction to the Legal Committee to prepare language. Now the apportionment is another matter which need not necessarily be included in such language, but we ought to make some progress, not just put everything off, when there are some things that the Legal Committee can be working on.

COM. WATSON: I yield, Judge Stone. If you say refer it to the Legal Committee, that is the thing to do.

MR. CLYDE: Mr. Chairman, it seems to me that about the only thing the Legal Committee could do at this point would be to recognize that this is the law of the river. As far as making the apportionment of that obligation, the Legal Committee can do nothing to draft language there until you decide how you are going to apportion the obligation at Lee Ferry, (a) to the Lower Basin and, (b) to Mexico.

COM. STONE: Mr. Clyde, that is exactly what I said. The Legal Committee is not authorized to incorporate it but certainly they could leave that part blank and we could get some language without taking some time in the future to do it and to have it before the Commission. That is my only purpose in it.

MR. WEHRLI: Judge Stone, I agree with what you say. It occurs to me that the language in relation to this obligation may necessarily have to be coupled with the language in relation to the apportionment of the obligation for delivery at Lee Ferry, or at least that it might be desirable.

COM. STONE: I recognize that, Mr. Wehrli. I think that is true and that is a matter which the Legal Committee could report back on.

MR. WEHRLI: I would merely want to make this further suggestion that while the Legal Committee would have no authority and no business trying to allocate either obligation, I would favor at this time referring to the Legal Committee the task of preparing such language as the Legal Committee would deem appropriate for apportioning these obligations. Perhaps you wouldn't want to go that far but I think the Legal Committee could be doing something in attempting to draft some language on both subjects.

COM. STONE: That is the apportioning of the obligation at Lee Ferry. I wouldn't oppose that; I think that is all right. I would go as far as Mr. Wehrli suggests.

COM. CARSON: Mr. Chairman, it seems to me that whatever language is prepared along that line that would in any way differ from that suggested by the International Boundary and Water Commission would require substantive decision by this Commission.

Speaking now as Arizona, a Lower Basin State, we are not directly concerned in the division of the obligation of the Upper Division to make deliveries at Lee Ferry. But the obligation of the Upper Division to make deliveries at Lee Ferry for use in Mexico is not limited to a deficiency of the

surplus, but includes the delivery at Lee Ferry of the surplus to help suppl the burden to Mexico in a very large quantity.

The Colorado River Compact apportioned water to Mexico in an indeterminate amount until fixed by the United States but provided that it should first be supplied out of the surplus. So then it seems to me that the obligation of the States of the Upper Division to deliver water at Lee Ferry is not limited to the 75,000,000 acre feet every ten-year period as set out in the Colorado River Compact, but in addition to that 75,000,000 acre feet every ten-year period, some surplus would have to be delivered there for Mexico.

Now, according to our engineer's figures, and I believe they are the Bureau figures, the virgin flow of the River at the Mexican Boundary, with the allocation to Mexico and the apportionment to the Upper and Lower Basins, reduces the surplus in the whole river to some 220,000 acre feet on the average above all of our rights. That necessarily then includes the obligation of the States of the Upper Division to make delivery at Lee Ferry in addition to the 75,000,000 acre feet every ten years for use in the Lower Basin, approximately a million acre feet a year on the average to discharge the obligation to Mexico in the absence or the disappearance of surplus, at which time if there was any deficiency in the surplus to Mexico, then the Lower Basin would supply half the deficiency and the Upper Division half.

So it is a very complicated affair right in there that I think would require the additional engineering information that I understand you feel you have to have before you could make or begin to get down to the question of the apportionment of the beneficial consumptive use of the 7,500,000 acre feet apportioned to the Upper Basin, or an apportionment of the obligations to deliver at Lee Ferry. So that the Legal Committee now would not be able to do much in addition to what the Boundary Commission suggests, which is that: "Nothing in this Compact shall be construed as affecting the obligations of the United States of America to the United Mexican States under existing treaties." That is about as far as the Legal Committee could now go until further substantive decisions are made.

COM. STONE: Mr. Carson, I don't quite follow you. I have always contended for engineering data when it is necessary; but I don't quite see why you need any engineering data on this subject. We must recognize, of course, the obligation on that surplus to make deliveries at Lee Ferry. That is a legal matter.

COM. CARSON: Yes.

COM. STONE: We don't know what that is and I doubt whether the Engineering Committee can lend any light on it; and if they did, the obligation would remain the same no matter what it is. I think your statement demonstrates the advisability of the Legal Committee considering the languag submitted by the International Boundary Commission and the suggestions which have been made here and make some progress by working on it.

COM. CARSON: Well, if you refer it we will do the best we can wit it, but I wanted to call your attention to those other things.

COM. STONE: Whether the Engineering Committee said it was 1,500,000 acre feet or 500,000 acre feet, it is still an obligation. And then added to that is the additional obligation imposed by the Colorado River Compact for each state to share equally if the surplus defined in the olorado River Compact is deficient to meet Mexican obligations.

THE CHAIRMAN: For each basin to share, you mean.

COM. STONE: Each basin, I mean. So that the discussion here does indicate that inherent to this question are legal matters. I still insist that this is a matter which should in the interest of progress and can well be referred to the Legal Committee for consideration.

COM. WILSON: Mr. Chairman, as I understand, the only thing before the Commission is Judge Stone's substitute motion, which requires that this be referred to the Legal Committee for further consideration?

COM. STONE: That is right.

COM. WILSON: Mr. Watson's motion was that action on it be deferred. Now, I don't think it makes a bit of difference. If you read the question here, the question that is asked is: "Shall compact contain any provision relating to the delivery of water at Lee Ferry for the use of Mexico in the event there is not sufficient surplus water to supply the Mexican share." If you answer that "yes", it means simply that the compact will have some language in it to cover that. Whether you defer action or whether you refer it to the Legal Committee, it may be determined not to say anything about it, while we all recognize the obligation. The only point I can see there is to determine whether you are going to say anything or nothing. In either event we recognize the obligation of the Mexican Treaty. Now I will vote on either motion, "yes."

COM. STONE: Mr. Wilson, I think you have got a point there and I believe my motion should be to the effect that tentatively the compact should contain language and that the matter be referred to the Legal Committee.

COM. WILSON: I am not sure yet that we can all agree that it should contain any reference at all. I think perhaps it should. But why make up our minds now that you are going to say something about it when we can change our minds later and decide not to?

COM. STONE: We have a lot of confidence in the Legal Committee and if we refer it to the Legal Committee we will be making progress.

MR. HOWELL: For the purpose of determining how extensive this motion should be, I would like to ask Mr. Riter a question. If I understood him rightly yesterday in making his report, with that modesty so characteristic of engineers, he stated the Engineering Committee was unable to determine the exact obligations of the Upper Basin under the Mexican Treaty. Did I misunderstand you?

MR. RITER: Well, I don't remember exactly what I said yesterday. I did quite a bit of talking, more talking than I should. But I have heard conflicting legal philosophies regarding the obligation of the Upper Basin to deliver water to Mexico. In my own mind there is no question about it. In my own mind the Upper Basin unquestionably has an obligation to supply the Mexican Treaty. There are people present in this room who do not agree with me.

COM. STONE: You don't mean to supply the Mexican Treaty. We don't have it all.

COM. BISHOP: Supply the shortage would be enough, wouldn't it, Mr. Riter?

MR. RITER: There are some people in this room who believe we don't

have to deliver anything at Lee Ferry to help meet the obligation imposed by the Mexican Treaty. I don't share that view.

MR. HOWELL: Well, the only reason I made this inquiry, Mr. Chairman, is to determine whether or not it wouldn't be a good thing in view of the statement of the Chairman of the Engineering Advisory Committee that this matter or the obligation under the Treaty of the Upper Basin States be referred to both the Engineering and the Legal Committee.

MR. ROLLINS: I was wondering about the wording of Paragraph (a); I am wondering if our obligation ends as Upper Basin States in connection with the Mexican Treaty, if a shortage should develop which would require our furnishing water to Mexico--if our obligation ends if we deliver it at Lee Ferry. Wouldn't we have to be responsible for our portion of the deliver at the International Boundary?

CCM. STONE: No, the Compact makes that clear.

THE CHAIRMAN: Well, the Chairman is a little bit confused about the intent of the Commission on this. It seems that the Commission should decide, first, whether or not it wants to have language referring to this matter, and if so the lawyers presumably are to work it out. And apparently that is the intent of the motion, to indicate, maybe very cautiously, that the Commission has a notion there should be a provision and hopes that the lawyers will work something out.

CCM. STONE: Mr. Chairman, Mr. Wehrli says that he has some suggestion to make to clarify the motion. Maybe he has got something that will solve it. What is it?

MR. WEHRLI: I didn't have any suggestion, Judge Stone, but Mr. Watson's motion having been withdrawn and you having made a substitute motion and then having sort of rephrased your substitute motion, I was wondering if you wouldn't start over on your motion and make such motion as you feel ought to be made. I thought that might clarify the record on it.

CCM. STONE: Very well. I withdraw my former motion and now make this motion: that with reference to the question appearing as Subsection (a) under Group III appearing on the agenda, the Commission, subject to review and reconsideration, believes that the compact should contain language relating to the deliveries of water at Lee Ferry for the use of Mexico in the event there is not sufficient surplus water as defined by the Colorado River Compact to supply the Mexican share; and also language which will consider the obligations under the Mexican Treaty for delivery of water from the surplus; and that the matter be referred to the Legal Advisory Committee.

Now, my thought in submitting this motion is that the discussion here indicates that there are legal questions. The record shows that the International Boundary and Water Commission has made a proposal. That proposal should be considered along with any language which the Legal Committee might have in mind. I also call attention to the fact that my motion specifies that it is a subject for further review and consideration. We will be better able to consider this if some specific recommendation comes from the Legal Committee.

CCM. BISHOP: Second the motion.

MR. WALLACE: Mr. Chairman, a question.

THE CHAIRMAN: Mr. Wallace.

MR. WALLACE: What about drought?

COM. STONE: My motion doesn't cover Subsection (b) on drought, just (a). That is reserved for further action.

THE CHAIRMAN: Is there further discussion of the motion?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Do you now wish to consider Item (b) of Group III on page 2 of the agenda which reads: "Should the compact contain any provision relative to extraordinary drought in order to take advantage of the applicable provisions of the Mexican Water Treaty."

COM. WATSON: Mr. Chairman, it is very apparent that we should, if we do have the obligation. Therefore, we should answer this item in the affirmative and refer it to the Legal Advisory Committee. I so move.

THE CHAIRMAN: Is there a second to Mr. Watson's motion?

COM. BISHOP: Second the motion.

THE CHAIRMAN: Is there a discussion of the motion?

COM. WILSON: On that same thing, I am not sure the affirmative answer is yes. It may be but it appears to me that we answer (a) up there and say we recognize the obligation in some appropriate language. Then under (b), in case of extraordinary drought, that obligation may be limited. If we answer (a) yes and use appropriate language, it may be entirely unnecessary to say anything about extraordinary drought, which is a matter the International Boundary and Water Commission will enforce against Mexico if appropriate.

MR. BREITENSTEIN: Mr. Wilson, my thought in submitting that was that there is no provision in the Mexican Treaty which really places into effect the provision on extraordinary drought. As I understand it, the matter is left for determination by the United States but no agency is really designated to make the determination. It seems to me that we ought to have something in here which would recognize the right of the administrative agency which we set up to say to the United States Section that we have got an extraordinary drought and so the share of water delivery to Mexico should be scaled down. In my own mind, there should be some specific direction to the agency which we set up which would cover this subject.

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Then the understanding is that we will try to get through by four o'clock tomorrow afternoon but whether we do or not, we will call it a day.

COM. STONE: What time do we meet this afternoon?

THE CHAIRMAN: That hasn't been disposed of. We shall recess now. What time shall we come together?

MR. ROLLINS: One-thirty.

THE CHAIRMAN: Is one-thirty satisfactory? (No response.) Let it be understood then we will convene at one-thirty today.

(12:00 Noon, Recess.)

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(1:30 p.m. Meeting reconvened.)

THE CHAIRMAN: Gentlemen, will you come to order, please. It appears now that the Commission is ready to consider Item (a) of Group IV, which reads: "What general provision should be incorporated in the Upper Basin Compact to recognize the validity and applicability of the Colorado River Compact."

COM. BISHOP: Mr. Chairman, I move that a provision be incorporated in the compact recognizing the validity and applicability of the Colorado River Compact, and that the drafting of such a provision be referred to the Legal Advisory Committee.

COM. STONE: Second the motion.

THE CHAIRMAN: Any discussion of the motion? Are you ready for the question?

COM. WATSON: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: We will now consider Item (b) of Group IV, which reads: "Should the definitions contained in Article II of the Colorado River Compact be incorporated without change in the Upper Basin Compact." Gentlemen, the Chair would suggest now that you discuss this matter freely and then finally let's get a motion to dispose of it which you can all agree to.

MR. BREITENSTEIN: I suggest that before any action is taken on that those definitions should be read to the Commission here.

THE CHAIRMAN: That is a very good suggestion. Mr. Wehrli, will you read the provisions referred to?

MR. WEHRLI:

"ARTICLE II. As used in this compact--

"(a) The term 'Colorado River system' means that portion of the Colorado River and its tributaries within the United States of America.

"(b) The term 'Colorado River Basin' means all of the drainage area of the Colorado River system and all other territory within the United States of America to which the waters of the Colorado River system shall be beneficially applied.

"(c) The term 'States of the upper division' means the States of Colorado, New Mexico, Utah, and Wyoming.

"(d) The term 'States of the lower division' means the States of Arizona, California, and Nevada.

"(e) The term 'Lee Ferry' means a point in the main stream of the Colorado River 1 mile below the mouth of the Paria River.

"(f) The term 'Upper Basin' means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River system above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry.

"(g) The term 'Lower Basin' means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry.

"(h) The term 'domestic use' shall include the use of water for household, stock, municipal, mining, milling, industrial, and other like purposes, but shall exclude the generation of electrical power."

THE CHAIRMAN: You have heard the definitions as read by Mr. Wehrli. What are the wishes of the members of the Commission?

MR. WEHRLI: Mr. Chairman, I think we are of the opinion that these definitions should be included in the compact but that this is not necessarily

an exhaustive list of definitions that you will need in the compact on the Upper Basin. We would favor inclusion of these definitions but with the understanding that it may be necessary to add some others.

COM. STONE: Mr. Chairman, Colorado concurs in the statement made by Mr. Wehrli for Wyoming. And we would suggest that the Legal Committee be instructed to give consideration to such other definitions as may be needed and desirable in the compact now under negotiation.

THE CHAIRMAN: Do you suggest that as a motion, Judge Stone?

COM. STONE: I am just discussing it is all.

THE CHAIRMAN: All right. Are there any other suggestions?

COM. WILSON: Mr. Chairman, I agree in substance with what has been said but I understand the Legal Committee wants some authority from this Commission before they bring something back. Now it seems to me that there ought to be a little discussion somewhere as to whether each one of these definitions shall be copied verbatim into our compact. Obviously there are a few of them that don't fit our compact. Some of them are of such a substantial nature that we want to put them in our compact word for word whether all of them go in or not, and I think that the Committee ought to have further suggestions from the Commission.

The general provision that you adopted there under (a), the language of that, would in effect cover the definitions. Then it is a question of which ones you want to specify, or does the Commission want to say, "Now, without regard to applicability or whether they fit, copy each definition word for word", and then add some more. There should be some discretion it seems to me in the Legal Committee to come back and suggest that maybe some of the definitions shouldn't be set out verbatim in our compact.

COM. STONE: Mr. Wilson, do you think we might make progress now--it isn't a difficult matter--if we would go over each definition and determine here whether in the judgment of the Commission such a definition may not be applicable and unnecessary or whether any change in definition should be made?

COM. WILSON: I think that might be all right, Judge Stone.

COM. STONE: I think we might be making some progress that way, and yet I am wondering whether we could legally change a definition, if we use it at all, that is contained in the Colorado River Compact.

COM. WILSON: I am assuming that the Committee will write out a general provision recognizing the validity and applicability of the whole compact. Now, when that language has been decided upon, is it then necessary to follow that up and put every definition in the new compact word for word?

COM. CARSON: Mr. Chairman, in accordance with the suggestion of Mr. Wehrli that it may be advisable to define terms in this compact in addition to the terms that were defined in the Colorado River Compact, it would seem to me that article relating to definitions probably should be the last one considered by this Commission after the other articles are in and we determine whether any of the terms there used appear to require specific definition. The Legal Committee could be instructed here to consider and recommend to the Commission any specific definitions of terms, either included in the Colorado River Compact or in the Upper Basin Compact, as it would deem advisable to have specifically defined when the whole compact is completed.

MR. WEHRLI: If that is a motion, we would join in it, Mr. Carson.

COM. CARSON: I would like to make that as a motion.

COM. BISHOP: Second the motion.

THE CHAIRMAN: Motion has been made and seconded. Is there a discussion of the motion as presented by Com. Carson? (Question is called for.) The question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

MR. BREITENSTEIN: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: We now come to Item (c) of Group IV of the agenda which reads: "Should paragraphs (f) and (g) of Article III of the Colorado River Compact relating to the apportionment of unapportioned water be carried over into the Upper Basin Compact."

Mr. Wehrli, can we borrow your voice to read the paragraphs (f) and (g) of Article III of the Colorado River Compact so the Commissioners may know what they are directing their attention to?

MR. WEHRLI: (f) of Article III provides:

"Further equitable apportionment of the beneficial uses of the waters of the Colorado River system unapportioned by paragraphs (a), (b), and (c) may be made in the manner provided in paragraph (g) at any time after October 1, 1963, if and when either basin shall have reached its total beneficial consumptive use as set out in paragraphs (a) and (b).

"(g) In the event of a desire for a further apportionment as provided in paragraph (f) any two signatory States, acting through their governors, may give joint notice of such desire to the governors of the other signatory States and to the President of the United States of America, and it shall be the duty of the governors of the signatory States and of the President of the United States of America forthwith to appoint representatives, whose duty it shall be to divide and apportion equitably between the upper basin and lower basin the beneficial use of the unapportioned water of the Colorado River system as mentioned in paragraph (f), subject to the legislative ratification of the signatory States and the Congress of the United States of America."

MR. BREITENSTEIN: Since Colorado suggested that I might say one of the things we had in mind was: If there is any surplus water in the

Colorado River which is subject to allocation, of course the Upper Basin doesn't want to give away the right to participate in some of that surplus water. It seems to me there should be in an Upper Basin Compact some provision for allocation among the States of the Upper Basin of that portion of surplus water which may be allocated to the Upper Basin in accordance with these provisions of the Colorado River Compact which have just been read.

THE CHAIRMAN: Mr. Breitenstein, is it your idea that the final allocation which may be made on a percentage basis would be limited to the unapportioned water or would it include the surplus?

MR. BREITENSTEIN: Well, my idea, speaking only personally, is that whatever allocation we make among the States of the Upper Basin at this time is an allocation of III (a) water and not of surplus.

THE CHAIRMAN: Then when the matter of surplus water is determined you would proceed under the provisions of the Colorado River Compact in order to make a further apportionment?

MR. BREITENSTEIN: It would seem to me that further apportionment would be desirable. It may be that apportionment shouldn't be on the same basis as the apportionment of the III (a) water. Now I don't know; it is just a possibility.

THE CHAIRMAN: Of course, that would afford an opportunity at that time, then, to rectify any inequities which might pop up in the compact we are talking about.

MR. BREITENSTEIN: That is a possibility. I would be surprised if any of the states here were willing to make an allocation among the States of the Upper Basin of surplus water. Maybe they are; I don't know.

THE CHAIRMAN: Mr. Breitenstein, let me ask you this: Could they really do that without violation of the existing compact?

MR. BREITENSTEIN: Oh, I think it is possible. You could say when, as and if the Upper Basin is determined to be entitled to any surplus water, then that water shall be allocated in a certain way.

THE CHAIRMAN: Thanks, Mr. Breitenstein.

Com. Carson, do you have any remarks on this item?

COM. CARSON: Well, Mr. Chairman, I agree with Mr. Breitenstein that you probably ought to have some reference in there so as to preserve the right of the Upper Basin to participate in that further apportionment between the Upper and the Lower Basin, preserve that so there will be no question about it. But I don't believe it would be proper now to undertake to apportion it until that apportionment is made between basins.

THE CHAIRMAN: Com. Wilson?

COM. WILSON: Well, my present thought on it is in line with what Mr. Breitenstein says. However, I don't know whether the Commission, when it comes to making the allocation, is going to specify III (a) water. I don't know. That is a matter I think that would have to be given some very serious consideration. But I am perfectly willing to use language that will preserve our right to participate in the apportionment of surplus water when it is available under the terms of the Colorado River Compact.

THE CHAIRMAN: It would seem to the Chairman--I don't know how you would term it--but that notice should be taken of the possibility of the availability of unapportioned water in this compact and it should be definitely understood what this compact allocates.

Com. Stone, do you have any further comments?

COM. STONE: I do not believe it is good policy, and irrespective of what Mr. Breitenstein said, I still question the possibility of making any apportionment of surplus water. At least it isn't good policy in this compact to attempt any apportionment of the surplus water. I believe that the paragraph should be referred to in appropriate language.

The states of the Upper Colorado River Basin may not apportion surplus water defined in the Colorado River Compact in the absence of the other two states of the Colorado River Basin. As Mr. Breitenstein suggests, we might agree among ourselves that if an apportionment is made, the apportionment shall be in accordance with the agreement contained in this compact, but after all that is an agreement reached in a meeting or in a negotiation at which the other states are not parties. I think it would be very bad policy.

COM. WILSON: I would like to call your attention to the provisions of that Paragraph (f), that it isn't necessarily true that this apportionment will be made in 1963.

COM. STONE: It isn't, certainly; you are right about that.

COM. WILSON: In 1963, if either basin shall have reached its total beneficial consumptive use, and that might be fifty years after 1963.

COM. STONE: That is what I said. They could apportion it under certain conditions and that is a definite condition.

MR. BREITENSTEIN: I didn't say as a matter of policy I favored making apportionment of any surplus water. In answer to the Commissioner's question I said it was a possibility. I think that is right. But the Boulder Canyon Project Act states, so much III (a) water plus not more than half the surplus to California; and the Arizona contract states so much water plus not more than one-half of the surplus.

COM. CARSON: Of course, that means surplus available in the Lower Basin.

MR. BREITENSTEIN: That is right. You could do the same thing up here but I think it is bad policy to do it.

COM. STONE: In my opinion, whether it is possible or not possible, it is clearly a bad policy.

THE CHAIRMAN: Off the record. (Discussion off the record.) Does the Commissioner for Wyoming or Mr. Wehrli have anything to offer on this item?

MR. WEHRLI: We are willing to leave it to the future, but if that is done I believe the Legal Advisory Committee ought to be given the task of drafting the necessary language that would have to go into the compact. I don't believe it is a subject that you can ignore. I think you have got to make some reference to it in the compact and that the Legal Committee

ought to draft such a provision if it is agreed by the Commissioners that no apportionment should be made in the compact at this time.

COM. WILSON: Mr. Chairman, I move that the question set out in the agenda under IV (c) be referred to the Legal Advisory Committee with instructions to that Committee to put in appropriate language such provision dealing with paragraphs (f) and (g) of Article III of the Colorado River Compact which they deem necessary to protect the rights of the Upper Basin in any water that may be unapportioned. Of course they report back to the Commission.

COM. STONE: Second the motion.

THE CHAIRMAN: Are there any further comments on the motion by Judge Wilson? (Question is called for.) Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: The next item on the agenda is Item (d), Group IV, which reads: "What, if anything, should be done with relation to Article VI of the Colorado River Compact pertaining to controversies between two or more states."

Will you please read Article VI of the Colorado River Compact, Mr. Wehrli?

MR. WEHRLI:

"Should any claim or controversy arise between any two or more of the signatory States: (a) With respect to the waters of the Colorado River system not covered by the terms of this compact; (b) over the meaning or performance of any of the terms of this compact; (c) as to the allocation of the burdens incident to the performance of any article of this compact or the delivery of waters as herein provided; (d) as to the construction or operation of works within the Colorado River Basin to be situated in two or more States, or to be constructed in one State for the benefit of another State; or (e) as to the diversion of water in one State for the benefit of another State, the governors of the States affected upon the request of one of them, shall forthwith appoint commissioners with power to consider and adjust such claim or controversy, subject to ratification by the legislatures of the States so affected.

"Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or by direct future legislative action of the interested States."

THE CHAIRMAN: The Chairman would like to ask a question as to what effect any action taken on this item would have on the administrative setup which you tentatively discussed and approved a day or so ago.

COM. STONE: Mr. Chairman, Mr. Breitenstein has a statement to make on this Item (d), page 3 of the agenda. Perhaps he will clarify your question.

THE CHAIRMAN: Would be very glad to hear from Mr. Breitenstein.

MR. BREITENSTEIN: My thought was that the Commission should give consideration to this article of the Colorado River Compact but I do not mean to imply that I think there is any reason for incorporating a similar provision in the Upper Basin Compact. Frankly, I don't like the way that Article VI of the Colorado River Compact reads at all. I see no reason whatsoever for incorporating it in an Upper Basin Compact. You noticed in the reading, of course, that one of the articles mentioned was facilities in one state for use in another state. We are doing here what that provision contemplates. We have made arrangements, in what has been tentatively adopted, for the operation of facilities in one state for the benefit of another state. In my opinion that is perfectly proper under Article VI and is in accord with it.

My recommendation is that we do not carry over into the Upper Basin Compact Article VI of the Colorado River Compact.

THE CHAIRMAN: Com. Carson, do you have anything to offer on this item?

COM. CARSON: Mr. Chairman, I agree with Mr. Breitenstein that it is not necessary that this article come over as it is written here. I don't think it would be completely applicable. I thought it might be covered in that other clause that we have referred to that we haven't yet been instructed to write, that is, at the request of one or more states, the other states would appoint commissioners to consider any matter.

MR. BREITENSTEIN: Mr. Carson, I didn't mean to imply that I wasn't in favor of what you just mentioned. My point was that there was no necessity to carry Article VI over into the Upper Basin Compact. Something such as you suggest I think might be well done.

COM. CARSON: That is the same thought that we both had. As it is written here it would not be proper to be brought over as is.

MR. WEHRLI: Mr. Breitenstein, are you talking now about the same thing or something different than what we discussed in the Legal Advisory Committee about review by the commissioners, or would the two go together in some way?

MR. BREITENSTEIN: They are probably two things. I had in mind the possibility of having a provision for review and also that the Commission might desire to set up some machinery for ironing out disputes. I don't know whether they would or not. But regardless of what action is taken on those two my recommendation is that Article VI should not be carried over.

MR. WEHRLI: My thought about the matter is that if you don't carry over Article VI--I think we can agree with you on that--nevertheless this might be the appropriate time to make some request of the Legal Advisory Committee to prepare something on the subject.

MR. BREITENSTEIN: I agree. It might be a good idea.

COM. STONE: Mr. Wehrli, are we not here though considering provisions of the Colorado River Compact, what provisions should be carried over, under this group? Can't we dispose of this matter as a matter of policy and then revert to those questions which you raise?

MR. WEHRLI: That will be agreeable.

COM. BISHOP: Mr. Chairman, I move that Article VI of the Colorado River Compact not be included in the Upper Basin Compact.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion has been made and seconded. Do you wish to discuss the motion? (Question is called for.) Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

(Discussion off the record.)

COM. STONE: Mr. Chairman, Colorado makes this motion: That the following suggested language be referred to the Legal Committee for its consideration, such language being suggested for incorporation in an Upper Colorado River Basin Compact, namely: "The failure of any state to use the water allocated to it for beneficial consumptive use shall not constitute any relinquishment of such water to the Lower Basin or any state thereof." Further that the Legal Committee be asked to study this language and feel free to substitute therefor any other language which in its judgment would be more appropriate for such purpose or enlarge on it if it sees fit.

COM. WILSON: Second the motion.

THE CHAIRMAN: Are there any further comments on the motion as offered by Judge Stone?

COM. WATSON: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Off the record. (Discussion off the record.)

(3:05 p.m. Recess.)

(3:15 p.m. Meeting resumed.)

THE CHAIRMAN: Now, gentlemen, I believe we are ready to consider the items under Group V as shown on the agenda. Item (a) of Group V reads: "Should the compact endeavor to encompass rights and obligations arising out of or affecting interstate tributaries."

MR. BREITENSTEIN: May I state the thought I had in mind in putting that down?

THE CHAIRMAN: We shall be very glad to have you state it.

MR. BREITENSTEIN: Everything under Group V is related and to me the basic question for decision by the Commission is whether or not these matters pertaining to the tributaries should all be settled and concluded by one general overall basin compact or whether the idea is to have separate compacts between the states affected on particular tributaries. That general proposition is involved in everything which is under Group V. There is only one small item which is different; that is in connection with the existing La Plata River Compact.

MR. WALLACE: What is your suggestion?

MR. WEHRLI: I would suggest, Mr. Chairman, that subparagraph (b), having some different aspects than the others in that group, be considered first, or else consider (a), (c), (d), (e) and (f) together. It seems to me that (a), (c), (d), (e) and (f) are entirely germane, (b) is a little bit different, and (g) and (h) are somewhat different.

COM. STONE: I have somewhat the same opinion, that we can't settle anything under (a) because it requires separate treatment as evidenced by (c), (d) and so forth.

MR. WEHRLI: I think we should take up either (b) or else--

MR. BREITENSTEIN: I agree with you, Mr. Wehrli. I think the most appropriate thing is to take up (b) first. I think that can be disposed of very simply.

THE CHAIRMAN: We will consider Item (b), which reads: "What provision shall be made with relation to the existing La Plata River Compact.

MR. WALLACE: What is the---off the record. (Discussion off the record.)

COM. STONE: It seems to me we should have a provision recognizing that compact and the validity of its terms and that nothing in this compact which is under negotiation shall be construed as having the effect of invalidating any of the terms of that existing compact.

COM. WILSON: Judge Stone, I will say so far as I know the water users in both Colorado and New Mexico have indicated that they desire that the La Plata Compact be continued in force and effect so far as their individual rights are concerned.

COM. STONE: That is my understanding.

COM. WILSON: If that is true, it seems to me it might be desirable to put something in the compact to show that it is to continue in force and effect.

COM. STONE: Mr. Chairman, as representing one of the states party signatory to the existing La Plata Compact, I move that the continuance and the validity of such La Plata Compact be adequately protected by appropriate language in an Upper Colorado River Basin Compact; and that the matter be referred to the Legal Committee to draft appropriate language.

COM. WILSON: Second the motion.

MR. WEHRLI: Mr. Chairman, we agree that the validity of that compact must be recognized but it seems that whenever an apportionment of water is made to the respective states under the compact, of course as to each state it would have to be subject to the provisions of the compact we are now endeavoring to negotiate, that is to say, subject to the percentage allocation of beneficial consumptive use and subject to the provisions relating to the obligations of delivery at Lee Ferry. I think that probably would be implicit but I think it is a matter which should be mentioned and understood.

COM. STONE: Colorado doesn't question that.

COM. WILSON: Neither does New Mexico.

COM. STONE: That matter will be considered in making the apportionment.

MR. WEHRLI: I would merely suggest then that in referring the matter to the Legal Advisory Committee that Committee ought to consider perhaps a little bit more than your motion might indicate and that a provision merely recognizing the validity of the compact is not quite enough. I think we may have to have some other provisos in connection with it.

COM. STONE: I might say, Mr. Wehrli, that my motion set forth the idea and included the statement that the Legal Committee use appropriate language to carry that out. So to the extent that the question you mentioned should be incorporated, I assume it would be incorporated in appropriate language. I have in mind the matter you mention.

COM. CARSON: Mr. Wehrli, it would seem to me that would be covered by a general clause that would go in there that all rights to beneficial consumptive use of water in any state be satisfied from the water apportioned to that state, including the La Plata water or whatever it is.

MR. WEHRLI: I am not quite prepared to agree with you on that but I think the record is clear enough as to this reference to the Legal Advisory Committee and it would be up to that Committee to attempt to use such language as it feels necessary. So I have no disagreement with the motion that has been made.

COM. WILSON: I assume the water that is used in New Mexico and also in Colorado by individual water users is capable of measurement. It is a peculiar compact. It provides for alternate use, so many dates in one state, so many days in another. But I assume we can find some way to measure it so as to make it come within the allotment of each state.

MR. WEHRLI: To make my position entirely clear, I am assuming that a condition might arise when Colorado would have to respond to the supplying of some water to meet the obligation at Lee Ferry. Obviously, of course, Colorado might use its own discretion presumably as to where that water comes from, but this particular water in the La Plata River as we view it wouldn't be free from the general obligation of the State of Colorado any more than any other portion of its supply.

COM. STONE: I might say this off the record--(Discussion off the record.)

THE CHAIRMAN: Are there any further comments on the motion as made and seconded? Are you ready for the question?

COM. BISHOP: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Now, gentlemen, as pointed out by Mr. Breitenstein, these items are related. What are the suggestions for a combination of items for consideration?

COM. STONE: I suggest we go to Item (c) of Group V.

THE CHAIRMAN: Off the record. (Discussion off the record.) Gentlemen, you have before you the consideration of Item (c), which reads: "What adjustment must be made between Colorado and New Mexico in connection with the use of San Juan River water."

COM. WILSON: I yield to Judge Stone on that point.

COM. STONE: I might yield to Mr. Wilson. However, I think we must approach these subjects frankly and realistically. It is very obvious because of the topography of the country that any water apportioned to New Mexico has to come out of the San Juan Basin. It therefore creates a problem requiring special treatment and adjustment in the compact now under negotiation.

COM. WILSON: I agree that is an adjustment that must be made and perhaps it can be made in this compact. I realize that out of any allotment that is made to New Mexico, the only source where we can obtain the water is the San Juan and its tributaries. And if by chance we got enough water to affect Colorado's potential future uses on the San Juan, that is a matter that Colorado and New Mexico will have to come to agreement on, if ever it should become necessary for Colorado to forego some future uses on the San Juan in order for New Mexico to have its allotment. That is a matter that will have to be agreed upon and determined. As I visualize it from whatever allotments are made to Colorado, Colorado will have to choose from which tributaries she is going to take that water.

MR. WALLACE: You have one choice.

COM. WILSON: And I am assuming you wouldn't want to take it all from the San Juan. I am assuming that Colorado--I will use the word arbitrarily--would not arbitrarily choose to take a large portion of her percentage of allotted water out of the San Juan if the result would be to prevent New Mexico having any source to go to at all to get the water allotted to her. I assume you won't agree to an allotment to New Mexico that you felt would deprive you of San Juan water that you just had to have. I don't know where that line is. I do know your present uses on the San Juan are comparatively small and I do know that your potential possibilities are comparatively small so far as the Colorado River report goes, but that is a matter we will have to adjust. I don't know that there can be an adjustment today. I am willing to listen to a discussion on it.

COM. STONE: There are two questions which Colorado must keep in mind: One is that the development of the land and water resources in the San Juan Basin in Colorado are dependent solely upon waters of that tributary. I know of no possibilities for Colorado to take any surplus waters out of another tributary for use within that basin.

The other question involved here relates to deliveries at Lee Ferry. It can be assumed for the present at least, that when New Mexico's desires and apportionments are taken care of out of this basin, that it will greatly reduce water remaining with which to aid in making deliveries at Lee Ferry. That may place a heavier draft so far as Colorado is concerned on other tributaries within the state. So that it does become a rather involved problem.

In a real sense, this San Juan River constitutes a separate river in which two states are primarily interested and which could, and in the absence of an Upper Basin Compact probably would, ultimately mean a separate compact. It is Colorado's present view that we should attempt to adjust these problems within the framework of the compact now under negotiation. We hope that that can be accomplished. I can't see now what we can do about it unless it is the subject for separate discussions between the two states.

MR. WALLACE: Does the Dolores have any relationship there? Can you take any water out of the Dolores down in the San Juan Basin?

COM. STONE: It is physically possible but I don't think there is

enough surplus water in the Dolores that would make that likely. I imagine that there might be--from a physical point of view--more likelihood of taking some water out of the San Juan into the Dolores. But it is one of these problems which points up the proposition that the blanket apportionment of "X" amount of water to Colorado--no doubt the same thing is true as to other states--does not answer the question.

MR. WEHRLI: Maybe you can't answer this or don't feel like answering it, but is your present view of the matter that the making of an agreement with New Mexico on the San Juan River would be the necessary prerequisite to the conclusion of the compact we are negotiating on, or what is your view of that?

COM. STONE: My view about it is that I think it would be well for the two states to have some discussions on that matter in order to complement the making of this compact. Does that answer your question?

MR. WEHRLI: Well, not entirely. Suppose that you and New Mexico are unable to agree; can we still go ahead and make this compact we are engaged in attempting to negotiate here?

COM. STONE: Well, I think probably that your question would go to New Mexico more appropriately than Colorado. New Mexico is wholly dependent upon the San Juan River.

MR. WEHRLI: May I ask the question then of Judge Wilson to see what his view is, if he cares to express himself.

COM. WILSON: Naturally I would say, Mr. Wehrli, if we can't arrive at an agreement in this compact that whatever water is allotted to us can be obtained by us, we won't agree to the compact. In other words, I don't see how you could draw a compact that would allot the right to use so much water to New Mexico unless there were provisions in the compact that made that possible of accomplishment, and to that extent I would say that the main compact is in a measure dependent upon our being able to make some agreement.

COM. STONE: For Colorado I want to say I appreciate fully Mr. Wilson's statement. I hardly see how he could take any different position.

It seems to me, gentlemen, frankly, that this San Juan matter is an important one as disclosed by the discussion that must be taken care of in this compact now under negotiation.

THE CHAIRMAN: Gentlemen, is it not possible that this matter will have to be taken care of in the allotment, the allotment itself would indicate that?

COM. STONE: That isn't enough. That is what we are just trying to point out.

THE CHAIRMAN: Let me ask a little further then if that isn't enough. I haven't been able to determine yet whether the Commission intends to specify percentages on tributaries or a lump sum percentage which will cover all the tributaries.

MR. BREITENSTEIN: Those questions are posed later on.

COM. STONE: Those questions come later. But certainly, Mr.

Chairman, as to the San Juan River, I will say this, frankly it would be very unfair to New Mexico and I don't see how New Mexico could ever accept a blanket allotment to Colorado without some adjustment with Colorado on the San Juan.

THE CHAIRMAN: In other words you feel, Judge Stone, that the percentage would have to be specified in the compact on that stream.

COM. STONE: Certainly some appropriate arrangement.

COM. WATSON: The question I would like to ask is: Will it be necessary for us to make a compact in the future dividing certain waters between Wyoming and Utah, and will this compact that we are now making just simply say that that compact will be made and we will acquiesce in the terms?

COM. STONE: Mr. Watson, in answer to that--I thought I covered it in my other statement--you can't do it that way. No lower state such as New Mexico could accept such a provision--that is for Mr. Wilson to say, this is just my view.

I think we should all try to be equitable in these matters. We could leave New Mexico high and dry almost so far as their possibilities for the utilization of Colorado River water is concerned. They must get their water from the San Juan. If we simply say we are including within the blanket apportionment to New Mexico and to Colorado the waters of this stream or a proportion or amount of water of this stream and that will be determined by future compact, then if Colorado said, "Well, that is fine. We just won't make a compact"--and we are the upper state, it isn't right and it won't settle the Upper Colorado River Basin problems if we leave those things in that condition. We can't do it.

COM. WATSON: Judge, may I add this in explanation of the condition: There is ample water rising in the Uinta Mountains to cover the land that exists in Wyoming and there is a willingness on the part of the State of Utah to make a compact with Wyoming to apportion the water, we will say, of Henry's Fork. Now, my question relates to this: Shall we go ahead this summer and make the compact as soon as we can and then let it be a part of this compact that we are writing at the present time, that is, in the nature of the La Plata Compact that already exists?

COM. STONE: Sure that can be done if it is done before this compact is closed.

COM. WATSON: But we don't divide water between Wyoming and Utah in this compact; we make a separate compact and accept this compact, is that it?

COM. STONE: That is a matter for those states to determine.

There are two possibilities: You can do it within the framework of this compact; or you as a matter of policy may desire to do it by a separate compact which would be consummated prior to the making of this compact. However, I can see possibilities where that procedure might hold up this compact because both of them may come before the Congress at the same time, one ahead of the other.

THE CHAIRMAN: Well, it seems to me that in simple language, the compact which is made first governs.

COM. STONE: That is correct.

MR. BARLOW: Mr. Chairman, I would like to ask this question with

that thought in mind, would it be well that Wyoming and Utah have an agreement on the Henry's Fork, included in this compact the same as New Mexico and Colorado on the San Juan and not figure on negotiating anything after this compact?

THE CHAIRMAN: Well, Mr. Barlow, if you negotiated after this compact it would have to be with due recognition of the provisions in this compact. Whichever compact is negotiated first governs.

COM. STONE: Whichever one is approved first.

THE CHAIRMAN: Approved first, yes, correct.

COM. BISHOP: Mr. Chairman, we wouldn't like to go to the trouble and expense of negotiating a compact on the Henry's Fork or on the Little Snake River when it can be taken care of by a paragraph in this compact. We had a meeting in Craig, Colorado, to get together on this and each state has appointed an attorney and they are supposed to draft the language. I believe we tentatively agreed that it could be done and our attorney it seems hasn't been able to get together with Mr. Breitenstein, who represents Colorado. If it is all right with Mr. Breitenstein, I would like to have Mr. Wehrli serve on that so we can get it done. Let's get it done and over with. If that is the right way to do it, let's do it.

MR. BREITENSTEIN: You are getting down now to Item (d). I think we should make every effort possible to adjust our differences on the Little Snake and incorporate appropriate provisions in this Upper Basin Compact. I assure you Colorado is willing to do everything possible.

THE CHAIRMAN: Whatever work you did do it seems to the Chairman would be helpful. You would have to use your own judgment whether you would get your compact ahead of this one or not, but certainly you will not be wasting your efforts, if you work out the situation on that stream.

MR. WALLACE: Why not confine the discussion to the San Juan until we get that behind us.

COM. WILSON: I move that the Commission refer Paragraph (c) of Group V on the agenda to the representatives of the States of Colorado and New Mexico and that they report back to this Commission at a subsequent meeting what adjustments they have arrived at and which they think can be incorporated in this compact.

COM. WATSON: Second the motion.

THE CHAIRMAN: Is there a discussion of the motion? Are you ready for the question?

COM. WATSON: Question.

THE CHAIRMAN: The question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Now, Mr. Breitenstein, as you prepared this agenda, what item do you suggest be taken up at this juncture?

MR. BREITENSTEIN: (d), the one with relation to the Little Snake River.

THE CHAIRMAN: Very well, we will consider Item (d), which reads: "What adjustment must be made between Colorado and Wyoming with relation to the uses of the water of Little Snake River."

COM. BISHOP: I move that the States of Colorado and Wyoming be requested to confer on an apportionment on the Little Snake River and report such agreement as they may be able to arrive at back to this Commission as soon as may conveniently be done.

COM. STONE: Colorado will second that motion.

COM. WATSON: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

COM. BISHOP: For the record, Wyoming appoints Mr. Wehrli as the attorney to represent Wyoming in the drafting of that compact.

THE CHAIRMAN: Gentlemen, are you now ready to consider Item (e): "What adjustment must be made between Wyoming and Utah with respect to the uses of the water of Green River tributaries arising in Utah."

COM. WATSON: Mr. Chairman, I move that the States of Utah and Wyoming appoint their representatives to confer on the apportionment and report back to this Commission.

COM. BISHOP: I will second the motion.

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

COM. BISHOP: Mr. Chairman, I appoint on that committee Mr. Wehrli, the legal adviser, and Mr. Person, the engineering adviser.

COM. WATSON: As for Utah, I will appoint the adviser to the State Engineer, Mr. Clyde, and Mr. C. O. Roskelley.

THE CHAIRMAN: Gentlemen, Item (f) is the next on the agenda under Group V; do you wish to consider that item at this time: The item reads: "What adjustment must be made between Colorado and Utah with respect to uses of water on the main stream of the Colorado River, the Yampa River, the White River and the Dolores River, and other interstate streams tributary to either the Green River or the Colorado River."

MR. WALLACE: How shall we handle that, Judge Stone?

COM. STONE: We felt that that was a matter which concerns principally the rights of Utah and we would like in the first instance to have your suggestions.

COM. WATSON: Mr. Chaiman, in reading this item, as far as I can recall the diversions from the Yampa are largely in Colorado. I don't know of any lands in Utah. Are there any, Mr. Breitenstein?

MR. BREITENSTEIN: It joins the Green in Colorado.

MR. MERRIELL: The Echo Park reservoir will be very largely supplied by the Yampa.

MR. WALLACE: The Deadman's Bench is how large?

MR. BREITENSTEIN: I don't recall the exact area but it lies between the White and Yampa in both Utah and Colorado.

MR. WALLACE: It is a large area and there is a report on it.

MR. BREITENSTEIN: It is described in the Colorado River Basin report.

MR. WALLACE: It is described in the Green or somebody else's.

MR. BREITENSTEIN: Yes, there is an old report on it.

MR. WALLACE: Are you familiar with that situation, Mr. Merriell?

COM. STONE: Mr. Merriell is familiar with it. I will ask him--Deadman's Bench.

MR. MERRIELL: Quite a little of that land is in Utah.

MR. WALLACE: The major part is in Colorado, though.

MR. MERRIELL: It will be supplied with water from White River.

COM. WATSON: The land in Utah lies west of Artesia, Colorado, which is near the State Line.

MR. MERRIELL: A good deal of that Deadman's Bench project is in Utah.

MR. WALLACE: Hadn't that better go to a committee to see whether you should make separate allocations there on those streams or whether the allocations should remain in the mass?

COM. STONE: Such action is agreeable to Colorado, Mr. Wallace.

COM. WATSON: I move that the States of Colorado and Utah each appoint representatives to meet and confer on these rivers, the Yampa, the White and the Dolores, consider all the facts and report back to this Commission.

COM. STONE: Colorado seconds the motion.

COM. CARSON: Mr. Chairman, may I ask a question there?

THE CHAIRMAN: Yes.

COM. CARSON: In this you left out the main stream of the Colorado River and also the main stream of the Green River.

COM. WATSON: Include everything in Subsection (f).

COM. CARSON: Doesn't the Green River flow out of Utah into Colorado and back?

MR. MERRIELL: Practically no development, though.

COM. WATSON: Include all matters under (f).

COM. CARSON: The Green isn't mentioned on that.

MR. BREITENSTEIN: I didn't think there would be any problem over the main stem of the Green.

COM. CARSON: As a member of the Commission I would like to know there wasn't.

MR. BREITENSTEIN: Maybe I am not right, I don't know. That was my guess when I drew this up.

COM. STONE: What do you say about that?

MR. MERRIELL: I don't anticipate any development on the Green River in Colorado except possibly reservoirs, no.

COM. CARSON: When we meet again I would like to know that Colorado and Utah are agreed on all those matters if possible.

COM. WATSON: Question, Mr. Chairman.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Does Colorado wish to announce the appointment of any conferees?

COM. STONE: May Colorado reserve the appointment of these conferees on Item (f) of Group V of the agenda?

MR. WALLACE: For how long?

COM. STONE: We will try to do it expeditiously, within a matter of two or three weeks.

COM. WATSON: Utah will agree to that and will appoint its commissioners.

THE CHAIRMAN: Presumably you will communicate with each other as to time of the meeting.

COM. STONE: That is right.

THE CHAIRMAN: Now we come to a very interesting item, Item (g), which reads: "In the allocation of beneficial consumptive use of water shall there be specific allocations to tributary drainage basins in each state."

COM. WILSON: Mr. Chairman, just to get this started I would like to make a motion.

THE CHAIRMAN: Very well, Judge Wilson.

COM. WILSON: In reference to Paragraph (g) of Group V, I move that any allocation made under the terms of this compact be made to the states as such and not to any basin so that each state may determine for

itself the source from which it will take its allotted portion of the water, subject of course to the understanding that as to New Mexico and Colorado on the San Juan, it will be necessary to specify in the compact what portion of Colorado's allotment shall come from the San Juan Basin.

COM. BISHOP: Second the motion.

MR. MERRIELL: Mr. Chairman, I concur in Mr. Wilson's suggestion. The way it will have to be worked out will be by tributary basin but I think the compact should make the allocation only by states.

COM. STONE: I dislike to disagree with my colleague, Mr. Merriell, but I do to a certain extent, and with Fred Wilson. I am at a loss to know how we can answer that one until we have some report and some action on what has been done with respect to (c), (d), (e) and (f).

MR. MERRIELL: That is the way it will have to be worked out, no question about that.

COM. WILSON: The Engineering Committee as I understand is working on that very problem.

MR. MERRIELL: But in the final language in the compact, I agree with Mr. Wilson that it should be an allocation purely by state.

COM. STONE: Such allocation to a state would have to be subject to the special provisions of the compact with respect to certain tributaries.

COM. WILSON: I understand the Engineering Committee will furnish facts and data as to the tributaries so as to enable each state to determine how it can get its water out of any particular tributary.

THE CHAIRMAN: The Chairman would like to ask Judge Stone a question: Do you make allocation to tributary basins in the Republican River Compact?

COM. STONE: That is correct, sir.

THE CHAIRMAN: The Chair recognizes Mr. Riter.

MR. RITER: The Engineering Advisory Committee will determine the facts with regard to streamflow and present uses by tributaries. The report of the Bureau of Reclamation is the only document that I know of which compiles all the project potentialities by tributaries.

It seems to me from an engineering viewpoint, bearing in mind the discussion we had with Mr. Clyde before our recess, that the final allocation should be by states. I have this in mind that there are project potentialities within each state that are presumably larger than the water which will be allocated to each state, and I feel that each state should not tie its hands by coming out in a formal document and subdividing its own allocation among its tributaries. It seems to me that each state should preserve a certain amount of flexibility where its water will be used within the state.

THE CHAIRMAN: Mr. Riter, the Chairman would like to ask you a question: If you were in the position of some of these commissioners or the state engineers, in supporting this compact before the various legislatures, how would you answer the question propounded by a legislator in a certain tributary basin as to what he would get out of this compact and his people in the way of irrigation development unless you specify how much of the allotment to the state comes out of a certain tributary?

MR. RITER: Well, I couldn't answer the question.

MR. HOWELL: It would surely have the fellow that wasn't going to get any against you.

THE CHAIRMAN: I realize that.

MR. WEHRLI: I don't know whether you heard it or the reporter got it but Mr. Bishop seconded the motion made by Mr. Wilson.

THE CHAIRMAN: I certainly didn't hear it. Pardon me for my neglect.

MR. WEHRLI: He didn't speak very loud.

MR. WALLACE: From your experience, what is the wise thing to do, Judge Stone?

COM. STONE: I might remark that (g) and (h) are interrelated. Before we reach any conclusion we might consider (h).

THE CHAIRMAN: That is entirely satisfactory to the Chairman. (h) reads: "Shall an upper state be required to deliver to a lower state any specific amount of water from any tributary."

MR. WEHRLI: I can see that those two are interrelated but I don't apprehend that even though you might decide under (h) that a certain amount of water would have to be delivered to a lower state upon a particular tributary, that would necessarily mean that the allocation of beneficial consumptive use in each state would not be made to the state itself rather than to drainage basins within the state.

THE CHAIRMAN: I think this discussion of (h) is pertinent to the discussion of (g) and it is permissible in spite of the fact that a motion is before us in regard to (g).

COM. CARSON: Mr. Chairman, it seems to me that if you limited the discussion to (g), to be specific, allocations to tributary drainage basins in each state, that would only be in case of interstate tributaries I take it. It wouldn't tie in with (h). In other words, I think that when any of these interstate tributaries are involved, the allocation will be made to the state in a percentage of use. Still, there would have to be a provision to protect the lower state as well as the upper state. What percentage would come out of the interstate tributary and how much of that interstate tributary flow would be deliverable at the state line for use in the other state?

As I understood Judge Wilson's motion, I don't think it quite encompassed everything it should insofar as these interstate tributaries are concerned. We are not directly concerned for Arizona, but I don't see how you can make an apportionment blanket to a state without specifying what quantity of that apportionment shall come out of one of these interstate tributaries or what part of the flow of the interstate tributary would be delivered at the line.

COM. WILSON: Mr. Chairman, I agree that these questions are interrelated but I call your attention to the fact that (g) goes to the point of whether allocation shall be made in the compact to a basin or to a state. That is the point that my motion went to.

Now then, if you assume that the allocations are to be made to a state and not to a basin, then take up Paragraph (h): "Shall an upper state be required to deliver to a lower state any specific amount of water from any tributary." The obvious answer would be, yes, if necessary to effectuate the allotments that are made in the compact. I don't know whether the two can be decided together or not.

COM. STONE: Mr. Chairman, with respect to both (g) and (h) and in answer further to Mr. Wallace's question, it occurs to me that there are many factors and decisions that should be made before any decision should be attempted on these two paragraphs. I understand that the engineers are making depletion studies, making certain studies as to all of these tributaries. We have already agreed that some of these states shall meet and discuss the matter of apportionment of water and use of water on certain tributaries. It seems to me that those two matters are clearly subjects which should be deferred for future action.

MR. WALLACE: Until the report of the Engineering Committee?

COM. STONE: Or until the Engineering Committee can give us the data we need for the consideration of it, and also until these special committees dealing with different tributaries have been able to make some report.

COM. WILSON: I didn't expect either one of these to be settled definitely here today. I made the motion, and I don't know whether I want to withdraw it, but it is obvious that these things can't be worked out until the Engineering Committee report and until we determine just how the allocation should be made and the amount of it.

THE CHAIRMAN: Well, the Chairman is certainly confused on it. I don't see why you need to wait for any engineering data to determine whether you want to make the allocation in a lump sum or to tributaries. I can't see how further information would help. Mr. Riter, I would like to have your comment on that.

MR. RITER: I don't know whether I can add much more, Mr. Bashore. I do not know what is going to be used as a basis of the compact. I presume that the Commissioners will certainly consider project potentialities. The information the Bureau of Reclamation has is already available to the Commission on that basis.

Now, the engineers have furnished you factual information on streamflow at key gaging stations. We have not yet furnished you information on present uses or flows at state lines.

I still feel in my own mind that the compact itself should be somewhat along the line that Mr. Wilson has in mind, the allocation should be to the state. I feel that it is entirely within the state's own business after the water is allocated to it how it is going to use such allocated water.

COM. CARSON: Except on interstate tributaries.

MR. RITER: Yes, there will have to be some agreement on that. I recognize that.

COM. STONE: I for the life of me can't get Mr. Riter's reasoning on that. How in the world can Colorado and New Mexico on the San Juan make an equitable adjustment and still say that you make a blanket apportionment to each state? Certainly if it is a blanket apportionment there have got to be some special provisions to take care of such situations.

MR. RITER: Well, Judge, I excepted that tributary.

MR. WEHRLI: Isn't the situation this: that if you made a blanket apportionment to each state percentage-wise and then required, let us say, certain state line flows, that blanket apportionment would be indirectly affected by those required flows. But I am wondering if you have in mind that instead of making a blanket apportionment to each state in percentages, you contemplate making an apportionment to a tributary basin in percentages. It seems to me that the apportionment should be to the states in percentage, if we are assuming that we are to make a percentage apportionment. Of course the use of that water will be affected indirectly by the required state line flows, but I don't think that that necessarily means or requires any attempt to divide up within the State of Colorado, or any other state, the total amount of use of that state as to all of the tributary basins.

COM. STONE: Perhaps I can clarify what I have said somewhat. I agree with Mr. Riter's general principle that it should be the business of a state to use the water wherever it sees fit and can obtain projects for such utilization, but we can't disregard the situation with respect to interstate tributaries. If those tributaries were in one state, the question would be simple and could be answered by that general principle. But where you do have an interstate tributary such as the San Juan and one state dependent wholly upon that tributary, then you cannot cover the situation by a blanket apportionment to each state unless such apportionment is subject to special provisions of the compact with respect to such interstate tributaries.

MR. RITER: I don't disagree with you.

MR. WEHRLI: I don't believe, Judge Stone, the views you have just expressed conflict with Judge Wilson's motion--at least they don't in my mind.

COM. WILSON: I don't think what Judge Stone says conflicts with what I have in mind but I can give you an illustration if the figures I use are not taken as having any implication. Let's assume there is an allocation to Colorado to use 40 percent of the total of 7,500,000. Now then, as Mr. Riter said, it is up to Colorado to determine where she is going to get that water. If you say you are going to take 25 percent of that out of the San Juan you are going to forego the right to take it out of some other stream, either the main stem or some other tributary, and I think that is a question for Colorado to determine, what the interests of her state require her to do, where you are going to get the water. And obviously if you decide to take 25 or 30 percent of your allotment out of the San Juan, assuming it is there, you might make it impossible for New Mexico to get a smaller allotment from that same source.

I take it that Colorado would have to say, "Now how much of this are we going to take out of the San Juan?" It might have to be spelled out in the compact. And I don't believe that contradicts what Judge Stone said nor what Mr. Riter said. Somebody in Colorado under this particular circumstance would have to determine that and it might be difficult to determine. It might be the people on the tributary that you want to give the least water to might be there clamoring for more, I don't know.

THE CHAIRMAN: Gentlemen, this has been a rather interesting discussion. It is now about 4:40 and you have all worked pretty well on this today and this is a very, very important question. Perhaps you would like to adjourn and think about it a little bit and come at it with

a fresh view tomorrow morning at say about 9:30. Do I hear a motion to that effect?

COM. WATSON: I move we recess until 9:30 tomorrow morning to continue this agenda and that this evening this Commission meet to correct the minutes of the last meeting.

THE CHAIRMAN: Is there a second?

COM. STONE: Second the motion.

(Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

(4:40 p.m., Friday, February 20, 1948, recess until 9:30 a.m., Saturday, February 21, 1948.)

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Denver, Colorado
February 21, 1948
9:30 a.m.

(All Commissioners present.)

THE CHAIRMAN: The Commission will please come to order. Last evening we were considering the items under Group V, Items (g) and (h). There was quite a bit of discussion on those items and apparently some uncertainty as to the disposition of them, and apparently we adjourned with the idea of having more time to think about them and perhaps this morning the ideas may be more clarified.

COM. WILSON: As I recall, sometime yesterday afternoon we got down to that portion of the agenda under Group V designated as (g) and (h) and I made a motion. I am not sure right now what the motion was and I would like to withdraw that motion and have it deleted from the record.

I want to say this: When I read (g) I thought the answer to it was so obvious that everybody could agree that the allocation should be made to the states as sovereign states. That is what I saw in that (g). Apparently there is more in it than that. When you tie (h) into it, obviously my motion was not sufficient to cover all the elements that enter into both of those questions.

What I have in mind now is that, without being technical at all, sometime, somewhere in the compact there is going to be language that will allocate to each state the right to use a definite portion of the water allocated to the Upper Basin States by the Colorado River Compact. To my mind, and I don't believe anybody will disagree, that language should allocate that water or grant it or whatever term you want to use, to each sovereign state. I think I am clear up to that point and that is what I had in mind in moving yesterday that the answer to (g) should be to the states and not to the tributary drainage basin because I couldn't conceive of an allotment being made to a drainage basin. The allotment should be made to the state and adjustment in each drainage basin might be necessary.

I am not going to make another motion but I do want to say this, that this language would carry out the idea I had combining (g) and (h).

COM. STONE: Will you put that in the form of a motion? Colorado will agree to that.

COM. WILSON: I so move.

COM. WATSON: I will second that motion.

MR. WEHRLI: Mr. Wilson, I don't know that we necessarily disagree with that proposal but I don't believe we are able to say at this time or to agree at this time that there must necessarily be on each interstate tributary a minimum flow fixed or a flow of some kind fixed. There may be cases in which that may be necessary. If the motion means that we are agreeing, even tentatively, to the proposition that this must necessarily be true on all interstate tributaries, I don't think we would feel like going along on it.

COM. WILSON: I am not familiar enough with the upper tributaries to say whether it is or is not. As to the San Juan I think it is necessary obviously.

COM. STONE: I don't understand that implies all tributaries; that is, where necessary, was your idea, wasn't it, Mr. Wilson?

COM. WILSON: Well, interstate tributary, if it is necessary. I think it wouldn't be necessary to making the allotment but I apprehend after it is made, each state will want to know where its water comes from and how much water is taken from each tributary and these interstate flows, that is, the gaging stations at the state line, would have to be kept either for the benefit of the Commission or of the state itself. I am not sure that it would be absolutely necessary on every tributary.

COM. WATSON: The facts can be easily ironed out with any state concerned on any tributary that Utah might be interested in. That would be particularly true with the Henry's Fork area that rises on the north side of the Uintas and flows into Wyoming and back into the Green.

In the case of the tributaries in Colorado except the Yampa the acreage lying in Utah is small and therefore we think that arrangement could be made with Colorado for an agreement between Utah and Colorado.

THE CHAIRMAN: Well, gentlemen, you mustn't forget it seems to the Chairman in the consideration of Items (g) and (h) that it is just as important to consider the obligation the tributary drainage basin has in meeting the collective obligation at Lee Ferry as to think about what benefit that basin is going to get.

COM. STONE: Mr. Chairman, it is our interpretation of Mr. Wilson's motion that that very item is covered. I think he made it quite specific. And assuming he did that, could not the question raised by Mr. Wehrli be covered by letting the record show that the motion made by Mr. Wilson does not necessarily imply application to all tributaries, but to such tributaries where the general principle contained in his motion is necessary. If that is put in the record to cover Mr. Wehrli's position, I am certain the question raised by the Chairman is covered by Mr. Wilson's motion.

MR. WEHRLI: May I ask a question? Maybe this is premature, but in considering this matter as to tributary basins are you thinking about fixing a certain amount of beneficial consumptive use for a particular tributary basin, or are you thinking only of fixing the use in that basin by requiring an outflow from the basin of a certain amount?

COM. STONE: As we conceive that motion it is difficult to state whether one or the other would apply--perhaps both. In other cases it may

be accomplished by a requirement of a minimum delivery on a tributary at a state line. I think that gets into details which would have to be spelled out and worked out in these arrangements which were suggested yesterday, arrangements between states on particular tributaries such as the San Juan. I don't see that Mr. Wilson's motion applies any hard and fast rule as to that, but it is obviously necessary on some of the tributaries.

COM. BISHOP: Mr. Chairman, at this point I would like to explain what my conception of the situation on the Green River might be. Wyoming might be compelled to deliver a certain percentage or a certain number of acre feet of water at the Utah Line. But I can't see how that is going to affect or prevent Utah and Wyoming, for instance, up here on a tributary that happens to head in Utah--several tributaries head in Utah and flow into Wyoming--having an agreement that we will administer the water on a priority basis in that basin in accordance with the laws of the two states, recognizing the priorities and amount in the two states. I can't see we should go on each one of those several tributaries and see that Utah delivers a certain amount of water at the state line. Utah will automatically deliver that water at the state line if they go according to priority on those tributaries.

I just want to make that explanation so you see what we have in mind. Just how they are going to work, if they say we have got to deliver a certain percentage of water in the Green River at the state line, maybe that is the way to do it. But I don't see where this agreement on the tributaries needs to take into consideration the amount of water that Utah has to deliver at the Wyoming State Line. That is automatically taken care of by an agreement that we will have a commissioner administer the water on that stream just like it was all in one state, the recognition of the rights in those two states.

COM. STONE: Mr. Bishop, that may be an appropriate arrangement there, but we shouldn't defeat a general principle which may have to be applied on others.

COM. BISHOP: Judge Stone, I don't think there is any argument between us there. I agree with the motion of Mr. Wilson that it covers that situation and if it doesn't I would like to have Mr. Wilson tell me why.

COM. WILSON: There may be tributaries up in Utah and Wyoming that I am not sufficiently familiar with that you probably might adjust by interstate agreement and not have to account for each tributary outflow. But as a general rule--I know it is applicable to the San Juan--there must be specified in the compact these things that are mentioned in the motion.

COM. BISHOP: I think that is all right.

COM. STONE: Question.

THE CHAIRMAN: Question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Now, gentlemen, do you wish to proceed with the consideration of Group VI or go back to the consideration of Item (a) under Group V?

COM. STONE: Mr. Breitenstein suggests that there should be an indication as to whether the states attempt to take care of these matters in one compact, namely, the compact under negotiation. It could be argued that such indication is evidenced by the action on the other subdivisions; however, he suggests that such an indication might be more specifically covered and in order to make progress I would suggest to him that he make on behalf of Colorado the motion that he has in mind in order to get the matter before the Commission.

MR. BREITENSTEIN: I thought the Commission should take action to the effect that the states will attempt in this Upper Basin Compact to determine the rights and obligations of the various states arising out of or affecting interstate tributaries of the Upper Colorado River.

COM. BISHOP: I will second the motion.

THE CHAIRMAN: Motion is made and seconded. Do you wish to discuss the motion?

COM. WATSON: Question.

THE CHAIRMAN: The question has been called for. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Apparently we have covered Group V and we now proceed to the consideration of Group VI. Is it your wish to consider Item (a) first as shown on the agenda or to proceed in some other manner? Which item do you wish to take up first regardless of its position on the agenda?

COM. STONE: Mr. Chairman, it seems to me that Item (a) under Group VI, "Definition of the term 'beneficial consumptive use'." could be disposed of rather expeditiously. Mr. Wehrli suggested that he had a

definition that he may wish to submit later. It appears to Colorado that that is a matter which ought to be worked out between the Engineering and Legal Committees. It is understood by all to be a definition which should be carefully considered. It is very obvious it has both legal and engineering implications.

For those reasons, Colorado moves that the drafting of such a definition be worked out by the Legal and Engineering Committees and be referred to those Committees for that purpose.

COM. WATSON: Second the motion.

MR. WEHRLI: Mr. Chairman, I don't wish to be in default on any promise that I made. I have worked out what I think would be an appropriate definition of beneficial consumptive use as related only to the apportionment that we hope to make between the states. I will distribute that definition if it is desired as I said I would do, but if it isn't, it doesn't make any difference.

COM. STONE: You would be willing to distribute that to the Engineering and Legal Committees, would you not, Mr. Wehrli, for their consideration?

MR. WEHRLI: I would distribute it now or at any time you wish.

COM. WATSON: I suggest you distribute it now.

MR. WEHRLI: It is something that can be considered and if you don't wish the thing to go into the record, that doesn't make any difference either. I think it is a very difficult problem in this compact.

THE CHAIRMAN: Off the record. (Discussion off the record.)

COM. STONE: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: We now come to Item (b) of Group VI which reads, "Method of measuring beneficial consumptive use."

COM. STONE: To expedite the matter I might state that it is Colorado's position that (b), (c), (d), and (e) cannot now be determined until more information is made available by the Engineering Committee and discussion at this time would merely result in waste of time.

COM. WATSON: I so move.

THE CHAIRMAN: Who seconds the motion? Is there a second to the motion?

COM. STONE: Second.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

MR. WEHRLI: I didn't hear that motion. Was it a reference to both the Engineering and Legal Committees?

COM. STONE: That referred those items (b), (c), (d), and (e).

MR. WEHRLI: Was it a reference to both of the committees or one or the other?

COM. STONE: It was a reference to the Engineering Committee, that we could not make any progress on those items until further data and information was made available by the Engineering Committee.

THE CHAIRMAN: We now come to Article 6 which is entitled, "Discussion of means of correlating the work of the Engineering and Legal Committees."

COM. STONE: Mr. Chairman, that whole matter could be handled quickly by direction from you as chairman that the chairmen of the two committees make appropriate arrangements to work together where it is required.

THE CHAIRMAN: Yes, I think that is a good suggestion. Let the record show that the chairmen of the two committees are to correlate their work and meet according to their best judgment. Does that dispose of Article 6 to the complete satisfaction of all the members of the Commission? If so, we will now consider Article 7 which reads: "Discussion of a time schedule for the preparation and completion of a draft of the compact."

MR. WEHRLI: Perhaps you would have to discuss 7 and 8 together.

THE CHAIRMAN: It appears to the Chairman that the two articles are very closely related and if you wish to discuss them both together, certainly there is no objection. Article 8 reads: "Determination of time and place of next meeting."

COM. WATSON: You wish to discuss the matter of the next meeting place first?

COM. STONE: I move that the next meeting of this Commission be held at Vernal, Utah, on July 7th at ten o'clock a.m. and continuing for such time as may be required.

COM. WATSON: I second your motion.

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for to vote on the motion fixing the time and place of the next meeting. Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

MR. WALLACE: I have enjoyed this meeting and I appreciate the spirit that has been displayed and I am very happy to recognize the experience and wisdom displayed by the delegation from Colorado and thank them for preparing the agenda, which has been very useful in the deliberations of this conference. Further, I would like to say for my old friend--not my old friend, my young friend Mr. Carson from Arizona, that in spite of the comparatively small interest that Arizona has in the result of this conference--what can I say nice about you, Charlie?

COM. CARSON: I can't imagine.

MR. WALLACE: Whatever it is I would like to say it as I regard you an extremely useful member of this organization. I would like to go right down the line but I think maybe that is enough to say because for these two groups I have a very, very high regard.

COM. CARSON: Thank you.

COM. STONE: Thank you, Mr. Wallace; we appreciate that. Mr. Chairman, on the record the Chairman has been referring to and for about three days we have been referring to specific items on the agenda. In order that the record may be intelligible, may I suggest that at the beginning of this meeting the entire agenda be placed in the record.

THE CHAIRMAN: Yes, that is a good idea.

MR. BREITENSTEIN: Off the record. (Discussion off the record.)

THE CHAIRMAN: That is with the exception of Item (e), Group III on page 3 of the agenda.

COM. STONE: That is correct. Item (e) of Group III appearing on page 3 would not appear on the agenda as appearing in the record.

(Pursuant to the foregoing, agenda was copied into the record.)

MR. WEHRLI: Mr. Chairman, I don't know that my ideas exactly coincide with those of the Chairman of the Legal Advisory Committee or with those expressed by others present, but it doesn't seem to me quite essential for the Legal Advisory Committee to be entirely bound and limited by the instructions given to it by the Commissioners in session here. I would like to move that the Legal Advisory Committee, in addition to the matters specifically referred to it, prepare such additional introductory and formal provisions as the Committee believes should properly become a part of the compact; and that the Committee also give attention to a skeleton outline placing the different provisions in what the Committee deems to be a proper sequence.

Let me explain that I don't have in mind that the Committee will deal with any substantive matters except as same have been referred to the Committee. But I believe it would be helpful if the Legal Committee would correlate to some extent the different matters that have been assigned to it and come back with a report putting those in some proper relation to each other, leaving appropriate places for other things to be inserted, and also giving some attention to preparation of introductory statements that usually appear in these compacts and other formal matters that have not been specifically assigned to the Committee.

COM. STONE: Did you make that in the form of a motion, Mr. Wehrli?

MR. WEHRLI: Yes, I did.

COM. STONE: If that is a motion, I second it.

MR. WEHRLI: Of course, Mr. Bishop makes the motion.

THE CHAIRMAN: Yes, that is understood, seconded by Colorado. Is there a discussion of the motion as made by Mr. Bishop?

COM. WATSON: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Now, the Chair will not insist on his suggestion if you all understand what is to be done in the meantime, but the Chairman probably is a little more dense than some of you and I don't understand it and I still think a clear statement and concise statement should be made by someone on the work to be done in the interim and the correlation of that work so there will be no misunderstanding about it. We have about 45 minutes until twelve o'clock.

MR. WEHRLI: Mr. Chairman, as we understand it, there will be a preliminary meeting--

COM. STONE: Pardon me. I was going to suggest, Mr. Wehrli, that since the specific procedure which has been discussed and apparently approved was submitted by Mr. Breitenstein as a member of the Legal Committee from Colorado, I should be glad to ask Mr. Breitenstein on behalf of Colorado to place that procedure in the form of a motion in compliance with the suggestion of the Chair.

MR. WEHRLI: That is very agreeable.

THE CHAIRMAN: Mr. Breitenstein.

MR. BREITENSTEIN: The motion is that in the period between now and the next meeting of the Commission on July 7, the committees which have been authorized between the states affecting tributary basins, and the Legal Advisory Committee and the Engineering Advisory Committee, should be so correlated that prior to the meeting on July 7, there is presented to the Commission in the event of agreement between the states, recommendations as to the method of treatment of the tributaries and as to all other matters which have been discussed and referred to the Legal Advisory Committee and the Engineering Advisory Committee; and that it shall be the obligation of the representatives of the various states on those committees under the overall control and direction of the Chairmen of the Engineering Committee and the Legal Committee to so coordinate their efforts that this may be accomplished.

THE CHAIRMAN: Thank you, Mr. Breitenstein. That is a very clear statement I think.

COM. WATSON: Second the motion.

THE CHAIRMAN: Is there discussion of the motion as submitted by Mr. Breitenstein? Are there any questions concerning the motion? Mr. Riter?

MR. RITER: I can't remember all that he said. I would appreciate it, if the motion passes, if I might have a copy of it for my guidance in advance of the complete transcript of the whole meeting.

THE CHAIRMAN: And also for Mr. Carson, I believe, too.

MR. WALLACE: Question.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Yes.

THE CHAIRMAN: Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: New Mexico?

COM. WILSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: The Chairman at this time would like to express his appreciation of the intelligent manner in which the press has reported the progress of the Commission meetings. I find no fault whatever with the articles which I have read and I think the press is to be commended for its intelligent handling of this complex matter.

COM. CARSON: I move that the Commission meet at two o'clock to edit these minutes.

THE CHAIRMAN: Is there a second to the motion?

COM. STONE: I second the motion.

THE CHAIRMAN: Is there a discussion of the motion?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

COM. STONE: Move we adjourn.

(Motion is seconded, a vote is taken and the motion carries unanimously.)

(11:30 a.m., Saturday, February 21, 1948, Commission adjourned until 10:00 a.m., Wednesday, July 7, 1948, at Vernal, Utah.)

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JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	**V, W**	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

7-3

CARD

J. R. RITER'S MEMORANDUM

POWER POSSIBILITIES AT BOULDER DAM

BOULDER CANYON PROJECT

OCTOBER 25, 1940

* * * * *

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COMMISSIONER'S OFFICE
BUILDING 53, DENVER FEDERAL CENTER
DENVER 25, COLORADO

IN REPLY
REFER TO: D-700

NOV 10 1959

RECEIVED
NOV 12 1959
UPPER COLORADO
RIVER COMMISSION
Salt Lake City, Utah

Mr. Ival V. Goslin, Engineer-Secretary
Upper Colorado River Commission
Ray Building, Room 103
366 South Fifth East Street
Salt Lake City 2, Utah

Dear Ival:

In response to your request of November 9, 1959, I am sending you my copy of a memo dated October 25, 1940, subject "Power Possibilities at Boulder Dam, Boulder Canyon Project."

I do not have any extra copies of the transmitted memo; hence, I would appreciate it if you would return it to me after you have had an opportunity to review it and extract therefrom data useful in your current considerations.

In my reference to Table 5, you will note that the minimum 10-year inflow under 1988 conditions was less than 75,000,000 acre-feet. It was the awareness of that situation in making the 1940 studies that prompted me to realize the necessity for holdover storage capacity in the Upper Basin to permit the Upper Basin to meet its Compact obligation at Lee Ferry and to concurrently utilize water allocated to it under the terms of the Compact.

The computations underlying the study were in computation books. I recently had occasion to search for the books but have been unable to locate them. However, I believe that the memo and the accompanying charts will probably give you the information you desire.

Sincerely yours

J. R. Riter

J. R. Riter
Chief Development Engineer

Under separate cover (71823)

Denver, Colorado, October 25, 1940.

MEMORANDUM TO HYDRAULIC ENGINEER
(J. R. Riter)

Subject: Power possibilities at Boulder Dam - Boulder Canyon Project.

This memorandum presents the results of Lake Mead operation studies to determine the firm and secondary power output possibilities at Boulder Dam, with upstream irrigation development as of 1938 and 1988 respectively.

Some revisions have been found desirable in the 1929 studies, which are presented on your report of January 31, 1930, "Hydrology of the Boulder Canyon Reservoir, with reference especially to the height of dam to be adopted." The reasons for the revisions in the study are enumerated as follows:

(a) Results of a detail reservoir survey, made by aerial cartographic methods, for the Soil Conservation Service, show about 1,800,000 acre-feet more storage capacity in Lake Mead than formerly determined.

(b) Stream flow records have been secured of the Colorado River, at a point just below the Boulder Dam, since 1931, enabling a closer estimate of the run-off relations with stations having longer record.

(c) Census data for 1929 and surveys made by the Bureau of Reclamation in 1935 permit a closer estimate of the extent of irrigation development in the Colorado River watershed under 1938 conditions of development.

(d) Provision is made for the installation of a greater power output capacity at Boulder Dam, than contemplated in the 1929 report.

(e) Operating experience since 1935 has demonstrated that the flood inflow to the reservoir cannot be reliably predicted prior to April 1. This necessitates a revision of operating plans in the winter months.

(f) Overall power plant efficiencies for generation of firm power have been less than the 83%, used in our 1929 studies.

(g) Dredging operations in the channel below the Boulder Canyon Power Plant are expected to lower the tailwater elevation to 642 feet, thereby increasing the power head by 5 feet.

(h) Observations of evaporation from pans adjacent to the reservoir indicate that evaporation losses are 6 feet per year, instead of 5 feet used in the 1929 studies.

Two sets of studies have been conducted for the 44-year period, 1897 to 1940 inclusive, using overall power plant efficiencies for firm power of 83% and 78%, respectively. The results thereof are shown in tables 6 and 7. Reservoir operations are shown on the 4 charts which accompany this memorandum. Study has also been made to determine the firm power output which can be maintained through the 1934 critical period with an overall power plant efficiency of 80%.

Storage Capacity

The original area and capacity curves for Lake Mead were determined from topographic surveys made in 1919-1921 on a scale of 2 inches per mile, with a contour interval of 50 feet. In 1934, the Soil Conservation Service made a detail topographic map on a scale of 1000 feet per inch with 5 and 10-foot contour intervals, using aerial cartographic methods. The capacity table prepared in 1940 from the latter survey has been used in the study of 1938 conditions. It is estimated that silting between 1938 and 1988, will reduce the reservoir capacity by 3,000,000 acre-feet. The following table shows the storage capacity at various elevations:

Table 1

Contour Elevation Feet	Storage Capacity - 1000 A. F. Old Capacity Table (1)	1938 Conditions (2)	1988 Conditions (2)	Remarks
650	0	0	0	
700	78	74	25	
750	381	336	250	
800	967	907	700	
850	1,980	1,903	1,500	
900	3,501	3,376	2,700	
950	5,504	5,390	4,300	
1000	8,048	8,036	6,700	
1050	11,325	11,475	9,600	
1100	15,438	15,868	13,700	
1150	20,444	21,284	18,500	
1200	26,470	27,898	24,900	
1221.4	29,406	31,142	28,100	Top of spillway gates*
1229	30,504	32,359	29,300	Maximum ws. elevation

* Gates closed (in raised position)
(1) Capacity data used in 1929 studies.
(2) Adopted for these studies.

The flood control storage capacities shown in the 1929 report are retained in the present study as follows:

1938 Conditions - 9,500,000 acre-feet, between contents of 22,800,000 and 32,300,000 acre-feet.

1988 Conditions - 4,000,000 acre-feet between contents of 25,300,000 and 29,300,000 acre-feet.

Comparison of the inflow to Lake Mead, with the outflow and measured changes in storage content during the initial filling period of 1935 to 1938 inclusive, shows unaccounted for losses of about 2,400,000 acre-feet. Large losses are not observed in 1939 and 1940, when the reservoir stage was fairly constant; hence it is concluded that the unaccounted for loss in 1935 to 1938 represents water stored in the ground adjacent to the reservoir, i.e. bank storage. It is possible with a series of years

of low run-off and continuous drawdown of the reservoir that as much as 1,500,000 acre-feet of such bank storage may be recovered. Over such a series of years the total bank storage return would be but a small percent of the total inflow; in view thereof and to be conservative, the reservoir operation studies reported herein have neglected the ebb and flow of bank storage. However, the water lost to bank storage during the initial filling period (1935 to 1938 inclusive) has been included in the estimate of reservoir inflow.

Inflow to Lake Mead

Derivation of the past flows at Boulder Canyon and determination of corrections to reflect stream flows with 1938 conditions of upstream development are presented in Exhibit B (Pages 64 to 80 inclusive) of report by E. B. Debler, dated December 1934, "Stream Flow of Lower Colorado River and Its Tributaries." Annual flows are taken as derived in the 1934 report for the years 1897 to 1931 inclusive; for the years since 1931, the inflow to Lake Mead has been estimated as described herein.

1932 to 1934 Inclusive

Taken from Bureau of Reclamation records below Boulder Dam.

1935 to 1938 Inclusive

Closure of diversion tunnels at Boulder Dam was made in February 1935 and the storing of water started in Lake Mead. Table 2 is a comparison of discharges at Boulder Dam and at Grand Canyon for recent years. This table also shows the storage changes in Lake Mead during the years since 1934.

Table 2

Unit - 1000 Acre-Feet

Calendar Year	Flow-Colorado River: Grand Canyon	Flow-Colorado River: Boulder Dam (1)	Indicated Gain Grand Canyon to Boulder Dam	Net Change in Lake Mead Storage During Year
1923	17,970	19,506	1,536	
1924	11,986	12,971	985	
1925	12,796	12,920	124	
1926	13,550	13,629	79	
1927	18,242	18,406	164	
1928	14,983	14,889	-94	
1929	19,860	19,732	-128	
1930	12,766	12,905	139	
1931	6,598	6,816	218	
1932	15,818	16,310	492	
1933	10,038	10,166	128	
1934	4,185	4,373	188	0
1935 #	10,615	10,152	-463	+3,673
1936 #	12,469	12,151	-318	+5,873
1937 #	12,540	12,465	-75	+5,914
1938 #	15,861	15,746	-115	+8,148
1939	9,089	9,760	671	+168
1940 *	6,441	6,861	420	+575
# Averages:	12,452	12,803	351	

* For 9 months, January to September only.
\# Years 1935, 1936, 1937 and 1938 excluded from averages

(1) Flows 1923 to 1931 inclusive estimated from Topock. Flows 1932 to 1934 recorded at dam. For 1935 to 1940 flow equals sum of outflow at dam, increase in storage and evaporation loss at 6' over mean area.

The large losses, experienced during the filling period between Grand Canyon and Boulder Dam, can reasonably be accounted for by filling of bank storage. The outflow in these years corrected by visual storage changes and evaporation loss does not give a true measure of the inflow in view of the relatively large amounts of water lost in bank storage. In view thereof inflow to

the reservoir in the years 1935 to 1938, inclusive, is estimated to equal the flow at Grand Canyon plus 350,000 acre-feet per year. This figure represents the average net gain between Grand Canyon and Boulder Dam with similar average run-offs at Grand Canyon.

1939 and 1940

In these years the inflow to Lake Mead is estimated to equal the outflow corrected for visual changes in storage and evaporation losses. Inflow for the months October to December 1940 were estimated from advance records to October 13 and comparison with other recent years, to complete the record for the year.

Table 5 shows the past annual flows and the estimated depleted flows to reflect conditions with development as of 1938 and 1988 respectively.

Past Upstream Development

Past flows reflect the results of varying upstream irrigation development. Table 3, taken from census data, and surveys made by the Bureau of Reclamation in 1935 indicates the progress of irrigation development in the Colorado River Basin.

Table 3
Irrigated Area - Acres*

Year	Upper Basin (Above Lees Ferry)	Lower Basin (Above Boulder Dam)	Total Above Boulder Dam
1899	515,000	28,000	543,000
1902	638,000	37,000	675,000
1909	1,011,000	41,000	1,052,000
1919	1,355,000	64,000	1,419,000
1929	1,450,000	57,000	1,507,000
1935	1,291,000	40,000	1,331,000

*Rounded to nearest 1000 acres.

Irrigated areas have been assumed to have increased uniformly from 1899 to 1902, from 1902 to 1909 and from 1909 to 1919. The data indicate a relatively uniform increase for these years. A

continuation of the growth in these years would have resulted in an area in 1929 far in excess of that reported. This situation is not unexpected as the urge for development generated by war conditions was definitely checked by economic conditions in 1921. While some new lands have been placed in cultivation since 1921, these have been offset by the suspension of irrigation in other lands. The growth assumed to continue until 1922, when the 1929 area was reached; thereafter the area has been assumed as constant. The differences in the 1929 and 1935 areas are due largely to differences in determining irrigated areas. The 1935 figures are based on actual field surveys, while census figures reflect statements of irrigators.

Normal average annual stream depletion due to irrigation development above the Boulder Dam watershed is estimated to average 1.5 acre-feet per acre irrigated. This figure is adequate to allow for evaporation losses from irrigation reservoirs.

Depletions vary with run-off conditions. In years of high run-off these are increased diversions for immediate uses and storage is replenished in both surface and underground reservoirs. The reverse is true in low years. Allowance has been made for this by assuming depletions for any year to depart from the normal by a percentage equal to one-half the departure of the stream flow from normal. The percent of deviation is based on the average virgin flow of the Colorado at Lees Ferry for the years 1897 to 1934 inclusive, shown in the 1934 report. Transmountain diversions to other watersheds are assumed to vary from the normal each year in a manner similar to that assumed for irrigation depletions.

Data on transmountain diversions from the Colorado River watershed above Boulder Dam are presented in Table 4.

Table 4

Name of Diversion	Diversion From	Present Normal Annual Diversion-Acre-Feet	Year Completed
Grand River Ditch	Colorado River	14,000	1903
Busk-Ivanhoe Tunnel	Frying Pan Creek	5,000	1925
Erwing	Eagle River	2,000	1880
Tarbell	Cochetopa Creek	2,000	1914
Berthoud (Church)	Fraser River	1,000	1909
Boreas Pass	Blue River	1,000	1909
Strawberry	Duchesne	90,000	1913
San Pete	San Rafael	8,000	1935
Twin Lakes Tunnel	Roaring Fork	40,000	1935
Moffatt Tunnel	Fraser River	40,000	1936
Miscellaneous	Various	6,000	Various
Total		209,000	

Depletion as of 1938

Normal depletions (anticipated in 1934) with 1938 conditions are summarized on pages 76 and 77 of the 1934 report as follows:

Irrigation Within Basin	
1929 area above Lees Ferry	2,175,000 acre-feet
1929 area between Lees Ferry and Boulder Dam	85,000 " "
Resumption of irrigation on dormant lands	150,000 " "
Increased use by reason of Taylor Park Reservoir	25,000 " "
Transmountain Diversions	209,000 " "
Total	2,644,000 acre-feet

Due to the generally low run-off which has prevailed since 1934, much of the anticipated "Resumption of irrigation on dormant lands has not been experienced." However, the depletions as shown in the 1934 report for 1897 to 1933 inclusive have been adopted. Past flows for the years 1935 to 1940 inclusive have been taken as representative of 1938 conditions.

Corrections to past flows and flows with 1938 conditions of development as shown in table 5.

Depletions as of 1988

Total normal depletions (of the virgin flow of Colorado River) with anticipated 1988 conditions of development, are shown in the 1929 Hydrology Report to be as follows:

Upper Basin above Lees Ferry	
Irrigation	4,850,000 Acre-feet
Transmountain Diversions	601,000 " "
Evaporation losses from Reservoir	768,000 " "
Subtotal Upper Basin	6,219,000 Acre-feet
Lower Basin above Boulder Dam	
Irrigation	202,000 Acre-feet
Transmountain Diversions	20,000 " "
Evaporation from Reservoirs	152,000 " "
Subtotal Lower Basin	374,000 " "
Total above Boulder Dam	6,593,000 Acre-feet

While the individual items of the 1988 estimated depletions may be changed somewhat, it is believed that the total is reasonably correct. To obtain the stream flows with 1988 conditions a normal increased depletion of 6,593,000 minus 2,644,000 or 3,949,000 acre-feet was deducted from the stream flows which represent 1938 conditions. The actual depletion for any individual year was varied from the normal by a percentage which is equal to 1/2 of the percent of deviation of the virgin flow at Lees Ferry from normal.

The depletions and 1988 stream flows at Boulder Dam are shown in Table 5.

LF BC

1988 6219 6593
Prev (1938) 2559 2644
3660 3949

Power Output Capacity

Space has been provided in the power house for the ultimate installation of the following power units (exclusive of station service units):

15 - Each with capacity of 82,500 kw. = 1,235,500 kw.
2 - Each with capacity of 40,000 kw. = 80,000 kw.

Total 1,317,500 kw.

It is contemplated that output capacity will be available at various dates as follows:

Year	Number of 82,500 kw. Units	Number of 40,000 kw. Units	Total Output Capacity kw.
1942	11	1	947,500
1956	12	1	1,030,000
1971	13	1	1,112,500
1988	15	2	1,317,500

For the purpose of determining the amount of secondary output available with 1938 run-off conditions, output capacity of 947,500 kw. was assumed.

Overall Power Plant Efficiency

Results of study of power plant efficiency made by the electrical section are presented in the following memorandum of October 18, 1940 by Chief Electrical Engineer L. N. McClellan:

"1. The original hydrology studies of the Boulder Canyon Project were based on an average overall operating efficiency of 83%. In actual practice, however, the overall operating efficiency has averaged about 75% thus far, as shown by the graph attached hereto. This low efficiency has been due to several factors:

"(a) The efficiency of the turbines of units N-1, 2, 3, and 4, is about 3% lower than the efficiency of the other turbines in the power plant, and these original four turbines have produced the major part of the output thus far. The original four turbines were designed for 50

cycle operation and they are now being operated at 60 cycles. The 60-cycle runners in these units are necessarily larger in diameter than they should be for most efficient performance, since they had to be installed in the turbine casings, the diameter of which is large enough for 50-cycle runners. This larger diameter of the runners increases the skin friction and reduces the efficiency.

"(b) The turbines were operated at heads considerably below those for which they were designed for some time while the reservoir was filling. This resulted in low operating efficiency during this period.

"(c) It has been necessary most of the time to release more water than could be utilized for generation of power, and consequently there has been no incentive for high operating efficiency.

"(d) The lessees of the power plant, particularly the City of Los Angeles, have operated all available generating units most of the time in order to provide "spinning reserve" for their power system. Much of the time these generating units have been operated at only partial capacity and the efficiency is considerably lower when the units are operated below half rated output.

"(e) Unit A-8 has been operated at half output or less much of the time, which has reduced the operating efficiency of this unit.

"2. If the generating units are operated in a range of from about three-quarter to full load, the following average overall operating efficiency can be attained:

Penstocks	98%
Turbines	88%
Generators	97%
Transformers	99%
Overall operating efficiency	83%

This indicates that the basis used in the original hydrology studies was appropriate for a plant operated so as to secure the maximum kilowatt-hour output.

"3. The overall operating efficiency actually obtained in practice will depend upon the extent to which the operating agents insist upon operating the Boulder generating units as "spinning standby." An overall operating efficiency of 78% would appear about right to assume, based on the operating performance to date. If the "spinning standby" is reduced to a reasonable amount, it should be readily possible for the operating agents to secure an average overall operating efficiency of 80%."

Studies have been made for both 1938 and 1988 conditions for the years 1897 to 1940 inclusive, using overall power plant efficiencies as follows:

Firm Power	Secondary Power
78%	83%
83%	83%

Study has also been made of the years since 1932 to determine the firm power output which can be produced, with an overall efficiency of 80%. A maximum allowable shortage of 10% is assumed for any one month.

Operation of Reservoir

An operating plan has been evolved to satisfy the requirements for flood control, irrigation and power development. Studies of the 1884 flood (largest historic flood) and of the 1909 flood (largest of record) show that storage space of 9,500,000 acre-feet with 1938 run-off conditions and 4,000,000 acre-feet with 1988 run-off conditions is required to be available on April 1 to control these floods to the following discharges:

Month	1884 Flood	1909 Flood
April	55,000 second-feet	35,000 second-feet
May	65,000 " "	35,000 " "
June	75,000 " "	35,000 " "
July	75,000 " "	35,000 " "
August	50,000 " "	35,000 " "

Floods of large volume occur in the months of May to July as a result of snow melt augmented in some years by heavy rains on the watershed. To secure joint use for flood control and power development of the storage capacity reserved for flood control purposes, and to permit the use for flood control if needed, of part of the power storage, it is anticipated that predictions will be made of the magnitude of flood inflow by the use of snow surveys and data on accumulated winter precipitation on the watershed to March 1, April 1 and May 1, respectively.

Winter precipitation in percent of normal is shown on page 204 of the 1929 Hydrology Report. For the purpose of the present studies, the data on accumulated winter precipitation were also compiled for the years 1930 to 1940 inclusive.

To control "flash" floods caused by cloudbursts in the late summer or winter storms on the lower elevations of the watershed, storage capacity of 2,500,000 acre-feet is reserved with 1938 conditions, and 1,000,000 acre-feet with 1988 conditions.

Demands at Boulder Dam for irrigation and domestic use in the lower basin are estimated to be as follows (these are same as shown on page 201 of the ~~1929~~ Hydrology Report):

1930

Month	Demand - 1000 Acre-Feet 1938	1988
January	260	380
February	305	455
March	440	680
April	530	830
May	585	915
June	630	990
July	630	990
August	585	915
September	530	830
October	440	680
November	305	455
December	260	380
Totals	5,500	8,500

Releases at Boulder Dam for power purposes will more than meet the 1938 irrigation requirements. It is expected that by 1988 regulatory storage will be provided at the Bullshead site or elsewhere to regulate the power releases to conform to irrigation demands.

The firm power output, assuming a maximum allowable shortage in any one month of 10%, was determined in the 1929 studies to be as follows:

With 1938 run-off conditions - 4,330,000,000 kw-hr. annually.
With 1988 run-off conditions - 3,880,000,000 kw-hr. annually.

The operating studies shown herein are based on the assumption that these firm power outputs will be maintained so far as possible. It is further assumed that 1/12 of the annual firm power will be produced each month.

Water released from the reservoir in excess of that required for firm power production is assumed to be used (to the extent of the power plant capacity) for the production of secondary energy.

Plan of Releases

The following operating rules (which are largely empirical and based on recorded conditions) have been applied to govern the release of water from the reservoir:

(A) On March 1, if the accumulated winter precipitation from October 1 to February 28 is greatly in excess of normal (125% of normal used with 1938 conditions and 110% of normal with 1988 conditions) up to 35,000 second-feet will be released, if necessary to lower the reservoir content to the flood control level (22,800,000 acre-feet with 1938 conditions and 25,300,000 acre-feet with 1988 conditions) by March 31. If the accumulated winter precipitation to February 28 is less than normal, firm power only will be produced in March.

On April 1, a forecast of probable flood inflow is made using the data on accumulated winter precipitation to March 31. With the normal expected inflow to the following March 1, a rate of release is calculated such that the storage content on the following March 1 will be 1,200,000 acre-feet above the flood control level. This rate of release is applied during April unless greater releases are found necessary: (1) to maintain the firm power output or (2) to clear the reservoir for flood control purposes. The rate of release for flood control is such that the "Maximum Probable Flood Inflow" to July 31 will not exceed elevation 1229 feet (content of 32,300,000 acre-feet with 1938 conditions or 29,300,000 acre-feet with 1988 conditions).

On May 1. The process, described for April 1, is repeated. The rate of release determined on the May 1 forecast is applied to the months of May and June.

On July 1. It will be possible with conditions then existing in the watershed to make a fairly reliable advance estimate of the magnitude of the July run-off. Assuming that the predicted July run-off will equal the actual run-off a rate of release is determined, such that the average run-off from August to February inclusive the reservoir will be drawn to a content of 1,200,000 acre-feet above the flood control level on the following March 1. This rate of release is adopted unless greater releases are found necessary for flood control purposes or to produce firm power.

From August 1 to February 1. Rates of release are calculated each month such that the average run-off conditions the reservoir will be drawn to a content of 1,200,000 acre-feet above the flood control level by the following March 1. Greater releases are made, if necessary, to produce firm power.

To avoid undue waste of water for power purposes when the reservoir is drawn to low levels and to facilitate recovery of storage, releases are cut when the storage content drops to 17,000,000 acre-feet to the following amounts:

With 1938 conditions - 900,000 acre-feet per month.

With 1988 conditions - 700,000 acre-feet per month. This rate of release, together with storage released from Bullshead Reservoir, will meet the annual irrigation requirements of 8,500,000 acre-feet.

Reservoir Content at End of 1896

Studies of the virgin inflow to Great Salt Lake in Utah presented in the Weymouth Report of 1924, show excessive run-off in 1884, followed by two years of normal run-off in 1885 and 1886. From 1887 to 1896 inclusive run-off averages about 85 percent of normal. Rough reservoir studies from 1884 to 1896 assuming that the inflow to Lake Mead is proportional to the computed virgin inflow to Great Salt Lake show reservoir contents on December 31, 1896 as follows:

1938 conditions - At flood control level (22,800,000 acre-feet)

1988 conditions - 20,000,000 acre-feet.

These reservoir contents were assumed at the beginning of the study on January 1, 1897.

Table 6
Possible Power Output - 1938 Conditions
Million Kw-Hr.

Year	Overall Efficiency 78% for Firm Power and 83% Secondary Power: Firm Energy	Secondary Energy	Total	Overall Efficiency 83% for Both Firm and Secondary Power: Firm Energy	Secondary Energy	Total
1897	4330	1934	6264	4330	2375	6705
98	"	1109	5439	"	1439	5769
99	"	1935	6265	"	2207	6537
1900	"	1096	5426	"	1299	5629
01	"	766	5096	"	1091	5421
02	"	74	4404	"	0	4330
03	"	0	4330	"	0	4330
04	"	0	4330	"	0	4330
05	"	90	4420	"	613	4943
06	"	1537	5867	"	2751	7081
07	"	3421	7751	"	3643	7973
08	"	1106	5436	"	1435	5765
09	"	3441	7771	"	3717	8047
1910	"	1545	5875	"	2045	6375
11	"	2271	6601	"	2412	6742
12	"	3054	7384	"	3330	7660
13	"	1094	5424	"	1315	5645
14	"	3448	7778	"	3529	7859
15	"	1581	5911	"	1832	6162
16	"	2435	6765	"	2637	6967
17	"	3561	7891	"	3710	8040
18	"	1750	6080	"	1900	6230
19	"	441	4771	"	686	5016
1920	"	2829	7159	"	3320	7650
21	"	2965	7295	"	3373	7703
22	"	2672	7002	"	3074	7404
23	"	3073	7403	"	3197	7527
24	"	1296	5626	"	1676	6006
25	"	677	5007	"	895	5225
26	"	1315	5645	"	1592	5922
27	"	2190	6520	"	2583	6913
28	"	2006	6336	"	2370	6700
29	"	2799	7129	"	2970	7300
1930	"	1277	5607	"	1603	5933
31	"	202	4532	"	111	4441
32	"	443	4773	"	843	5173
33	"	0	4330	"	54	4384
34	"	0	4330	"	0	4330
35	4097	0	4097	4274	0	4274
36	4161	0	4161	4289	0	4289
37	4232	0	4232	4330	0	4330
38	4330	0	4330	"	547	4877
39	"	0	4330	"	124	4454
1940	"	0	4330	"	0	4330
Ave.	4319	1396	5715	4328	1643	5971

Table 7
Possible Power Output - 1988 Conditions
Million Kw-Hr.

Year	Overall Efficiency 78% for Firm Power and 83% Secondary Power: Firm Energy	Secondary Energy	Total	Overall Efficiency 83% for Both Firm and Secondary Power: Firm Energy	Secondary Energy	Total
1897	3880	0	3880	3880	0	3880
98	"	138	4018	"	442	4322
99	"	0	3880	"	386	4266
1900	"	769	4649	"	975	4855
01	"	0	3880	"	0	3880
02	"	0	3880	"	0	3880
03	3315	0	3315	3844	0	3844
04	3090	0	3090	3364	0	3364
05	3149	0	3149	3493	0	3493
06	3582	0	3582	3690	0	3690
07	3880	0	3880	3880	0	3880
08	"	0	3880	"	490	4370
09	"	3715	7595	"	4216	8096
1910	"	1884	5764	"	2005	5885
11	"	1601	5481	"	1809	5639
12	"	1156	5036	"	1410	5290
13	"	190	4070	"	470	4350
14	"	2005	5885	"	2133	6013
15	"	1552	5432	"	1768	5648
16	"	2062	5942	"	2524	6404
17	"	2310	6190	"	1926	5806
18	"	1022	4902	"	1157	5037
19	"	108	3988	"	328	4208
1920	"	1814	5694	"	1899	5779
21	"	2496	6376	"	2651	6531
22	"	2957	6837	"	2889	6769
23	"	1180	5060	"	1847	5727
24	"	1433	5313	"	1492	5372
25	"	424	4304	"	588	4468
26	"	209	4089	"	433	4313
27	"	287	4167	"	702	4582
28	"	866	4746	"	928	4808
29	"	1913	5793	"	1913	5793
1930	"	54	3934	"	231	4111
31	"	0	3880	"	55	3935
32	"	0	3880	"	0	3880
33	3636	0	3636	"	0	3880
34	3109	0	3109	3552	0	3552
35	2801	0	2801	3158	0	3158
36	2766	0	2766	3120	0	3120
37	2812	0	2812	3155	0	3155
38	2950	0	2950	3290	0	3290
39	2959	0	2959	3295	0	3295
1940	2674	0	2674	3001	0	3001
Ave.	3659	731	4390	3750	909	4659

Firm Power Available with 80 Efficiency

The studies reported herein show minimum monthly power outputs in comparison with that required for 100% supply of firm energy as follows:

Units - Million Kw-Hrs.

Stream Flow Conditions	Required Monthly Output for Full Firm Power	Overall Efficiency 78% for Firm Power: Minimum Monthly Output	Overall Efficiency 78% for Firm Power: % Shortage	Overall Efficiency 83% for Firm Power: Minimum Monthly Output	Overall Efficiency 83% for Firm Power: % Shortage
1938	361	322	11	344	5
1988	323	210	35	237	27

If an overall efficiency of 80% were maintained for firm power, it would be possible to produce 4,330,000,000 kw-hrs. annually under 1938 conditions with a maximum shortage in any one month of 9%.

Studies shown in the 1930 Hydrology Report for 1988 conditions of development limited the maximum rate of release for firm power to 14,000 second-feet (average of 845,000 acre-feet per month). With these limitations applied in the critical period of 1900 to 1906 inclusive, the minimum monthly power output with 83% overall efficiency and 3,880,000,000 kw-hrs. annual firm power was determined (in the 1929 studies) to be 291,000,000 kw-hrs. The firm power shortage in the month of minimum output was limited to 10%.

If the firm power releases from the reservoir in the years 1930 to 1940 inclusive were permitted to continue at a maximum rate of 14,000 second-feet, the live storage capacity of the reservoir would be exhausted. Irrigation shortages would be experienced and maximum monthly power shortages would be greater than indicated herein. The operating rules were accordingly modified to limit releases from the reservoir to that required to meet annual irrigation requirements, when the storage contents are less than 17,000,000 acre-feet.

A preliminary study to determine the effect of limiting releases to 700,000 acre-feet per month (which is estimated to be required to meet annual irrigation requirements) when the storage

(11,600 cfs

content is less than 20,000,000 acre-feet, shows minimum monthly power output and shortages in firm power as follows:

Efficiency	Output in Minimum Month	Percent Shortage of Firm Power (1)
78%	217,000,000 kw-hrs.	33
80%	228,000,000 kw-hrs.	29
83%	245,000,000 kw-hrs.	24

(1) 323,000,000 kw-hrs. required for full firm output.

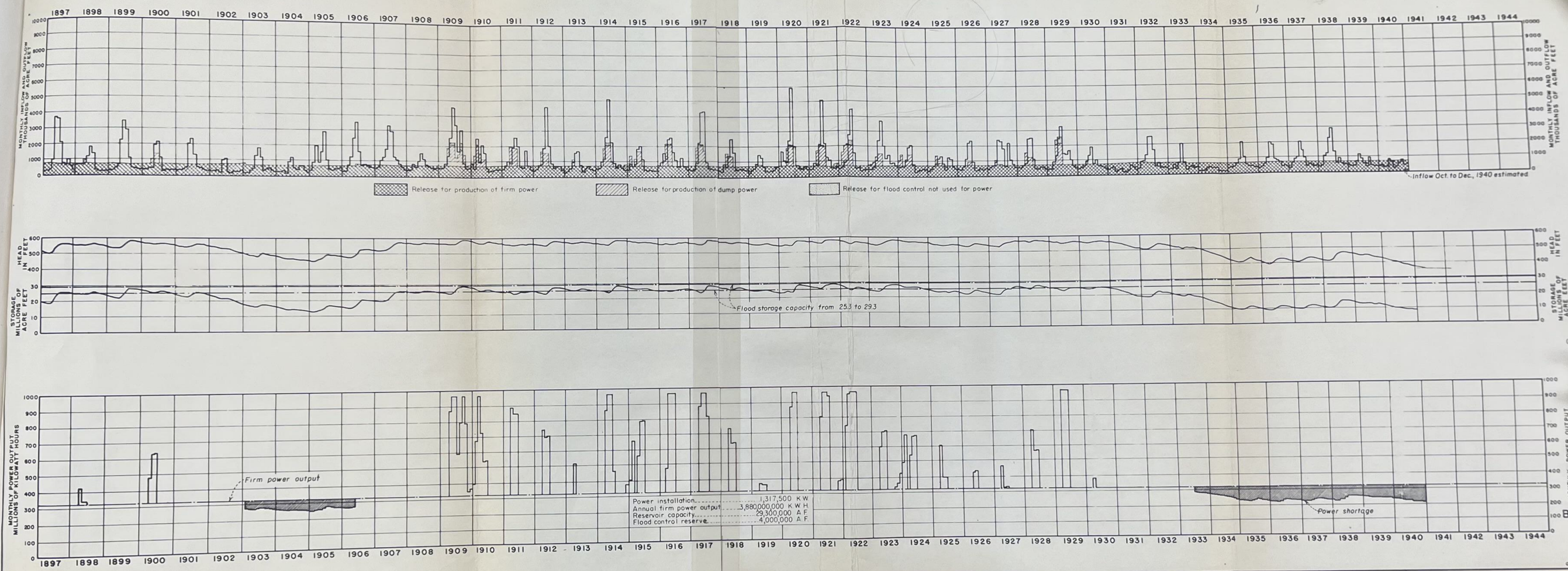
Preliminary studies through the critical period from 1930 to 1940, inclusive, with the operating plan modified as described herein, show that the firm power output which can be sustained with a maximum allowable shortage of 10% in any one month is about 3,200,000,000 kw-hrs. annually with 1988 run-off conditions. The operating plan described herein would be modified to the following:

(a) Overall efficiency for firm power - 80%.

(b) Maximum release for firm power - 700,000 acre-feet per month.

- - -

J. R. Riter



360
647

NOTES

Overall efficiency

For firm power	78%
For secondary power	83%
Tailwater elevation	642 ft

BOULDER CANYON

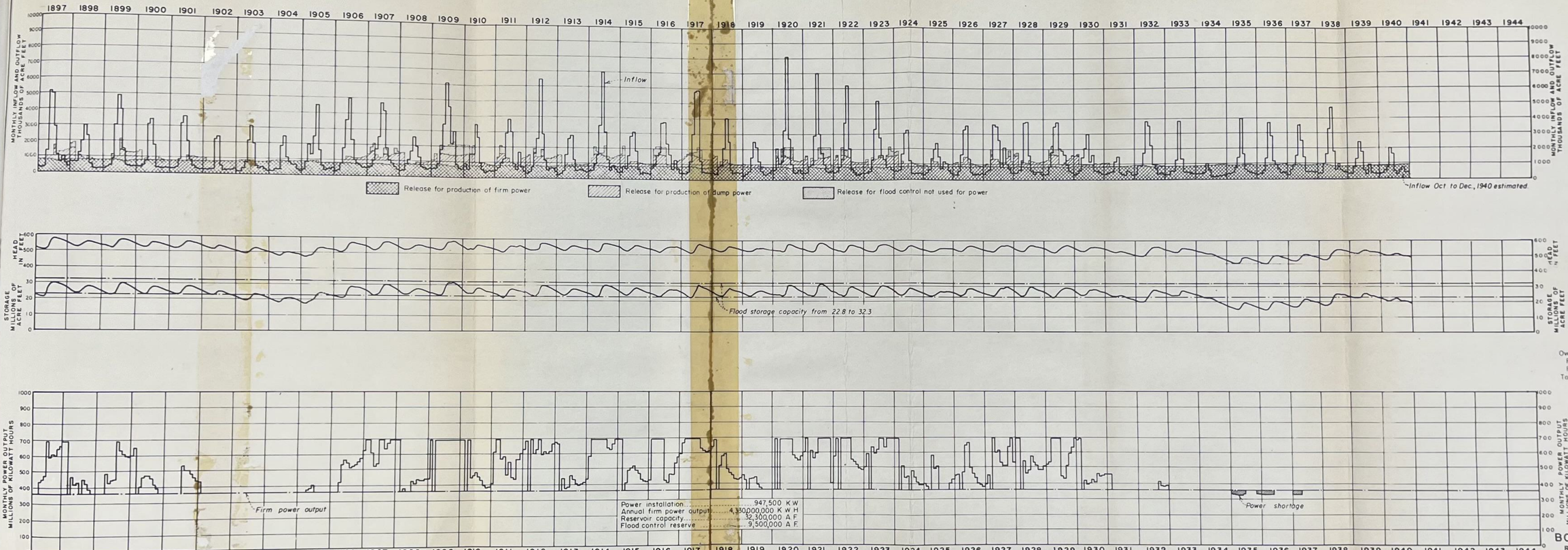
RESERVOIR OPERATIONS

CONDITIONS AS OF 1988

HIGH WATER ELEVATION 1229

OCTOBER 25, 1940

45-D-13242

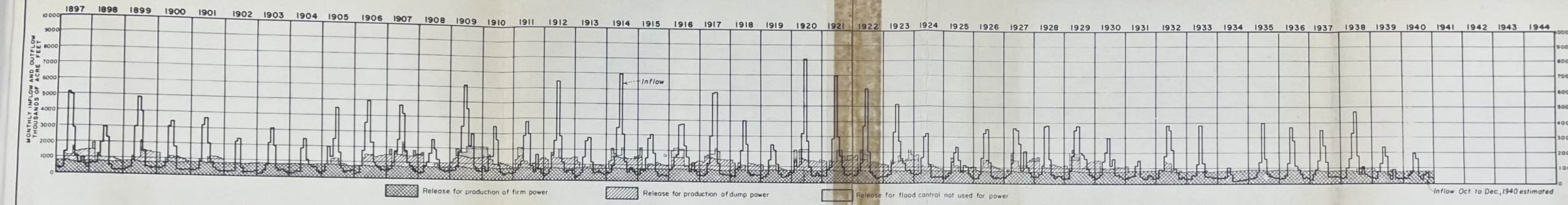


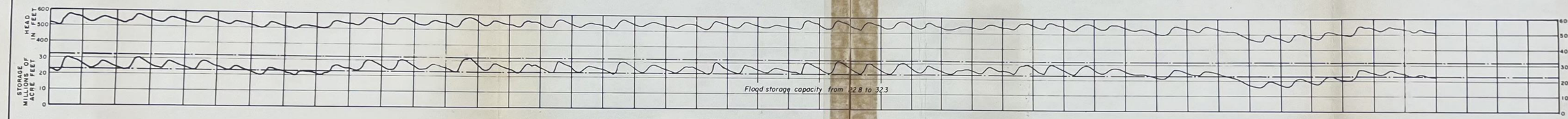
NOTES

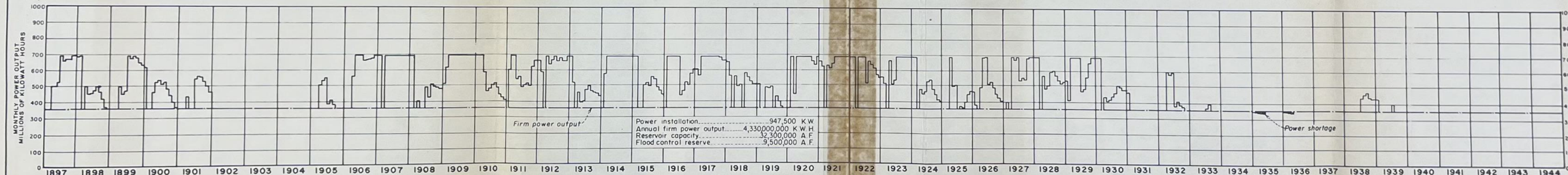
Overall efficiency	
For firm power	78%
For secondary power	83%
Tailwater elevation	642 ft.

BOULDER CANYON
RESERVOIR OPERATIONS
CONDITIONS AS OF 1938
HIGH WATER ELEVATION 1229

OCTOBER 25, 1940 — 45-D-13241





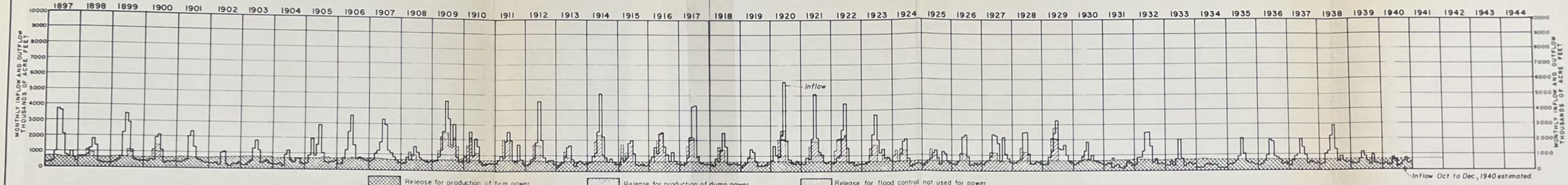


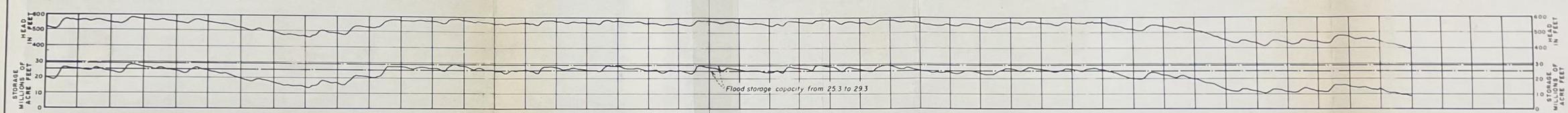
NOTES

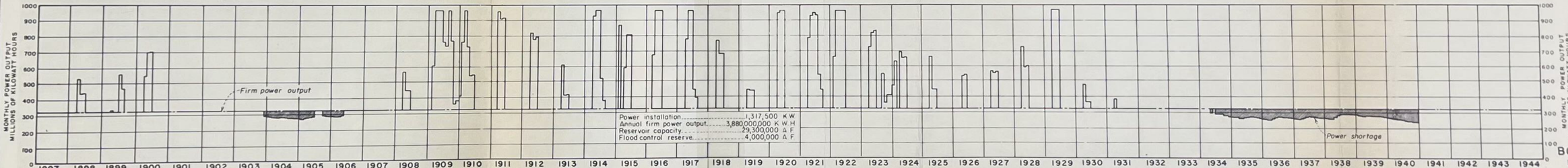
Overall efficiency	
For firm power	83%
For secondary power	83%
Tailwater elevation	642 ft.

BOULDER CANYON
RESERVOIR OPERATIONS
CONDITIONS AS OF 1938
HIGH WATER ELEVATION 1229

OCTOBER 23, 1940 45-D-13243







NOTES

Overall efficiency
For firm power 83%
For secondary power 83%
Tailwater elevation 642 ft

BOULDER CANYON

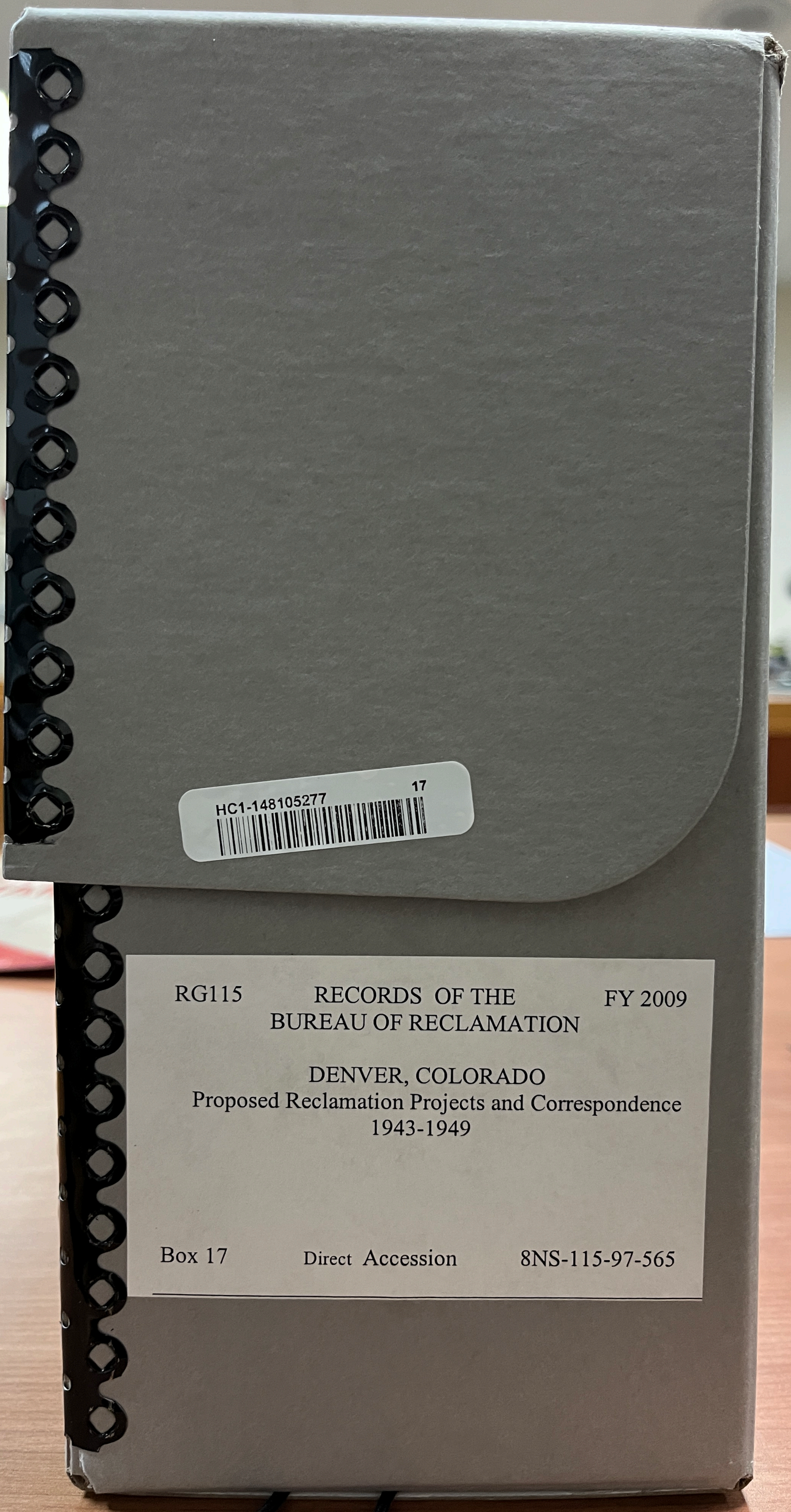
RESERVOIR OPERATIONS

CONDITIONS AS OF 1988

HIGH WATER ELEVATION 1229

OCTOBER 25, 1940

45-D-13244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RG115 RECORDS OF THE BUREAU OF RECLAMATION FY 2009

DENVER, COLORADO
Proposed Reclamation Projects and Correspondence
1943-1949

Box 17 Direct Accession 8NS-115-97-565

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JLH:CAH

BRANCH OF PROJECT PLANNING
Customhouse
Denver 2, Colorado.

April 12, 1944.

From Acting Director

AIR MAIL

To Commissioner

Subject: Total depletions above Lees Ferry under 1988 conditions - Upper Colorado River Basin.

1. Reference is made to your teletype, WA 3172, of April 10, 1944, which reads:

"FURNISH TOTAL DEPLETIONS BY YEARS 1931 TO 1940 INCLUSIVE UNDER 1988 CONDITIONS IN UPPER COLORADO RIVER BASIN ABOVE LEES FERRY USED IN PREPARATION OF TABLE FIVE EXHIBIT THIRTY-FIVE A BOULDER CANYON ADJUSTMENT ACT HEARINGS SUBMITTED OCTOBER 25, 1940 AT LOS ANGELES WRIGHT PRESIDING."

2. This office replied, by teletype, to your teletype on April 11, 1944, as follows:

"Reurteletype W 3172. Total depletions above Lees Ferry in thousands acre-feet are:

1931	4,630
1932	6,432
1933	5,338
1934	3,575
1935	5,436
1936	5,810
1937	5,735
1938	6,458
1939	5,236
1940	5,063 "

3. The total depletions in the Colorado River Basin above Lees Ferry under 1988 conditions were computed by the methods used in the report of December 1934 by E. B. Debler, "Streamflow of Lower Colorado River and Its Tributaries." The computed virgin streamflow of the Colorado River at Lees Ferry for the 10-year period 1931-1940 totals 124,618,000 acre-feet. The computed total depletion above Lees Ferry under 1988 conditions totals 53,763,000 acre-feet. It was recognized, when the October 25, 1940, studies were made, that such depletions exceeded those allowable

under section (d), Article III of the Colorado River Compact, which reads as follows:

> "The States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years reckoned in continuing progressive series beginning with the 1st day of October next succeeding the ratification of this compact."

4. Adjustments were not made in the depletions computed for the October 25, 1940, memorandum (exhibit 35-A, Boulder Canyon Adjustment Act hearings) because it was anticipated that by 1988 some adjustments might be made in the compact requirements to permit upstream depletions as indicated.

5. In making current hydrologic studies for the Bridge Canyon Project, it is assumed that holdover storage would be provided above Lees Ferry to permit an ultimate average annual depletion of 7,500,000 acre-feet in the upper basin and also insure an average annual flow of 7,500,000 acre-feet at Lees Ferry in the 10-year critical period 1931 to 1940, inclusive.

\- - -

John R. Riter

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

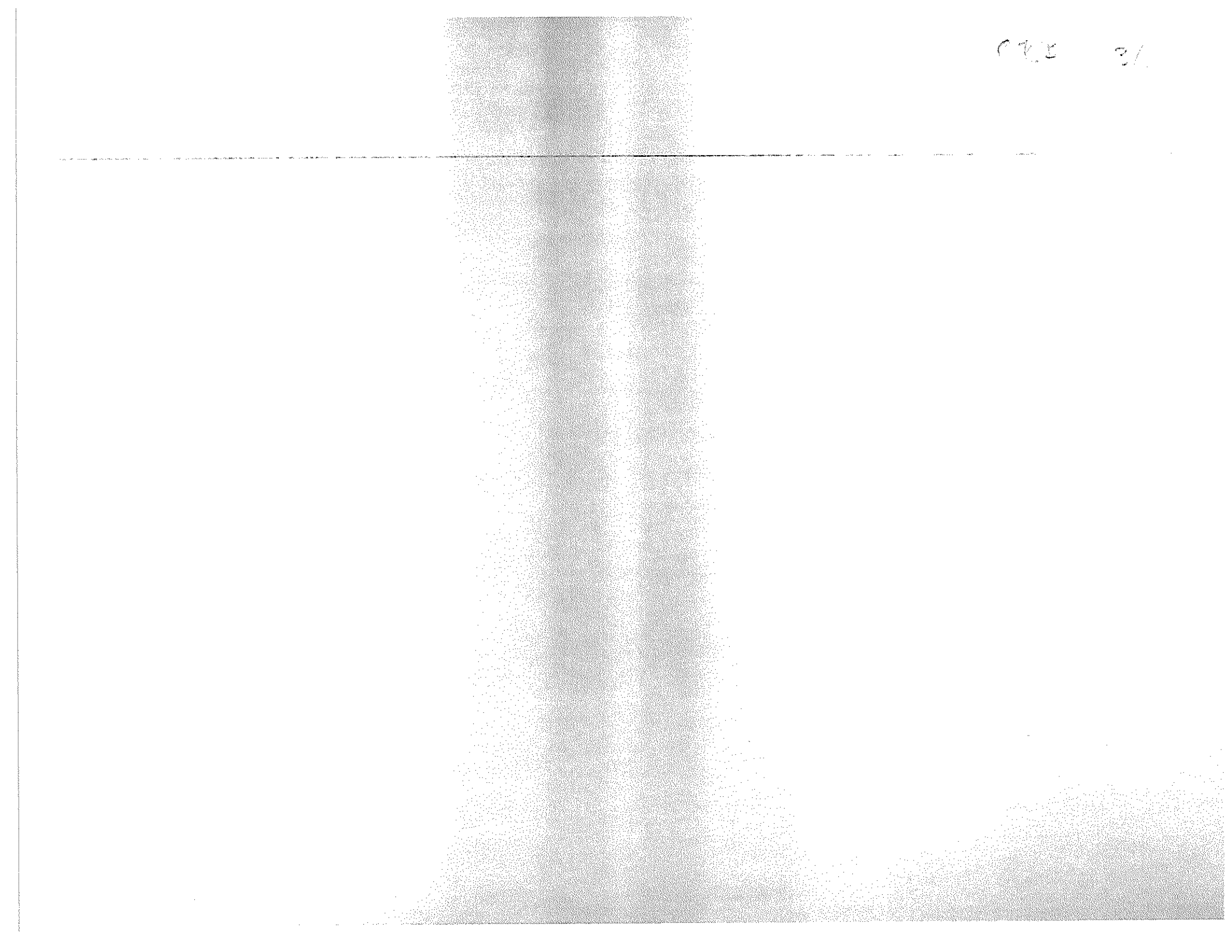
Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	**X**	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

RG 115 RECORDS OF THE BUREAU OF RECLAMATION FY 93

Engineering & Research Center

Studies, Reports, & Projects, 1899-1978

Box No. 3 8NS-115-93-001



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11-44
RETURNED
CONGRESSIONAL UNIVERSITY AND RESEARCH
RETURN TO
DEPARTMENT AND BUREAU

COLO. RIVER BASIN PROJECT

PROCEEDINGS
OF THE
COMMITTEES OF FOURTEEN AND SIXTEEN
OF THE
SEVEN STATES OF THE COLORADO RIVER BASIN
AND
THE POWER ALLOTTEES

Consideration of
Proposed Report of the Bureau of Reclamation
On a Comprehensive Plan of Development of the
Colorado River Basin

Meeting Held November 10 and 11, 1944
DENVER, COLORADO

Transmitted with ltr from D.O. to Cong. 5-22-45

Indexed
FILE IN BOOKCASE

C3

572-1968

PROCEEDINGS OF THE COMMITTEES OF FOURTEEN AND SIXTEEN OF THE SEVEN STATES OF THE COLORADO RIVER BASIN AND THE POWER ALLOTTEES

CONSIDERATION OF PROPOSED REPORT OF THE BUREAU OF RECLAMATION ON A COMPREHENSIVE PLAN OF DEVELOPMENT OF THE COLORADO RIVER BASIN

MEETING HELD NOVEMBER 10 AND 11, 1944

DENVER, COLORADO

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Denver, Colorado
November 10-11, 1944

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FEDERAL POWER COMMISSION		
John C. Beebe	Regional Administrator	San Francisco, Calif.

MEETING OF THE COMMITTEES OF FOURTEEN AND SIXTEEN

OF THE SEVEN STATES OF THE COLORADO RIVER BASIN

AND THE POWER ALLOTTEES

November 10 and 11, 1944

Shirley-Savoy Hotel, Denver, Colorado

The meeting was called to order by Chairman Stone at 10:20 o'clock a. m., on Friday, November 10, 1944.

JUDGE STONE: The meeting will please come to order.

We first should determine the procedure to follow in this meeting. We have a lot to do and it must be completed in two days.

The Bureau of Reclamation expects at this meeting to present the tentative report on the plan of comprehensive development. The presentation by the Bureau will then be followed by the comments from the various states. When you see that in a major way you are cutting the pattern of future development for one of the largest rivers in the United States, you will realize that there is before us a sizable task.

It is obvious that in two days' time we cannot accomplish the work that we hope to get done unless we have some very well defined procedure. The Chair suggests a procedure, and that is subject to determination or final fixing by the members of the Committee. The procedure suggested is this: That the report will first be presented; that then we will take up one of the basins, either the Lower or the Upper Basin. The Chair suggests that we commence with the Lower Basin; that each state within the Lower Basin will be allotted time within which to make its presentation. And I believe that it will be necessary to fix the time if we are to hear from all the states and get through.

After we dispose of each state in the Lower Basin, if that is what the Committee finally decides, then we shall take up the Upper Basin States and proceed in the Upper Basin with each of the four states, allowing each state a given length of time.

It should be understood in this meeting that those who are here as advisers and consultants appear for various sections in various states, and when it comes to the comments from each state, the representative from that state will be expected to call upon the advisers and consultants, those appearing from various sections of the state, to secure such comments as those thus appearing may wish to make.

We must keep also in mind that there are other federal agencies here, and following the comments of the states, or prior to those comments, those agencies will be given an opportunity to make such statements as their representatives wish to make.

I believe that we must very carefully follow some procedure like that if we are to do the work here.

Now, the suggestion has been made as to the procedure. I should also like to call your attention to the fact that the report of the Bureau of Reclamation is a tentative, confidential report to be discussed with this group, and it is not for publication. Therefore, if there are any newspaper reporters here, or anyone here conducting any publicity, he should keep in mind that anything released to the public through the press, or given publicity otherwise, should first have a clearance--anything appearing in this report or any statements from the federal agencies--should be obtained through the federal agency making the report. The same rule should apply to the various states.

In a meeting of this kind it is probably clear that certain states will make statements for the purpose of this meeting which those states do not desire to make public, and any statement coming from any state should be cleared through that state.

This room is large and there is quite a sizable attendance. We keep the proceedings, and those who speak should speak loudly. When anyone wishes to speak he should give his name in order that the Reporter may get it for the record.

I have made arrangements to have Jeannette Klein here so that if there is anyone who wishes any stenographic help or assistance, she will be available at any time so that you may dictate any statements or any other material which you may wish to put in writing and present. She will be available here at this table to help you.

May I ask the Committee whether the procedure suggested by the Chair is acceptable? If not, suggest any change in the procedure you think advisable.

MR. SMITH: Chairman Stone, I wonder if it would not be more logical and a better procedure to begin at the beginning and have the upstream states make their statements first rather than the downstream states? I just throw that out as a suggestion.

JUDGE STONE: Are there any further comments?

MR. SCATTERGOOD: I have the same feeling, gentlemen. We cannot very well make our comments on water coming down below until we hear from the Upper States. And I would like to offer the suggestion that the other federal departments follow the presentation, which will enable the states more intelligently to make comments.

JUDGE STONE: The suggestion has been made by Mr. Smith and Mr. Scattergood that the procedure be followed by starting with the upstream or Upper Basin States, and that the other federal agencies follow the Bureau before this is done.

Does Arizona have any comment on that?

I believe that we must very carefully follow some procedure like that if we are to do the work here.

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Does Arizona have any comment on that?

MRS. BUSH: No. We are satisfied either way.

JUDGE STONE: New Mexico?

MR. WILSON: I do not see that it makes much difference.

JUDGE STONE: Mr. Delaney?

MR. DELANEY: I do not see as it makes much difference.

JUDGE STONE: Mr. Wallace?

MR. WALLACE: Normally, I follow my leader. I move, Mr. Chairman, that the suggestion made by the Chair be approved.

JUDGE STONE: Do you make that as a motion?

MR. WALLACE: Yes, sir.

GENERAL GILES: I will second it.

JUDGE STONE: Motion has been made by Mr. Wallace, seconded by General Giles, that the procedure suggested by the Chair be followed. Is there any further discussion?

Mr. Scattergood?

MR. SCATTERGOOD: Mr. Chairman, I do not think it is clear as to what your statement was as between the states and the other federal departments.

JUDGE STONE: Mr. Wallace, does your suggestion cover the other federal agencies or does it apply just to the states?

MR. WALLACE: Wouldn't it be wise for the Chairman to repeat his suggestion?

JUDGE STONE: The suggestion first made was that we start with the report by the Bureau of Reclamation, followed by comments of the states; the states in the Lower Basin make their comments first, to be followed by comments of the states in the Upper Basin, and then the other federal agencies offer their comments. The two changes suggested were that we change the order of the Basins and that the other federal agencies follow the Bureau.

My inquiry was, your motion goes to the order of the states and not to the federal agencies.

JUDGE O'ROURKE: Mr. Chairman, it seems to me you are tying yourself down to a program that is too rigid and too definite. It seems to me we should take this a little at a time. A great many of us here have little or no information concerning this report, or concerning the reports or the connection of the other agencies in connection with this report.

It is my idea that we should first hear the report of the Bureau of

Reclamation. After we have heard that we may be in a position then to adopt some definite idea of a pro ram to follow in handling this situation.

As far as I am concerned, and as far as the group from Southwestern Colorado is concerned, we have no information whereby we could intelligently vote on the program proposed by the Chair at this time, or on the motion, rather. You certainly cannot vote intelligently on a motion unless you understand what is back of it and the reasons for the motion. We certainly don't know about that at this time.

JUDGE STONE: I appreciate Judge O'Rourke's comments. However, I want to emphasize that we have to have some definite procedure or we will never get through. We just can't throw it open.

The suggestion was that we would hear from the Bureau. Now, if a member of the Committee wishes to make a motion that we hear from the Bureau and then decide the other afterwards, that would be appropriate.

GENERAL GILES: Mr. Chairman, we do not have any secrets about this. The reason why I think it would be better to have the Lower Basin States first is that the development is so much farther ahead down there; they have a great deal more to talk about than we have in the Upper Basin States. If we could hear from them first, that seems to be the logical thing to do. But other than that, it does not make any difference to me.

MR. WALLACE: Mr. Chairman, with the consent of my second, I will withdraw my motion and make another motion.

GENERAL GILES: I consent.

MR. WALLACE: I ove that we hear from the Bureau of Reclamation and other federal agencies, and at the conclusion of that, we decide on further procedure.

(The motion was seconded from the floor.)

JUDGE STONE: Motion has been made and seconded that we hear from the Bureau of Reclamation and the other federal agencies, and as soon as those statements are in, then we shall decide upon further procedure. This motion is to be voted upon by the members of the Committee. Those who are in favor indicate the same by saying "aye." Opposed? (After voting.) The motion is carried.

Now, we are faced with another situation; Mr. Hewes and Mr. Hauser, who are the two members of the Committee representing the water interests of California, will arrive on a train this morning and they have not yet arrived. The Wyoming representatives have not yet arrived. I am advised that Mr. James Howard is appearing for Mr. Gaylord for the Power Allottees, and that he is on the same train. Therefore, we have two of the members of the Committee from two of the states, and one of the Power Allottees' representatives not here. It is obvious that we should not proceed with hearing this report with the representatives of two of the states not yet here.

Mr. Robinson, you have taken that matter up with your California group, have you?

MR. ROBINSON: Yes, with some of them.

JUDGE STONE: What suggestion do you have?

MR. ROBINSON: I discussed it with a portion of the California representation. Some have not arrived in time to be in that discussion. Among those who were present the feeling was that possibly some matters could proceed, but so far as the actual discussion of the report which has now been made the first order of business, the presentation of the report, the preference of those who participated in this partial group discussion was that we prefer that the ones who, unfortunately, are not yet here should be present, particularly, because that includes two representatives of the water interests in California.

Those who are present from California are mostly from the power interests. Mr. Simpson, of San Diego, I think I am right in saying, is the only one representing the water interests. Excuse me, Mr. Elder and Mr. Simpson. The men from Los Angeles are indirectly just as much interested in water, because we constitute the biggest potential customer of the Metropolitan Water District. But, primarily, the delegation so far here represents the power interests rather than the water interests. So far as the membership on the Committee is concerned, there is no representation.

JUDGE STONE: I think it is clear that it is not fair to proceed until these two states' representatives are here. The train, I understand, Mr. Robinson, is on time and is scheduled to arrive at 10:30.

MR. ROBINSON: That is our best information. We are not positive that they are on that train, but that is our best information.

JUDGE STONE: The Wyoming people are driving.

MR. SCATTERGOOD: Mr. Chairman, it seems to me we would save time, because of the work needed to be done in the preparation of the comments, if we adjourn until after lunch so we will know just where we are to go ahead and work. I regret that is the situation, and to have to make such a suggestion, I am perfectly willing to come to the meeting at night later on, after dinner, to get the work done. I believe it would save time, and I would move that we adjourn to lunch.

(The motion was seconded from the floor.)

JUDGE STONE: Before the Chair entertains that motion, there are some preliminaries we might take up.

JUDGE O'ROURKE: Mr. Chairman, some of us are getting a little old. We don't hear quite as well as we used to. And for the benefit of us who are incapacitated that way I wish some of the people who talk would speak up, because we would like to hear what is going on. We have a little difficulty in hearing.

MR. SCATTERGOOD: Mr. Chairman, the suggestion was that in the long run we would save time if we adjourned until after lunch so that preparations could be made in the meantime. But that motion will be held in abeyance until the Chair has mentioned what else he has in mind.

JUDGE STONE: Yes, may we hold that in abeyance for the moment, Mr. Scattergood?

MR. SCATTERGOOD: Yes, certainly.

JUDGE STONE: Colorado has not arranged for addresses of welcome and that sort of thing because we had a lot to do, and this is a working conference. So we are not taking up time for that.

GOVERNOR CARR: They are welcome just the same, aren't they, Judge? (Laughter.)

JUDGE STONE: I was going to say that in the days gone by and not so long ago our good friend, Ralph Carr, used to welcome this Committee. I am sure he could say a few words of welcome since we have a little time on our hands. We did not arrange it because we didn't want to take the time.

GOVERNOR CARR: Welcome, Gentlemen. (Laughter.)

JUDGE STONE: You know, Ralph spoke up at the wrong time. (Laughter.)

We have with us today a new man in our group who represents one of the large interests in the Colorado River Basin, a man whom we have heard of, or some of us have, for many years. Many of you have not, perhaps, had an opportunity to meet him. I refer to Mr. Samuel B. Morris, who is the new Manager of the Department of Water and Power in Los Angeles.

Mr. Morris, we should be glad to have you say a few words. (Applause.)

MR. MORRIS: I might say I just came up here to Denver for the opportunity of listening and seeing, and not of speaking. I have been on the job for about six weeks in Los Angeles, and while I have known something of the proceedings which have gone on in prior years--in fact, I attended some of the meetings of the original Colorado River Commission when the allocation was made between the Upper and Lower Basins, at that time being with the City of Pasadena,--but for the past nine years I have been in academic circles at Stanford. I resigned my work there the first of October to accept the position with the City of Los Angeles in the Department of Water and Power.

I am here to meet you all, many of you I have known in the past. I have known the engineers of the Bureau of Reclamation and held them in high regard for many years. I have known a good many of you.

I carry no statement for Los Angeles because I do not know anything about it, really. I am here to learn as much as I can. I hope to gain information from all of your views individually so that from those views I may learn your position better before I build up any prejudices on my own part.

I think it is a very opportune time for me to come here and learn. I am entirely in the learning stage, Mr. Chairman. (Applause.)

JUDGE STONE: We have a new man sitting on the Committee from Nevada, Mr. Shaver. We have all known and admired Tom Smith. He has been with us since the beginning. He stays with us always but occasionally he brings someone else with him. Mr. Shaver, may we hear from you, from Nevada?

MR. SHAVER: Mr. Chairman, this, of course, is a little sudden. I did not come here to make any speeches at all. As you say, I am a newcomer in the Committee. I visited the Committee at the July meeting in Reno.

I agree with you that Tom Smith is the big man of our Committee in more ways than one. I feel a little small when I stand alongside of Tom. I am like Mr. Morris. I am here to listen today and see if I can intelligently gather a little information we might need on our Nevada side. I will leave all of the speaking to Tom Smith. I thank you. (Applause.)

A PARTICIPANT: Mr. Warne is now here.

JUDGE STONE: Mr. Warne, will you come up here, please?

Gentlemen, I should like to introduce Mr. William Warne who is the Assistant Commissioner of the Bureau of Reclamation. Mr. Warne has stepped up his time in coming to Denver so as to meet with this Committee. He is going to sit here with this group from the Bureau of Reclamation.

Mr. Warne, we will be glad to have just a word from you now.

MR. WARNE: I am very glad to be here. Like most of the rest of you, I think I probably have not had sufficient time to skim through the report which will be the principal subject of the discussion here.

I feel confident that this is going to be a fruitful meeting. We will see more of each other during this meeting and during the other meetings that I have to attend.

I am very happy to be here, Judge, and will be at your disposal as long as your meeting is in session. (Applause.)

JUDGE STONE: I am so glad you are here.

(Pause while press photographs are taken.)

JUDGE STONE: The Wyoming representatives of our Committee have arrived, and we will take their appearances. Will you stand and give your names, gentlemen, please.

MR. ROLLINS: H. Melvin Rollins, Member of the Committee.

JUDGE STONE: Do you have any consultants with you?

I think it is a very opportune time for me to come here and learn. I am entirely in the learning stage, Mr. Chairman. (Applause.)

JUDGE STONE: We have a new man sitting on the Committee from Nevada, Mr. Shaver. We have all known and admired Tom Smith. He has been with us since the beginning. He stays with us always but occasionally he brings someone else with him. Mr. Shaver, may we hear from you, from Nevada?

MR. SHAVER: Mr. Chairman, this, of course, is a little sudden. I did not come here to make any speeches at all. As you say, I am a newcomer in the Committee. I visited the Committee at the July meeting in Reno.

I agree with you that Tom Smith is the big man of our Committee in more ways than one. I feel a little small when I stand alongside of Tom. I am like Mr. Morris. I am here to listen today and see if I can intelligently gather a little information we might need on our Nevada side. I will leave all of the speaking to Tom Smith. I thank you. (Applause.)

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MR. ROLLINS: H. Melvin Rollins, Member of the Committee.

JUDGE STONE: Do you have any consultants with you?

MR. ROLLINS: No.

JUDGE STONE: Another consultant from Utah has come in, Mr. Skeen. Will you stand up, please, Mr. Skeen?

MR. SKEEN: Edwin Skeen.

JUDGE STONE: We have some other newcomers to this group, including the men representing certain areas who have not met with us before. I should like to introduce Mr. Dutcher, who is the President of the Gunnison Watershed Association. We would be glad to have a word from you, Mr. Dutcher. (Applause.)

MR. DUTCHER: Thank you, Judge Stone. I came here to listen. I am going to be a good listener. I do not know much of what this meeting is about. I came here to find out. After that I can tell you more as to what our group is going to do. I thank you. (Applause.)

(At this point the remaining California representatives arrived.)

MR. SCATTERGOOD: Mr. Chairman, in view of our recent arrivals, I withdraw my motion, with the consent of my second.

JUDGE STONE: Very well.

The two California representatives have arrived, and we will take their appearances. Will you stand, so we may know who you are?

MR. HEWES: Evan T. Hewes, Committee of Fourteen, California.

MR. HAUSER: Lew s A. Hauser, Committee of Fourteen, California.

JUDGE STONE: May we take the appearances of those from California who have just come in with Mr. Hauser and Mr. Hewes?

MR. DOWD: M. J. Dowd, Imperial Irrigation District, El Centro, California.

MR. SHAW: Arvin B. Shaw, Jr., Assistant Attorney General, Los Angeles.

MR. JENSEN: N. H. Jensen, Metropolitan Water District, Los Angeles.

JUDGE STONE: There are some others who have come here, I believe some of the Army Engineers. May we have those, please?

COLONEL PUTNAM: R. W. Putnam, United States District Engineer, Los Angeles.

JUDGE STONE: I understand some newspaper reporters have come in since I made the announcement that the meetings of this group are of an executive nature. Anything released with respect to this report of the Bureau of Reclamation, or report by any other agency, should be cleared through that agency. Any statements made by the states should be cleared through these states in order that the states may be able to control the question of the release of any matter which may be of a confidential nature.

We are glad to have the press here and for them to know what is going on. We will appreciate it if that arrangement will be carried out.

Now, since all of the members of the Committee are here, I think we should take advantage of all of the time that we have and proceed with the submission of such statements as the Bureau of Reclamation desires to make with respect to this report.

MR. ROBINSON: Mr. Chairman, there is still one vacancy on the Power representation.

JUDGE STONE: Yes, there is one vacancy. I understand Mr. Elder will sit on the Committee for Mr. Gaylord until Mr. Howard arrives. Is that right?

MR. ROBINSON: Yes.

JUDGE STONE: Will you come up here, please, Mr. Elder?

Mr. Warne, may we now proceed with the submission of the report by the Bureau? You may proceed in such way as you wish to direct.

MR. WARNE: This report has been prepared through the good offices of the Regional Directors of Regions 3 and 4, Commissioner Page and Acting Director of the Branch of Project Planning, Mr. "Randy" Riter.

I came in only a few moments ago and have not had time nor opportunity to discuss the matter of the procedure with you gentlemen. I assume that they have a procedure outlined among them and I shall therefore turn the meeting over to Mr. Riter for procedure in presenting the report to you.

JUDGE STONE: Mr. Riter.

MR. RITER: This report has been prepared, primarily, in the Salt Lake City and Boulder City offices. As you know, we divide the Basin into the Upper Basin and Lower Basin. Mr. Larson is responsible for the preparation of the material concerning the Upper Basin portion of the report. Mr. Moritz prepared the material for the Lower Basin portion. It is their report. They are the prime movers in bringing this document together.

Mr. Page was special consultant, to give them the benefit of the background of his long years of experience in building Boulder Dam, and back in the earlier days, in his younger days, working on the Grand Valley Project; and then, his experience as Commissioner of Reclamation. He acted in a consulting capacity.

Some of the technical phases of the report were thrashed out by our office. We were responsible for the conduct of the details.

As a matter of procedure, I would like first to hear from Mr. Page for a brief statement, because he is responsible for the introductory portion of the report. Then, I think it would be appropriate to call on Mr. Larson for presentation of the material in the Upper Basin. The supporting staff of the Bureau will be available to assist these two Directors in their presentation.

In case questions should come up on some of the details that they may want to follow, we will be available to assist. As a matter of procedure, we will hear first from Mr. Page.

MR. PAGE: I have very few remarks to make, as the printed document is the report of the Bureau of Reclamation. I have only these few comments to suggest: In the first place, it is not a comprehensive plan. It is a tabulation or summation of the things which the Bureau has found in its studies and investigations in the Basin, and we are presenting it to this Committee for help.

We are rather proud of the form in which it appears, but we also realize that there are a good many controversial questions among the different peoples and this is a good place to improve this report by receiving suggestions from the various people who are the most interested. I do not want the states to get the idea from that that every suggestion will be brought into this report because, in the final analysis, it must be a Bureau report, and we hope to lay the ground work for the states.

No comprehensive report can at this time be prepared, with the uncertainties that exist, first, between the states and, second, between the United States and Mexico. Both of those matters have to be straightened out before anyone can make a comprehensive story of the water use in the Colorado River.

I just want to repeat that we are asking you and your Committee for help to improve this report. And may I make one other request? That is that the suggestions we have be confirmed in writing so that we may have the confirmations before us in order that we will know just what you have to say. That will make more clear just what your ideas are for these improvements, if it is possible to do so. I will have some further comment to make in the course of the meeting.

JUDGE STONE: All right, Mr. Riter.

MR. RITER: I think we should proceed with the Regional Directors first, and let them handle their respective basins in the manner they see best, calling on those of the Bureau whom they wish to call on for specific questions.

If it is agreeable, then, in line with the thought suggested by Mr. Scattergood, we might start with the top basin, and call on Mr. E. O. Larson, Director of Region 4, Salt Lake City, for a presentation of the Upper Basin portion of the report, the portion above Lee Ferry.

MR. LARSON: About four months ago--

JUDGE STONE: Pardon me, Mr. Larson, please. Will you speak as loudly as you can so everybody can hear?

MR. LARSON: I will try to do that.

About four months ago the responsibility was placed on the Field Office of the Bureau to get out a comprehensive report or a resumé of all of the potential irrigation and multi-use projects in the Colorado River Basin, and describe them briefly in the report, with the report being, I assume, for several purposes:

One of those purposes being to bring the Committee of Sixteen up to date on everything that has been covered. And I assume it is also to be used by the Bureau of Reclamation in enabling it to submit the report to the Post-War Planning Committee of the Senate. It certainly will be used as a guide to know where we are headed in preparing detailed project reports and basin reports in the future.

A mass of information has been gathered by the Bureau in the past, and the thing that impressed me is the large amount of work done in many years in the matter of making soil classification records covering millions of acres. We have tried from that to summarize the areas where it is possible to build reservoirs and canals, and give a brief description of such in this report.

To get the report together we have called upon our Field Offices. We have sub-offices in various places in the region, one in Cheyenne that works on the Green River Basin; one at Vernal, one at San Juan, and others at Grand Junction, Durango and Salt Lake. By using all of those field men and calling them in, we tried as quickly as possible to get this report, and we did succeed in finishing it twenty-four hours ahead of the deadline.

There are corrections in this report that will have to be made that we have found already, and some changes and some additions. These will be explained as we go along. There is also a set of maps to be added which will show the location of the potential reservoirs and canals and irrigated areas for each project that is included. All of the maps are glued together on the board at this end of the room (indicating.) They are too small to be seen from here in detail, but they may be examined. We are sorry that the finished map is not yet available, but it will be.

In the final report there will be a pocket of maps for each state involved.

We have divided the Upper Basin into divisions, the Green Division, being the Green River to its mouth joining with the Colorado; the Grand Division, being the Colorado River proper, and everything below the junction of the Colorado and the Green is the San Juan Division. We have discussed all of the potential projects in these three divisions in the Upper Basin. We have also tried to show in the report the summation of the present irrigated land and the number of acres of new land, both by divisions and by states.

Now, it is not possible at this meeting, I do not believe, to describe each project. We have 76 potential irrigation projects that we have covered in the Upper Basin and some 32 power projects. If we were to spend 15 minutes on each one it would require more than 25 hours of constant explanation without any questions. So that does not look feasible. I might suggest, Judge Stone, possibly we might list the projects as we take them up with each state, or in some other way, because the statement will take 24 hours or so if we try to describe each project using 15 minutes for each; or 12 hours if we use seven minutes or so on each project. So it is a large task if we explain each one.

I should make one further observation, that in covering the projects in some cases we have detailed reports either completed or near completion. We have in a few cases reports on the sub-basins or smaller drainage basins, like

the Green River Basin or Sub-basin. In some cases we have those reports completed. They will show what will be necessary as time goes on, and what we will have to do.

I need instructions from here on as to whether you want me to read--

JUDGE STONE: May I suggest, Mr. Larson, that if possible, you or someone else from the Bureau discuss and give an overall explanation of the manner in which the water supply was appraised, and the manner which, in an overall way, you have applied it for use in the Basin.

MR. LARSON: I would suggest that after Mr. Moritz gets through with his portion, perhaps Mr. Riter, who has worked on both sides of the problem explain the general theory of the water supply, and how we set that up.

JUDGE STONE: I am just wondering this, Mr. Riter and Mr. Larson, if we are not in a way getting the cart before the horse? In other words, we are dealing with the overall water supply in the first instance. You have taken that water supply and attempted to show, in a general way, at least, how it will be utilized or may be utilized in the future, and it would seem to me logical that that statement would precede any statement as to projects.

Do you agree with me, Mr. Riter?

MR. RITER: Mr. Chairman, Members of the Committee of Sixteen, and Gentlemen: The Colorado River Water Supply has been a subject that has been studied for a good many years. In formulating our plans for the report, we had in mind the limitations. We had in mind the Colorado River Compact which apportions seven and a half million acre feet for beneficial consumptive use to the Upper Basin States, and it was our plan in formulating projects to bear this in mind.

Now, when you speak of water supply, there are two phases, one general overall phase from the standpoint of the basin. A gauging station has been maintained at Lee Ferry, which is the dividing point between the Upper and Lower Basins and has been since about 1902. Gauging stations have been maintained at Yuma since 1922. And then there have been gauging stations at the principal tributaries, so that by means of estimating and correlating we have been able to build up a record since 1897 to 1943. That was the basic period we used for the so-called overall water supply studies.

During this period from 1897 to 1943, irrigation in the Upper Basin has not been steady. It has changed very materially. In some cases there has been a gradual and in other cases an accelerated increase. So that as we have estimated, we have tried to estimate the use each year in applying a correction factor.

So we start out with the stream flow at Lee Ferry, if no developments were made, and we find for the long-time period of 1897 to 1943, the average figures of 16,271,000 acre feet a year. With that as a starting point, we then tried to determine how much the conaumptive use now is in the Upper Basin, that is with conditions as reflected for the period 1931 to 1940. The reason we selected the period 1931 to 1940, is that that is the lowest consecutive ten-year

period of run-off on the stream. We felt if we used that as a yardstick in measuring the water supply available for individual projects, that we would be on a sound basis. In other words, new projects that must be developed would have to live through this drought period in order to be sound.

Therefore, we adopted that ten-year period as the basis on which to make the water supply studies for the individual projects.

On page 128 of the report there is a summary which gives an estimate of the present and potential stream depletions from irrigation, development, evaporation losses from reservoirs and from transmountain diversions during the ten-year period.

This table shows that in the Upper Basin the total depletion was around 2,440,000 acre feet. That includes one or two projects which have not yet progressed to completion. We feel since reviewing the preliminary report that that table is inadequate. That covered just a ten-year period. We feel we should present a table, and that table is now in the process of being prepared, to present the total depletion and average depletions projected back through the period of 1897 to 1943. That table shows approximately 2,600,000 acre feet. I am having that table mimeographed today and I hope before the day is over to have copies to pass out for you. That is a table which we will insert after the one on page 128.

That was the starting point for analysis.

Mr. Larson has told you in previous investigations that were carried on since the passage of the Boulder Canyon Project Act in 1928, that the Bureau has been engaged in classifying land. At the Reno meeting that was the only information we had to present on lands classified as being suitable for irrigation if a water supply could be made available.

In preparing this report we used the available short-term records on the tributaries and expanded these by correlation with other records which extended over a longer period of time, and tried to analyze the water supply, and tried to formulate the actual projects that could be served within the Basin.

We then tabulated these projects and made calculations to determine the acreage that could be served, and the amount of water that they would use, bearing in mind that these are the roughest kind of figures. They are not detailed estimates. Time would not permit us to make detailed studies. But we have carried those sufficiently far so we feel the pattern of development is fairly sound.

As you people found out from the testimony of the states at the Reno meeting, the project potentialities, including irrigation within the Basin, potential transmountain diversions to the portion of the states located outside of the boundaries of the Basin, and so forth, would exceed the allotment of 7,500,000 acre feet.

Mr. Larson has attempted to present here for the Bureau a sort of a plan.

It is open for your consideration. We had to make decisions as to which projects to leave out and, in some cases, we found out we would have to leave out some irrigable land because local water was not available. The mere fact that water was available at Lee Ferry was not proof that there would be water at the storage dam, so we had to eliminate some of those lands on account of an inadequate water supply at the point where it could be diverted.

In the final windup for the Upper Basin, we found we could irrigate an additional 1,100,000 acres and furnish a supplemental water supply to about 470,000 acres which are now inadequately supplied and which now suffer shortages. At the present time, on the basis of the long-time average, our estimate shows the exportations from the Upper Basin average 639,000 acre feet. That does not include the exchange of water. That includes water physically taken out of the Basin, and does not include the transfer of water from the Dolores Basin to the San Juan Basin, which we consider is an intra-basin use.

We found out we would have enough water to support additional transmountain diversions of about 2,100,000 acre feet.

In the revised table, the Upper Basin potential use adds up to a little more than 7,500,000 acre feet. This includes reservoir evaporation losses, and averages around 7,656,000 acre feet. So that in order for this plan to be sound and to be within the limits of water supply the development possibilities that our report now shows will need to be pared down a little bit by process of elimination so we do not exceed the seven and a half million acre foot use of the water. I think I am safe in saying that. Some may disagree with me.

There were some projects described in the report but not tabulated. For instance, from Utah. We want your reaction on those. You have two large projects of which we describe the possibilities. Tentatively, we have assumed that they should not be in the pattern of development, but we are open to discussion. That is one of the questions we wish to bring up with you.

Your Colorado River--Great Basin Diversion which proposes to bring one million acre feet of water through a long aqueduct and tunnel which would serve something like 350,000 acres of new land in Central Utah, when we analyzed it we felt it was just too costly; we felt it would take too much power to support that project. We have eliminated that tentatively, and we do not have it listed in the total of the 7,656,000 acre feet.

There is the large body of land near Cisco, Utah, part of it in Colorado, most of it in Utah, as I recall the acreage is around 100,000. To serve that land would require a pumping lift of greater than 600 feet. I know it is greater than that because it is about 600 feet to the top of the reservoir. If we do serve it by pumping, the plan we have described is a gravity plan which would involve a 35-mile tunnel from the Colorado River, beginning at Grand Valley up above Grand Junction, and would involve a very extensive canal system. Then, it would involve replacement storage for the existing irrigation of Grand Valley. The lands are not first-class lands. The bulk of the lands are so-called class 2. We feel it would cost, as I recall the figure, in excess of $400 per acre. How much, I do not know. But we carried that study sufficiently

far that we feel probably that project would be eliminated.

If you disagree with us and want that put in, we would like to listen to your reasons for it, so we may have the information. It may be that our figures do not appeal to some of you on the possible transmountain diversions but we tried to be realistic on those things.

Our figures are not and cannot be final because they were, necessarily, estimated in many cases. But we feel that the pattern of development that was evolved by the boys working from Region 4 office is, probably, somewhere close to the final pattern of development in the Upper Colorado Basin.

Now, then, the Upper Basin has another obligation under the compact besides having the privilege of using seven and a half million acre feet of III (a) water. They are also under the obligation of delivery at Lee Ferry of a total of seventy-five million acre feet of water each ten years. In order to do that we found it would need main stem reservoirs of total capacity in the neighborhood of thirty-five million acre feet. In the low ten-year period we would probably use only twenty-five million acre feet. It would be impounded in years of high run-off and released in years of low run-off by delivering an average of seven and a half million acre feet of water in the low period. This would also make possible a production of large quantities of hydroelectric power. We feel that a market will develop in time, both in the Basin and outside the Basin where the hydroelectric energy could be sold and help finance the development of the reservoirs.

At this time we cannot go into the details as to how much will be paid by water and how much will be paid by power. At this stage of the game we are trying to lay a pattern of development.

In summary, then, there are more than enough projects in the Upper Colorado Basin, including the present and potential transmountain diversions, including the developments within the Basin, furnishing a supplemental supply to those areas that are short, and expanding the area by a little over a million acres, to utilize all waters allotted the Upper Basin.

Mr. Larson has told you there are a number of projects listed. We have tried to give a brief description of the projects, and have tried to give an estimate of the costs. It is impossible to estimate prices under present-day conditions. From the study of past trends of prices we felt that prices of January, 1940 might be considered as normal construction cost. We do not know what the future construction costs will be. Judging from the past they will no doubt go down after the war. On those projects, of course, we do not have finished specifications, either. These estimates are based upon experience. We estimate canals by so much per mile, based upon experience, constructing canals of similar types elsewhere. As to the costs of our dams, in some cases we had detailed estimates, yes, but in many cases we had to use rough approximations based only on a cross-section and profile of the damsite, estimates of yardage, and applying judgments. But we tried to conform them all to the same standards, so that in comparing projects you have some kind of a yardstick.

I do not know what else I can contribute at this time, Judge, without going into the details of the projects. Our map is on a small scale and you have to get close to it to see it. I am sorry we do not have copies of it available to pass around as yet. The printer has his troubles also. We had hoped to have maps available today to pass out, and I am sorry we do not have. We promised Judge Stone we would have them, but we have to get along the best we can with the one map we have on the wall.

There is a description of the individual projects in that report. Some of the people interested in their particular divisions might want this, and Mr. Larson may decide to read it. I think it would be a good idea to do that. Our highlights are, primarily, irrigation and power. They are the two principal products of our water. In formulating the plans, we are not unmindful of the fact that water is also used to preserve fish and wildlife. We are not unmindful of the recreational values of a stream of water or pool of water for fish and wildlife purposes. We are not unmindful of the municipal requirements of water, or the requirements for industrial purposes. We did not add in the consumptive use for industrial purposes. That is a detail we will probably have to discuss with you where the areas are located, so you can decide where you want to use that water and how.

We know there are other uses. We know the Colorado River Basin--and I am speaking now generally of the Upper Basin--is rich in undeveloped mineral resources. We have hopes that the hydroelectric energy made available and the water made available will be an aid in developing this country. We know that irrigated lands mean farms. Farms mean trade centers and commercial centers, and the expansion of all of the mineral resources as to which I, myself, by training, am not able to tell you the process, the intricacies necessary to develop. But we know from the experts of the other branches of the federal government that the development must go hand in hand.

I have stressed the millions of acres of land that we have to consider. I think I will turn this back to Mr. Larson again.

JUDGE STONE: Mr. Riter, may I make this suggestion? And I trust it may be approved by the Committee. That while we are on this question of overall water supply, before we go into details as to developments, that we have a statement respecting the overall application of the water supply and utilization, now, in the Lower Basin?

MR. WALLACE: May I ask a question before you leave the Upper Basin?

JUDGE STONE: Yes. After Mr. Wallace asks his question.

MR. WALLACE: You will have the Bonneville report out in a very little while?

MR. RITER: That is next on the schedule.

MR. WALLACE: That will be out when?

MR. RITER: I will let Mr. Larson make his own promises.

MR. WALLACE: There is a rivalry between the development in the Bonneville Basin and the Colorado River Basin, and we should have that report before we make a detailed statement on behalf of the State of Utah.

MR. RITER: Mr. Wallace, I don't know whether you have read all of the details. Mr. Mathews here from the Power Utilization Branch, I think, in writing his chapter on power markets, he had available the results of the Bonneville Basin survey of power markets, and used the figures used in that report, and quoted them in this report as part of a justification for the statements regarding a market for hydroelectric energy that will be developed in the Upper Basin.

If you wish to go into that, Mr. Mathews is here to answer those questions.

MR. WALLACE: We will have some notions if Mr. Mathews will speak of them, before we get through with that matter. But this is not the time.

JUDGE STONE: May we now proceed with the water supply and the manner in which you propose to utilize it in the Lower Basin, in the same manner as you have gone over it with the Upper Basin?

MR. RITER: With your permission, I will call on Mr. Moritz. He is the prime mover and he has had the responsibility for that. He is the spokesman for the Bureau of Reclamation in that regard and I would like to call on Mr. Moritz, the Regional Director, at this time.

MR. MORITZ: Mr. Chairman, Members of the Committee and Gentlemen: Mr. Riter stated the Regional Director is the prime mover. But he needs a lot of help. And he has had a lot of help in making up this report. I propose to take very little time because time is going to be very, very short. I shall confine my remarks to just some general statements.

The statement made by Mr. Larson in regard to the Upper Basin and as to the phases we are going through, applies to the Lower Basin. The Lower Basin is divided into the Little Colorado Basin, which is more or less self-distributive; the Virgin Basin, including the Muddy, the Gila Basin, which includes most of the Arizona territory adjacent to the lower Gila, and the Boulder Basin, which includes everything along the main stem of the River.

When we began this report my region was practically totally devoid of any project planning operations and also, naturally, all assistants, so we had to get together a group very quickly. By our high-pressure operations for the past four months we produced something--and we think it is pretty good--as painting a total picture of what the problem is and its general elements. We have blended the colors pretty well so they can be unscrambled and intensified in one spot and reduced in another. And that is the thing that we hope will be developed here today, unless everybody agrees with what we have said here--which we do not anticipate--because that would indicate that we had done a poor job.

We do not expect that everyone will agree with any part of this, or that any one part will be agreeable to everybody. But the attempt has been to paint a general picture in the Lower Basin, and I think that is similarly true of the Upper Basin, thereby covering the whole picture. As Mr. Page has said, what we

desire here today from the standpoint of the Bureau of Reclamation is to get the views of the Committee of Sixteen on what they do not like about this report. We are not concerned so much about any statements as to what you do like because that takes care of itself.

If I can get any further light on developing a better picture than we have so that we may proceed with our detailed investigations with some confidence that the results that we finally obtain will be generally acceptable, that is what we hope will develop from this meeting.

I want to say, finally, in connection with Mr. Page's remarks as stated, that we want your views. We hope that no major changes will be requested that will involve a complete rewriting of very much because there just is not time to do it. This report has to be submitted to Congress, as I understand it, on the first of January. We have had every available man in my Region who could be pulled off of projects working on it up until the first of November, and we would very much like to get back to our regular business, immediately, if possible.

Now, we do not expect there will not be some changes. We have already found some that need to be made. But any major changes, it strikes me--and I think my colleagues will agree--any major changes would consume too much time. So I hope that everyone will take the view of this entire matter that this is a preliminary report. It is an unfinished picture, and nothing final is going to develop from it now.

I think that is all I have to say at the present time.

JUDGE STONE: Mr. Moritz, may I ask this: Would you care to state just how you took the water supply available for the Lower Basin, considering the compact and the terms for the use of that water under the compact, how you applied that in the Lower Basin to work out a pattern or picture for the present use and the potential development?

MR. MORITZ: If you will permit me, I will ask Mr. Vaud Larson who handled the overall calculations in the preparation of the report.

JUDGE STONE: Very well.

MR. MORITZ: This is Mr. Vaud Larson, not to be confused with Mr. E. O. Larson.

JUDGE STONE: Cousins, aren't they? (Laughter.)

MR. MORITZ: They are both good men. Mr. Vaud Larson has had the full responsibility of making this Lower Basin report, and has had only my administrative assistance.

MR. VAUD LARSON: Mr. Chairman, Members of the Committee, Ladies and Gentlemen: In the Lower Basin we have an idea or an estimate on the amount of water available, and to some extent that water has been allocated among the

states. There are many questions yet, and it is impossible to determine at this time just how much water could be made available to the various states. Therefore, in outlining our projects we have made an attempt to list them as an inventory. The depletions, as we have shown them, exceed the available water supply. Therefore, it will be necessary that some of these projects be reduced in size, or possibly some of them eliminated.

In starting out, we started with the virgin flow at Lee Ferry of 16,271,000 acre feet. Allowing seven and a half million to the Upper Basin States, that leaves 8,771,000 acre feet at Lee Ferry. The net inflow or increase between Lee Ferry and Boulder Dam is estimated at 1,060,000 acre feet.

The net river channel losses, in addition to the gains, result in a depletion of possibly 500,000 acre feet between Boulder Dam and Lee Ferry--Boulder to Laguna Dam,--which would leave the virgin flow at Laguna Dam 9,331,000 acre feet.

The projects as we have outlined in the report show a depletion of 120,300 acre feet in the Little Colorado River Division; in the Virgin Division, 179,500 acre feet; in the Boulder Division, 7,156,000 acre feet. The reservoir losses on the main stem, 774,000 acre feet. The depletion by diversion to Central Arizona from the Colorado, as we have outlined, is approximately two million acre feet. 1,990,000 acre feet, to be more exact. With the result a negative depletion or, in other words, we exceed the available water supply by 890,000 acre feet, which does not include any water that would be allocated to Mexico. Therefore, the projects, as we have them outlined, will have to be reduced and possibly some of them eliminated.

JUDGE STONE: They cannot hear. Will you speak a little louder, please? Will you make that statement again?

MR. VAUD LARSON: I will repeat the last statement: The projects we have outlined in the report show that we have exceeded the available water supply by 890,000 acre feet, which is in addition to whatever water may be allocated to Mexico.

I think that covers in general the water situation in the Lower Basin.

MR. ARLEDGE: That is on the long-time average, I take it, 40-years?

MR. VAUD LARSON: Yes.

JUDGE STONE: That would be worse on the ten-year average than on the long-time average, would it not?

MR. VAUD LARSON: Yes.

Other than going into the various projects, I think that probably covers the situation.

JUDGE STONE: It is now 12 o'clock, and it would seem that we would just as well recess now and reconvene at 1:30.

May I make this suggestion again? We have a lot of work. Please be on time and take the seats you had this morning.

We will stand adjourned until 1:30 this afternoon.

(Thereupon, at 12 o'clock noon a recess was taken until 1:30 o'clock p.m.)

Afternoon Session

The meeting was called to order by Chairman Stone at 1:50 o'clock p.m.

JUDGE STONE: The meeting will come to order, please. Since we convened this morning there are some additional appearances. I believe Mr. Feast is here from the Colorado Game and Fish Department. Is Mr. Feast here?

MR. FEAST: Yes.

JUDGE STONE: Give your name for the record, please.

MR. FEAST: C. N. Feast, Director of the Colorado Game and Fish Department.

JUDGE STONE: Are there any others who have come in this afternoon whose appearances are not noted as yet?

MR. JOHNSON: Ed. Johnson, from Sheridan, Wyoming.

JUDGE STONE: We will proceed now with the further presentation by the Bureau of Reclamation. Mr. Larson, were you through with your presentation of the Lower Basin?

MR. VAUD LARSON: Yes, sir.

JUDGE STONE: Was there anything further to offer on the overall water supply matter?

MR. RITER: Mr. Chairman, during the lunch hour one or two people asked me some more questions about the Lower Basin, and with the permission of the group assembled, I would like to take a few minutes to supplement the statement by Vaud Larson.

On page 19 of the report is a tabulation which gives the long-time averages of the Lower Basin. From that tabulation, we find at Yuma, which is the lower station which is above the diversions for the Imperial Valley, and also above the mouth of the Gila River, there is a long-time average of 16,451,000 acre feet. The Gila River, which drains the extreme western part of New Mexico and most of Arizona, has an estimated long-time average flow, an undepleted flow, of 1,271,000 acre feet. If we add those two together, the undepleted flow of the Colorado River, at the Mexican boundary, would be 17,722,000 acre feet. We assume that the Upper Basin will deplete that by seven and a half million acre feet. That will leave a virgin supply of 10,222,000 acre feet.

In its natural state we know the river overflows its channels and loses

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In its natural state we know the river overflows its channels and loses

much water trapped in sloughs, and we estimate that upon control some of the natural losses would be reduced. These figures I am giving you are estimates. We feel that there will be around 380,000 acre feet of channel losses that could be conserved in the Lower Basin, so that the Lower Basin supply will be in the neighborhood of 10,602,000 acre feet.

The Lower Basin is peculiar, in that the development has progressed more rapidly than it has in the Upper Basin. There are projects initiated to serve in the neighborhood of two million acres. As of 1943, the area actually irrigated in the Lower Basin was approximately 1,350,000 and that leaves roughly 600,000 acres of unirrigated land under existing projects. Now, that figure, 600,000 is a tentative figure. That is the best estimate we can make on the basis of our present land classifications on some of these initiated projects.

The 1,350,000 acres now irrigated, plus the reservoirs necessary to regulate the water, we estimate will deplete the stream by about four and a half million acre feet. This four and a half million acre feet includes the water now exported to the Metropolitan Water District. I do not have the exact figures of what are included in that. Mr. Larson says it was only 32,000 in 1943. That is what we estimate the 1943 use. In the future, then, in selecting projects for future development, there are lots of questions, there are lots of alternate opportunities to use this water.

You people in Arizona know that there is to be a compromise as to how much water you use in Central Arizona and how much you use on the Gila Project, which is an initiated project. The people in California will probably have to make some adjustments as to where their water can be used.

In treating the subject in the Lower Basin, at the present moment we do not feel on a very secure footing in setting forth a definite plan. So we have tried to make the Lower Basin presentation in the nature of what we might call a selective inventory. We do not include the full 585,000 acres in the Gila Project. We tried to restrict the Gila Project to what we felt was the full development of the initial unit.

Hearings held down in Arizona in September indicate a very definite need for additional water in order to save lands now in cultivation. There are something like 700,000 acres in the Gila Basin. That is a highly developed area, and if water is not brought into it, we feel there is going to have to be some abandonment of land.

So in forming this inventory we have tried to split the water where we felt it would be needed, so we have included here a plan for bringing water into Central Arizona. We have included the Gila Project in part. Now, the projects we describe on the map and the projects we describe on the report will include about 600,000 acres of land that are not now irrigated under initiated projects.

MR. WALLACE: Where is that land?

MR. RITER: The biggest part of it, of course, is in the Imperial Valley,

and some in the Gila Project. Those projects have been initiated. There are 610,000 acres of projects of lands that are now irrigated but badly in need of a supplemental supply. Tentatively, then, we figured there will be about 234,000 acres of new lands, lands for which works have not yet been provided. By the time we figure the additional reservoir loss, and figure the consumptive use for those lands, and figure the more complete utilization of the Metropolitan Aqueduct, and the exportations of water to San Diego, that increased use will be 6,595,000 acre feet. This means, then a requirement for the projects we have described in the Lower Basin of 11,092,000 acre feet.

I do not know how far we should go in this report in treating the Mexican Treaty. The agreement, as you know,--and which has not yet been ratified by the Senate,--provides for delivery to Mexico of a million and a half acre feet of water. If we add that to the use that we have set up in the United States, that would mean a total requirement of approximately 12,600,000 acre feet. Compare that with an available supply of about 10,600,000 acre feet. There is roughly, 2,000,000 acre feet short.

That is one reason we need your cooperation in writing this report. There are problems, very definite problems. I think the problems are more acute in the Lower Basin than they are in the Upper Basin. There are a number of reasons for that. The principal one, I think, is you are further advanced, from the standpoint of the use of the water. The Lower Basin is very close to its ultimate from the standpoint of water supply.

Later on there will be a discussion of the projects. You will have an opportunity to question. You will have an opportunity to find out exactly where the acres are located that we are planning on.

No doubt, some of your engineers in the Lower Basin will want to question our unit rates on the use of water. We would like to get your best judgment on that. In trying to find out the unit rate on the use of water, we have applied all of the information available to us, figured on projects located in Colorado drainage available for use downstream--we have taken the unit rate. In other words, we have used as consumptive use figures the total diversions for the projects that take water physically out of the watershed and will not return it. And this includes the Imperial Valley area. This includes the Metropolitan Water District area; your San Diego area. We have set as stream depletion the total diversion.

Our engineers in making this report have to be bold. We know we are here as targets. The things we say you people are going to shoot at and tear to pieces. We welcome your criticism. We hope in criticizing the figures we have suggested in our tentative report that you will be helpful and be constructive in your criticisms because we want things in the report that will truly be a pattern of development to which the states and this Committee will subscribe.

That is about all I have to offer at this time.

MR. SHAW: May I ask a general question of Mr. Riter?

JUDGE STONE: Mr. Shaw, before you do that I have in mind that if the

statements on water supply are concluded, we should now invite those here present to ask any questions on those matters which have thus far been discussed by the Bureau. And may we have it understood on the part of everyone that at this time it will be limited to questions? Comments will come later. If there is nothing further, Mr. Shaw has a question. And if there are others may we have them now?

MR. SHAW: Mr. Riter, do I understand correctly from the statements you made this morning that in the Upper Basin the yardstick or the measurement on which the inventory is shown was the period of scarcity of 1931 to 1940?

MR. RITER: We used the period of 1931 to 1940 as a yardstick to gauge the projects to be constructed.

MR. SHAW: Do I understand in the Lower Basin you used the long-time period 1897 to 1943, giving the result of water supply 10,600,000?

MR. RITER: I described the long-time periods on the flow in the presentation of the Lower Basin. I used the long-time period.

MR. SHAW: That gave the result of 10,600,000 that you just gave us?

MR. RITER: 10,600,000 is the average water available in the long-time period, yes, sir.

MR. SHAW: Would you be kind enough to give us the figures for the period of scarcity, for 1931 to 1940, in the Lower Basin so we will know when the pinch comes what we have to deal with?

MR. RITER: That can be figured, yes, sir. We would start out on the assumption that the Upper Basin used seven and a half million acre feet a year. And that could be figured out, Mr. Shaw. I do not happen to have the figures with me at my finger tips.

MR. SHAW: We will be glad to have the figures.

MR. FOWLER: Mr. Riter, going a little bit further than Mr. Shaw has outlined there, you have shown on page 19 the flow at various points, Lee Ferry down to Laguna Dam for the long-time period. Would it be possible for you to have the reconstructed flows at those points for that period?

MR. RITER: Some of this we already have in the Upper Basin. For instance, we have the Green River at the mouth. We have the Colorado River above the Green River, and we can present the others, if you think desirable to make the report complete.

MR. FOWLER: As I understand your table, the flows for 1931 to 1940 on the Little Colorado, which appear at page 190, and a similar table for the Virgin appearing at page 210, and for the Colorado River Basin at page 226, and the Gila on page 251--those are flows for all those lands not reconstructed, but--

MR. RITER: They were recorded--in other words, we tried to make the report explicit. If we could use recorded flows, we attempted to do so. If we could use reconstructed flows or estimated virgin flows, we tried to do so.

MR. FOWLER: Have you made any reconstruction of those various stages?

MR. RITER: I don't recall that we have.

MR. FOWLER: If they are available, I would like to have them put in.

MR. RITER: In other words, what you wish to have in the Lower Basin is information for the ten-year period, 1931 to 1940, to show so-called estimated virgin flow at the points shown on page 19, and also the key stations on each one of the divisions of the Lower Basin.

MR. FOWLER: To appear at pages 190, 210, 226 and 251.

MR. TIPTON: Mr. Chairman, one question of Mr. Riter: In this period of 1930 to 1941, in using the yardstick for development of the Upper Basin, as I understood you, you took the water that would be available during that period to each of the individual, we will say, large projects, and assumed that the project could not very well exist, with a ten-year period of shortage. But you assumed in that sort of an analysis whatever holdover storage might be available to the individual project, did you not? In other words, it is not based exactly on the run-off of the streams for that low ten-year period. It is based upon the kind of water supply that can be made available to the project with the storage facilities that would be practicable to construct for that project--

MR. RITER: Yes, that's right, Mr. Tipton.

MR. TIPTON: Then, going a little further, there would be another limitation on upstream development other than the water supply available to the individual project; that would be the water supply available to the entire Upper Basin on account of the limitation of the compact, to deliver 75 million acre feet in that ten-year period. So there again you assume a release of water from holdover reservoirs, do you not?

I wanted to get that plain so as to give a comparable figure for the Lower Basin, the usable supply during the ten-year period of low run-off--you would bring into the picture the amount of holdover water that would naturally be released during that low water period. That would be the use of the water for the Lower Basin during the low ten-year period, and would not be the actual reconstructed flow during the low-water period, minus the Upper Basin uses.

MR. RITER: On this ten-year period, Mr. Tipton, we made all the studies on the tributaries on the basis of the ten-year period. We analyzed each one of these projects separately, but we used the ten-year period we selected as the basis of analysis, with reasonable allowable shortages.

Now, then, your other statement about the overall picture, we assume holdover storage reservoirs, which I term replacement reservoirs, would be constructed on the main stem of the Colorado and the Green to release storage

impounded during previous years of high run-off, so that the Upper Basin would deliver at Lee Ferry an average of seven and a half million acre feet during the ten-year period. So that the only limitation, so far as the upstream development is concerned, would be the water physically available at storage or diversion sites. Is that clear?

MR. TIPTON: The point I was making, the comparable figure you give respecting the Lower Basin would involve water which could be released from the reservoirs in the Lower Basin that had been impounded during your flush years. It would not be just on the basis of the reconstructed river during the low-water period, minus the use in the Upper Basin.

MR. RITER: I have in mind, Mr. Tipton, that we start out with the flow of at least seven and a half million acre feet.

MR. TIPTON: I do not think you get the point.

MR. RITER: What you mean is in addition to that, they would have holdover storage in Lake Mead?

MR. TIPTON: That would put it on a comparable basis with the treatment of the Upper Basin development, and during the low water period. I think we need not discuss this any further for the record here. I can explain more fully what I mean.

MR. RITER: I know the point you are driving at. In other words, one of the elements of supply in the Lower Basin would be the storage released from the reservoirs in the Lower Basin, the principal one being Lake Mead. Is that the point you are trying to make?

MR. TIPTON: Yes.

MR. SHAW: May I clarify my question? It was directed--I think Mr. Tipton has come close to it--to the usable supply in the Lower Basin during the ten-year period, 1931-1940.

MR. RITER: Yes, that is correct.

JUDGE STONE: I believe Mr. Scattergood has a question.

MR. SCATTERGOOD: Well, I should like to ask Mr. Riter, if I understand correctly, if the figure 7,656,000 in the Upper Basin is for an average year, and that shown in the report of 6,908,000 is the result during the low period? Is that understanding correct?

MR. RITER: Yes, sir. For the projects that we have shown in the report?

MR. SCATTERGOOD: That is what I mean.

MR. RITER: We analyzed the depletion--bear in mind, they are estimates. We found in the low ten-year period this depletion. But there is one correction:

To make that table strictly comparable we must add another factor. Storage released from holdover reservoirs. If you take the virgin flow from Lee's Ferry and subtract 6,900,000 acre feet, you would get below seven million acre feet. So the net replacement would be less than 6,900,000 acre feet, by virtue of storage they would release from the holdover reservoirs in the Upper Basin.

Now, the 7,656,000 acre feet is my estimate for the same projects for the long-time average. Does that clarify your question, Mr. Scattergood?

MR. SCATTERGOOD: Yes. Simply released to the particular projects selected.

MR. RITER: That's right.

MR. SCATTERGOOD: I wanted to ask you if you can give us an approximation of what the shortage in the Lower Basin would be instead of the Mexican water plus 800,000 acre feet a year during the low period. Have you any approximation of that?

MR. RITER: I have not figured the low period in the report. I think that is the point Mr. Shaw wanted. In other words, he felt the report was incomplete unless we also discussed what would happen in the Lower Basin during the low ten-year period.

MR. SCATTERGOOD: I just wanted to know if you had tentatively arrived at an approximation.

MR. RITER: No, we hadn't.

JUDGE STONE: Are there other questions now?

(No response.)

If there are no other questions on this matter, we will proceed with the further statement by the two Regional Directors as to the project development. I am inclined to think that Mr. Larson ought to treat the projects a little more extensively than he indicated, but not as extensively as would be required to give a fifteen-minute explanation of each. At least, there should be reference to the list of projects for the various areas in each Basin. And if you can do that, any particular comment on a project where it is required, that might be given. Can you proceed on that basis, Mr. Larson?

MR. LARSON: I can proceed by reading the name of the project, how many acres of new land and supplemental land, the total estimated construction costs by Basins, and come on down the river. That is on page 74. That would be of particular benefit to those who do not have the report, and they will at least know the names of the projects we have in mind.

We start with the Upper Green River right at the top. The first is the West Side Project. Before I go on with that, I might say that Kendall Reservoir, the large reservoir in the Upper Green, will serve both the West Side Project and the individual projects on the East Side of Green River. If you have that in mind, I will go ahead.

Now, on the West Side of the Kendall Reservoir, the first covers 29,050 acres of new land; 37,000 acres of supplemental land, land on which additional water supply can be used, a total of 66,050 acres.

The Daniel Unit or project, 5,160 acres of new land; no supplemental lands, a total of 5,160 acres.

The Elkhorn Project, 134,030 acres of new land; no supplemental lands; total, 134,030.

The total cost of those three, which all depend on the Kendall Reservoir, is $27,500,000. This is based upon 1940 costs.

Going on, the Paradise Unit, 4,490 acres of new land; no supplemental lands. Cost, $400,00[illegible].

The Eden Unit, 20,250 acres of new land; no supplemental lands. Cost, $1,100,000.

The Lower Big Sandy, 11,850 acres of new land; no supplemental lands, Cost $900,000.

The LaBarge Project, 3,370 acres of new land; 5,540 acres of supplemental land, or a total of 8,910 acres, costing $700,000.

The Fontenelle Project, 2,050 acres of new land; 3,720 acres of supplemental land, a total of 5,770 acres. Estimated cost $800,000.

The Seedskadee Project, 40,830 acres of new land; no supplemental lands. Cost $4,600,000.

The Opal Project, 16,020 acres of new land; 5,400 acres of supplemental lands. Total, 21,420 acres. Cost $3,600,000.

The next two projects are listed as one, so far as cost is concerned. That is the Lyman Project, 3,100 acres of new land and 20,910 acres of supplemental lands. Total, 24,010 acres. And the Henrys Fork Project, 17,140 acres of new land and 21,090 acres of supplemental lands, total 38,230 acres. The cost for both of these projects is $5,800,000.

Now, the total for the Upper Green is 287,340 acres of new land; 93,660 acres of supplemental lands, or a total of 381,000 acres. The total estimated cost is $45,400,000.

The next on the list, the Yampa and White River. The Little Snake River, 92,110 acres of new land; 15,710 acres of supplemental lands, or a total of 107,820 acres. Total estimated cost of $20,500,000. Upper Yampa Project, 3,460 acres of new land; 11,140 acres of supplemental lands. Total, 14,600 acres. Total estimated cost, $2,300,000.

Wessels Project, 6,010 acres of new land; 380 acres of supplemental lands, total 6,390 acres, the estimated cost being $1,100,000.

Mount Harris, 16,600 acres of new land; 1,450 acres of supplemental lands, total 18,050. Estimated cost $3,300,000.

The Great Northern project, 16,010 acres of new land; 3,260 acres of supplemental lands, total 19,270 acres. Estimated cost $2,700,000

The Yellow Jacket Project, 31,820 acres of new land; 5,950 acres of supplemental, total 37,770 acres. Estimated cost, $4,700,000.

Deadman Bench Project, which covers land both in Colorado and Utah, 89,720 acres of new land; no supplemental lands, total 89,720 acres. Cost $17,000,000.

The Maybell Project, 8,540 acres of new land; no supplemental lands, total 8,540 acres. Cost $700,000.

Josephine Basin Project, 2,400 acres of new land; no supplemental lands. Total 2,400 acres. Estimated cost $300,000.

Piceance Creek Project, 610 acres of new land; 2,380 acres of supplemental lands. Total, 2,990 acres. Estimated cost, $800,000.

Miscellaneous and small areas, 8,910 acres of new land; no supplemental lands. Total, 8,910 acres, at a cost of $700,000.

The totals of Yampa and White River, 276,190 acres of new lands; 40,270 acres of supplemental lands. Total, 316,460 acres, at an estimated cost of $54,100,000.

Going down to the Uinta Basin, we have the Moon Lake Project Extension. Moon Lake is a reclamation project. 26,300 acres of new land; 86,200 acres of supplemental lands, and that includes some Indian lands also, a total of 112,-500 acres. Cost $7,900,000.

The Castle Peak Project, 21,700 acres of new land; 2,100 acres of supplemental lands. Total, 23,800 acres, costing $5,300,000.

The Mosby Project, 3,800 acres of new land; 400 acres of supplemental lands, total 4,200 acres. Cost, $1,100,000.

The Vernal Project, 1,900 acres of new land; 22,300 acres of supplemental lands, total 24,200 acres. Cost, $1,500,000.

The Jensen Project, 800 acres of new land; 3,600 acres of supplemental lands. Total, 4,400 acres. Cost, $300,000.

The Fruitland Project, 1,600 acres of new land; 400 acres of supplemental lands. Total, 2,000 acres. Cost, $400,000.

Minnie Maud Project, no new land; 800 acres of supplemental lands, total 800. Cost, $100,000.

The Green River Project, 11,000 acres of new land; 1,000 acres of

supplemental lands. Total, 12,000 acres. Cost, $400,000.

The total in the so-called Uinta Basin is 67,100 acres of new land; 116,800 acres of supplemental lands. Total, 183,900 acres. Cost, $17,000,000.

On the Price and San Rafael Rivers, in Utah, Emery County Project, 3,300 acres of new land; 20,000 acres of supplemental lands. Total, 23,300 acres. Cost, two and a half million.

The Buckhorn Project, 3,800 acres of new land; no supplemental lands. Total, 3,800 acres. Cost, $1,200,000.

The total for the Price and San Rafael Rivers is 7,100 acres of new land; 20,000 acres of supplemental lands. Total, 27,100 acres. Cost, $3,700,000.

Under Miscellaneous Areas, there is the Gunnison Valley Project, 10,830 acres of new land; no supplemental lands. Total, 10,830 acres. Cost, $1,100,-000.

That is the total of what we term the Green Division. Everything above the mouth of the Green is 648,560 acres of new land; 270,730 acres of supplemental lands, or a total of 919,290 acres. The total estimated cost of all those projects is $121,300,000.

Before going on to the Grand Division, I will read the figures on the possible transmountain diversions. That appears on page 75.

On the Upper Green River, the South Pass Diversion, in Wyoming, the estimated annual diversion there is 46,600 acre feet. Estimated construction cost is $1,203,000.

The Hams Fork Diversion, also in Wyoming, 33,000 acre feet of estimated annual diversion, average, cost, $5,600,000.

The Green River-Bear Diversion, from Green River to Bear River, Utah, is 290,000 acre feet. Cost, $38,000,000.

The Yampa and White River Basin, Little Snake-North Platte Diversion, Colorado, 47,000 acre feet, at a cost of $1,304,000.

The Uinta Basin, Rock Creek Tunnel Diversion--that is to the Green River Project of the Salt Lake Basin, 48,000 acre feet, at a cost of $4,900,000.

The Price and San Rafael Basins, Gooseberry Diversion, the Gooseberry Project, 11,500 acre feet estimated average annual diversion, at an estimated cost of $1,200,000. Those costs are exclusive of storage.

The Ferron-Manti Creek Diversion, Utah, 15,000 acre feet. Cost $360,000.

The White River Diversion, Strawberry Project, 4,200 acre feet of annual diversion. Cost, $320,000.

The total of those transmountain diversions, 495,300 acre feet. Cost, $53,247,000.

MR. RITER: I want to call your attention to the fact that the figures Mr. Larson quoted on amount of water divertible were the averages during the ten-year low period. On a long-time basis, these diversions will probably be about 20% more. In other words, that is something you have to figure out.

In connection with the Little Snake-North Platte, I would like to record that for the benefit of Wyoming rather than Colorado, there again is another point you may want to get together on and decide what plan you want shown tentatively.

I want also to call your attention to the fact that those figures are lower than the low year figures. On a long-time basis you get more water out of them.

MR. E. O. LARSON: Going to the Grand Division, which includes everything from the Colorado to the Junction of the Green River, upstream: The Colorado River above the Gunnison River, the Troublesome Project, new land 6,800 acres; supplemental lands, 3,600 acres. Total, 10,400 acres. Estimated construction cost, $2,210,000.

The Muddy Creek Project, 3,620 acres of new land; 2,520 acres of supplemental lands. Total, 6,140 acres. Cost, $500,000.

The Fourmile Project, 500 acres of new land; 1,400 acres of supplemental lands. Total, 1,900 acres. Estimated cost, $600,000.

The Cattle Creek Project, 900 acres of new land; 5,500 acres of supplemental lands. Total, 6,400 acres. Cost, $430,000.

The Capitol Creek Project. No new land; 2,000 acres of supplemental lands. Total, 2,000 acres. Cost, $130,000.

Woody Creek Project. Also no new land; 2,000 acres of supplemental lands. Total, 2,000 acres. Cost, $170,000.

The Silt Project, 1,100 acres of new land; 5,200 acres of supplemental lands; total, 6,300 acres. Cost, $1,320,000.

MR. WALLACE: Those are all within the Basin?

MR. LARSON: What is it?

MR. WALLACE: Are those all within the Basin?

MR. RITER: Yes, those are within the Basin.

MR. LARSON: Yes, those are within the Basin.

MR. WALLACE: You are reading the transmountain diversions?

The total of those transmountain diversions, 495,300 acre feet. Cost, $53,247,000.

MR. RITER: I want to call your attention to the fact that the figures Mr. Larson quoted on amount of water divertible were the averages during the ten-year low period. On a long-time basis, these diversions will probably be about 20% more. In other words, that is something you have to figure out.

In connection with the Little Snake-North Platte, I would like to record that for the benefit of Wyoming rather than Colorado, there again is another point you may want to get together on and decide what plan you want shown tentatively.

I want also to call your attention to the fact that those figures are lower than the low year figures. On a long-time basis you get more water out of them.

MR. E. O. LARSON: Going to the Grand Division, which includes everything from the Colorado to the Junction of the Green River, upstream: The Colorado River above the Gunnison River, the Troublesome Project, new land 6,800 acres; supplemental lands, 3,600 acres. Total, 10,400 acres. Estimated construction cost, $2,210,000.

The Muddy Creek Project, 3,620 acres of new land; 2,520 acres of supplemental lands. Total, 6,140 acres. Cost, $500,000.

The Fourmile Project, 500 acres of new land; 1,400 acres of supplemental lands. Total, 1,900 acres. Estimated cost, $600,000.

The Cattle Creek Project, 900 acres of new land; 5,500 acres of supplemental lands. Total, 6,400 acres. Cost, $430,000.

The Capitol Creek Project. No new land; 2,000 acres of supplemental lands. Total, 2,000 acres. Cost, $130,000.

Woody Creek Project. Also no new land; 2,000 acres of supplemental lands. Total, 2,000 acres. Cost, $170,000.

The Silt Project, 1,100 acres of new land; 5,200 acres of supplemental lands; total, 6,300 acres. Cost, $1,320,000.

MR. WALLACE: Those are all within the Basin?

MR. LARSON: What is it?

MR. WALLACE: Are those all within the Basin?

MR. RITER: Yes, those are within the Basin.

MR. LARSON: Yes, those are within the Basin.

MR. WALLACE: You are reading the transmountain diversions?

MR. LARSON: That was before I took up the Grand Division, yes. I should explain that we are now on page 102. The West Divide Project, 400 acres of new land; 7,700 acres of supplemental lands. Total, 8,100 acres. Estimated cost, $1,300,000.

Hunter Mesa Project, 4,700 acres of new land; 2,300 acres of supplemental lands. Total, 7,000 acres. Cost, $1,500,000.

Roan Creek Project. No new land; 3,100 acres of supplemental lands. Total, 3,100 acres. Cost, $610,000.

The Collbran Project, 7,100 acres of new land; 18,900 acres of supplemental lands; total, 26,000 acres. Cost, $1,940,000.

The Grand Valley Extension Project, 5,000 acres of new land. No supplemental lands. Total, 5,000 acres. Cost, $415,000.

Miscellaneous areas, 20,480 acres of new land; no supplemental lands. Total, 20,480 acres. Cost, $1,320,000.

The subtotal for the Colorado River above the Gunnison River is 50,600 acres of new land; 54,220 acres of supplemental land. Total, 104,820 acres. The total cost, $12,445,000. Now, we will take next the Gunnison River;

The Ohio Creek Project, 3,470 acres of new land; 11,300 acres of supplemental lands; total, 14,770 acres. Cost, $1,080,000.

Tomichi Creek Project, 3,100 acres of new land; 8,300 acres of supplemental lands; total, 11,400 acres. Cost $1,860,000.

Cochetopa Creek, 3,900 acres of new land; 4,700 acres of supplemental lands. Total, 8,600 acres. Cost, $1,150,000.

The Minnesota Project, 200 acres of new land; 2,600 acres of supplemental land. Total, 2,800 acres, Cost, $820,000.

Leroux Creek Project, 3,900 acres of new land; no supplemental lands. Total, 3,900 acres. Cost, $2,800,000.

The Grand Mesa Project, 5,200 acres of new land; 18,200 acres of supplemental lands; total, 23,400 acres. Cost, $1,920,000.

Miscellaneous areas on the Gunnison, 26,660 acres of new land; no supplemental lands. Total, 26,660. Cost, $1,190,000.

The subtotals for the Gunnison River are, 46,430 acres of new land; 45,100 acres of supplemental lands. Total, 91,530. Cost, $10,820,000.

Now, on the Colorado River between the Gunnison and the Green Rivers, we have the Saucer Valley Project, 5,000 acres of new land; 1,300 acres of supplemental. Total, 6,300 acres. Cost $940,000.

The Nucla Project, 5,700 acres of new land; 5,800 acres of supplemental lands. Total, 11,500 acres. Cost, $1,500,000.

The San Miguel Project, 40,900 acres of new land; 14,100 acres of supplemental lands. Total, 55,000 acres. Cost, $6,590,000.

The West Paradox Project, 5,500 acres of new land; 3,900 acres of supplemental lands. Total, 9,400 acres. Cost, $640,000.

The Moab Project, 1,200 acres of new land; 1,950 acres of supplemental lands. Total, 3,150 acres. Cost, $775,000.

The Hatch Creek Project, 4,000 acres of new land. No supplemental lands. Total, 4,000 acres. Cost, $400,000.

Subtotal for the Colorado River between the Gunnison and Green Rivers, 62,300 acres of new land; 27,050 acres of supplemental lands. Cost, $10,845,000.

The total for the Grand Division, to its mouth in the Colorado, 159,330 acres of new land; 126,370 acres of supplemental lands. Total, 285,700 acres. Cost, $34,110,000.

Now, the potential export diversions from the Grand Division;

First, is the Colorado River above the Gunnison--at page 103.

The Blue River-South Platte Diversion, Colorado, 466,000 acre feet (estimated annual diversion), cost, $148,000,000.

The Frying Pan-Arkansas Diversion, Colorado, 53,000 acre feet. Cost, $2,500,000.

The Twin Lakes Tunnel Diversion, Colorado, 6,600 acre feet. Cost, $300,000.

The Gunnison River;

The Gunnison-Arkansas Diversion, Colorado, 410,000 acre feet. Cost, $84,000,000.

The Gunnison-Rio Grande Diversion, Colorado, 10,000 acre feet. Cost, $200,000.

The Colorado River between Gunnison and Green Rivers;

Montezuma Valley Enlargement Diversion, Colorado, 28,000 acre feet. Cost, $1,300,000.

The Dolores Diversion, also Colorado, 116,000 acre feet. Cost, $12,200,000.

The Blanding Diversion, Utah, 1,800 acre feet. Cost, $135,000.

The total potential export diversion from the Grand Division is 1,091,400 acre feet, at a cost of $248,635,000. This is all export diversion.

Now, we go to the San Juan Basin, the San Juan Division, next. That is everything between Lee Ferry and the Junction of the Green and the Colorado. You will find it on page 123.

San Juan Basin: Pulce-Chama-Navajo Project, 15,900 acres of new land; 1,950 acres of supplemental lands. Total, 17,850 acres. Cost, $1,627,000.

The Carracas Project, 840 acres of new land; 190 acres of supplemental lands. Total, 1,030 acres. Cost, $36,000.

The O'Neal Park Project, 5,820 acres of new land; 1,780 acres of supplemental lands. Total, 7,600 acres. Cost, $880,000.

The Hammond Project, New Mexico 3,700 acres of new land; no supplemental lands. Total, 3,700 acres. Cost, $725,000.

The Shiprock Project, 70,000 acres of new land; no supplemental lands. Total, 70,000 acres. Cost, $21,141,000.

The Pine River Project, 15,100 acres of new land; 1,200 acres of supplemental lands. Total, 16,300 acres. Cost, $1,835,000.

The Florida Project, 6,300 acres of new land; 13,800 acres of supplemental lands. Total, 20,100 acres. Cost, $2,290,000.

The Animas-La Plata Project, which includes all of the Animas-La Plata, new lands in that project, 86,300 acres; supplemental lands, 24,700 acres. Total, 111,000 acres. Cost $35,534,000.

The Montezuma Valley Extension, 10,000 new lands; no supplemental lands. Total, 10,000 acres. Cost, $1,300,000.

The McElmo Project, no new lands; 1,000 acres supplemental lands, total, 1,000 acres. $390,000.

The Dolores Project, 40,000 acres of new lands. No supplemental lands. Total, 40,000 acres. Cost, $12,200,000.

The Blanding Project. No new lands; 3,800 acres of supplemental lands. Total, 3,800 acres. Cost, $567,000.

The Navajo Indian Projects, 34,200 acres of new land; 14,600 acres of supplemental lands. Total, 48,800 acres. Cost, $2,910,000.

The last, the Navajo Indian Projects, includes a list of a lot of Indian projects given by the Indian Bureau to put in here.

The Western Tributaries:

The Fremont River 100 acres of new land; 9,000 acres of supplemental lands. Total, 10,000 acres. Cost, $800,000.

The Torrey Project. No new land; 1,200 acres of supplemental lands. Total, $200,000.

The Escalante Project, 3,000 acres of new land, costing $900,000.

The total of the San Juan Division, 292,160 acres of new land; 73,220 acres of supplemental lands. Total cost, $83,335,000.

The potential export diversions from the San Juan Division, San Juan River:

The Weminuche Pass Project, Colorado, 21,000 acre feet, $265,000.

The Piedra-Rio Grande, Colorado, 70,000 acre feet, $8,200,000.

The San Juan-Chama Project, New Mexico it should be, instead of Colorado, as on page 124 of the report, 247,000 acre feet at a cost of $19,968,000.

Western Tributaries of the Muddy-Creek Diversion, Utah, 7,000 acre feet at an estimated cost of $600,000.

This makes a total of 345,000 acre feet potential export diversions, at a cost of $29,033,000.

JUDGE STONE: That is a list of the potential irrigation projects?

MR. WALLACE: Will you mention the transfer of water from the Sevier Valley into the Colorado River Basin?

MR. LARSON: I can't find it here.

MR. WALLACE: Is it in the book?

MR. LARSON: Yes. That is the list of all the potential irrigation projects.

JUDGE STONE: That does not include the power or regulatory reservoirs?

MR. LARSON: The power is in another list.

JUDGE STONE: I think it would be well to include, now, the power reservoirs in the Upper Basin. Then we will go to the Lower Basin.

JUDGE O'ROURKE: Before going to that, will you read the last exportation from the Grand Division? That, strictly speaking, is not an exportation, in the sense it is taken out of the Colorado River Basin. Is that right?

MR. RITER: Yes, that is right. We have kept the books by these divisions. That is a transfer of water from one stream of the Colorado Basin to another stream of the Colorado River Basin. In other words, a change or transfer of

water from the Dolores River to the San Juan Basin.

MR. SHAW: That was not taken into account in your final tables of water exported from the Basin?

MR. RITER: I do not remember how the table is set up. I do not recall whether we added that in as a transmountain diversion, giving you credit for return flow, or whether we didn't.

MR. SHAW: Will you refer to the table at page 128 and tell me what the three-star item is?

MR. RITER: In preparing the summary on page 128, we did not add into the transmountain diversions the water which was transferred from one Colorado River stream to another.

MR. SHAW: Thank you.

MR. RITER: But we did include the consumptive use on that water in the Colorado River Basin. Is that clear now, Mr. Shaw?

MR. SHAW: That is clear.

JUDGE STONE: Pardon me just a moment. Mr. Howard, will you come up, please? Gentlemen, Mr. James Howard, representing the Power Allottees is now here.

Very well. Proceed.

MR. RITER: Mr. Nielsen will continue with the report.

MR. NIELSEN: I will give you the names of the project, the stream, the installed capacity. I don't know whether you want the kilowatt hours, or not; or the estimated construction costs.

JUDGE STONE: Yes, please.

MR. NIELSEN: On the Green River, proceeding downstream--

JUDGE STONE: Pardon me, but is that the installed capacity which you mentioned?

MR. NIELSEN: The installed capacity; annual firm generation, and the estimated construction cost. This is shown on page 151 of the report.

The first is Burnt Lake, on Fall Creek. Installed capacity, 1,500 kilowatts; generation, 9,000,000 kilowatt hours; cost, $350,000.

Flaming Gorge, on the Green River, just above the Wyoming-Utah line, 30,000 kilowatts installed capacity; 158,000,000 kilowatt hours; ten million dollars.

Red Canyon, on the Green River, 12,000 kilowatts; 68,000,000 kilowatt hours; cost, $4,100,000.

Echo Park, on the Green River, just below the mouth of the Yampa, 120,000 kilowatts installed capacity; 668,000,000 kilowatt hours, generation, cost $43,000,000.

Split Mountain, on the Green River, 90,000 kilowatts; 486,000,000 kilowatt hours; $23,000,000

Desolation, on the Green River, below the White River, 78,000 kilowatts; 433,000 kilowatt hours; cost, $21,000,000.

Rattlesnake, on the Green River, just above the Price River, 78,000 kilowatts; 434,000,000 kilowatt hours; cost, $23,000,000.

On the Yampa River:

Juniper, 15,000 kilowatts; 87,000,000 kilowatt hours; cost, $5,800,000.

Cross Mountain, on the Yampa River, 18,000 kilowatts; 99,000,000 kilowatt hours; Cost, $5,000,000.

Slater Falls, on Slater Creek, which is in the Yampa River Basin, 7,500 kilowatts; 43,000,000 kilowatt hours; $3,100,000.

Lily Park, on the Yampa River, 10,000 kilowatts; 47,000,000 kilowatt hours, cost $1,900,000.

On the Colorado River:

Gorge Canyon, on the Colorado River, 30,000 kilowatts; 177,000,000 kilowatt hours; cost, $3,800,000.

Dewey, on the Colorado River, just below the Dolores, 140,000 kilowatts; 797,000,000 kilowatt hours; cost, $38,000,000.

Moab Project, on the Colorado River, 60,000 kilowatts; 344,000,000 kilowatt hours; cost, $9,900,000.

Dark Canyon, on the Colorado River below the Green, 350,000 kilowatts; 1,843,000,000 kilowatt hours; cost, $105,000,000.

Glen Canyon, on the Colorado River, 400,000 kilowatts; 2,188,000,000 kilowatt hours; cost, $64,000,000.

On the Gunnison River:

Sapinero, 18,000 kilowatts; 100,000,000 kilowatt hours; cost, $7,800,000.

Lake Fork, on the Gunnison River, 6,000 kilowatts; 12,000,000 kilowatt hours, cost, $1,300,000.

Ouray Project, three plants, on the Uncompahgre, 16,000 kilowatts; 64,000,000 kilowatt hours; cost, $3,200,000.

On the San Juan River;

Animas, two plants, on the Animas River, 52,000 kilowatts; 192,000,000 kilowatt hours; cost, $28,000,000.

Emerald Lake, on the Pine River, 15,000 kilowatts; 72,000,000 kilowatt hours; cost, $6,200,000.

Bluff Project, on the San Juan River, 52,000 kilowatts; 289,000,000 kilowatt hours; cost, $19,000,000.

Gooseneck, on the San Juan River, 30,000 kilowatts; 152,000,000 kilowatt hours; cost, $5,200,000.

Slick Horn Canyon, on the San Juan River, 30,000 kilowatts; 176,000,000 kilowatt hours; cost, $6,300,000.

Great Bend, San Juan River, 36,000 kilowatts; 203,000,000 kilowatt hours; cost, $10,000,000.

The total in the Upper Basin, installed capacity, 1,695,000 kilowatts; annual firm generation, 9,141,000,000; cost, $47,950,000. This is exclusive of transmission grid.

JUDGE STONE: Now, Mr. Moritz, may we proceed with the projects in the Lower Basin, and give the page, please?

MR. MORITZ: Page 202 in the book.

The Little Colorado Division potential developments are listed as;

Snowflake Project, 6,700 acres of new land; no supplemental lands; total, 6,700 acres; estimated cost, based on 1940 prices, $2,600,000.

The Holbrook Project, 1,800 acres of new land; 600 acres of supplemental lands; total acreage, 2,400; estimated cost, $1,300,000.

Right there, I wish to call attention to those who have the books that there is an error in this table. The figures were transposed in the book, and the figures I am reading are the correct figures.

JUDGE STONE: Will you read those again, please?

MR. MORITZ: Yes. The first one is correct, as shown in the table. But Holbrook is $1,300,000.

The next project is Black Creek, 4,000 acres of new land; no supplemental lands; total, 4,000 acres; estimated cost, $1,800,000, instead of the $1,300,000 as shown in that table on page 202.

The Winslow Project, 19,750 acres of new lands; no supplemental lands; total, 19,750 acres; estimated cost, $19,000,000.

On the San Juan River;

Animas, two plants, on the Animas River, 52,000 kilowatts; 192,000,000 kilowatt hours; cost, $28,000,000.

Emerald Lake, on the Pine River, 15,000 kilowatts; 72,000,000 kilowatt hours; cost, $6,200,000.

Bluff Project, on the San Juan River, 52,000 kilowatts; 289,000,000 kilowatt hours; cost, $19,000,000.

Gooseneck, on the San Juan River, 30,000 kilowatts; 152,000,000 kilowatt hours; cost, $5,200,000.

Slick Horn Canyon, on the San Juan River, 30,000 kilowatts; 176,000,000 kilowatt hours; cost, $6,300,000.

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MR. MORITZ: Yes. The first one is correct, as shown in the table. But Holbrook is $1,300,000.

The next project is Black Creek, 4,000 acres of new land; no supplemental lands; total, 4,000 acres; estimated cost, $1,800,000, instead of the $1,300,000 as shown in that table on page 202.

The Winslow Project, 19,750 acres of new lands; no supplemental lands; total, 19,750 acres; estimated cost, $19,000,000.

The total of all, 32,250 acres of new land; 600 acres of supplemental lands; total, 32,850 acres; estimated cost, $24,700,000.

That is all in the Little Colorado River Division.

The Virgin Division, on page 218;

The Kanab Creek Project. No new land; 1,000 supplemental acres, estimated construction cost, $200,000.

The Hurricane Project. 14,000 acres of new land; 6,500 acres of supplemental lands. Total, 20,500 acres. Estimated cost, $9,200,000.

The Santa Clara Project. 2,000 acres of new land; 1,700 acres of supplemental lands. Total, 3,700 acres. Estimated cost, $1,700,000.

Panaca Valley Project, 2,000 acres of new land; 2,000 acres of supplemental lands. Total, 4,000 acres. Estimated cost, $1,300,000.

Moapa Valley Project, 1,500 acres of new land; 2,500 acres of supplemental lands; total, 4,000 acres. Estimated cost, $700,000.

Moapa Valley Pumping, new land, 6,000 acres, no supplemental lands; total, 6,000 acres. Estimated cost, $2,800,000.

The grand total for the Virgin Division, new land, 25,500 acres; 13,700 acres of supplemental lands; total, 39,200 acres, at an estimated cost of $15,900,000.

That is the Virgin Division.

The Boulder Division, at page 242;

Virgin Bay Pumping Project, 2,800 acres of new land; no supplemental lands; total, 2,800 acres. Estimated cost of $1,300,000.

There are no supplemental lands in any of these, so I will not read them.

Las Vegas Pumping Project, 20,000 acres of new land; total, 20,000 acres; estimated construction cost, $8,400,000.

The Davis Reservoir Pumping Project, 2,000 acres of new land; total the same acreage; estimated construction cost, $500,000.

Big Bend Pumping, total acreage, 3,700. Cost, $700,000.

Fort Mohave, 5,100 acres; $800,000.

Mohave Valley, 10,000 acres of new land; $1,900,000.

Palo Verde Mesa, 16,000 acres of new land; total the same; estimated cost, $3,100,000.

In the same tabulation we have the Marble Canyon-Kanab Creek Power Development. No acreages are involved in the rest of this statement. Perhaps I better read these, anyhow:

The Marble Canyon-Kanab Creek Power Development, total estimated cost, $382,000,000.

The Coconino Flood and Silt Retention Project, the Coconino Dam for flood and silt retention, $3,200,000. There is an asterisk there which indicates that this includes power, and flood and silt control developments.

The Bridge Canyon Power Development, $117,200,000, with a similar asterisk.

The Alamo Reservoir, flood control, $3,200,000.

The San Diego Project, Water Supply, estimated at $25,300,000.

The Sentinel Reservoir, on the Gila, flood control, estimated, $15,000,000.

The total estimated new land, 59,600 acres, at an estimate of $562,600,000. When we get that, we will have a lot of power.

That is a list of the Boulder Division.

At page 267, potential developments in Gila Division, Colorado River-Central Arizona development, includes the following:

Paradise Valley Unit, 85,000 acres of new land; total, 85,000 acres.

Salt River Unit, 20,000 acres of new land; 384,900 acres of supplemental lands; total, 404,900 acres benefited.

San Carlos Unit, no new land; 157,400 acres of supplemental lands, total the same.

The costs are all added up here in one figure for the entire Central Arizona Potential Development. I will read them later.

The Charleston Unit, no new land, 2,600 acres of supplemental lands, total, 2,600 acres.

Safford Valley Unit, no new land; 32,460 acres of supplemental lands; total the same.

San Francisco Unit, 2,000 acres of new land; 2,500 acres of supplemental lands; total, 4,500 acres.

Duncan Valley Unit, no new land; 8,100 acres of supplemental lands; total the same.

New Mexico Unit, no new land; 5,500 acres of supplemental lands; total the same.

A summation of those separate units that have just been read, in the Colorado River-Central Arizona Project, total estimate is $462,900,000. This includes that portion of the cost of Bridge Canyon and Coconino projects for irrigation for the purposes of this report.

MR. SHAW: How much, Mr. Moritz?

MR. MORITZ: I will have to go to another part of the report to find that.

The Chino Valley Project, no new land; 2,540 acres of supplemental lands, estimated construction cost, $150,000.

The Hassayampa Project, 8,800 acres of new land; no supplemental water; total, 8,800 acres. Estimated cost, $6,650,000.

This makes a total for the Gila Division of 115,800 acres of new land; 596,000 acres of supplemental lands; total, 711,800 acres, at an estimated cost of $469,700,000.

I might summarize all of those figures. Those who have books have the table on page 270, listed there by Divisions and States and by estimated construction costs.

The Little Colorado Division, in Arizona, $24,700,000; the Virgin Division, Virgin River, $2,000,000; the Boulder Division, $522,500,000; the Gila Division, $456,400,000, all in Arizona, or a grand total for the four divisions in Arizona of $1,005,600,000.

For California, $28,400,000; for Nevada, $16,500,000; for New Mexico, $13,300,000; for Utah, $9,100,000.

In the same table, we show the estimated transmission grid, being $192,100,000, or a total estimated cost of $1,265,000,000. Those are all potential projects.

Some of the projects in California are not reflected in any of those figures, and it might be of interest to read from another table on page 237, covering the Boulder Division, irrigated and irrigable area under present developments, but not fully developed.

The Colorado River Indian Reservation, 5,000 acres of land now irrigated; the additional irrigable area would be 95,000 or a total of 100,000 acres.

The Palo Verde Irrigation District irrigated in 1943, 38,000 acres; additional irrigable lands, 37,000, or a total of 75,000 acres.

These figures are all for 1943.

The All-American Canal, began in 1943. The Imperial Irrigation District, irrigated 400,400 acres; there were 122,600 additional irrigable acres, or a total of 523,000.

Coachella Valley, 16,000 acres irrigated in 1943; there were 69,000 additional irrigable acres, or a total of 85,000.

East Mesa, additional irrigable area only, 40,000; total, 40,000.

West Mesa, total, 50,000--all additional irrigable.

Pilot Knob Mesa, 15,000 acres additional irrigable, total.

Yuma Project, irrigated in 1943, 58,800 acres; additional irrigable area, 8,500 acres, or a total of 67,300 acres,

The Gila Project, in Arizona, the North Gila Valley irrigated in 1943, 4,400 acres; additional irrigable area, 1,000; total, 5,400 acres.

Yuma Mesa irrigated in 1943, 100 acres; additional irrigable area, 69,900 acres, total 70,000 acres.

Wellton-Mohawk irrigated 7,800 acres in 1943; additional irrigable area, 70,000 acres, or a total of 77,800 acres.

The South Gila Valley, 6,600 acres irrigated in 1943; 1,000 additional irrigable acres in area, by pumping, or a total of 7,600.

The Las Vegas area, in the immediate vicinity of Las Vegas, 1,200 acres irrigated in 1943; no area additional irrigable; total, 1,200 acres.

The Williams River, irrigated in 1943, 1,700; no additional irrigable area; total, 1,700 acres.

The total of that table of irrigated and irrigable area under present developments; irrigated in 1943, 540,000 acres. Additional irrigable area, 579,000 acres, or a total of 1,119,000 acres.

On page 289 of the book, potential hydroelectric development in the Lower Basin. Development Plants;

Marble Canyon, Main River, 22,000 kilowatts ultimate installed capacity; 164,000,000 kilowatt-hours annual firm energy; estimated construction cost, $32,000,000.

Kanab Creek, also on the Main River, water diverted from the Main River back into the Canyon Reservoir, ultimate installed capacity, 1,250,000 kilowatts; annual firm energy, 6,570,000,000 kilowatt hours; estimated construction cost, $350,000,000.

Bridge Canyon, also on the Main River, ultimate installed capacity, 650,000 kilowatts; annual firm energy, 3,440,000,000 kilowatt hours; estimated construction cost, $120,400,000.

That represents only that portion of the total cost allotted to power for the purposes of this report. It includes Coconino Dam,

The Buttes Plant. That is on the Gila. Ultimate installed capacity 5,800 kilowatts; annual firm energy, 8,000,000 kilowatt hours.

The Horseshoe Plant, ultimate installed capacity, 10,000 kilowatts, at an estimated construction cost of $900,000. This is to be used for replacement power.

The Hooker Plant, on the Gila, New Mexico, ultimate installed capacity 3,000 kilowatts; annual firm energy, 8,000,000 kilowatt hours; estimated construction cost, $16,000,000. That includes the irrigation features.

The Virgin Plant, on the Virgin River, 2,000 kilowatts; annual firm energy, 3,000,000 kilowatt hours. The cost is summarized for three units here and I will read that later. Under the same list, Bench Lake, installed capacity, 800 kilowatts; annual firm energy, 2,000,000 kilowatt hours. The Warner Valley Plant, 1,800 kilowatts ultimate installed capacity; 10,000,000 kilowatt hours annual firm energy.

Those three Virgin Plants are on the Virgin River, and the three are assembled into a total cost of $9,200,000, which includes the irrigation features.

Subtotal for power plants, ultimate installed capacity, 1,927,800 kilowatts; annual firm energy, 10,182,000,000 kilowatt hours; estimated construction cost, $528,500,000. In the same table are shown transmission lines at an estimated construction cost of $192,100,000, to transmit all of this energy. That is the story.

JUDGE STONE: Thank you.

MR. WALLACE: What are the main items in the Central Arizona Irrigation Project?

MR. MORITZ: The main items?

MR. WALLACE: Yes. How much power is there in there?

MR. MORITZ: You mean, in the project itself?

MR. WALLACE: Yes.

MR. MORITZ: They would probably use more power than produced, so far as the average is concerned.

MR. WALLACE: The cost of the main River dam.

MR. MORITZ: The development, in the overall cost, would be allocated to power and irrigation. Practically all power development for all practical purposes is on the main River.

MR. WALLACE: So in order to make it operative, you will have to have an additional cost of some $400,000,000?

MR. MORITZ: No. That is the cost of the irrigation development.

JUDGE STONE: We must take a recess in the interest of the Reporter. May I ask that Mr. Shaw, Governor Carr, Mr. Wallace, Mr. Warne and Mr. Page come here at this table immediately after we take a recess? We will take a recess of about ten minutes.

(A recess was taken until 3:50 p. m.)

GENERAL GILES: Gentlemen, we are interested in having a complete roll of the appearances. Is there anyone in this group who has not signed this roll?

JUDGE STONE: I see that there are two representatives from agencies of the Department of Agriculture here. May we have those appearances, please?

MR. McGINNIES: Mr. Chairman, representing the United States Forest Service, my name is W. G. McGinnies, Director of the Intermountain Forest Service, Fort Collins.

MR. WILM: Harold G. Wilm, in charge of Watershed Research, Fort Collins.

CHAIRMAN STONE: Gentlemen, we have had the statements from two Regional Directors representing the Upper and Lower Basins of the Colorado River. I think, now, we should afford opportunity for any questions which anyone may wish to ask Mr. Larson or Mr. Moritz, respecting the projects which they have read to you. Are there any questions?

MR. SCATTERGOOD: I have one question of Mr. Moritz as to the amount of diversions above the established Boulder Project. I have in mind the statement in the report contemplating some diversion from Bridge Canyon of water from the river which would be above the established Boulder Regulating and Storage Project. I wonder if the Reclamation Bureau, Mr. Moritz, or his assistants in this matter, have determined upon any amount of water contemplated that is tangible enough to justify advising us at this time? If not, all right.

MR. MORITZ: Mr. Scattergood, and Members: For the purposes of this report we had to assume something, so we assumed there would be two million acre feet diverted above Bridge Canyon. That is not fixed, but merely for the purposes of the report. What it is going to be will depend upon further investigations, and very extensive investigations that are necessary to determine what is the most practicable, feasible diversion of water to Central Arizona. Does that answer your question?

MR. SCATTERGOOD: Yes.

JUDGE STONE: May I ask this question, please? Is that below Lee Ferry and above Boulder?

MR. MORITZ: Yes. At Bridge Canyon Reservoir.

MR. SCATTERGOOD: Otherwise, it might be below Boulder.

MR. MORITZ: It could be below Boulder or above Bridge Canyon.

MR. SCATTERGOOD: From your answer I do not know whether it is worth while to ask the second question, as to whether you have in any tangible way given a thought to relating that to the established Boulder project, in case water is diverted above Boulder. I would judge from what you said now that you have not done that.

MR. MORITZ: That is correct. We have not done that.

JUDGE STONE: Are those all of your questions, Mr. Scattergood?

MR. SCATTERGOOD: Yes, sir.

JUDGE STONE: Are there any other questions?

MR. ROLLINS: I would like to ask if all the Indian lands proposed to be irrigated, as were given us in our last meeting in Reno, were included in this report?

MR. MORITZ: We included in the Lower Basin 100,000 acres of Indian lands in the Boulder division. That is, the Colorado River Indian Reservation, which is 95,000 acres more than were irrigated in 1943.

JUDGE STONE: Mr. Arledge has a question.

MR. ARLEDGE: One further question of Mr. Moritz: If I remember correctly, this does not have to be accurate for the purposes of the question,--there were something like a million acres of land shown by Larson. I wonder if you had taken that amount into account in your additional potential diversions?

MR. MORITZ: Acres?

MR. ARLEDGE: Yes.

MR. MORITZ: The figures I just gave you were 100,000 acres, or some 95,000 acres of the lands in the Indian Reservation.

MR. WALLACE: What are the potential irrigable acres of Indian lands? They have a sort of a prior right, haven't they?

MR. MORITZ: 233,000 acres in the Lower Basin.

JUDGE STONE: Mr. Page?

MR. PAGE: As I remember, at the Reno meeting, they said they would have a diversion of about three million acre feet. That probably includes both diversions, I think Mr. Larson also should report on that, to see whether they are all in here now.

MR. LARSON: I remember mentioning the figure of 86,000 acres receiving a supplemental water supply. That included any lands that needed water. If you will remember, from the San Juan Division, I read figures 34,200 acres of new

lands; 14,600 acres of supplemental lands on the Indian Projects down there, and we included it in the summary. There are not so many Indian Projects in the Upper Basin, but I believe they are all included.

JUDGE STONE: Are there any other questions?

MR. SMITH: In order to make this clear, I think it was stated at the Reno meeting by the representative of the Indian Service that it would be 294,160 acres, for which he estimated the requirements will be 1,671,980 acre feet diversion. The question I wanted clear, is that amount of water included in the total amount of water subject to use in the Lower Basin?

MR. SHAW: May I supply some other figures? I do not know what page Mr. Smith was reading from, but Mr. Wathen stated at page 149 of the Reno Report, "Our proposed expansion is to 600,545 acres, and our total estimated diversions will then be 3,129,790 acre feet, or 2,117,870 acre feet in excess of our present diversions."

MR. WALLACE: Is that divided between basins?

MR. SHAW: No, sir.

MR. WALLACE: May I ask, Mr. Larson, in your statement, have you covered all of the arable land in the Upper Basin that belongs to the Indians?

MR. LARSON: That is my understanding. On page 383 of the report you will find the statement submitted by the Indian Bureau. Our data has been taken from that table. That is my remembrance of it, anyway. I think we should also mention, Mr. Chairman, the fact that we are talking about "depletions," not about "diversions." The statement at Reno was the total "diversions." They ought not to be confused. "Depletions" and "diversions" are two different things.

MR. WALLACE: Will you read that portion you mentioned, Mr. Shaw?

MR. SHAW: At Mr. Wallace's request, I will read from Mr. Wathen's statement: Mr. Wathen stated: "I think it is all in the Lower Basin, except 87,500 acre feet in Colorado, 935,000 acre feet in New Mexico, and 298,510 acre feet in Utah. The balance is in the Lower Basin."

JUDGE STONE: Those of you who have asked questions concerning the Indian Lands, has that been cleared up? Are there any further answers to the statements made by Mr. Shaw, or questions asked by others? Mr. Riter?

MR. HEWES: I would like to know if the figures used by the Bureau here as depletions are to be considered against the figures used by the Indian Service at the Reno meeting for diversions. In other words, do the figures used by the Bureau in the report you have read here today cover the entire diversions as used by the Indian Service in the Reno meeting?

MR. RITER: I do not know as I can give a correct answer to your question. I am not familiar with every detail of the report. Generally speaking, the

diversions are greatly in excess of the depletions. I think in the statement I gave before, when I discussed how we set out the depletions, I said we took the diversions and subtracted the return flow we estimated came back from the stream. Mr. Larson stated that he included the Indian lands. He explained that. In other words, he said, in the San Juan Basin, they speak of a lot of small projects which the Indian Service desired to serve with water.

I am not prepared to state exactly what was done in the Lower Basin in that regard. I know that we allowed for an expansion in the Parker Indian Project, and in the smaller ones in the Little Colorado. I know we allowed for some expansion in the Little Colorado Basin. I know a large part of the Indian Projects are small, served from springs which do not contribute to the general supply of the Colorado River. Beyond that, I shall have to rely on Mr. Moritz and his staff to tell you what happened in the Lower Basin. I do not have all of the detailed information with me. Wehther they are prepared to answer at this time, I do not know.

JUDGE STONE: Mr. Moritz, are you prepared to answer that?

MR. MORITZ: I am not prepared to answer that, unless Mr. Larson can.

MR. VAUD LARSON: I might state that in the Little Colorado they included some 5,000 acres of Colorado land on the Virgin River. We provided for supplemental water on the Parker Project. The Indians have land there on the Colorado River Indian Reservation. We allowed 95,000 acres. And also the Indian Reservation at Fort Mohave.

MR. WALLACE: Will you add that in?

MR. VAUD LARSON: The project runs 95,000 acres. Also in the Gila Project for the Central Arizona Diversion, we have provided for supplemental water for the Indians, on the San Carlos Project. To go beyond that, there are many of the small Indian Projects. I could not give you any more data than that at the present time.

JUDGE STONE: Are there any further questions on this matter?

MR. HEWES: I would like to ask one more question.

JUDGE STONE: Mr. Hewes?

MR. HEWES: Mr. Larson, do I understand you correctly that the Indian Service did give you a list of the projects that are included in the report, and the entire list that was furnished you was included in the report?

MR. VAUD LARSON: This list that they have furnished for this report is not the one they gave you. This was sent in and just arrived in time to be included in it.

JUDGE STONE: Are there other questions?

MR. LARKIN: Mr. Chairman, I would like to ask one question.

JUDGE STONE: Mr. Larkin?

MR. LARKIN: Not having seen the report, I am rather handicapped, but what I would like to know, is there in the report anything which shows the net power that will be available to power contractors from these various projects after all the pumping loads have been taken care of?

MR. VAUD LARSON: Yes. The table Mr. Moritz read gives the power available at each one of the power developments. I do not know what page that was on.

MR. LARKIN: As I understand it, you did not take out the power to be used for irrigation, so we are unable to determine what net will be available.

GENERAL GILES: It is on page 289, Mr. Larson.

MR. VAUD LARSON: Not entirely, because it will be impossible to determine the power developments at this time. Generally, we have excluded the same. We are able to determine, for instance, on the Virgin River, there will be some pumping requirements, and those have been excluded. Power developments that are for pumping have not been included. The replacement power has not been included, but we do not have the pumping requirements at this time.

MR. RITER: Might I add that we must bear in mind the scope of this report. The report is not a detailed project report. It does not purport to go into that detail. The report is an effort to present a pattern for development. Our power output is figured on the averages, average run-off during the low ten-year period. In the market studies, in the main, they have tried to make allowances for some irrigation pumping. In other words, where irrigation pumping is not a direct project use, they have tried to allow for that as being part of the market demands. Before we are in position to talk with power contractors, there must, of necessity, be a great many detailed studies made.

We have tried to represent in here in round numbers our appraisal of the firm power costs to builders on the stream. In that connection, you have, as in Boulder Canyon, a diminution each year. The figures presented in our tables are the average between present conditions and ultimate conditions.

If a project should be authorized early in the game, the power output would be more than our table shows. Conversely, if a power project we have described should be authorized and constructed 80 years from now--I presume irrigation development will develop that fast--then the power cost to builders would be less. In other words, we have tried to base this on the average between the so-called "1950," which we call the immediate future, and the "ultimate."

I do not know whether that answers your question to your satisfaction.

MR. WALLACE: Is there an estimate anywhere as to the amount of power that will be required in the Central Arizona Project for pumping purposes?

MR. RITER: The Central Arizona Project, as it is described in the report, will, in the main, be a gravity project. In other words, to bring the water

from Bridge Canyon to the McDowell Dam, there will be no pumping ... that. However, as I understand it, there will be some pumping, some large amount of groundwater pumping, in order to utilize some of that water. I do not think that detail has been worked out, as yet.

JUDGE STONE: Are there other questions?

MR. PYLE: Mr. Chairman, I would like to ask the Reclamation Service in regard to the Dolores-Dove Creek Project. I see there are 40,000 acres, estimated cost of $12,200,000. We would like to know how that figure was arrived at. It is pretty definitely known, I believe, by the reclamation men in our country, that there is available water and land for around 100,000 acres on a ten-year minimum average. That is our impression. We are not making the positive statement, but we believe an investigation will pretty nearly bear that out. I would like to know how they arrived at that? If it is because these waters were appropriated somewhere else, that might be justifiable, but it would eliminate the Dolores Irrigation Project from the picture as too expensive, because we do not think they will find much power there.

The reason I am asking this question is because if that report, in its present condition, were to go in before Congress, it would, naturally, be detrimental to, or destroy, our program. So I would like to have that clarified, if possible, before we present that program. There is no question but what there is a great discrepancy in regard to water and land that can be put together. It may be said they are taking this water from one basin to another. But it is not taken from one basin to another. It is taken from the Dolores River and put in the Colorado Watershed. After it reaches the Colorado River it is not reclaimed anymore, and goes on to Boulder Dam.

You understand, there is no criticism and we could be wrong, but as far as we see that situation there is a discrepancy there of 80,000 acre feet that would immediately destroy our program. We would like to see if it can be clarified before this report is presented.

MR. RITER: Our study shows 40,000 acres are all we can now serve, with an adequate supply during the ten-year period. We have a record on the Dolores River, I think the McPhee Reservoir Site. There are some lands irrigated on the Dolores River downstream from McPhee.

As you recall, the present Montezuma Project takes water out above McPhee Site. We have negotiated with those people and found out how much they plan to expand their area. I do not recall the exact figures, but we have an agreement with them on some 10,000 acres included in their plan, and we have allowed for the additional water that they would take, to serve that extra 10,000 acres. We have allowed for the water that must be by-passed to serve the few thousand acres downstream--not very many, they are small acreages--and then we have computed the remaining surplus water, the water that actually flows into the McPhee Reservoir Site.

The McPhee Reservoir Site was planned to be built as large as we possibly could make it without interfering with the Montezuma Canal. Then the water that is left is the water that would be diverted. According to the calculations we

have made, that would be adequate for 40,000 acres. In other words, I think, if I remember the figures, it is about 120,000 acre feet a year we take over there. If we have made a mistake in the figures, I don't believe it likely. I have reviewed those several times, and that is as far as we can stretch it to give you a full supply.

MR. PYLE: I would say, if that is the final decision of the Reclamation Service, to do what they can do for that proposition, of course, we from the outside happen to know that average flow is around a minimum of from 375 to 575,000 acre feet over quite a period. I am a little familiar with the situation. Of course, the measurements they have are at the McPhee, and that is 585,000 for a high period. I do not think your measurements show as low as 375. Assuming the Montezuma Irrigation District takes out for 10,000 acres, that would reduce it by 30,000 acre feet and subject to a thousand acre feet below the McPhee, I do not believe they are using over 400 acres. It would seem it is too conservative, and if it is not further investigated, naturally, it would destroy our proposition. We are not disputing the Government in any way, but we know there is too much of a stretch there somewhere, and we would like to know about it.

MR. RITER: I do not have the figures here today, but if you wish I will try to bring them to you tomorrow, so we can get together. It is our intention, in developing these projects, to stretch the water supply as far as it will go, and cover the most land. I do not recall whether the figures you mentioned as run-off figures were after the present Montezuma Project. You remember, the present project is around 40,000 acres.

MR. PYLE: They abandoned a lot of that when they came up to their full capacity.

MR. RITER: Those figures that you quoted, are they run-off figures above their diversions?

MR. PYLE: Yes. The highest was 585,000 acre feet for everything, after they took all of the records. That is, your McPhee situation is 10 or 12 miles below the intake of the irrigation district.

MR. RITER: I do not have those figures with me today, but while you are in town I will be very happy to show those to you. After all, we are human. We may have made a mistake. If we made a mistake, we want to rectify it. That is the purpose in coming to this meeting. Those figures are down at our office, and if you will see me afterwards I will be glad to show them to you.

MR. PYLE: I will be glad to do that. You can see that $300 an acre for water without any power puts us out. We believe that the water and the land are both there, and that the waters are not appropriated farther down the river, and are still there.

MR. RITER: I cannot answer definitely. The only rights we allowed for on that stream are the Montezuma District, with expansion which they told us they would take. And we allowed for the people along the Dolores River. One thing to remember, you may get 585,000 in one year, but every year is not the same.

MR. PYLE: We can come back to that same figure of 375 to 500. There is still a big margin som where.

MR. RITER: I think the best way to go into that is if you will come down to the office and we will figure that out.

JUDGE STONE: I wonder, Mr. Riter, if you will get those figures and take that up with Mr. Pyle and his group before the meeting adjourns? Will that be satisfactory?

MR. RITER: I will try to.

MR. PYLE: Any time. We don't care when. But if the report goes into Washington the way it is on that proposition, it puts us out.

JUDGE STONE: Those are the things we want to bring out.

MR. PYLE: You have been over the country yourself and you know the water and the land is there.

JUDGE STONE: In the Colorado report this is exclusive of an additional 8,800 acres, about 120,000 acres of arable lands there.

MR. PYLE: With supplemental or additional water it runs around 115 or 125,000. That is a reasonable report. If that is covered in there, that would justify this construction. But as it is now, if that goes in that way, it would be too bad for us. If they investigated thoroughly on the minimum run-off, they would find those figures in there would not be justified.

MR. RITER: I am sure that we did not intentionally short-change you. Our report showed 40,000 acres are all you can irrigate. I am sorry I do not have the figures with me, but I will be very happy to go over that situation with you. I am confident we can convince you that we are right. And if we are wrong, we shall repay our confidence the other way.

JUDGE STONE: Are there other questions?

MR. LAKE: There is one point in which I am so very much interested, and that is the evaporation loss from the reservoirs. I understand, of course, we all do, that the evaporation losses will depend upon the altitude, the coolness, the depth of the reservoir, and things of that kind. But in this blue book, there at the bottom of page 5, "Present and potential depletions (of described projects) in the Lower Basin are estimated at 11,092,000 acre feet, of which 870,000 are charged to main stream reservoir losses." Now, that is eight percent.

I can readily see that the evaporation loss on one reservoir shall not be over a certain percent in two months. It might be very much less. If any reservoir was depleted by standing around, with evaporation a few inches or a hundred inches a year, but as the reservoir stood there it would get warmer and the evaporation percentage would be greater.

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I do not know what the evaporation loss is, figured in percentage of a large number of projects, but in the statements made here on page 4 of this same book, it says, in this period of drouth for ten years the record flow is 10,142,000 acre feet which was used to arrive at the virgin flow which is given as 12,234,000. That is against 16,000,000, the estimated overall of the 46 year period. Now, there is a difference there of 4,000,000 acre feet short, an average of 4,000,000 acre feet. Whom is that chargeable against? The Upper Basin States or the Lower Basin States?

Then, another question comes up: If it is true that the evaporation loss in these lower altitudes, say, Utah, Arizona, Western Colorado, approaches eight percent, should we go in another ten-year period where we have gone into this ten-year period of 27,000,000 acre feet that were supposed to be a reserve to supplement the Upper Basin States' share, 27,000,000 acre feet to be distributed in a new reservoir and the loss in that is eight percent a year? Where are you going to come out at the end of 10 years? That is eighty percent loss in evaporation alone. I wonder if you can explain to us about this evaporation loss?

MR. RITER: Mr. Chairman and Mr. Lake, the figure on evaporation loss varies, depending on climatic conditions, as you have indicated. Up in the higher mountains, I dare say evaporation loss will probably be less than one foot a year on the exposed water area--I mean, the net loss. You know, under natural conditions if you put a reservoir there you will have losses. You might have a marshy area. Down in the lower altitudes, the experiments indicate they might be as high as six or seven feet a year. That is trying to answer your question academically.

The total depletions, the way we have calculated them, include the losses from reservoirs; they include losses from reservoirs used both for irrigation and for transmountain diversion. Those figures have been included in the figures of depletion. I cannot give you evaporation losses here. I do not have the information handy.

Your second question, concerning the dry period, as I recall, in round numbers you put the question something like this: In the long-time period you have something like 16,000,000 acre feet. In the ten-year period it is nearer 12,000,000, taking the average. If the Upper Basin takes out, for instance, 7,000,000, that would only leave about 5,000,000.

In the reservoirs on the main stem, the Colorado and the Green Rivers, it is the plan that during this drougth period the storage will be released from those reservoirs to make up the difference, so that the Upper Basin would continue to enjoy the use of the water on the projects in the Upper Basin, but it would release storage from the replacement reservoirs on the main stem, so the Upper Basin would satisfy and deliver an average of seven and a half million acre feet.

I do not exactly understand your third question, as I recall it. Are you trying to get a breakdown in evaporation?

MR. LAKE: The report on evaporation shows eight percent on the Lower Basin

States. If we had this period of dry years, the evaporation loss alone would be tremendous in depleting the store of water to carry us over.

MR. RITER: In our estimates for all the main stem storage, we figured around 800,000 acre feet loss. That is an offhand figure. I do not remember the exact figure. We figured we would provide enough storage capacity so as to meet evaporation losses on the replacement reservoirs, and in addition to release enough water to meet the obligations of the compact. Our calculations have been based to take that evaporation loss into account. I do not know whether that fully answers you or not.

JUDGE STONE: Does that answer your questions, Mr. Lake?

MR. LAKE: Regardless of how much more reservoirs you provide or attempt to fill, the evaporation percentage continues, and it will seriously endanger the water that you hope to impound to make up the difference.

MR. RITER: In our studies, we did take account of the evaporation. In our studies we have allowed for that.

JUDGE STONE: Are there any other questions? (No response.)

If there are no other questions, following the procedure outlined, and on which we have agreed thus far, may we now have any statements or comments which the Corps of Engineers wish to make at this time? May I call upon Colonel Putnam?

COLONEL PUTNAM: Mr. Chairman and Members of the Committee, Members of the Bureau, and Others: I am here like most of you, to get some information which will be beneficial in working out certain programs entrusted to the War Department and the Corps of Engineers.

As explained at your Reno meeting, we have, under instructions from Congress, certain examinations and surveys to make in regard to flood control on some of the tributaries on the Colorado River. These examinations and surveys are under way, as far as war activities will permit. They are not so far along but what we can and will change them and our conclusions in respect to the development of these streams, if the overall program for the Colorado River in any way indicates they should be changed.

I wish to assure you that I am glad to be here and keep my ears open, and bring back something to help me to do our work. I thank you.

JUDGE STONE: Mr. Gardiner, of the United States Geological Survey, is there anything to add in addition to what was given at the Reno meeting?

MR. GARDINER: Mr. Chairman, I haven't anything to add. I am glad to be here and to learn what I can, and how we can aid in your work.

JUDGE STONE: For those who are not familiar with it, may I call your attention to the fact that the Proceedings of the Committee meeting at Reno contain quite complete statements, and some maps submitted by the United States

Geological Survey, submitted through Mr. Woolley and Mr. Gardiner.

Mr. Beebe, of the Federal Power Commission?

MR. BEEBE: Mr. Chairman, as usual I haven't anything particular to say, but I do want to compliment the Bureau because I think they have gotten out a wonderfully good job in a short time. I am sorry that I have not had a chance to much more than look at the cover, and I cannot comment on it further. But I, like Colonel Putnam, am here to listen and will take back a great deal of information. I thank you.

JUDGE STONE: The Fish and Wildlife are represented here. May we hear from the representative of that agency, please?

MR. BENNETT: Mr. Chairman, Members of the Committee, and Gentlemen: In deference to the tremendous job which you have in covering this exceptionally large inter-Basin area, I will be very brief.

Basically, any of these impoundments are beneficial to wildlife. That is a pretty broad statement. The amount of benefit, and it may be negative, depends primarily on the method of operation. We recognize that a dam or a reservoir constructed for a particular purpose primarily should be used for that purpose. But we also feel that the methods of operation can be so regulated that fish and other wildlife reserves will obtain the maximum benefits. In any of these areas there are a few items which have a particular bearing on wildlife. The amount of permanent storage or dead storage area below which water will never be drawn. Shallow areas, as a rule, are of much more benefit to fish and wildlife than the deeper areas. With the exception of your higher tributaries, which are primarily adapted to trout and cold-water fish, I will make a broader statement still: Anything which the Reclamation Service and the Corps of Engineers do, with the exception of these high mountain areas, is of great benefit to wildlife, regardless of operations.

If the gentlemen from Utah, Arizona and California will pardon me, I would say that the Colorado River and portions of the Green in the lower reaches, as I have observed, have been practically a biological desert in the past, and anything you can do to reduce and stabilize the water flow will be extremely beneficial.

I am here to answer any questions that anybody cares to ask, but primarily to listen. I thank you.

JUDGE STONE: We have two representatives from the Department of Agriculture. Do you gentlemen have anything to say?

MR. McGINNIES: Mr. Chairman, Members of the Committee, and Friends: Like some of the others, out of deference to the long program that we have I will keep my remarks very brief. But I just would like to inject here the thought that although most of you people are primarily interested in water after it flows down the stream, there is also some water in the same relationship that has to be considered on the watershed. This may not all be a negative relationship. There are some new things that are coming out of research that indicate

that the amount of water from these watersheds can be regulated by management. So that not only is it possible to consider the needs of the watershed, the estimated grazing, wildlife, recreation, and the many other things that enter into making the country livable, there is also the possibility that the folks who are working on the watershed, Forest Service, and our land owners in the great areas are going to be in position to assist you in some of your problems.

I am here primarily to listen. I would like to learn more about it, but I hope all of you will have at least some little thought for the water on the watershed. I thank you.

JUDGE STONE: Mr. Wilm?

MR. WILM: I think Mr. McGinnies has covered the subject.

JUDGE STONE: In view of the large figures we have heard presented, I presume that all of this should be very interesting to the Budget Bureau, and that Bureau is represented here. May we hear from Mr. Vawter who is representing the Bureau of the Budget?

MR. VAWTER: Mr. Chairman, Ladies and Gentlemen; I am here to listen, observe and learn. Right now, as I see it, the Bureau of the Budget has no immediate or direct interest in this report. However, eventually, either as a whole or piecemeal, I believe it will come to their attention. At that time in Washington, they may see fit to call upon our office here for some information factual, or some statement as to inter-agency relationship. I am sure this meeting is very beneficial to me, and I hope eventually to help the Bureau by being here.

JUDGE STONE: Are there any other federal agencies here who have any statements to make? (No response.) Are there any questions anyone wishes to ask any of the federal agency representatives? You have asked questions of the Bureau of Reclamation. Are there questions you wish to ask any of the others? (No response.)

If there are no questions, we have come to the point, then, when we will start in with the comments and statements of the representatives of the various states. In handling that, I will ask each member of the Committee of Sixteen, or the members of the Committee of Sixteen to inquire of those groups or agencies from their own states in handling the program for each state.

It is fifteen minutes to five. We must relinquish this room for another meeting at 5:00 o'clock. But before we adjourn, we should agree upon the procedure with respect to the statements from the states, and in that regard I wish to say that the two representatives of the Power Allottees will be given an equal time with the representatives or each of the two representatives from the states. So that means the seven states and the Power Allottees, or eight units to hear from. We must, if we are to get through within the allotted time, keep this in mind.

The Chair, after having made the recommendation, will be glad to entertain a motion as to the procedure to be adopted tomorrow.

Does anyone on the Committee have a suggestion to make as to that? This will probably be the most interesting part of the program, after we have received all of this information.

GENERAL GILES: Mr. Chairman, unless I hear a real good reason why we should not call the states alphabetically, I move that we call them in the usual manner that we have called for reports from the states, alphabetically.

MR. DELANEY: Second the motion.

JUDGE STONE: Motion has been made and seconded that we call upon the states alphabetically, irrespective of where they or any of them are located within the Basin. That motion has been seconded. Are there any remarks? (No response.) Are you ready for the question?

MR. SHAW: Mr. Chairman, this subject-matter that we have before us is divided into two grand divisions, the Upper Basin and the Lower Basin. The states, as such, in some instances overlap the boundaries between the two divisions. The report has been made up, however, generally speaking, respecting the boundaries of the two divisions. It would seem to me a little more orderly if the discussion were to follow the order of the report, rather than the artificial state boundaries.

Let me point out the effect of calling the states alphabetically: You start with the Lower Basin; you jump to the Upper Basin and back again, and the result is a hodgepodge of discussion which, it seems to me, could be more clarified and simple if each division were to have its allotted time, and deal with one subject at a time.

With that in mind, Mr. Chairman, I present, on behalf of the California delegation a substitute motion that the Upper Basin be allotted tomorrow morning as a group to select their own time, and devote it as they please, to be followed by the Lower Basin tomorrow afternoon.

And I would like, not as a matter of personal privilege at all, but just as a matter of explanation, to say that some of us have received copies of this report only last Saturday, and we have spent a part of the time since last Saturday traveling here. We would like to have the opportunity of taking the rear position in the discussion tomorrow afternoon rather than tomorrow morning. I therefore present the substitute motion, Mr. Chairman.

JUDGE STONE: Is there a second to the substitute motion?

(The motion was seconded from the floor.)

JUDGE STONE: The motion has been seconded. Before you vote on this, I would like to call Mr. Shaw's attention to this: That under your motion and suggestion, you divide the entire day tomorrow. It seems to me it is very obvious that after the presentation by the two Basins, the states of the two Basins, we must reserve time for general discussion of action or recommendations of the Committee. If we divide the entire day between the two Basins we have

no time left for that purpose.

MR. SHAW: Without making it a part of the motion, that, of course, wants to be taken into account. I assume the meeting will convene at 9:00 o'clock in the morning.

JUDGE STONE: Yes.

MR. SHAW: That allows three hours for each Basin, and reserves a part of the afternoon for that discussion.

JUDGE STONE: Then is your motion amended in that respect?

MR. SHAW: I do not think that calls for an amendment, but call it so if you like.

JUDGE STONE: Is there any discussion on the substitute motion? (No response.) Are you ready for the question? Those in favor of the motion, indicate the same by---

A PARTICIPANT: A point of order, Mr. Chairman: Are we voting on the substitute motion?

JUDGE STONE: Yes. I will call that again. Those in favor indicate the same by saying "aye." (Pause.) Those opposed? (After voting.) Call the roll, Mr. Secretary.

GENERAL GILES: Arizona?

(Answer "No.")

California?

(Answer "Yes.")

Colorado? (No response.)

JUDGE STONE: I can't be the Chairman and vote also.

MR. DELANEY: I will vote "No."

Nevada?

(Answer "Yes.")

New Mexico?

(Answer "No.")

Utah?

MR. WALLACE: You made the motion (addressing Secretary Giles.)

no time left for that purpose.

MR. SHAW: Without making it a part of the motion, that, of course, wants to be taken into account. I assume the meeting will convene at 9:00 o'clock in the morning.

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A PARTICIPANT: A point of order, Mr. Chairman; Are we voting on the substitute motion?

JUDGE STONE: Yes. I will call that again. Those in favor indicate the same by saying "aye." (Pause.) Those opposed? (After voting.) Call the roll, Mr. Secretary.

GENERAL GILES: Arizona?

(Answer "No.")

California?

(Answer "Yes.")

Colorado? (No response.)

JUDGE STONE: I can't be the Chairman and vote also.

MR. DELANEY: I will vote "No."

Nevada?

(Answer "Yes.")

New Mexico?

(Answer "No.")

Utah?

MR. WALLACE: You made the motion (addressing Secretary Giles.)

GENERAL GILES: I am always ready to support my motion. I vote "No."

Wyoming?

(Answer "Yes.")

Power Allottees?

(Answer "Yes.")

GENERAL GILES: That is a tie!

JUDGE STONE: Gentlemen, if there is no objection, I will call into the picture an umpire. Since the Bureau has been so overly overworked this afternoon, and they have had a hard job on their hands all day, may I suggest, since this is a tie vote, that we ask the Bureau to indicate to us how this shall be presented as to Basins? Do not be afraid of offending anyone, either.

MR. WARNE: Why don't you flip a coin?

MR. RITER: If it comes heads we go with your motion; if it comes tails, we go by states. (Flips coin.) It came tails, so we go by states, I presume.

JUDGE STONE: It was whether the Upper Basin should be first, or the Lower Basin.

MR. TIPTON: Before anybody makes another motion, I want to support what Mr. Shaw said. I think it is much more logical to present this by Basins. To my mind, I can't see any difference whether it is the Upper Basin first or the Lower Basin first. After each Basin's representatives present what they have to present, there will be plenty of time for further discussion.

MR. WALLACE: Mr. Chairman, I move a substitute motion: That the time be limited to two hours each, and that the Upper Basin be first. If that is the desire of the gentlemen, I am perfectly willing. And if there is additional time required, we can discuss that at the end of these two-hour periods.

GENERAL GILES: Mr. Chairman, if that is the way these boys feel, I will withdraw my motion with the consent of my second.

MR. DELANEY: I will withdraw my second.

JUDGE STONE: There is a substitute motion, that the time be limited to two hours for each Basin, and that we have first the Upper Basin, to be followed by the Lower Basin. Are there any remarks? (No response.) Are you ready for the question? Those in favor indicate the same by saying "aye." (Pause.) Those opposed?

The motion is carried, and the procedure tomorrow will be two hours for each Basin, starting out with the Upper Basin. Each Basin will arrange its own time.

I understand that there are certain of the states that wish to caucus or have separate meetings this evening. Are there any announcements as to that? (No response.) If not, I wish to make an announcement on behalf of Colorado, that all of those here from Colorado meet on the mezzanine floor of this hotel at 8 o'clock, and that must be promptly at 8:00.

GOVERNOR CARR: Can't we do that now instead of at 8:00? I cannot be here tonight.

JUDGE STONE: It has been suggested that the Colorado group remain now, or that we go to the mezzanine floor. We cannot remain here, Governor, because we have to relinquish this room. It is suggested that we go there now and dispose of the caucus at this time. Is there any objection to that? (No response) If not, we will follow that procedure.

I want to ask California--I understood you had a caucus?

MR. HEWES: I wish to announce to the California group that I would like for them to meet in rooms 271 and 272 at 7:00 o'clock, in this hotel.

JUDGE STONE: The meeting, then, will stand recessed, to reconvene at 9 o'clock in the morning. May we be on time.

(Recess at 5:00 o'clock p. m.)

SATURDAY, 9:00 A. M. - NOVEMBER 11, 1944

JUDGE STONE: The meeting will come to order, please. Apparently some of the members of the Committee are absent.

(Chairman Stone thereupon called the roll, as follows:)

Arizona	Here	
California	Here	
Power Allottees	Here	
Nevada	Here	
New Mexico	Here	
Colorado	Here	(Except Frank Delaney)
Utah	Here	
Wyoming	Here	

JUDGE STONE: Are there any new appearances on the part of the consultants or advisers? Is anyone here that was not here yesterday?

MR. GUEST: A. L. Guest, Paonia, Colorado, Delta County, representing the North Fork Water Conservancy District.

JUDGE STONE: Mr. Guest comes into the meeting immediately with one real virtue. He talks loudly so everybody can hear him. I hope everybody will follow his example here today so we can hear.

In accordance with the procedure outlined yesterday and approved by the Committee, we are to proceed with the comments of the states, with two hours on each side. That means a half an hour for each state and a half an hour for the Power Allottees. We will take in each group the states in alphabetical order. That means that the first presentation will be made by Colorado, and I am going to ask Mr. Delaney to call on these men in order.

MR. FRED JENSEN: Mr. Chairman, I am here representing a stockmen's association, and am also a member of that committee. The stockman seems to have been the forgotten man in this project to a very large extent over in the Gunnison Valley, and we are harder hit there than any other industry. We would like to have a little time for Governor Carr on rebuttal to represent the stockmen's interests.

JUDGE STONE: We will proceed now with Colorado.

MR. DELANEY: Colorado will call on R. J. Tipton to make certain suggestions.

MR. TIPTON: Mr. Chairman, and Ladies and Gentlemen of the Committee: I will get around here so I can see the Bureau representatives. I have a cold and have difficulty in talking.

The Committee and its advisers have been confronted with a physically impossible task. They have been confronted with the obligation of reviewing a report 400 pages in length, with two representatives to each state and numerous advisers here, and that to be done in a very short time. Well, it could not be done; it could not be done adequately. That is unfair to the states, it is unfair to the Bureau. I have had the report one day, a bare day, and I glanced through it the best I could in a very objective way, observing the form, style, and substance. I have some very definite ideas about the style and form, which I shall not take the time to discuss at this time. We can do that with fewer people. I have some definite ideas about the substance, and I will only cover the ones that are general in character. Most of my suggestions will be suggestions that would come probably from the Upper Basin States rather than from Colorado alone, and I hope that the suggestions will be considered in the proper light and that th y are made for constructive purposes.

In 1930 the Upper Basin States met to start compact negotiations. Those negotiations ended in August of 1931, when our good friend, Mr. Wallace, said Utah did not have sufficient information to carry on compact negotiations, and it would have to await the result of the Bureau's investigations. It has taken all this time for any sort of a report to be gotten out.

Now, this report does have considerable material in it that would be useful to the Upper Basin States in compact negotiations. It does lack one thing, that there should be put in the report the source of water supply by states in the Upper Basin, and it would be well to carry that down to the Lower Basin. That would round it out.

Another item that may be of some assistance to the Upper Basin States I think in the treatment of the Upper Basin has not been made quite plain in the

report. I may be incorrect in this, because, as I said, I did not have time to read the report carefully, but I think it is not made quite plain how the low water period was handled. Mr. Riter explained very well yesterday that the low use in the Upper Basin during the low water period was not on account of the obligation at Lee Ferry to deliver 75,000,000 acre feet, that 75,000,000 acre feet being held over from water which Mr. Riter called replacement reservoirs, but was primarily due to lack of water at points of diversion for various projects that were chosen for the Upper Basin framework. I think that should be made a little bit clearer in the report. I think it is also quite important not only to show the low water period of use in the Upper Basin, but also the average. I think that would be quite helpful to everyone, and I think it should be done.

Now, the most important item that I have to discuss--and I consider it quite important--is the difference in the method of treatment of the Upper Basin and the Lower Basin largely with respect to Compact allocations. I think the Director of the Upper Basin and his staff did a very good job. I agree 100 percent with his methods. As to the details, some of my studies are somewhat different. For example, in the amount of storage capacity, by his method he got 75,000,000 acre feet in the ten-year period. I got a somewhat different answer. But that is not here nor there. I am not going to discuss those details. According to the allocation of the compact, 7,500,000 is what has been allocated to the Upper Basin. The Director of this region, the Upper Basin region, made an attempt and a good attempt to cut the cloth to the pattern. I think he did a good job so far as major projects are concerned. There are numerous variations made by you of minor projects. Those selections cannot be made at this time. The final selection will be made years and years and years in the future, but so far as it went, I think the selection was good.

I have absolutely no quarrel with the water supply studies, either the Upper Basin or the Lower Basin or overall. There might be some modification of the methods, which would modify somewhat the water supply. A different method was used in the Lower Basin. It is my impression that the Compact provisions were ignored.

The water supply available to the Lower Basin for use at the present time under the allocation of the Compact is 8,500,000 acre feet. My remarks now are directed largely at page 272 of the report. The statement is made that after the Upper Basin uses its seven and one-half million, there will be 9,331,000 acre feet of available supply for the Lower Basin. Now, I am paraphrasing. It does not exactly say the Lower Basin. That is not the available supply for the Lower Basin. The available supply for the Lower Basin is 8,500,000 acre feet. Just as the Upper Basin Director assumed that the available supply for the Upper Basin was 7,500,000, he now says 9,922,600 acre feet of potential uses, "exclusive of the Gila River and any allocation to Mexico by international agreement." It is therefore evident that the projects discussed will need to be modified to conform with the available water supply. What available water supply? I maintain the available water supply is not 9,331,000 acre feet, the available water supply is 8,500,000 acre feet at the present time. The Bureau report indicates that on the Gila there is being consumed 1,135,000 from the main stream, after deducting 1,135,000 acre feet. That is what is There would be left from the main stream, after deducting 1,135,000 acre feet. That is what is eight and one-half million available, 7,365,000 acre feet.

available for the Lower Basin, not one acre foot more or one acre foot less.

MR. WALLACE: What is that figure?

MR. TIPTON: Well, assuming the Bureau's estimate of consumption on the Gila to be correct, 1,135,000, taking that off the total allocation, would leave 7,365,000 acre feet from the main stream. The total water supply available, as estimated by the Bureau, including the Gila is 18,102,000, with an increase of 380,000 acre feet of recovered losses. Incidentally, as I say, I cannot quarrel with that, because my estimate was 18,096,000 allocated by the Colorado River Compact, no more and no less. That leaves 2,102,000 acre feet for allocation under III (c) and III (f) of the Compact. III (c) takes care of Mexican water and III (f) is water to be allocated sometime after 1963, but not before one of the Basins has consumed all its allocations made by Article III (a) and III (b) of the Compact. The Mexican water comes out of the 2,203,000, or whatever it might be. I am not talking about the pending treaty at all or some other treaty, or what not. If any water is left over, that is not available to either Basin until sometime after 1963, and the procedure is definitely set up how it should be allocated, not allocated to the Lower Basin, but between the two Basins. I want it plainly understood that the Upper Basin has not foregone whatever its equitable share might be of what I choose to call III (f) water. It may be said that Section 4 of the Boulder Canyon Project Act provides otherwise. It suggests possible terms. Among those terms was the division of surplus, which I call III (f) water, to the extent of a half. First, a compact was never entered into, and second, that apportioning of it would not have been likely, because the Compact does say that it is the states that divide this water. Congress can not do it; the states did not say that. The states said by compact this III (f) water shall be allocated sometime after 1963 to the two Basins. We have not foregone the use of that, it is very meticulous in this report that the Upper Basin is out to 7,500,000.

Mr. Riter said yesterday the average would be 7,350,000 which would mean a little more paring. All the projects they set up come to seven and a half million. I agree with that. It is correct, it is proper. Also the proper available supply in the Lower Basin shall be considered 8,500,000 acre feet, and not one acre foot more.

Now, whatever allocation is made in the future will have to take care of itself, but we are still in the picture. I don't want that to be misunderstood in any way. Now, just because for the available projects we have more than enough water supply does not mean anything. All of our projects we want in the South Platte Basin here add up to more than the water supply. We have over-developed. We have more projects than available water. What of it? If we in the Upper Rio Grande take the water supply in that river, so we are going to have the use of that water supply, we can irrigate more than we are irrigating. But we can't. We have got an equitable share in that, so much. The Lower Basin has an equitable share, and it is no more than eight and a half million acre feet.

We have a tunnel in the Rooky Mountain region, we have thirsty lands in the South Platte. We can use considerably more water than is set up here for trans-mountain diversion, but it would not be equitable. We need to figure it out,

So summarizing--and I think I can speak for the Upper Basin--we respectfully suggest that the water supply, or that the consumption of these projects you had set up be shown in the report, both on the short time drought period and the long time period. We suggest that the sources of the water by states be given. I would suggest further that some summary of your operation study of the main stream reservoirs be put in, some engineering information. I think many things could be put in to round this out as an engineering report.

We suggest these things, the Upper Basin respectfully insists that the Lower Basin treatment be exactly in accordance with the provisions of the Colorado River Compact. That is the law of the River, that is what the states decided, and we respectfully insist that that be done. That is all.

MR. DELANEY: I will now call on C. L. Patterson, Chief Engineer for the Colorado State Water Board.

MR. PATTERSON: By permission of Wyoming, my remarks, together with those of Mr. Tipton, may run slightly over the half hour allotted to Colorado, but I will try to make them very brief.

First, as far as Colorado is concerned, we have hoped for a report from the Reclamation Bureau concerned primarily with reclamation. We find upon examination of the report that it is principally power. For example, in the State of Colorado, the total cost, exclusive of transmission grids in the Basin is given as $380,000,000. I added up all of the irrigation projects and I find a total of $107,262,000. I assumed that the transmountain projects mentioned in the report were included in the Colorado total. They amounted to $243,465,000, and that balance of $129,273,000 would cover the amount of river reservoirs and power projects.

I was told then yesterday, after Mr. Riter had explained the report, that the transmountain costs were not included. If that be true, then of the $480,000,000 proposed for expenditure in connection with Colorado projects, we have this relation, irrigation, $107,262,000, and power, $372,738,000.

The report on its face shows that the power generated by these potential Upper Basin power projects cannot be sold within that Basin, that same must be transmitted to adjacent areas. Realizing that there is a difference between The Salt Lake and the Denver situation, that perhaps Colorado River power can beneficially be transmitted to the Bonneville Basin for use there, the reverse situation prevails in the State of Colorado.

We cannot analyze this report until we have heard from the South Platte Basin director and the Arkansas Valley director as to the power features of these transmountain projects.

Now, in a primary way we are told, because I have been working with representatives of the Bureau and the Federal Power Commission upon a power report for this area, that Western Slope features of three transmountain projects were going to develop maximum amounts of power, roughly half as much as the interior Basin. The question is are those power plants to be built along the Colorado

River, and in that way devote the development of power to those projects. We say no, that should not be done. Therefore, we cannot analyze fully the Upper Basin phase of this report until we have reports on the Arkansas and reports on the South Platte that will cover those projects.

Now, a second point I would like to make has to do with the treatment of one loss in the Upper Basin. The report says that the Colorado River is a gaining river to the Black Canyon and thereafter it is a losing river, due to evaporation losses in desert regions. More accurately it should say that there are evaporation losses and natural losses, both in the Upper Basin and in the Lower Basin, that the tributary contributions in the Upper Basin happen to be greater than the natural channel losses, whereas in the Lower Basin the reverse is true, the tributary contributions, except in times of flood, are less than the natural losses. This has an important bearing upon the manner in which the Bureau has interpreted and applied the Colorado River Compact.

If in the use of the virgin flow, the Lee Ferry virgin flow basis, the Upper Basin can beneficially consumptively use seven and a half million acre feet, that necessarily means that the total supply of water, measured as original runoff or production was more than at Lee Ferry by whatever way the channel loss from points of production to the place where it was measured, that that loss was there under natural conditions and will be there after irrigation development has taken place.

However, we come to this interesting thing; After we convert that river to a long series of reservoirs, then we are charged with the losses of these reservoirs, estimated at something over 800,000 acre feet during the years of drought cycle, as though we had caused it or as though it was of benefit to us. I think it is going to mean that the Bureau must come to estimates of water resources as they are originally produced in the places where they are produced, and must estimate the natural channel losses in order to evaluate against the points of measurement such as Lee Ferry. Now, I have not time to go into the details of the analysis we have made in that regard. I will have to leave that out.

I do want to call attention to the fact that the report does break down costs, present and potential depletions, and other matters by state boundaries within the Upper Basin, but it does not give us any information, as Mr. Tipton suggested, as to the source of this water. I think it is very apparent that until we know that we cannot very well proceed with any discussions such as are requested in the report as to a compact among the Upper Basin States.

To put it more bluntly, and in line with the suggestion of Mr. Tipton, I have a note in here, you will recall, Note 6 on page 6, "From a hurried inspection of the report, no statement was found comparing the allocations of the Colorado River Compact for the Lower Basin with the present and future depletions of the described projects." I won't go into that because Mr. Tipton covered that very carefully.

I might also say the report, while it analyses or interprets the Compact, in a great many of its phases is entirely silent on the question of surplus as

that word is used in the Compact. That also was covered pretty well by Mr. Tipton. There is one point I think that should be mentioned. I believe it is necessary for a more complete and accurate picture. The Bureau makes allowance for what they call present depletions on projects that are recently constructed, under construction, or authorized but not yet in operation. They allow for the depletions, for example, of the Colorado-Big Thompson project and for projects in Utah and Wyoming, as though we are dealing with some time in the future after these projects come into the picture, come into operation. Previously the Bureau has made estimates of upstream depletions, and based on those estimates they corrected the recorded flows at Lee Ferry. And so we find now that the allowance made for so-called present depletions differs some 300,000 acre feet from the allowance previously made by the Bureau for crediting recorded flows at Lee Ferry or converting them to virgin flows.

I do not need to go into the list of projects for which allowances of that kind have been made, but I do offer this thought that the Bureau has ignored a similar effect upon projects now authorized or under construction by agencies other than the Reclamation Bureau. I do not need to mention but two to illustrate that. One is the City of Denver, which has built the water bore of the Moffat Tunnel. They built the tunnel at Jones Pass. Though not completed, the collection systems have allowances for they are down to the average they were diverting during the 1931-1940 period, or perhaps what they diverted in 1940, I am not sure which, but certainly those constructed projects upon completion of their collection works are going to divert more water than you have allowed for. The same is true with respect to a lot of individually constructed ditches in Western Colorado. They have under them considerable areas of irrigable land, and in the future may be expected, as is their right, to irrigate more than the Bureau found that they were irrigating during the drought period of 1931 to 1940. It is a natural process of development. No allowance is made for them whatever in Colorado and Utah in estimates for the Upper Basin.

There is one item of 571,000 acres of land not now irrigated for which allowance was made for these future depletions.

I want to mention just briefly the element of cost. I think we should all realize that now that some figures of cost have been added to projects that have not been investigated in detail that this question does develop very concretely that the estimated costs of the irrigation projects in the Upper Basin, if evaluated in terms of total benefited acreages, will probably average around $200 an acre, and if evaluated in terms of new land, something over $150 an acre, and if evaluated in terms of new land, some costs ranging from $160 and some dollars, if evaluated on the total benefited acreage, to more than $210 an acre, if evaluated on the basis of new land. I think the fact is they are relatively high costs, considering that that region as a whole is a livestock country. While there may be limited areas that can afford such costs, the mass of the projects cannot. So I think the report should more carefully distinguish between projects that may be feasible from a financial standpoint and those which manifestly must have large measures of federal subsidy if they are to be built.

One final word: We have no way of checking the estimates as to consumptive uses in other states. Within Colorado we do feel that the estimates

made by the Reclamation Bureau are as good as can be made at this time, so far as the present and potential depletions of irrigated land in Western Colorado are concerned. We have no suggested revisions in that category at all.

But we do want to mention one thing that perhaps has been overlooked or ignored, and I believe a specific illustration rises out of the study made generally between our Board and the Bureau on the Uncompahgre project in Western Colorado. To boil that down to a final conclusion means this; During the development of that project large bodies of water were stored in the ground. So far as the recorded flows at Lee Ferry were concerned, it resulted in seepage conditions. Water continued to be lost from evaporation, from seeped areas. Drainage now under way year by year is progressing in that area. This consumptive use study we made in cooperation with the Reclamation Bureau shows conclusively by elimination of these evaporation pans in that seeped land, 20,000 acres can be added to the irrigated area on the Uncompahgre project, without increasing the depletions of the Colorado River one acre foot.

I believe, gentlemen, in the analysis of this question of depletions you should make allowance for what will be a declining rate in the future, and that unless you do, you are going to distort the picture of what this water supply of the Colorado River will ultimately be.

I believe, Mr. Chairman, that is all the time allotted to us.

JUDGE STONE: Wyoming has relinquished ten minutes of its time to Colorado, and Utah says that another ten minutes may be allotted from their time, if it is needed.

I will ask Mr. Delaney to call on the next speaker.

MR. DELANEY: I will now call on Frank Merriell, and present him as the engineer for the Colorado River Water Conservation District.

MR. MERRIELL: Mr. Chairman, Ladies and Gentlemen of the Committee, and Visitors: I do not think any of us realize how great a body of fact and of study is embodied in this report which has been assembled in such a short time. As Mr. Tipton intimated, work was in progress on it several years ago. Probably things that were studied twenty years ago are embodied in this report, and in spite of that fact, the job is not nearly completed, and it will be necessary to spend a great many more years before the final answer is achieved. However, this report is now before you for your suggestions and your criticism, and I think properly before such a body as this, because it is the answer of the whole Bureau or the whole region, and you are the people who must pass upon it, not only for your purposes, but for the other purposes for which this report is necessary.

I believe we should give serious consideration to the fact that this report, while it is an inventory of the things we hope to see or to accomplish, is also a very necessary thing to be done from the national point of view. We must get our picture into the state of affairs along with all the other basins in the West.

There are, however, two men more interested perhaps in this report than all the rest of us, who are not represented here. Those two men are, first, the man who is going to sign repayment contracts for irrigation projects, and, next, the man who is going to buy some part of the billions of kilowatt hours of energy with which the report deals; and I believe that the reaction of those men, their ability to carry out their end of the bargain which you are setting up for them, and their willingness to carry out that bargain are perhaps the most important things to be considered in the final form of this report.

As to the report itself and its engineering features, let me say this: We have in Colorado two rivers which are practically completely developed, the South Platte River and the Arkansas River. In the process of the development of those two rivers certain relations or interrelations between water supply and its use have developed, which could not have been foreseen, and if vaguely foreseen, could not have been evaluated. It may be that in the total development of the Colorado River the same kind of relations and interrelations will not be so completely developed. But, as Mr. Patterson suggested, it is very probable that as time goes on we shall find that the best estimates that we can make of the availability of the water supply are immensely affected by these relations and interrelations between use and supply.

So we cannot hope at this time, in my judgment, to write a conclusive report on the Colorado River, but that need not, in my judgment, greatly influence us for this reason: I wish you all a long life and happiness, but I do not believe that anybody here will live long enough to see one-half of the things contained in this report realized, and I do believe that during the course of that development factors will enter in which none of us can foresee. Those factors, if experience is any guide, will demonstrate to us that the availability of water in the Colorado River is probably underestimated now, and cannot be estimated except upon the basis of actual experience.

MR. DELANEY: I will now call on Ed Dutcher, as a representative of the Gunnison River Water Users Association.

MR. DUTCHER: Mr. Chairman, first of all, on behalf of the group that I represent, I want to say that we are indeed grateful to have the opportunity to appear at this meeting. It has been extremely informative.

Now, most of the members of our Committee have not even seen this report. A few of us have had it for about thirty minutes to an hour. We are not in a position at this time to approve or disapprove the items that are contained in this report. We feel because of the importance of the matters involved that these projects should not only be studied but investigated and analyzed, and approved or disapproved, independently of each other project.

A cursory examination of the report has disclosed to us that in making the report those people had in mind two uses of water primarily, first the use of water for irrigation, and second the use of water for power. We are not unmindful of the importance of those uses of water. Experience has taught us that there are other important uses of water, especially in Western Colorado. They are becoming more and more important as time goes on. I have in mind particularly the use of water for recreational purposes. Recreation in Colorado is

now becoming one of the large businesses. We foresee that in the future it might become the biggest business. Although we do not deny, we question whether sufficient consideration has been given to these other important uses of water. We question whether there has been a way devised to protect the waters in the upper reaches of the rivers for fish life, and other recreational purposes.

As I said before, we feel that each project should be analyzed and studied, and then approved or disapproved on its own merits. At the present time we are not in a position to make any recommendation to this group as to those matters contained in the report. However, we do feel from our casual observation that not a sufficient amount of projects have been included. They have been omitted, maybe intentionally or maybe unintentionally, we don't know. But we feel that the people in each respective locality should be considered and they should be consulted with reference to the projects which are to be seriously considered in that respective locality.

We ask this Committee for a sufficient length of time to make our own study, with the cooperation of the Bureau of Reclamation, and then determine what other projects, if any, should be included, and what projects we feel are not economically sound. We would also recommend that these other uses of water be considered of vital importance. We feel that is particularly important to the section of the state that we live in.

MR. DELANEY: John B. O'Rourke, from Southwestern Colorado.

JUDGE O'ROURKE: Mr. Chairman and Ladies and Gentlemen, as a member of the Colorado Water Conservation Board, and speaking now for the Southwestern Water Conservation District, which embraces the eight counties in Southwestern Colorado, I want first to point out that I think that the Bureau has accumulated a mass of valuable information. They are getting now along to the point that we have been aiming at for some time. However, we have not had an opportunity to examine this report, and we have quite a vital interest in the waters of the Colorado River. Our section, or the eight counties from which I come, produce something in excess of 40 percent of the water that is furnished the Colorado River by the State of Colorado. We are not in a position to comment on this report either one way or the other, to approve or to disapprove any of the projects.

This Committee, or the members of the Committee from Colorado, are not in a position, I take it, to bind the State of Colorado or any section of the State of Colorado by approving or disapproving this report. Under the statutory setup which we have in this state, the handling of the water problems of the State of Colorado rests in the Colorado Water Conservation Board. This Committee is set up merely for the convenience of these groups from the various states, meeting together and ironing out our difficulties and carrying out the Compact of the Colorado River.

I think there is an obligation on the Colorado Water Conservation Board to take these matters up with their various sections, the various areas of the state. Each area of the state presents different problems, and as I say, we are not in a position now to either approve or disapprove it.

I do want to commend the Bureau for the magnificent job they have done. They have expended a lot of work and accumulated a lot of valuable information, I think information that is going to be helpful to us in developing the Colorado River Basin.

JUDGE STONE: That concludes Colorado's presentation. We shall next call upon New Mexico.

MR. WILSON: Mr. Chairman, I don't know just how much time has been allotted. As a matter of fact, it will take me only a few minutes to say what I have to say.

So far as New Mexico is concerned, of course, we are in the same position that all the rest of the states are in, in reference to this report. Our State Engineer, Tom McClure, did not see this report until this morning. Obviously our engineering department has had no opportunity whatever to examine any of the engineering phases of the report. For that reason nothing anyone from New Mexico at this time could say would be helpful to the Bureau.

However, I will say this: From what cursory examination I have made of the report, it will be very valuable to this Committee and to the states on account of the information it contains. But so far as being binding on any state, of course, I assume the Bureau does not intend to do that, and nobody here would have the power or authority to bind any state in reference to any of these projects.

Now, in the report I see that the few projects that affect New Mexico are the San Juan-Chama Transmountain Diversion and the so-called Shiprock projects, and some projects on the Gila. It is apparent, I think, from examining the report, that the Bureau has made no intensive investigation on the ground, especially with reference to the Shiprock and the Gila.

Many of you know Mr. McClure, our State Engineer, very well. I am sure if he were here he would want to convey to you this message which he has conveyed before, and that is that he, representing New Mexico, would like for the Bureau to spend some of this money in the State of New Mexico, especially on these two projects. I realize the fact that the detailed information so that the people of the state can select, if selection should become necessary, must come later.

Take the Shiprock project set up in here as a 70,000 acre project on the Navajo Reservation. The statement is made that it might be enlarged to 200,000 acres, but if enlarged, it might prevent the construction of the San Juan-Chama Diversion Project and perhaps some other projects. It is very obvious that before the people of New Mexico can consent to that or make a choice, there must be a detailed study made as to the cost and the feasibility of these projects. We hope the Bureau is in a position to make that detailed study. If the Bureau is not, some time or other the state at its own expense will have to find ways and means perhaps to make the study before an intelligent selection can be made.

Now, obviously I should not have said, perhaps, as much as I have said, because we are all in the dark as to what we should do about this report.

I want to congratulate the Bureau on the vast amount of work that has been done. I know you have worked under difficulties, but in common with some of the other gentlemen who have spoken, we do not want to be bound in the future by any statement made in this report on the theory that we acquiesced in it or consented to it or that this is a precedent. I realize these things have to be worked out in the future, and I do not know why the Bureau finds it necessary to submit this to Congress at this time. Maybe you have a good reason, and so long as the report is submitted to Congress, as you have described it here in the report itself, as tentative, incomplete, unconclusive, I don't know that it could hurt anybody, and I am sure that it has been very helpful.

JUDGE STONE: Any further statements from New Mexico? Is that all from New Mexico?

MR. WILSON: Yes, that is all.

JUDGE STONE: I will now call upon Utah.

MR. WALLACE: Way back yonder in 1928 the Boulder Canyon Project Act was written, and we of Utah succeeded in putting into the Act originally a proposition for the comprehensive development of the River, providing for a fund of $250,000. We certainly expected that within five years we would have some opportunity to review what might look then as a comprehensive development. We have waited from 1928, sixteen years. The suggestion was made then that we might make some sort of a compact between the Upper Basin States, but in discussion with Dr. Mead we came to the conclusion that it was wise to write a compact based on the facts, and up to now we have not had all the facts.

Now, we are ambitious in our state. We have an area, Southern Wyoming, Western Colorado, and Eastern Utah that is probably the richest mineral section on the face of the earth. There is said to be at least 10 percent of the known coal deposits of the earth within that area, and enough shales, sands, and that sort of thing to provide the United States with gasoline for many many years. Further, we have in nearby regions potassium, phosphorus, and plenty of nitrogen in the air so that we can provide fertilizer in the West for many years to come.

In order to do that we will need enormous amounts of cheap electric power. We lost a great electrolitic zinc plant, it went to Montana, because of the situation that we did not have the power and the water to take care of it.

Salt Lake City is the greatest smelting section in the United States, and I don't know but what in the world. We need a tremendous amount of power, and we need power rates upon the same basis that they will be given to other sections in the Colorado River Basin.

I may say to you gentlemen, because we would like to make as rapid development in our community as we can, it has been recognized before that we have been one of the regions of slow development within the Basin. That was one of the

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reasons why we had the Colorado River Compact written originally, because we recognized so far as development was concerned, we could not equal the rate of Southern California.

Of course, we have all had the report but a very few days. I spent about three days going through it the best I could, and of course we recognize the fact that the gentlemen who have written the report have so far made no recommendations, so, of course, we are not able to pass upon the report in its completed state. There will be ready for us in Utah, so I am given to understand, the Bonneville Basin report by the first of the month. There is a very intimate relationship between the development of the Colorado River Basin and the development of the Bonneville River Basin. We have a great deal of undeveloped water in the Bonneville Basin, but again we need the greatest amount of power to put it to the highest beneficial use. I only say what our ambitions are. We want our people to pay for development to the best of their ability. We feel every locality, state and nation benefits in the development of this River. My understanding is that this report is written upon the basis of containing benefits to the entire United States, and there are many, many projects set up in this report that cannot be paid for by the people that receive the immediate benefits, but must be spread out and paid for, as I say to you, locally and nationally.

We are very anxious, of course, as far as we are concerned about some other matters. We want to retain the control of our waters within the state. We do not want the United States to take possession of this great asset and develop it upon the basis that it will permit the control to go to Washington.

I was very much interested in the remarks of Mr. Tipton in which he spoke of years and years and years. We would like to have this river developed upon a concurrent basis; we would like to have these great projects in the Upper Basin built at the same time you are building the great projects in the Lower Basin. We will be able to develop and use all of the waters allocated to the Upper Basin within a reasonable length of time. I think we can say frankly to you people of the Lower Basin that we can develop them and use them just as rapidly as you can, but of course we have got to appeal to the United States for aid, as you have had to do. Utah, as you know, has an interest in both Basins.

Now, as to Utah's position in the matter: We are grateful to these men for the great mass of information they have gathered together. There is no possibility for us at this time to say exactly what Utah would like to do. It is our purpose to go home. You understand, all of you I assume, that the members of the Committee of Fourteen are simply advisers. We have not any authority to act on behalf of our states. We have been appointed by the Governors and must report to the Governors. It is the purpose of the Utah delegation, I assume, to return home, call a conference as the Governor may ask for, analyze the situation as best we can, and make a report to the Department of the Interior in writing, setting forth exactly what we would like to do now, or what we would like to have done.

I think, gentlemen, that is about all I can say, but I would like to repeat to you that we feel that we have one of the richest sections on the face

of the earth that we want developed not only for our benefit but for the benefit of the United States. We want it developed concurrently with the development of the Lower Basin, and we want it developed just as rapidly. We particularly want to hold back the water in the Upper Basin in the reservoirs during periods of excess flow, so that we can faithfully fulfill our obligation to you people, so that we can deliver the amount of water set out to you in the Compact.

I would like to call on Mr. Giles for his comments.

GENERAL GILES: Mr. Chairman and Ladies and Gentlemen of the Committee: There is not a great deal that I can add to what has been said by my colleague, Mr. Wallace, and by my associates that have already spoken for the other states.

I have been working on this Committee along with Mr. Wallace and the other people from my state and our colleagues who represent the respective states of the system since 1937, when the Committee was first suggested.

We, of course, as Judge O'Rourke pointed out, cannot bind our states. I think the Committee has well justified its existence. Many difficult controversies and problems have been worked out around the table, and I think much litigation has been avoided.

As pointed out by Mr. Wallace, the Project Act calls for the investigation that we are now having from the Bureau. We asked for it. We have been anxiously looking forward to it, and now it is here in a tentative form. It was very significant to me what Commissioner Page had to say in his opening remarks. He said, "We are here for suggestions, we are here to listen to you men of the Committee, what you have to say, and to your criticisms. We may incorporate your criticisms and your suggestions in the report, but we may not. There is no certainty that anything you say" -- now, I am paraphrasing what Commissioner Page had to say -- "there is no certainty that what you have to say will be incorporated in the report."

From what I have heard of the criticism this morning, in my opinion the Bureau had better incorporate some of these suggestions. Obviously we cannot put the stamp of approval on the report as it now stands.

With my associates I want to congratulate the Bureau on the splendid job of the Bureau, and the Committee, as far as we can bind our states, are speaking for generations yet unborn. A comprehensive development means a development of the river in perpetuity in keeping with the Compact provisions.

I want to go back to my state and call the interested parties together and go over this report and show them what the Bureau proposes for us. We would not want to add to this report or subtract from it. We have no authority to do that. When we speak for Utah and when the Bureau speaks for Utah and the rest of us, let us have a picture generally that everybody can happily approve. Let us not let it get us into litigation and trouble. Let us try to work together as we have done and iron out our differences as gentlemen should.

As Mr. Wallace suggested, if the seven states of this region cannot divide this great asset among us that is to satisfy the needs, may I say, in

every walk of life perhaps for generations yet unborn, how can you expect the world to settle its differences?

So I would say to the Bureau, you had better give us a little more time. I don't know what the urgency is. Maybe there is a real reason for this to be in the hands of Congress on January first. I would like to have that answered. There is not much time between now and January first for all of us to go back to our respective constituents and people and iron out such an important problem as this, and I would like to have somebody tell me why this thing must be in the hands of Congress on January first. If it must, it must, but it seems to me, gentlemen, we had better sit down a little more soberly about the division of these waters and where these projects are going to be, because, as I said, we are speaking for boys and girls that will come 200 years from now into this great region, and I think the Bureau too wants that kind of consideration.

I thank you.

MR. WALLACE: Mr. Bundy, Director of Water Development of the State of Utah.

MR. BUNDY: Mr. Chairman, I just wanted to say I have nothing further to offer. I might just make this one observation; due to the defense plant that was brought in there we are now at the crossroads, where we must decide what we are going to do, whether we are going to have agricultural expansion or industrial expansion and to what extent. Therefore, we feel that we want to go back to the people who are users of water for industries and talk to them and see if we cannot make some sort of determination as to where we will go from here, what our desires and requirements will be, before we can make any final decision which would help the Reclamation Bureau in determining Utah's use in the allocation of water.

I think myself I would like to see, as Mr. Giles has said--I believe with discussions that have been had, in view of the fact that the present report does not contain any recommendations by the Bureau, but left that vacant, it would be well for them to consider, and I believe they will in their recommendations if the report must go in immediately, the thoughts that have been brought out here.

MR. WALLACE: Mr. Watson, State Engineer.

MR. WATSON: Gentlemen, I did not expect to be called upon, but I wish to say I think the Bureau has done a very excellent job in the states. The reason that they have had to work under such difficulties in such a short time is because there is a demand that our Congress know the facts from us in order to set out a post-war program.

I confirm what Mr. Wallace has said, namely, that we are living, over in that country, in an area of great natural undeveloped resources, and if we say nothing more about the potash, the oil shales, and the coal, there is one thing we do have in that area that does not exist in other parts of the United States in the same proportion. That is the great deposits of phosphate, commercial fertilizer, which needs cheap electricity for its development, I would say, therefore, that our prime project in that area, aside from irrigation needs, is

the cheap electricity that we must have.

MR. WALLACE: Mr. Skeen, Assistant Attorney General.

MR. SKEEN: I have nothing to add.

MR. WALLACE: I would like to say just a word or two in compliment of the Bureau for the excellent report, certainly a comprehensive report so far as the list of projects is concerned, and to say to them that it will be of great value to us in making our decision as to what should be done for Utah. I would like to remind you that we have had tremendous development in our Salt Lake Basin. The greatest salt plant of the world owns its own lime, coal, and iron ores, and has a value of over $2,000,000.

We are grateful to one gentleman from California, Mr. Scattergood, for his study on the question of power throughout the entire West. He has done a magnificent job for you people of California. I have a notion he has an ambition to see that all of us throughout the West have great iron and power plants that will give us in Utah the same power rates as in California. I would like to express my gratitude for the studies Mr. Scattergood has made. He has even talked on the subject in Washington, and I only hope there will be great blessings, not only in the development of the resources of iron and coal, but in the bringing into every home the blessings of cheap electricity which will permit the housewife to manage her affairs with the least possible hard work.

I again express to you, Mr. Scattergood, our gratitude for that action.

JUDGE STONE: The statement on behalf of Wyoming will be given by Mr. Bishop, or Mr. Rollins.

MR. BISHOP: Mr. Chairman, and Ladies and Gentlemen: Mr. Rollins and I have not had an opportunity to study this report. We are not in a position to comment on it. I think it is a very good report as far as they have gone, I don't see how the Bureau of Reclamation can complete a comprehensive report of the Upper Basin until they know how the Upper Basin feels about the development. To me that is the most important item and the least talked about.

MR. ROLLINS: Mr. Chairman and Ladies and Gentlemen: I, of course, have been on this Committee only a short time, and none of you are expecting much from me. I would not for the world try to disappoint you.

I am neither a lawyer nor an engineer, by the way, and my chief interest in Reclamation is seeing two blades of grass grow where one grew before. I take pride in seeing the desert blossom into a rose. For many years my heart has been in this work.

I have learned this morning from remarks that have been made that it is not expected of us that we go into detail on this report or try to bind ourselves one way or the other as to its contents. However, there is one thing that has heartened me, and that is the fact that the Bureau of Reclamation when it was under stress really went into high. That pleased me very much, because

I remember that they started surveys about thirty-two years ago, and over in the lime country where I used to live years ago, I had looked forward as a boy when I got old enough to get on some land, we would have a project up there. I am just wondering now whether my grandchildren will have an opportunity to live under a project there.

However, this war has taught us, if it has taught us anything, that we can perform miracles in this country of ours. We have performed miracles of production. Things unheard of and unthought of a few years ago, almost unbelievable a few years ago, have been accomplished. If the same energy can be turned toward the construction of these great projects we would not have to wait as long as some of us feel this morning to get the country developed. If we really turn on the heat in getting out this report, it seems to me we can get this whole area developed much faster, in a much shorter time than we had ever dreamed of. Maybe that very thing will take place.

If I were to give any criticism at all of the report in the short time I have had to survey its contents, it would be that perhaps they have left out thousands and thousands of acres of land, at least in Wyoming, classed as second-class land, which some day may make homes for thousands of people if the water could be provided, but it may seem now in that high elevation and short seasons that we could not possibly produce crops that would justify the expenditure that some of these projects will necessarily cost, yet who knows but what in the future some new type of crops can be produced on that land that will far exceed in value anything we are growing now?

May I mention just one example on some of that second-class land? Only a few years ago some of the dairy men over there conceived the idea that inasmuch as you could not grow corn on that land, sunflowers could be profitably grown on that land that has been rejected by the Bureau, some of that second-class land. That is potentially a great dairy country. Already the Sequoia Valley has become a little Switzerland of America, and in the Bridger Valley the dairy industry is developing rapidly. So that I think that perhaps we may have not gone quite far enough, as far as Wyoming is concerned, and maybe before the report is finally accepted by Wyoming we will yet have to adjust our sights upward a little bit.

I don't know as I have any more to say. I am really grateful to the men who have spent the time and the effort they have to get this report in the condition that it is. It seems to me a firm foundation has been laid upon which may be built from this a great development of the Upper and the Lower Basin States. Thank you.

MR. WALLACE: Mr. Chairman, Utah has a minute or two. I would just like to say this word to Wyoming, we will be very pleased if Wyoming will develop every possible acre she can, using their water, so that we will know how much we have in Utah. We would like to see you build the Kendall Reservoir and other projects just as rapidly as you can. If there is anything we can do to help you, we shall be glad to. We think it is time to get together around the table and settle this thing we are talking about.

GENERAL GILES: If the Bureau is under a deadline stress, we want to be as helpful to you gentlemen as we can. I am wondering whether it is going to be possible for us to get our people together and make you a written report between now and the middle of December, say. When do you have to have this in? It seems to me we are all talking about no opportunity to examine the report and we cannot make any final suggestions to you. That is one thing I wanted to say before we got through, because I think we could be helpful to you.

JUDGE STONE: I think those are matters, Mr. Giles, that we should take up in the discussion as to any action the Committee may think advisable, after the statements from the various states are made.

GENERAL GILES: Yes.

JUDGE STONE: Does that conclude the statements on the part of the representatives of the Upper Basin States? The Upper Basin States have made their statements in an hour and thirty-five minutes. Under the procedure adopted there now remains two hours for the presentation on the part of the Lower Basin States. Those states will be called on in alphabetical order. Before we do that, however, we will take a short recess.

(Thereupon a short recess was taken.)

JUDGE STONE: The meeting will come to order, please. According to the time which I have, it is 11:20. Mr. Wallace says my watch is wrong and that it is 11:25, so it is probably 11:25. Now, the question has been raised with the Chairman whether we want to work straight through and conclude the two hours on the Lower Basin presentation, or whether it will be split for the noon hour. The Chair is making no arbitrary rulings on that. I am leaving it to the Committee.

MR. WALLACE: What do you want, California? An hour before luncheon and an hour after?

MR. SHAW: Mr. Chairman, I seriously doubt that the Lower Basin will consume two hours. From what I learned from discussions with representatives of other interests than California, my suggestion is that it now being close to half past eleven, we proceed to hear from the States of Arizona, Nevada, and the power contractors, and that such observations as California has to present be reserved until after lunch, say at one o'clock.

JUDGE STONE: Is that agreeable to the Committee? If there is no objection that will be the procedure. Is that agreeable to Arizona?

MRS. BUSH: O. K.

JUDGE STONE: Is it agreeable to Nevada?

MR. SMITH: Yes.

JUDGE STONE: Is it agreeable to the Power Allottees?

MR. SCATTERGOOD: Yes.

JUDGE STONE: Very well. We will proceed with Arizona.

MR. WILLIAMS: Mr. Chairman, Members of the Committee and Friends: We won't consume a lot of time in presenting what we have to say.

We do feel seriously that the Bureau has done a good job in the time they have had in filing this report, and we accept it as an inventory of the projects and as a starting point, something as a guide to work on and to work to. We realize we will have to have some time to eliminate the projects that are not feasible, and to decide on the ones in Arizona that are feasible and that can ultimately be presented to Congress for appropriations and construction, etc. So we accept the report for what it is purported to be. We are not in a position to bind Arizona, and we do not think it was ever intended by the Bureau that the report should be final or should bind any of the states or make it necessary for them to commit themselves.

We have several members here and consultants that we would like to hear from, and I think we will call first on Mrs. Nellie Bush, who is the senior member of our Board.

MRS. BUSH: Mr. Chairman and Gentlemen: I want to prove to you two things, first, that a lawyer does not always talk very long, and second, that a woman does not have to have the last word to be happy. At any rate, I want to say this: that of all the states that are against delay in any program, I think Arizona has the right, from the lessons she has learned in delay, to be the most skeptical of delay.

Personally since 1922 I have been interested in this and then as a member of the Legislature of Arizona. As you know and as I know, all the way through Arizona has lost, and lost a lot by delay. But I know too from legislative experience that if we go to a legislature or to any legislative body with an incomplete program and one that we do not know about ourselves and one that we cannot back up ourselves, we very often lose precious time. In other words, instead of facilitating it, it has the reverse effect, because when they say, well, look at this enormous thing, this mass thing you have in your report, then we have to admit it, and then it must go back to be studied, and those who are against any development, as Members of Congress may be in Western development, will say, "You didn't know what you were talking about before, and we don't know why we should take any of it."

So I am rather of the opinion that we of Arizona and the southern states should know something of the things we are really headed for, and have definite things in mind before we stamp it with our O. K. as the Committee of Fourteen or as a state.

Now, I think there may be some possibilities in this report. I do not think this meeting should break up with nothing done, as sometimes meetings have that I have attended in the last twenty years--not speaking of this, particularly, but of other meetings that were very essential to progress.

Some of us have been talking during this brief interim that we had just

now. There may be some projects that might get the green light and that might be even set aside for definite action, and might come out of this thing as an O. K. and a green light for the Bureau to present to Congress and therefore go ahead and give us some estimate on some that we did not yet know about. It seems to me that others may give you more on that, a more conclusive talk on it than I can. But I am not of the opinion that we should leave the whole thing up in the air. I think, however, every meeting must have some starting point, and if there are feasible projects we might start on, then I am for that. I don't know whether that is feasible here or not, but to my mind it is.

I just want to say this, we want to work with the Bureau. I think the Bureau knows that. We want to work with everybody who is getting ready for the postwar period.

We think Arizona is one state in the Union that has as many, or more, possibilities than any other state, for several reasons; we have a lot of good lands that are very thirsty. We have a lot of boys returning who want to be farmers. We want those people to have a place to light. We think we have an ideal place for them from a health view point and from development possibilities; and from a report of what has gone on in other developments of an acre of land in very similar land to ours, in our neighboring state California, that has proved just a beginning. You see the initial cost of land is so much and when we go into the ramifications, to someone passing by it looks on its face not at all feasible, perhaps. But taking all these things into consideration, we think we have the garden spot in the world for the returning soldiers.

So Arizona is very anxious that we have something definite, that we have something constructive, and that we have something that will not burden the future generations. So with these few remarks, I am going to turn the meeting over again to our other members and let them give the hope of Arizona. Thank you.

MR. WILLIAMS: As I say, we do not know all the answers in Arizona. In an endeavor to learn them, we have cooperative agreement with the Bureau, making our investigations generally with them on our projects.

Our engineer, who has devoted all of his time to this, is with us today, Mr. R. Gail Baker, and I will now call on him.

MR. BAKER: Mr. Chairman and gentlemen: After listening to the discussion so far I am quite confused as to the uses the report is to be put to. My understanding is that the report is more or less of an outline of the projects that we have before us to work out, cooperating not only between the Upper and Lower Basins, but also between the states within the different basins. If that is the right interpretation of the report, we of Arizona are certainly very much in favor of the report as it is written and presented. On the other hand, if the report is more than that, and is to be used as something more or less binding, I would say that the January first deadline is certainly one year, and possibly two years ahead of the time that it will actually take to work these problems out so that it can be handled in that way. Assuming, though, that the report is just an outline and there are problems to be worked out in the future, we of Arizona accept it almost as it is written, word for word.

Along that line, the State of Arizona has put up $200,000 to be matched by the Bureau, $400,000 to be used by the Bureau to work out these problems in Arizona. Certainly until we spend that $400,000, and maybe more beyond that, a comprehensive report that is at all binding cannot be written.

MR. WILLIAMS: You all know Mr. Carson, our legal adviser for Arizona. We would like to hear from him.

MR. CARSON: Mr. Chairman, I think the Bureau has done an excellent job in the way of making a kind of overall catalogue of possible projects in the Basin. I take it this report is to be binding on nobody, not even the Bureau or any man in the Bureau. I think there is no commitment on the part of the Bureau in favor of any project listed in the report, nor any commitment against any project not listed in the report. I think all of these specific projects depend upon future investigations and surveys.

The question, therefore, arises in my mind as to the value and the immediate urgency of this report. I understand that the Bureau is under positive orders for a deadline of January first, and I understand that the reason for that is that the President and the administration requested that they prepare and have ready for postwar construction at the conclusion of the war a three billion dollar program for permanent construction and to help absorb unemployment.

There are some things in the report that I am not sure would be conducive to favorable consideration by Congress of specific bills for specific projects when they come. I am thinking now particularly of some of these estimates of cost which are necessarily, and stated to be, merely rough estimates. We have heard this discussed by quite a few of these people who say that the acreage set out and the cost set out is prohibitive. I think that is true, and it may be true in other matters. So I would like to suggest to the Bureau that if possible, where there are no direct estimates of costs, perhaps it might be well in some of those instances to leave estimates of cost out entirely, unless it is somewhere within the realm of what you think it probably would cost, because I think when a midwestern Congressman or an eastern Congressman, who is inclined to oppose irrigation development anyway, would see some of those estimates of costs in relation particularly to some of those projects in the Upper Basin at a cost of $300 an acre where the annual crop return probably would not exceed $10, $20, or $30 an acre, would be immediately prejudiced against irrigation and development of the West.

But, accepting, as I think we must, that the Bureau is under a positive deadline, and that this is not our report and that they are not requesting that we adopt it or approve it or agree to be bound by it, then I think the question is for them as to whether or not it is possible to get more time for these states to consider this report, and if it is, I think it would be very much worth while; and then when the report was finally submitted, it would be of greater value in Congress and to all of these states. I don't know how much time that would take, but I would not think that it would take too much time.

I don't know whether that would be possible. If it is possible, I would say that I would recommend that that be done. If it just is not possible, why,

then we have not been of very great assistance, because we could not be under the circumstances.

All of us here representing all of these states desire in every way possible to cooperate with and support the Bureau of Reclamation. We consider the Bureau to be very essential to our development and to be the agency to which we all look, and we regret that in the time given us that we have had this report we are not able to be more helpful.

MR. WILLIAMS: That is all, Mr. Chairman.

JUDGE STONE: That concludes for Arizona?

MR. WILLIAMS: Yes, sir.

JUDGE STONE: Under the arrangement we are to hear before lunch from the Power Allottees, or the power interests, and from Nevada. We will first hear from Nevada. Mr. Smith, will you conduct that?

MR. SMITH: Chairman Stone, and Ladies and Gentlemen of the Committee of Fourteen and Sixteen, and Advisers: I express the same thought that several of the delegates here have expressed, that we have not had sufficient time to review and study this report prepared by the Bureau. I myself received it only on the eve of my departure for Denver, and such attention as I have been able to give it has just been piecemeal on the train, and such discussion as has been had here. Admittedly that is no grounds on which to pass upon a report so comprehensive, covering so much ground as this one.

So far as I have gone, it seems to be a most excellent report. It contains a great deal of compiled factual data, also more or less original work apparently on the part of the Bureau.

My thought is that if that is to go before Congress by January first, though, admittedly it will contain some errors and there will be a difference of opinion as to various features and data in the report. The danger is that it might be considered that once it goes before Congress and becomes a Senate document, it will be considered more or less an oracle, It will be the alpha and omega of everything, really, of the Colorado River, whereas it is not intended that way. At this time it is more or less preliminary in its nature. I would like to see more time given to the study of this report by the states before it is submitted, if that is possible, before it goes before Congress, so that changes may be made where they seem necessary.

With respect to Nevada, there may be some areas that were not considered by the Bureau. The report on page 7 gives the total acreage of new land as 43,100 acres. The area to be furnished with supplemental water as 4,500 acres, total 47,600 acres. We believe from our studies that there is considerably more land susceptible of development from the Colorado River in Nevada, somewhere between 50,000 and 60,000 acres. Also there were water uses that were not considered.

Assuming that 47,600 acres, taking that as the base figure, and using 5

acre feet duty, we would use 238,000 acre feet. If you take 6 acre feet duty, we would use 285,600 acre feet. Six acre feet duty may be a better figure to use in estimates of Nevada's use than 5, and has been used by the Bureau in some of the areas, notably the Las Vegas Pumping Project, where 20,000 acres is considered to have a duty of 6 acre feet.

Now, knowing that our tentative allotment, at least, is only 300,000 acre feet, you see immediately that from the Bureau's own figures just from irrigation alone our entire allotment would be practically used up.

Nevada may have been shortsighted prior to the passage of the Boulder Canyon Project Act on May 25, 1928, quite a while ago, in allowing the state to be limited to only 300,000 acre feet under the proposed tri-state compact authorized by that Act, but the Bureau of Reclamation had represented that we could not beneficially use that much for irrigation of suitable or available land, and by means of soil surveys and additional examinations made in later years it has maintained the same position.

These conclusions do not seem to sufficiently consider in the present study--I admit I have not had time enough to study it fully--there may be something there that I have over-looked--do not seem to consider the extremely important new potential water uses in addition to irrigation that existed, other than to point out on page 180 under the title "Other Economic Activities" that such uses may become important.

Perhaps some attempt should be made to evaluate this additional water use. Mr. Dutcher here has brought out that point, with which I fully agree. Mr. Rollins also brought out the point that there may be a great deal of land not now classified at all as agricultural land, that may not be agricultural land today, but tomorrow may be very much in that field, in that classification.

Nevada now uses in this respect about 15,000 acre feet per year in the manufacture of magnesium. Ultimately manufacturing, based on the use of cheap power there, may consume more than 50,000 acre feet of water, domestic and industrial uses, and not agricultural uses.

Another growing potential use, at present supplied from underground waters which may be already nearing exhaustion in the Las Vegas area, is for the irrigation of fine new home estates of from 5 to 50 acres, being built by men of wealth who are not primarily interested in the economics of agriculture. They come for the climate, and the high cost of water does not hold them back. Large tourist hotels also use much water.

These statements are made to emphasize Nevada's need to conserve every bit of Colorado River water she can now obtain. If these uncomputable uses eventually total 75,000 acre feet, our remaining 225,000 acre feet will not be enough to irrigate the 47,600 acres the Bureau now believes we have, not even at 5 acre feet per acre, which may be too low a duty, as I have said. In times of water shortage we would be very bad off.

Our position in regard to power from the Boulder Dam plant is much the same as that of California, and so it will remain until new hydro plants

are built on the lower river. When new plants are constructed Nevada may take power from them if costs of Boulder power become excessive for standby and generating facilities. Until then we are utterly dependent upon Boulder power, and if there is a shortage we must take our cut. The Californians must take Boulder power to the extent of their heavy contracts. We have some advantage, in that California must take our allotment if we do not, but that is more than evened up and offset by rigid long-term notices Nevada must give before withdrawing or relinquishing any power. The point is that we are entirely dependent on Boulder Dam power to fulfill our contracts with Nevada users for around 300,000,000 kilowatt hours per year, for which we pay Uncle Sam nearly $500,000 per year, and shortages of power there may seriously affect us.

Power and irrigation come from the available water, and regardless of arguments regarding the interpretations of the Compact, the Boulder Canyon Project Act, etc., when there is a shortage of runoff somebody must do without water. We do not think Nevada will have enough under her allotment. There will be periods of drought, and this country will be short-sighted indeed to grant to the Republic of Mexico a needlessly excessive amount. It is clearly evident now that ultimately the average amount of water will not be enough for our own needs. The Bureau's report shows this. A revised report will in all probability show more water needed than they have shown, and the time we may not have water enough for our own needs may not be so far in the future as some of you think.

I thank you.

JUDGE STONE: Are there other presentations from Nevada, Mr. Smith?

MR. SMITH: No, that is all.

JUDGE STONE: That concludes Nevada's statement.

Mr. Scattergood is going to be the ringmaster for the power outfit.

MR. SCATTERGOOD: Mr. Howard wishes to make a short statement.

JUDGE STONE: Very well.

MR. HOWARD: Mr. Chairman, I have been asked to make a statement for the Boulder power contractors. For the purpose of keeping faith with my associates I am making this statement, and in the interest of brevity I have reduced the matter to writing, and with your permission I will read it.

The report under consideration relates primarily to present and prospective uses of water for irrigation and, to a lesser degree, for municipal and domestic uses. While mention is made of power development, no detailed figures are given as to the specific sources of such power, nor the net power available for sale or for commercial uses, after application of energy to pumping in aid of the water projects mentioned.

Particularly it does not appear in the report that study has been given to the effect, upon production of power at Boulder, of proposed upstream diversions,

There is no factual discussion or data in connection with the relation of Glen Canyon or Bridge Canyon developments, and the diversion of water made possible by such dams, upon power production at Boulder.

The suggested developments upstream from Boulder are not in the report related to or integrated with the production of power at Boulder, although obviously in point of fact such relationship must ultimately be given consideration.

While under the scale of priorities set up in the Santa Fe Compact and in the Boulder Canyon Project Act power production is required to yield to certain other uses of water, nevertheless power is destined to carry a major part of the financial load. At Boulder (with the exception of a relatively small amount of revenue from storage and delivery of water for municipal and domestic use) the entire financial load is assigned to power. Certainly the Boulder power contractors who have made vast expenditures under their contracts are among the interests that should be considered.

As the development of the river progresses and specific projects are undertaken, it will be necessary to study each project in relation to existing projects and the development dependent on existing projects, to the end that to the greatest extent consistent with priorities the development of irrigation and power projects may be so integrated as to produce the best overall result.

The pending report, however, is apparently not intended to and does not offer a basis of discussion of power either as to future development or with respect to the effect upon present investments and development. For that reason the Boulder power contractors will not enter upon a discussion of details, but do not intend that failure to do so shall constitute an estoppel or prevent or limit consideration of the power situation, as the facts upon which such discussion must be based are disclosed.

Mr. Chairman, that is all that is to be presented, I think, on behalf of the power contractors.

If I may, I would like to change the subject for a moment. I take it we are about to adjourn for the noon recess.

Twenty-six years ago many of the men in this room were in uniform under orders. Today many of our sons are in the same state. When we adjourn, I move that we adjourn in honor of the men and women of 1918, many of whom did not come back, and in honor of the men who are now in the service.

VOICE: I second the motion.

JUDGE STONE: Thank you, Mr. Howard, for that most splendid suggestion, and may we carry out that suggestion. When we adjourn we will stand for a moment before we leave the room. Under the schedule we are not to adjourn, but to recess, to reconvene, as we did yesterday, at 1:30.

May we now stand and carry out the suggestion made by Mr. Howard.

(The assembly rose and stood in silence.)

(Thereupon a recess was taken until 1:30 o'clock p.m.)

Afternoon Session

CHAIRMAN STONE: The meeting will come to order, please. Are all the members of the Committee present?

GENERAL GILES: They all seem to be here, Judge.

JUDGE STONE: We have completed the presentation of the states and the Power Allottees, except for California. Who is to handle the California presentation?

MR. HEWES: Mr. Chairman, Ladies and Gentlemen of the Committee, and Guests: I wish to call on Assistant Attorney General Arvin B. Shaw, Jr, to make the California water contractors' presentation. I would like, Mr. Chairman, if Mr. Shaw does not use all of the time allotted to the water contractors, to reserve the privilege, with your consent, of making a few concluding remarks on the completion of his presentation.

MR. WALLACE: How much time would that be?

MR. HEWES: What is the status of the time now?

JUDGE STONE: I believe Nevada and the Power Contractors used only about a half hour. Is that not right?

MR. HEWES: I do not know, Mr. Chairman. I did not keep the time.

JUDGE STONE: Well, we are not going to be arbitrary about those things.

MR. SHAW: It won't be necessary. I will guarantee to you that I won't use an hour and a half.

We have a very momentous document before us, gentlemen, of course, and yet one which, I think we all understand, from the frank explanations that have been given by the Bureau, is not to be taken for something that it is not. It is apparently an inventory and not a plan of action, and must be so received.

Nevertheless, such a great and concentrated effort as has been put on this document is going to be misconstrued. Undoubtedly an effort like this is not accomplished every day or every ten years, This document may be taken by people who have not attended this meeting, and it will have very general circulation, I am sure, as more or less a Bible of the Colorado River, and as setting forth things that are immutable, even though it is apparent on its face it presents very many alternatives, and that it is not a thing frozen beyond change.

I anticipate that in the letter of transmittal, or in the foreword, the Bureau officers will probably take occasion to emphasize what they have told us

as to the nature of the document, so as to minimize that misconception which is certainly going to be indulged in by people who do not study deeply, but take such an official government publication as the last word, instead of being the first word.

We have appreciated very much, we are very much gratified at, the attitude expressed by Commissioner Page and Mr. Riter yesterday in asking for help and expressions of views and comments on correction of details, and so on. Time has not permitted any of us to do a fair job, or anything approaching a fair job in that direction. We have had this report in our hands one week, and I think Mr. Wallace is just about right in saying that it takes about three days to read it, without doing any thinking--I am not questioning Mr. Wallace's processes, but I am just talking about my own.

MR. WALLACE: I will agree with you.

MR. SHAW: So we come here unprepared to give you the kind of detailed criticism which the job deserves, which should assist, we think, in perfecting it. Unquestionably a document of this importance should be as near perfect as human effort will permit. It should not have factual inaccuracies in it. There are a few factual errors that we have noted in reading the report, most of them minor, still they should not be incorrect. I want to mention one which is decidedly major.

We will give the Bureau in writing as promptly as possible--that means within the next few days, if possible--a list of these details which we have hit upon, that is, which have hit our attention, as being flatly incorrect in fact, and we will submit also a list in writing of certain details of apparent misinterpretation of fundamental documents, such as the Compact and the Boulder Canyon Project Act, which we are bold to present, because we sense that what impresses us as a misinterpretation may largely be due to the kind of wrong inference, you might say, which arises from excessive condensation of very bulky material.

There are in a few places in the report references to the Compact or Compact provisions, and I may mention one or two which impress us as being, in an effort toward brevity, a little bit misleading. On these subjects generally we rather feel that even at the expense of a few more words it may be best, or you may find it advisable, to quote instead of characterizing or attempting to paraphrase. I feel that you may come to that conclusion, because otherwise you may, in the statement, be differing from what the Supreme Court of the United States some day decides the law is, and I hardly imagine that you would want to be preguessing the court too much.

One item which we think is major as to factual matter may or may not have attracted the attention of any of you. In a table setting out by states, I believe, the uses of water in the Lower Basin as of 1922--I can furnish the citation if you wish--there is a statement that in 1922 Mexico had under irrigation 200,000 acres. The next column states that there was additional irrigable land in Mexico amounting to 800,000 acres.

I realize that those figures have been reflected in previous government

reports, and I do not mean this discussion to be in any way unkind or as reflecting upon the authors of this document, or the prior reports.

I have in mind that in this document, at the top of page 3, you have given a specific definition of "irrigable land," which indicates that such lands must be within an established project or be reasonably probable of irrigation. Now, what may have been meant in Senate Document 142 by "irrigable land" in Mexico we do not exactly know. It was probably a general indication that there was some land in Mexico which, if everything was favorable to it, instead, as we now know, clearly being unfavorable to it, might have been irrigated.

But taking the present new and specific definition of irrigable land which you have used, we think it might be wise for you to consider eliminating or modifying the figure of 800,000, having in mind, if you please, that the 800,000 acres, if irrigable, would require 4,000,000 acre feet of water a year, which 4,000,000 acre feet, under natural flow conditions in 1922, did not exist. There was not that much water in the river available for Mexico. Second, that there were no works established to feed that 4,000,000 acre feet to the 800,000 acres, and there were works for the 200,000 acres. And finally, that Mexico could not, in point of fact, have developed, under 1922 conditions, the 800,000 acres of land.

And I may here note that at another point in the report in discussing the Mexican treaty it is said that some engineers are of the opinion that without Boulder Dam Mexico might have used up to but probably not in excess of 2,000,000 acre feet, that 2,000,000 acre feet reflecting a possible irrigation of 400,000 acres, and not a million acres.

Now, there is that inconsistency and contradiction in the text. We feel that the subject matter has enough significance that it deserves this much comment.

One general subject was brought out in very clear fashion yesterday in the discussion with representatives of the Bureau. That is that the authors of the report, as respects the Upper Basin, dealt with the period of scarcity of water supply, 1931 to 1940, and in the Lower Basin with the period of long term average, 1897 to 1943. Mr. Riter indicated, and we are very much interested in that, that there would be added to the Upper Basin division a statement or a summary using, instead of the ten-year period, the long term period. We will be very glad to have this comparable material to study, of course.

We believe in this discussion--and I won't ask the question directly now of Bureau representatives, but I will hope to be corrected if my statement is incorrect--we believe that the difference in the treatment of the two Basins in the two reports prepared in the two separate offices at Salt Lake City and at Boulder was more or less accidental, and the result of the fact that different forces of men, without the opportunity of comparing notes as they went along, were having to work under pressure to get out a heavy job in a very short time. If I am not correct in assuming that the difference between the two is as I have stated, the result of the difference in two forces of trained men who were working with a slightly different background, but if there was a material reason

for the difference in the treatment of the two divisions, we would be very much interested to know it.

We would also be very much interested, as was indicated yesterday, to see that the Lower Basin material is summarized in both fashions, the same as was indicated by Mr. Riter would be done with the Upper Basin, that is, showing the results of the water supply on the ten-year basis, 1931-1940, in addition to the showing on the long-term basis, because we believe those figures are of very high importance to us in the period in to which we are now proceeding.

One thing which has impressed us in dealing with the entire report may sound at the first impression as a quibbling over words, but I do not think, if you can bear with me for a few minutes, it really is. The word "depletion" is used throughout the report as a gage or index to what the states should be charged with, the depletion of water supply. That is not a term used in the Colorado River Compact or in any legislation with which we are familiar. Depletion may or may not equal the thing which the Colorado River Compact is based on, which is "beneficial consumptive use." It may or may not equal the provision of the California Limitation Act, which is "diversion less returns to the river." While there is an implication in the definition of depletion on page 3, qualifying the interpretation of the word as being diversions less returns to the river, it may not be so understood.

In two substantial respects in this Basin beneficial consumptive use is not the equivalent of depletion. One has been hinted at this morning. Suppose a marshy condition exists on or near the Colorado River, fed by water of the river. Suppose, that by channelization or drainage, water is salvaged and made usable from the main stream or from the tributary which it happens to be on, and is beneficially consumptively used. That water is chargeable against the Basin in question and against the state in which it is used. The use of this water may not affect the total of the stream flow at Lee Ferry or at any other point on the main stream, nevertheless the Compact charges against the user the amount of his consumptive use.

One still more definite and important, much more important, illustration exists in the Basin. The Gila and Salt Rivers rise in the mountains in Arizona and discharge into the Phoenix area amounts of water in excess of, we will say, 2,000,000 acre feet. As the report shows, those water supplies are almost completely used up in the Phoenix Area. On the theory, however, that the Gila in a state of nature is a wasting stream and in its lower reaches loses water to the sands and to the air and to plant transpiration, with the result that only, we will say, 1,300,000 acre feet, roughly, in a state of nature, would on an average reach the main stream of the Colorado, this report indicates that the depletion chargeable to Arizona would be only the 1,300,000--I mean Arizona and New Mexico, to be precise about it.

Now, that is odd. The two states have the benefit of 2,000,000 acre feet of water, and use it up. Still, on a theory which is not expressed in or in any way to be drawn from, the Compact or the Project Act, the result seems to be that in the Bureau's opinion, at least, Arizona is only chargeable and the Lower Basin is only chargeable with 1,300,000. I suggest to you it is quite possible that a court might apply the language of the Compact literally, and in

its decision say that beneficial use means beneficial use, and if it is consumptive, it is consumptive, and that is the end of it, without indulgence in engineering calculations as to what the virgin flow was or what the contribution to the main stem was, or what the depletion was; and although it is a basic thing, and although Mr. Moritz cautioned us yesterday that on account of the time factor it would be nice if we did not suggest any basic propositions to you, we feel that it is worth your giving attention to the language of the Compact, rather than developing a theory which a court may hereafter entirely correct.

Going to another subject, there is just an intimation in the report by a word or two--and I do not want to be critical of words in this statement at all, because we have not the time--but just an intimation of a theory that the Upper Basin is entitled to use water on an average of seven and one-half million acre feet a year under its apportionment under Article III (a) of the Compact. The language of Article III (a), of course, is that each Basin is apportioned seven and one-half million acre feet "per annum," which means obviously, of course, if you take it literally, each year, not an average over ten, twenty, or fifty years, not cumulative so that you may use 3,000,000 one year and 10,000,000 the next. I am not at all sure that the implication which has been mentioned is really anyone's opinion, but it may be, since it is rather basic, worth mentioning.

We come to a subject which I do not want to treat aggressively or belligerently, but very soberly and with all the earnestness at my command. At pages 41 to 44 of the report there is a very condensed statement, first, of the background for the Mexican treaty, and, second, of the terms of the treaty. Both parts of the statement are, of course, much condensed. A condensation of such vast and important subjects does sometimes lead us to implications which are not intended. But I state this to you, the subject mentioned is one of an extremely controversial nature. It is one upon which, for example, six members of this Committee of Sixteen have publicly announced their position as opposed to the treaty, and ten members have announced themselves for the treaty. With that kind of division, if you please, it is hardly to be gainsaid that there must be important and serious factors justifying, probably, the arguments which are made on both sides. I am trying to state this as impartially as I can.

There must be, if you please, some rational things which have persuaded men of serious character and standing to their positions. This treaty is a treaty, which, as the statement in the report shows, would upset the existing law of the United States, since Section 1 of the Project Act says that the benefits of flood waters--I am paraphrasing now--to be conserved by Boulder Dam shall be used "exclusively within the United States." That is the law today. We don't know whether it will continue to be the law forever, but that is the law which binds the United States as well as the states today. It may be that this treaty will be ratified by the Senate and it may be that it will not, and both possibilities are undoubtedly in the minds of the authors of this report and of the officers of the Department.

It seems to be wholly unnecessary to use in this report any statement referring to the Mexican treaty, for this reason, that in the first place the document is an inventory of projects within the United States, and is limited

to that, as is evidenced by the fact that the Mexican allowance which is one and one-half million acre feet, plus whatever more that allowance may be, is not carried into the final computations in this report at all. It is apparently a sort of a fifth wheel and does not affect the results arrived at by the Bureau in its summaries.

That being true, I will make a suggestion in a moment as to what might be done. We feel, gentlemen, very seriously that it is unfair and is out of line for this Department, which is not charged with responsibility for the Mexican treaty, to embody in an official government report material which may appear to the reader to be an argument for or against the adoption of the treaty. It is the business of the State Department to formulate and support such treaties as it sees fit. This Department's duties are to carry out the mandate of Congress from year to year as Congress lays it down. At present the mandate of Congress is clear. We think it is unfair to state in such a document as this such things as the statements appearing at the bottom of page 42, as to what many people fear and as to what is the opinion of some engineers, without naming them. It may be said that many more people do not fear than fear. If you want to count people you are at liberty to do so.

It may be said that there are engineers as fully qualified as those referred to who are not of the opinion expressed in the report. I suggest to you, therefore, that if any such statements should be made it would be at least fair to say that there are as many people or twice as many people who do not fear as those who fear, and that as many engineers are not of the opinion as those who are of the opinion. But I doubt very much if that kind of statement is worth anything to anybody, I mean such a balanced statement, because it does not lead to anything.

In the same paragraph of which I was speaking, some engineers are stated as being of the opinion that Mexico could have used, without Boulder Dam, 2,000,000 acre feet. There is no disclosure that they could not have used it without diversion from the United States side of the line; could not have used it without flood control which they did not have; that they were using all the land they had which was protected from floods. There is no statement that a water supply did not exist to provide the 2,000,000 acre feet. And going on from that, there is the further statement that it is probably possible--whatever that means--probably possible that under the conditions with Boulder Dam controlling the river Mexico might increase her use to 5,000,000 acre feet. That is not in accord with the opinions of the engineers upon whom we, with some justice, rely.

It is in our opinion a false quantity, in that the statute of the United States protects us against any such right being acquired as is intimated. I suggest to you that in view of the possibility that this treaty may not be ratified by the United States Senate, it is perhaps well that government agencies should not aid the Mexican negotiators of the next treaty, if there should happen to be one, with arguments which support their side of the case.

That is a thing which has not been done in the past. It is a thing on which Dr. Mead expressed himself during his life time. In his massive report in the treaty negotiations of 1930 there is positively and plainly set out the limit of Mexican use which he and other able men at that time believed was then

the condition.

We believe, and we very respectfully suggest to you that the whole statement with respect to the Mexican treaty is not only unnecessary but does not advance the purpose for which the report is made, that is, to inform Congress at this time as to what the possible pattern of development in the Basin may be.

For that reason we very respectfully ask that you reflect upon this subject and consider whether the section or the division stating the background of the Mexican treaty and its terms may not be eliminated without doing damage. It is a highly speculative thing at best, and we feel that if you would come to the conclusion to eliminate that chapter, it would eliminate some phases of friction that need not be cultivated.

I come to comment on--I might say to correct, two statements which were put in the record this morning by the able spokesmen from Colorado, as to matters we feel have been misapprehended by them. It is only because they are important that we feel they should be corrected.

First, the one very vigorously made by Mr. Tipton to the effect that the Lower Basin had no right to,--that it was wrong for the Bureau to include in the statement of possible uses in the Lower Basin, more than 8,500,000 acre feet. If I remember his statement correctly, it was to the effect that no use of surplus beyond 16,000,000 acre feet could be lawfully made in the United States until October 1, 1963, and only then when the states have by supplemental compact so agreed. I do not think Mr. Tipton fully considered the statement or meant it to be taken as literally as it was made, because that statement obviously means whatever surplus there is over 16,000,000 acre feet has got to go to Mexico until October 1, 1963. I refer you to a contrary opinion, contemporaneous with the execution of the Compact, expressed within sixty days after the Compact was signed, as contained in the Hoover-Hayden questions and answers in the Congressional Record, which you are all familiar with. This controverts Mr. Tipton's theory, which was not, in our view, the intent of the Compact. It was the intent of the Compact, as Mr. Hoover stated to Congressman Hayden, that there should be no impediment upon anyone's using in the United States what water was needed within or without the apportionments, or within or without the 16,000,000, and there was no intent to force into Mexico's hands the surplus beyond 16,000,000. But that is not all of it.

We respect the Colorado River Compact as a part of the law of the river, but it is not all of the law of the river. The Boulder Canyon Project Act is another important part, and it contains a provision requiring California to adopt, in consideration of the passage of the Project Act, a certain suggested act limiting California's use of water to 4,400,000 acre feet of water, plus one-half of the excess or surplus unapportioned by the Compact.

Now, that is the law. California did adopt the act, specifically in consideration of the Project Act. As we have stated to you before, we consider that that results in a compact between the United States and the State of California, evidenced by these two statutes. The Limitation Act was adopted,

and all of the Upper States and the Lower States, other than California, knew of it and I say approved of it, because the State of Utah shortly thereafter, knowing of these facts, was the sixth state to ratify the six-state compact, and the other states, the other four, which had previously in 1925 adopted resolutions approving the six-state compact, had six months after the adoption of the Project Act on December 21, 1928, to disaffirm, if they so chose, under the conditions prescribed by the Project Act. But they did not do so, and in June, 1929, the President declared the Project Act effective.

I suggest to you gentlemen, so far as California is concerned,--I am only speaking for California--it is too late in the day for you to say that California is not entitled to one-half of the surplus. I suspect very strongly that if the matter were considered sufficiently important by the other Lower Basin States they would affirm that the provisions of the second paragraph of Section 4 (a) of the Project Act, referring to the proposed Tri-State Compact, constituted a similar estoppel against the Upper Basin States. But I do not speak for them, of course.

We stand squarely on the proposition that the Bureau is correct in assuming that the Lower Basin States, which are the only ones at present likely to go into surplus, are entitled to go into surplus, and that the consideration of that surplus as part of their water supply is justified. We feel that the Bureau has correctly and clearly analyzed that situation. It could only be otherwise, if you please, on the assumption that, as Mr. Tipton said to you, until October 1, 1963 that water must go to Mexico. I do not believe you will accept that theory.

A second statement was made this morning regarding which I am less positive. I refer to the statement of Mr. Patterson, which, if I understand it correctly, was that, at least he intimated that, the Upper Basin should not be chargeable with reservoir evaporation loss. Now, I may have misunderstood Mr. Patterson's statement. It may have contained some refined qualification that I did not understand. If, however, that was his intent, it should be corrected.

Ever since the first negotiations on the Compact took place, I believe, reservoir losses in the Upper Basin have universally and uniformly been treated as a part of consumptive use, just as reservoir losses, I think, in every jurisdiction are considered a part of the consumptive use of the project to which they are attached.

So we feel that the Bureau has beyond question followed the accurate line in charging the Upper Basin with such reservoir loss as occurs from evaporation or otherwise.

Now, I said I was a little hesitant about making this statement as to what Mr. Patterson presented to you, because I understood some reference to come into that statement with respect to some natural losses, which might be absorbed in a way which might magnify or which might offset evaporation losses. If I am wrong, then please disregard this statement.

We have, in the very hurried time in which we have approached this matter --may I say that we have worked on it diligently--within the very few days we have had this report, we have obtained certain general reactions which I have tried to present to you in part. We have not gotten to the point where we can say that we understand the report. There is too vast an amount of detail to correlate and get in our heads in the time there has been, and much as others have expressed themselves here today, we cannot either exhaustively or accurately treat the subject.

Some things have occurred to us which might be done to this report by way of very brief amplification, and I will make the requests in order, if you please. They may or may not directly relate to modification of the report.

First, we were very much disturbed in reading the paragraph on page 53, which relates to the acquisition of salt by Green River, in its lower stretches. The description of that condition is not, of course in sufficient detail so that the scope of it can be understood very well. But we are sufficiently disturbed to ask that the Bureau, not necessarily in connection with this report, but in such time as may be available in the future, direct its studies toward the effect of that and other saline conditions in the Upper Basin which may affect the water supply for the Lower Basin.

As you know, we are at the bottom of the river, subject to all the uses of the Upper Basin, and we feel that such study as you may be able to give the subject will be justified in allowing the states of the Lower Basin to understand what conditions we will be confronted with in the future and to what extent we should go to a tremendous expense in order to build works for the use of that water.

A MEMBER: What page is that?

MR. SHAW: Page 53. The next point, we observe that there are overlapping alternative projects reported on throughout the Basin. The only projects reported on in California are the 16,000 acre Palo Verde Mesa Project and the San Diego Municipal Project. There has been under consideration by the Bureau the Chucawalla Project lying between Blythe and Indio, comprising 160,000 acres, I believe. We feel that the project should be at least mentioned in the report with enough description to characterize it, and that if that project is by reason of excessive cost or a deficient water supply, or one which cannot be expected, within the present views of the Bureau, to be constructed, that it may be so mentioned and kept out of the summaries, as was done in the case of the Colorado Great Basin Project and the project near Cisco, Utah. But we do not, if you please, like a fairly substantial sized project to be omitted, and have to say to our people, "Well, we don't know why the Bureau, which has had this project before it for many years in one way or another, does not choose now to name it."

We ask that the third table on page 242 be slightly explained by a footnote. That is the table headed "Potential Developments in Boulder Division by States." It shows Arizona, new land 10,000 acres. This, by the way, is the concluding schedule in the Boulder Division of the report. Arizona, 10,000

acres of new land, no supplemental water, total 10,000, estimated construction cost, $522,500,000; the next item, California, 16,000 acres new land, no supplemental water, total 16,000, estimated construction cost, $28,400,000.

Now, we know from a comparison with other parts of the report that the California estimated construction cost is supposed to cover $3,000,000 for the Palo Verde Mesa Project, and $25,000,000 for the San Diego Project. However, the use of the 16,000 acre figure in this schedule may attract the attention of some eastern Congressman, who will say to himself, "What on earth is the Bureau presenting to us?" It can be, of course, explained in a two-line footnote so that you won't be prejudiced to that extent.

I asked at the opening of this discussion that there be added to the report, as to the Lower Basin, the computation of the water supply under the 1931-1940 conditions, and we trust you will find that a reasonable request.

I have been asked also by several engineers to suggest that you consider the publication as an appendix of all the supporting hydrologic data, on the major stream systems at least, involved in the report, because this report when printed will for a good many years be referred to by engineers, who would like to have, I am sure, the detail which will enable them to comprehend just what the estimates are based on, and how they can properly be interpreted and applied.

Only one more thought, if you please; At the Reno meeting Mr. Riter told us--and I am speaking now from having recently read the transcript--that the Bureau intended, expected or some such expression, to discuss with each of the states the section or portion of the report applying to that state. Now, we have not been consulted. We gather that none of the other states have been consulted, and we quite understand that the time factor has not permitted it, and we do not feel at all hurt. We would very much appreciate it, however, if at the time we furnish you the written statements that we have mentioned, or even before, we might have an opportunity for conference with the officers of the Bureau who have this matter in charge, so that we may get our feet squarely on the ground toward understanding the subject matter and so that we may express in a more detailed fashion than is possible today some thoughts which you may be willing to accept in the way of improving the report. If in the next couple of days there should happen to be any time available, we will be very grateful for the opportunity of sitting down and talking the matter over.

We feel that the Bureau--and this is one thing which has been said many times today--the Bureau has done a magnificent job, a very heavy job in a short space of time, which indicates that sometimes we do our best work under pressure. We feel that the defects of the report are minor, in the main, as compared with the very great and massive accumulation of information contained in it.

(Thereupon a short recess was taken.)

JUDGE STONE: The meeting will come to order, please.

In order to expedite some of the details before we proceed further with

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(Thereupon a short recess was taken.)

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In order to expedite some of the details before we proceed further with

the discussion of the report, details which must be taken care of before the Committee of Sixteen adjourns, we have here the financial statement for the past year. The Chair will appoint a committee to go over it so that when we reach this there will not be that delay. If there is no objection on the part of the Committee, I wish to appoint General Giles, Mr. Fred Wilson, and Mr. Shaw.

There is one explanation. There is an item of $20.00 for mimeographing financial statement, which should not be included, and that should be deducted from the items of expenditures. I will ask the committee to keep that in mind, and I will hand to the members of that committee copies, so that we will save time. I am not taking it up now. I am giving it to you so that you can be going over it. I will just pass a copy out to all the members of the Committee. That item of $20.00 should not be included. It is charged in favor of Colorado, and it should not be included. Have all the members of the Committee a copy?

Mr. Hewes requested after Mr. Shaw got through with California, that the power group, I believe, be given further time, if desired. Was that not your request?

MR. HEWES: Mr. Chairman, I think the Power Allottees have completed their presentation, and I just wish to make a few remarks in closing.

I wish to express California's appreciation for the opportunity and the courtesy and consideration that was given to her in presenting her case. I wish also to emphasize that I do not believe it is possible for anyone to listen in on the sessions here the last day and a half without being additionally impressed with the many complexities and complications in the economic development of the Colorado River Basin. Certainly we must realize, more so than ever before, the necessity for cool, deliberate, intensive studies and analyses of how we are going to use these great natural resources before arriving at decisions and conclusions as to disposing of them.

To our friends in the Bureau of Reclamation and the authors of this document I wish to ask that they accept California's friendly suggestions and criticisms, as asked for by them, in the spirit that they have been given.

Thank you again for your tolerance and courtesy, Mr. Chairman and Ladies and Gentlemen.

JUDGE STONE: Except for details which will be taken up immediately preceding the close of the meeting, the balance of the time, such time as needed, will be devoted to a further general discussion, in order, if possible to arrive at some definite action or statement or position by the Committee of Sixteen. Whether that will be attained or not I do not know. We will find out, then. Whether that will be attained or not I do not know. We will find out.

You must also keep in mind that we must afford to the Bureau of Reclamation sufficient time, after it has had the benefit of any further discussion it may occur, to make such comments as Mr. Warne or his associates may care to make with respect to any recommendations or comments which have been made

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during the past two days by the representatives of the states, and we will afford ample time for that, Mr. Warne, if it seems necessary.

MR. WARNE: Thank you.

JUDGE STONE: And I believe you would prefer that that be reserved until we conclude further discussion and before any action is taken.

MR. WARNE: Yes, sir, at the close of your discussion or thereabouts.

JUDGE STONE: And before any action is taken.

MR. WARNE: Yes, sir.

JUDGE STONE: Very well.

JUDGE STONE: Now, we should pursue further discussion as expeditiously as possible and I hope without unnecessary controversy. The whole effort of this Committee has been to avoid it, but on the other hand, we have found that it has been healthy for representatives of the interested groups to clearly and plainly state their positions, and that has been evidenced this morning and this afternoon.

Before we do conclude this discussion, the Chair has a brief statement which he wishes to make, and I will reserve that until after we hear the other discussion.

In order to save time, I believe we had better proceed on the basis, unless there is an objection to it, of having anyone wishing to discuss it, to have him announced by a member of the Committee from his state. So if you have anything to discuss you should get in touch with or communicate that to a member of the Committee. I am doing that because there are nearly one hundred people here, and if we just throw it wide open, we may get into endless discussion.

I will now start with the states, and ask if there is further discussion on the part of Arizona.

MRS. BUSH: Not any.

JUDGE STONE: Nothing on the part of Arizona?

MRS. BUSH: No.

JUDGE STONE: California?

MR. HEWES: California passes, Mr. Chairman.

JUDGE STONE: The next state is Colorado. I will ask Mr. Delaney to call on anyone who wishes to speak.

MR. DELANEY: I understand Mr. Tipton has some further remarks to make, Mr. Chairman. Mr. Tipton.

MR. TIPTON: Mr. Chairman, Gentlemen, and Mrs. Bush: My remarks will be very brief. As usual, I can agree with a good deal of what my good friend, Mr. Shaw, says, but not all of it, and these remarks will be directed squarely at the subject matter, suggestions to the Bureau.

Mr. Shaw spent some time discussing the section of the report which had to deal with the Mexican treaty. I think that several points Mr. Shaw brought out require serious consideration.

I do not believe that the presentation in the report should be in any way unfair. As Mr. Shaw stated, if there is a discussion of the treaty, I think certainly it should show that there are two sides to the question as far as the United States interests are concerned.

And then I want to make this statement: Everybody in this room, I think, has the same objective in so far as the Mexican situation is concerned, and that is to hold any allocation to Mexico of waters of the Colorado River down to the lowest possible quantity. I think the only difference in the interests is in the appraisal of the situation. One group appraises the situation one way and another group appraises the situation another way, and it leads to a difference of opinion as to whether the pending treaty does apportion to Mexico the lowest amount of water possible.

Now, since we do have this common objective, I agree with Mr. Shaw that it would be unwise and rather dangerous to have in a published report anything that could be used by Mexico for ammunition in the future if this treaty fails of ratification. The treaty may fail of ratification. If this report comes out as a Senate document or a House report it becomes permanent, and we do not want anything in that that Mexico could use in the future to her advantage, some statement by a federal agency of the United States.

I do not know how that can be handled. I do not agree entirely with Mr. Shaw that the entire situation on the pending treaty should be eliminated. If it is eliminated, I would strongly urge that it be incumbent upon the Bureau to mention that the Colorado River Compact and the Boulder Canyon Project Act recognize that a treaty may be negotiated with Mexico apportioning water to her, and the Compact sets up a certain class of water for that purpose. Not only does it do that, but it states that if that is not sufficient, the deficiency must come out of the 16,000,000 acre feet apportioned by Articles III (a) and (b) of the Compact.

So the Bureau is attempting to paint a picture here, and in doing that it must consider the available water supplies, and in considering the available water supplies it must recognize that there may be some allocation of water to Mexico; it must recognize that the states themselves have agreed to that by Compact, agreed to an allocation, agreed that if there is an allocation that a certain kind of water be used for that purpose, it even might take all the surplus and cut down into the 16,000,000 acre feet. So the Bureau would be very remiss in its duty if it does not bring those matters clearly out in the event that this chapter on the pending treaty is eliminated. I think it would be well to bring that out anyway.

I will not say anything about the question of surplus, I think that has been covered by someone else.

I want to endorse what Mr. Shaw has said about the data included in the report which is quite helpful. I want to endorse what he said about the water supply available to the Lower Basin in the ten-year period. Repeating what I said yesterday, it should not be based upon just the average of the stream flow as of that time, but should take into consideration, of course, whatever water there is available from reservoirs, stored waters from flush years, the same way you treated the delivery at Lee Ferry.

I feel it would be helpful and only fair that the Bureau discuss a little more the quality of the water. I agree with Mr. Shaw on that. I don't know whether the Bureau is in a position to do that under the existing data. It is only fair to the Lower Basin that that should be done. It is not so much of a problem in the Upper Basin. It might be in some sections. In sections where it is or might be a problem that should be pointed out.

I want to clear up one thing, Mr. Shaw, Mr. Patterson's suggestion about reservoir evaporation. I think you probably did misinterpret that. The Upper Basin assumes, and interprets the Compact in such a way that reservoir evaporation shall be charged against its allocation. Mr. Patterson's point was that only new losses on the river occasioned by reservoirs should be charged; in other words, natural losses that had already taken place should not be charged to evaporation, but that there should be deducted whatever loss formerly took place in the Basin from transpiration and water loss in the stream.

That is about all I have to say. I could say something about California's claimed surplus, but I think somebody else can do that.

MR. DELANEY: I wish to call on Jean S. Breitenstein, the attorney for the Colorado Water Conservation Board.

MR. BREITENSTEIN: Mr. Chairman and Ladies and Gentlemen: I have just two things I want to mention. They both arise from Mr. Shaw's presentation. In saying what I have to say I realize this is not the place to make any legal arguments whatsoever.

The first has to do with Mr. Shaw's statement that the figure of 7,500,000 acre feet as used in III (a) of the Compact is an annual figure and not an average figure. Of course, Mr. Shaw and all the rest of you realize that the same language applies to the Upper Basin as applies to the Lower Basin. If 7,500,000 acre feet is an annual figure for the Upper Basin, it is likewise an annual figure for the Lower Basin, not an average figure. Also the same language is used in paragraph III (b) of the Compact with reference to the allocation of an additional 1,000,000 acre feet to the Lower Basin. There again the language is the same, and if the Upper Basin is to be treated as entitled to seven and one-half million acre feet on an annual basis, the whole eight and one-half million acre feet to the Lower Basin is on an annual basis.

The other thing I wish to mention has to do with surplus. Mr. Shaw was critical of Mr. Tipton's presentation this morning when he criticized the method

which was followed by the Bureau in the treatment of the water supply in the Lower Basin. He stated, as I understood it, that California, at least, of the Lower Basin, took the position that under the Boulder Canyon Project Act and under its contracts it was entitled to at least half the surplus. I merely wish to direct your attention to some of the other language in the Project Act, Section 4, the one which mentions the limitation upon California. The first paragraph winds up this way, after referring to the 4,400,000 acre feet, "plus not more than one-half of any excess or surplus water unapportioned by said Compact, such uses always to be subject to the terms of said Compact." And then again I believe it is Section 8 of the Project Act that refers to the Colorado River Compact generally, and it has this language, after referring to the united States, its permittees, licensees, contracts and uses, requiring the observation of the Colorado River Compact, and then it says, "Nothing in this Act to the contrary notwithstanding," therefore the Compact must be complied with, anything in the Act to the contrary notwithstanding.

Now, we all know that under III (f) of the Compact the surplus is not subject to apportionment until 1963, and then only if one of the Basins has attained full use of its water. The point, as I understand from Mr. Tipton's statement this morning, is that California and the Lower Basin do not have any firm right, under any provisions of the Compact, to that water, which is not subject to apportionment between the states before 1963. If it is subject to apportionment, no state and no individual or group of individuals within a state can claim or assert a firm right to that water.

MR. DELANEY: That is all for Colorado, as far as I know.

JUDGE STONE: Nevada. Mr. Smith.

MR. SMITH: No further statement from Nevada.

JUDGE STONE: New Mexico.

MR. WILSON: Mr. Chairman, I notice some of the states have intimated that they are going to file with the Bureau of Reclamation written statements sometime within the next few days. If that is done--perhaps some of the states do not intend to do that--I wonder if they would send copies to the Chairman, so that the other states may have copies of whatever each state submits. Is that agreeable, Mr. Shaw?

MR. SHAW: Certainly.

MR. WILSON: I believe I have nothing further on behalf of New Mexico, except I would like to take advantage of the opportunity to compliment Mr. Shaw on the very fair manner in which he presented California's case, and I am sure his remarks were directed to the Bureau. It will be up to the Bureau to weigh these suggestions and comply with them or not comply with them, as the Bureau feels best.

Insofar as the controversial matter with reference to the treaty is concerned, I feel sure the Bureau will and should give careful consideration to

the suggestions made by Mr. Shaw and Mr. Tipton.

Now, may I say in closing, it is obvious that some reference will have to be made to the treaty and the obligations to the United States and to Mexico. So offhand I make a suggestion, and may I say facetiously that this suggestion might be handed to you for what it is worth, that you might set up the Compact or the provisions of the Compact or the treaty or the Boulder Canyon Project Act, and then copy the custom of the radio stations and put in a footnote and say something like this: that any expressions of opinion as to any interpretation of the Compact or the Boulder Canyon Project Act in reference to the treaty are purely co-incidental and do not reflect the opinion of the Bureau. (Laughter.)

JUDGE STONE: Utah.

GENERAL GILES: Mr. Chairman, in looking over what the Bureau has said about dividing the water with reference to the treaty between the United States and Mexico, or the proposed treaty, it seems to me that they are almost compelled at least to say this; "Irrigation has now been developed to such an extent that all interested people should know with reasonable certainty the ultimate limit and respective rights to divert and use water of the river in order that existing developments may be made secure and sound plans may be formulated for the utilization of additional water of the river." I cannot see anything wrong with that paragraph. The only paragraph I see anything wrong with, which may be interpreted as proof that the Bureau has taken a definite stand on this matter, is that last paragraph on page 42; and I believe Mr. Shaw would concede that there is nothing else on that page, except that paragraph, that could jeopardize the Lower Basin or the Upper Basin, or anyone else interested in this matter.

VOICE: What is the last paragraph?

GENERAL GILES: "There is pressure for an international agreement because many people fear that time now runs against the interest of the Basin States."

Do you want me to read it all?

VOICE: Yes.

GENERAL GILES: "It is reported that Mexico has over 1,000,000 acres of land which could be irrigated with water from the River. If this land were fully developed about 5,000,000 acre-feet of water could be diverted annually from the River. Mexico has been rapidly increasing her use of the water of the River. In 1943 she diverted in excess of 1,800,000 acre feet. Prior to the regulation of the River by Boulder Dam, Mexico had used approximately 750,000 acre feet of water a year on her lands. Some engineers are of the opinion that without regulation of Boulder Dam, Mexico's use could possibly have approached but very probably could not have exceeded 2,000,000 acre feet of water annually. With the River regulated by Boulder Dam it is probably possible for Mexico to increase her use to approximately 5,000,000 acre feet annually."

Then it goes on with the provisions from the treaty itself. I do not know, Mr. Shaw, I think that the comments in this report are all right except for that paragraph, if we are going to make any decision on that question.

JUDGE STONE: Any further statement from Utah?

MR. WALLACE: The only statement I would care to make is that the Compact is the law of the river and the Compact and the provisions thereof cannot be changed without the consent of the State of Utah.

JUDGE STONE: Any further statement from Utah? If not, we come now to Wyoming. Mr. Bishop.

MR. BISHOP: Mr. Rollins would like to say a word.

MR. ROLLINS: I don't care to say anything particularly. However, reference was made to the condition of the water when it reaches California. I wanted to say for Mr. Shaw's benefit and others that when it left Wyoming it started out just as clean and white and pure as possible, and we are not going to be responsible for what happens to it as it goes through the other states. (Laughter.) I think that is about all.

JUDGE STONE: I trust that the Chairman may be excused for taking just a few moments to comment upon the procedure principally with respect to this report and what may be the procedure hereafter. I take it that the Bureau will desire some further expression from the Committee, and I also assume that the Committee would not wish to take any definite action or suggestions in that respect until we hear some further remarks on the part of Mr. Warne and his associates.

There are, however, some broad, over-all matters involved in this consideration, which I feel have either not been mentioned or in some cases, perhaps, not fully enough expressed.

First, I should like to emphasize the long and involved history of the Colorado River. Someone has remarked that the Colorado River is peculiar in that it lies wholly in an arid region, and that we do not have on the Colorado River, perhaps, the involved and complicated problems of such rivers as the Missouri, that river flowing through arid and semi-arid regions and a humid region and where there are conflicts between uses of water. That in a sense may be true. In another sense, those who have been engaged in attempting to settle the Colorado River water problems over the many years may realize that perhaps there are more involved and more complicated problems in the Colorado River Basin.

In the first place, we have been fortunate in that we have had a compact, even though we began to see signs and have seen signs for some time of a difference in the interpretation, and yet we have, as the Legislature and Congress have sometimes established, a law of the river.

It seems to me that we cannot overlook one outstanding matter which is not peculiar to the Colorado River but is peculiar to the whole West. There is

nothing which comes so closely to the people of the West as anything which has to do with the utilization of the water resources. When we get into a state we find that there are often intrastate problems which are difficult. Therefore, that is the great reason why meetings of this kind should be held with these interests, and these situations should be fully reviewed and considered by the Bureau of Reclamation and any other agency, not that the states wish to be unduly obstreperous or unduly concerned over their rights, but in my judgment in the interests also of the Bureau of Reclamation, because, after all, the Bureau of Reclamation is the agency that serves the West, and the welfare of that agency is very closely related to the welfare and the interests of the states.

And so when we consider what should be done with respect to this report, we must keep in mind what we do here and should not do here have not only a bearing upon the states, but in my judgment, upon the welfare and the progress that the Bureau of Reclamation may be able to make in the future.

There have been expressions made here today with respect to delay that may in the minds of the Bureau sound a rather sour note, namely, that we have said we have not had time to adequately study this report, and that we can neither agree with it nor disagree with it. It might then be concluded that we are, gentlemen, willing to listen to your report. We have our own ideas. We are not going to tell you whether we agree to it, and we are not going to tell you whether we disagree. That flat impression, of course, has been overcome in a measure by the definite suggestions made on the part of some of the states.

Now, that brings me to one other overall consideration of the matter of overall policy. It seems to me the states have been clamoring for a long time that when project developments are undertaken, either in the investigational stage or farther along, the states' rights and interests be considered by the interested federal agency. We cannot sustain that position, if when we are given an opportunity to offer our comments we do not proceed in a constructive manner. It seems to me that if the states do not take a constructive, helpful attitude the time may well come when the existing federal agencies will find out it is quite impossible to make progress, and the only solution is the creation of a dictatorship on these river basins, and thus far we have said that we are opposed to that sort of thing. We like too well and we believe too much in the existing federal agencies.

However, there runs a corollary to that proposition. The corollary is that even though we may seem sometimes to unduly ask for a delay, to be too vociferous in expressing our views, there is a very definite obligation on the part of the federal agency to afford the interests directly affected an ample and full opportunity to be prepared to express any views of a few groups in a state and all the interested groups in a state, and when a state attempts to do that it takes time.

I do not wish to review the situation in the State of Colorado, but I do know that it is the policy of the State Water Board, of which I am the Director, to be mindful of all of the interests within the State of Colorado. We cannot act wisely or constructively unless there is afforded an ample opportunity to go into these matters, and to understand these reports and the procedure which

is ahead of us.

I just make that statement to come to the final conclusion, that in connection with this we should mention the functions of this Committee. This Committee has been functioning since 1937. We have had our days when we were all, perhaps, together and agreed very decidedly. We have had other times when we have disagreed, and I think it should be said that when we have disagreed it has been an honest disagreement, and that such disagreement has not occurred until ample effort was made to work out those disagreements.

When this Committee started out we had in mind the provisions of the Project Act providing for a plan of comprehensive development, as we viewed it. Then we thought that as this plan went along an opportunity would be afforded to discuss and consider proposed project development, and in that way prevent a lopsided, inequitable or unfair development so far as the relative interests of the states were concerned.

In recent times, however, there has arisen the policy, apparently, of developing basin-wide reports and as far as possible comprehensive basin plans of development. Anyone will agree, I am sure, that we should cut the pattern and attempt to reach a time when a comprehensive plan of development may be realized, but that cannot be done without a full understanding, not only of the national interests, but also of the state interests and the interests within the states, and that is no small job. It is particularly involved in the Colorado River Basin, and just as fully involved within some of the individual states, perhaps all of them.

So it seems that upon this policy of developing a report for the entire Basin the Bureau has come here and presented one. As someone said, we have asked for it. It is what we have stated in the past was ultimately needed. We did not know when it could be accomplished.

The question before this Committee, it seems to me, is primarily this: Is this the type of report which will adequately protect the interests among the various states, the interests within the states, and is it the type of report which will expedite development? We all desire that development. This report has been variously described by the Bureau itself and it has been variously interpreted by some of the representatives of the states. It has been referred to as a tentative plan of comprehensive development. It has been referred to as a pattern of development. It has been referred to as nothing more than an inventory of projects. Now, I profess that the Bureau had a very difficult matter to consider when it decided upon what type of report should be gotten out.

I can see two possible plans; first, that it should be only an appraisal of the water resources within the Basin, including present uses and what is available for future use, and that in connection with that it would include an inventory of possible development; and that the purpose of such a report would be to indicate to Congress, to the Budget Bureau, and to all interested federal agencies the desire and the need for expediting the completion of investigations and obtaining the money for the construction of projects found to be feasible. That sort of procedure would be clear and would not be difficult. However, I

presume that in determining the nature of this report some had in mind a plan and a pattern of future development and the framework of the resources for future development.

Now, it is quite unnecessary for me to again reflect our high regard for the splendid job the Bureau has done in the short period of time. I do not question that in the least. But it seems to me that neither objective has been attained. It is neither a mere inventory of projects, together with an appraisal of the water supply and the present uses of the water, nor is it a complete nor can it be a complete pattern or plan of comprehensive development.

However, as evidenced by the remarks here made on the part of Mr. Tipton and Mr. Shaw and those from other states, there are involved in this report unmistakable principles and questions of a framework of future development, and there are serious implications and questions as to that framework. If that is true, then, it seems that not only would it be inadvisable for the Bureau, but it would be inadvisable for the states to proceed with encouraging a hasty completion of this report to Congress in January, 1945. I know, I think we know, how things proceed in Washington. If such a report is made, and if major questions of future ultimate development are not fully understood and in a substantial way agreed to rather implicitly in such a report, then when it comes before Senatorial or Congressional committees we are apt to find from one state or another disagreements with that report, indicating that it is something that the Congress could not safely proceed with.

Now, we want a report which can be a basis upon which we can proceed, and proceed expeditiously. It seems that if this report could be an appraisal of the water resources, a statement of the present development and an indication of the great need for future development, and if then periodically we could revise and change or develop it gradually, may I put it, into a plan of development, we would be proceeding in a way which is in keeping with the problems and questions which we can work out today.

Mr. Page or someone has said to us, "Do not indicate to us an entire change in policy in the form of this report, because we do not have enough time to do it." I am violating that injunction, but I am trying to do it in order to be helpful.

Now, there is one other thing which I think should be mentioned. We all of us know that in a large part of the Colorado River Basin States we have attained practically the limit of development under private financing, and that any extensive development in the future must be through some form of federal financing. We further know that on the basis of these figures that are presented in this report and on the present basis of the 1939 Reclamation Act and on the basis of the present policy in Congress, so far as we know it, most of what is in this report, or a large portion, at least, of what is in it--and it is true of my own state--could not be built, because it could not stand up under the present policy of justification. We have no evidence yet that that policy is to be changed by Congress. It is quite apparent that if we are to proceed in the West as we hope to and develop many millions of acres of new land and create new farms and new homes, there must be some change in policy. This report is

written upon the basis of the present policy, and I think we all know that even our present policy, sound as it is, is not fully subscribed to by Eastern interests, and this report with the figures of the large costs and the estimates based upon present unit costs, etc., may well result in deterring rather than influencing increased reclamation development in the Colorado River Basin.

All of the wealth of these states, new wealth, has got to come from a natural resource, and that resource is the water in the Colorado River. There is a tremendous problem here when it comes to cutting the cloth, cutting the pattern of future resource development.

The fact that the Bureau has gotten into it is clearly indicated by the matters of somewhat controversial nature discussed here this afternoon. I feel that we should be as helpful as possible, but I do not think that the states have had the time nor the opportunity to fully understand and analyze this report, to be as helpful as we should be. I further feel that if adequate time were allowed, or if the type of this report could be changed, that it would put the Bureau and the Reclamation program in the Colorado River Basin on a much sounder basis.

I am making these statements as an overall proposition, with the idea of thinking out loud in an effort to suggest that we want to be as helpful as we can, but I sincerely believe that we ought to allow--I am not thinking in terms of years, I am thinking in terms of months, possibly, but I believe that further time must be allowed if we are to be helpful and if we are to accomplish the purpose which is intended by this report.

This report should not be a matter of expediency in getting money. Badly as we need appropriations, we should not get ourselves into a bad situation in the future, and we should not amplify and increase controversies in the states merely because we want to get money for a project. There are other considerations which are basic and more important, realizing as we do that the best protection of water is the utilization of it.

I probably have made my statement too long.

MR. HEWES: May I have the privilege of the floor for a few minutes for Mr. Howard?

MR. HOWARD: Mr. Chairman, I fully agree with Mr. Breitenstein that this is not a forum in which to discuss purely legal matters. The time will probably come when we will have to settle some of these basic differences of opinion. We could argue all night and not get anywhere.

However, inasmuch as the record here shows in outline form, at least, the theory upon which the Upper Basin group has applied what is called the law of the river, it seems to me appropriate that in similar sketchy and outline form the theory presented by the California interests should appear in the same volume, and with your indulgence I will attempt to outline it as briefly as may be.

It has been stated that the Colorado River Compact is the law of the river. With that we can agree.

There is, however, another compact brought about by reciprocal legislation between the United States and the State of California. That compact has been fairly consistently ignored and not in any way recognized in discussions that have been had with respect to the river.

It is, I think, a well recognized principle of law that every document will be given effect so long as there is no inconsistency, and in the event of inconsistency the question arises which shall prevail. There is no inconsistency between these two compacts. One of them, the Colorado River Compact, measures the rights of the subscribers to that compact. It is a contract, and is determinative of the rights of the parties with respect to the subject matter.

To illustrate what I mean, if the United States says through treaty they have to allocate water to Mexico in the amount of 1,500,000 acre feet or any other amount, as between the states, I have no doubt the Colorado River Compact will control the method by which that water shall be supplied. So that so far as the relations between the parties to that agreement--and that is all it is--are concerned, it is the controlling document. However, there is this other document or reciprocal legislation. There is ample case law to support such a compact between the United States and one of the states of the union, evidenced by reciprocal legislation in that manner. It is evidenced by the Boulder Canyon Project Act, and the California Water Limitation Act. A certain agreement was made in the language of the acts. The Project Act says that California must, in consideration of the passage of the Project Act, limit itself in a certain manner. California on its part says, in consideration of the passage of the Project Act, we agree to certain limitations. This is not made for the benefit of Mexico, it is made for the benefit of the other states of the Basin. In that second compact words are used which indicate that the benefits of the Boulder Project shall be exclusively for the United States. There is nothing inconsistent with the Colorado River Compact in that language. There is no language in the Colorado River Compact which reserves to the United States the right to take any part of the Colorado River water and apportion it to a foreign country. All the Colorado River Compact says is in the event that shall be done, certain results will flow therefrom, so that the United States was at perfect liberty to contract and agree with the State of California. So far as the Boulder Act is concerned, the benefits of that project should not extend to the Sister Republic. Water rights and other contract rights are relative, that is, a man may have a preferred right against "A" and a defeasible right against "B". Looking at our rights, I think we must consider relative rights as between California and the states of the Upper Basin. The Colorado River Compact will no doubt control as between the states. As between the United States and the State of California, the statutory compact to which I refer will no doubt control, there being no inconsistency.

I say these things in a fairly dogmatic fashion. I think Mr. Breitenstein, Judge Stone, and the other legal lights of the Upper Basin and the Bureau of Reclamation will agree that no opinion with respect to the water rights of the Colorado River is so divinely inspired as to be unassailable. I do not think anyone can say that the position I have asserted is so out of line or so unreasonable as to be unsupportable, I believe, when the law of the river is stated. Mr. Tipton suggested that it would be proper for the Bureau of Reclamation to state that the Colorado River Compact is the law of the river. I

think if that be done it is only fair and right that the Bureau of Reclamation should also state the other compact, which is also the law of the river, and so long as they are not inconsistent, they both should be given effect.

Thank you very much, Mr. Chairman for the opportunity to say this. I hope I have not incited an argument. I am merely making the statement in a very sketchy manner. I think the record should show at least a hint as to the theory on which California has proceeded. I hope the representatives of the Bureau of Reclamation will give some consideration to that second compact.

I thank you.

JUDGE STONE: If there is no further discussion, I think now we should call upon --

MR. HEWES: May I ask Mr. Shaw if he has any comments?

MR. SHAW: General Giles has told you what I would concede with respect to the statement about the Mexican treaty. Unfortunately the subject matter requires such close analysis that I cannot accede to the statement which he has made for me, and it will take a little time for anyone to receive an analysis of the details of these three or four pages of the report intelligibly enough to get any real conclusion.

I rather incline to accepting Mr. Tipton's idea that there should be a plain statement in this document of the provision of the Colorado River Compact with reference to Mexico, not in Mr. Tipton's words, though. Mr. Tipton inserted words in the statement of the Compact provision which aren't in the Compact. Unfortunately there is something there which would take too long to argue out. If we could have a comparatively brief time in discussion of this subject, I think a statement could be arrived at which would fully comply with Mr. Tipton's expression, with my own, and probably satisfy General Giles too.

One further remark while I am on my feet, with the risk of injecting a sour note into the proceedings, and still with the utmost good humor. The Chairman has made one remark that I think must be noted. That is that we have had an opportunity to study this document. Respectfully I say that we have not had a genuine opportunity to study it. Perhaps a dozen of us in this room have had a chance to read it. Most of us have had nothing but a chance to look at the cover or a few words inside, perhaps. That is not a thing I blame anybody for. I understand the time element, and unfortunately we cannot, in the manner the Bureau has requested, be of the service which we should.

As I believe Judge Stone has said, we are obliged, therefore, to disavow, and ask that we never be charged with any genuine examination of this document prior to today. We hope we will get further time to consider it.

MR. TIPTON: Just to keep the record straight, I think, Mr. Shaw, my position was that I would prefer to have in this report some discussion of the pending treaty. I think the present one should be modified, but if the Bureau chooses to eliminate it, then I suggest the other alternative.

MR. SHAW: If it is done in the words of the Compact I think we will all be happy about it.

MR. WILLIAMS: Mr. Carson has a few remarks.

MR. CARSON: I have listened to this discussion about the inclusion or the exclusion of the Mexican treaty from this report. I am inclined to agree with Mr. Giles that there should be a statement in this report at least indicating the provisions of the Compact which provide for the delivery to Mexico, in the event of a treaty, and call attention to the fact that there is, and we must concede, some obligation to Mexico, although it might not yet be measured. I think Mr. Giles' suggestion of the elimination of that paragraph might answer the purpose. I agree that there should be nothing in this report that could ever be used to give any comfort to Mexico in the event this treaty now pending should not be ratified. We must at all times, I think, be very careful to give no publicity to any official statement that would give any comfort to Mexico for any greater quantity of water, because we are all trying to hold down the allotment to Mexico to the smallest quantity.

One other comment on the question of surplus water now included by the Bureau in its calculations of the available supply in the Lower Basin. I take it from Mr. Breitenstein's statement that he would not contend that nobody can use that surplus water until 1963. The statement is that nobody can acquire a firm right to it until 1963. In the meantime it can be used in the Lower Basin, subject to reapportionment in 1963, whether or not the California contention of a legislative compact has settled the question, because Paragraph III (e) of the Colorado River Compact provides that the states of the Upper Division shall not withhold water, and the states of the Lower Division shall not require delivery of water which can not be reasonably applied to domestic and agricultural uses. In other words, this compact was devised for the reservation of the rights and the protection of the rights of the Upper Basin States in order to permit developments to proceed in the Lower Basin and in the Upper Basin, and there is not in this compact any implied prohibition against the use of surplus water prior to 1963. It is, however, subject to reapportionment, unless California's contention as to a legislative compact should prevail. That is a question we do not now need to face, because under the language of the compact, water available in the Lower Basin is available for use in the Lower Basin.

MR. BREITENSTEIN: I did not say the Lower Basin could not use the water. My position was it had no firm right to use it. Arizona might be entitled to the surplus, California or the Upper Basin might be entitled to the surplus, and we certainly are not giving away our rights to it now.

MR. CARSON: That is right.

JUDGE STONE: Mr. Warne, at this point have you some comments to make?

MR. WARNE: Well, I hate to think what would happen if you gentlemen had had time to read this report. (Laughter.)

Let me say, not because of any particular statement that was made, but

because of the tenor of a number of them, not all of them, that we are not attempting to put any of you on the spot by sending you a report a few days before the scheduled meeting. I want to say that we are not trying to put you gentlemen on the spot by presenting the report to you so short a time before this meeting. We are not asking you to endorse or approve the report or commit yourselves to it, or to commit yourselves to be bound by it. As a matter of fact, we ourselves are not bound by the report in the form that it has been presented to you. Every one of these copies has stamped upon it on the front cover this note: "Confidential. This report is in tentative form and is not to be published or given general circulation. It may be materially revised in the final form to be issued." That note applies equally to the paragraphs of the report that various ones of you have read into your record here.

The purpose of making available to you the report in its existing form was to seek your aid, your comments, and your discussion for the guidance of the Bureau in its attempts to bring the report into a final form. We have had many very, very helpful suggestions both yesterday and today, and I think we have a good deal of work yet to be done on the report itself.

Now, I should like to talk from a series of notes that I made at random during the various discussions, and therefore the presentation will not be orderly, and it will not have any particular sequence.

First, we would be glad to discuss the details that the individual states propose here, with the representatives of anyone who would like to discuss them. Mr. Riter and the rest of us will be available around here for several days to come. We had planned to hold a meeting ourselves tomorrow beginning at ten, and probably these discussions would have to wait until Monday or some later time.

The suggestions that have been made with regard to the discussion of the treaty in the report I think are very pertinent, and I assure you they will be given the utmost consideration before the report is completed and issued in final form.

Many questions were raised bearing on the different angles of the problem of why issue a report at this time, ranging all the way from couldn't we wait until January 5, to why issue a report at all. This report may have been compiled hurridly and in the space of a few months, but the report has been in preparation for a great many years, as you know. Information that has been gathered at great expense and over a period of more than a decade has been summarized and set down here for the consideration of the peoples of the Basin. Some say, "How can you issue a report before we have completed an Upper Basin Compact?" Another speaker will and did say, "How can we reach an Upper Basin Compact until you have issued a report?" We are confronted with the problem here of which came first, the hen or the egg. We have this information. I do not see how we can expect the states of the Colorado River Basin ever to solve their problems until we make this information available to them. That is one very cogent reason, in my opinion, for the issuance of the report. We had set, and have been shooting for January first as the date of the completion of this report. The date has obvious connotations. It is anticipated that the new Congress will be preparing very soon in its sessions for the consideration of postwar activities. The scope of those are not within our power determinable. Those

activities will be based on the needs, as they develop, and it is our responsibility to prepare programs as near as we can to suit such needs as may develop. We have tried to do this.

In many drainage basins of the West we have various reports in different stages of preparation at the present time. One, in fact, has been issued, the Missouri Basin report. If it were true that the use of a large figure would operate against the development of the Colorado River Basin, I think it would have been appropriate to ask, did it operate against the proposals made in the Missouri Basin report, and I believe it can be fairly stated that the use of the cost of $1,257,000,000 for the projects in the Missouri Basin report has not operated against serious consideration of that document, and I believe it will not operate against serious consideration of sections of that report to be brought forward for consideration in the postwar period.

Mind you, this report is not a report to be used to propel a construction program that would encompass all the projects and plans that are included in this report. Neither was the Missouri Basin report for that purpose. Distilled from the Missouri Basin report was a group of projects costing approximately $400,000,000 and those are moving forward in a way which justifies my confidence that they will be authorized in the relatively near future.

I should think that out of this Colorado River report if we can get it completed and before the Congress, will come a reasonable construction program, reasonable by comparison with construction programs that will be undertaken in other basins in the West, reasonable in regard to size and scope and the critical character of the water problems of the Basin and of the individual states of the Basin, and reasonable in the cost and benefits of the balance sheets.

Now, it is certain that any relatively large construction program in the Colorado River Basin cannot be expected, unless reports are made to the Congress upon which we can base recommendations for them. The problems of thi Basin may not be as complex, in the sense of running the gamut of so many shadings, as those of some other basins, but perhaps they have been with us longer and have gathered about them more soreness than the problems in some of the other basins. No matter, I believe we must proceed in a manner which will lead us eventually to their solution. I cannot see how that can be done in the courts of law or negotiations that run without termination, or perhaps by legislation, but I believe we can make a definite approach towards these solutions with a reasonable and fair and just construction program that will bring all sections of the Basin closely to what we hope eventually to see, and that is the complete utilization of these resources beneficially within the region for the creation of homes and for their contribution, on the scale that they can contribute, to the welfare of the nation at large.

This Colorado River is the greatest resource, and it is a tremendous thing. We cannot be afraid of it, we cannot avoid it. We have got it here, and we know a lot about it now. We know a lot about the lands, something of the mineral resources, something of the characteristics of the people of the Basin, and all of these things are parts of the required knowledge to go forward in

the construction of works that will lead to the utilization of the Colorado River.

If you gentlemen would like time to present in writing more detailed and somewhat more specific suggestions with regard to the report, I would be glad to discuss with you what you think would be a reasonable time. We have got a big job on our hands to get this report done. It is of no use to us to prepare any report that will not have the support of the people of the area; it would be foolish; it would be better never to have started the investigations than to present something that results only in a dog fight that ranges from one end of the Basin to the other, with the Bureau of Reclamation in the middle. We want your help; we want your assistance. We will not attempt to bind you in the final report in any way. We will present something that we think is sane and reasonable and just, and through the help of you gentlemen to pass on it, that can go forward at once, can be selected and brought forward and constructed, and then we can move on to the next stage, perhaps rewriting this report at intervals and eliminating some field of controversy here, and perhaps a larger one there, as we go along, until in the end this document will be one of a series of documents that will make up the story of the development of the Colorado River Basin.

MR. WALLACE: It is your purpose to proceed in the immediate future?

MR. WARNE: It is our purpose to lay the groundwork, so that recommendations can be made for projects that can proceed in the immediate future.

There may be some other of the gentlemen here from the Bureau who would like to make a few remarks.

JUDGE STONE: Are there any others from the Bureau who wish to make statements?

MR. RITER: I would like to say this, from a technical phase of the report, my particular responsibility, I too have had a short time to read this report. Since Mr. Debler left the branch to take on his new responsibilities, I find I did not keep in as close touch with the report as I wanted to during its preparation.

Probably I am the one to blame for the Upper Basin going one way and the Lower Basin going another way in figuring the depletion. I have read the report clear through. I have had some time to think about it. I have discussed it with others of the Bureau's staff who have read it. I have discussed it with Mr. Debler, who was also given an opportunity to read it. The Bureau's review of this report is incomplete without his views. He has lived with the river for ten years longer than I have.

We recognize that the report as it now stands is not a perfect document. We recognize that in your brief reading of it you gentlemen have also found weaknesses. We appreciate very much your frank and fair comments on it.

I have had one thing instilled into me in my sixteen years of service with the Bureau, namely, that the fundamental purpose of the Bureau is to serve the

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West, and we want and we solicit the views and the criticisms of the states concerned with the Colorado River Basin, and we will not leave out of consideration this Committee. We want the views of this Committee, as was told you at Reno. One of the original purposes of our report was to try and write a pattern of development, a Bible, if you please, of the river. It was very apparent to me from the Reno meeting, and Mr. Debler claims it was apparent to him before we even started that that was impossible. My education was further extended at Reno, when for the first time I had ever been brought squarely face to face with controversial problems that had crystallized in my own mind.

So what we are attempting to present in this report, I think was described quite adequately, to bring together the information we have now tried to present, the picture as we now see it. As we receive additional information we will try to bring this up to date.

It is not my desire to make an oration, but I do want to thank all of you gentlemen, every one of you, who have criticized this report. I appreciate your frankness, I appreciate your fairness, which is a thing that is basic in this game. We are not bureaucratic. I want all the help I can get, I need it urgently. After all, we don't know everything. It is a problem that is too big for one individual to handle. Through the united and joint effort of everyone this problem can be solved.

MR. SHAW: I think it was intimated by Mr. Larson that some revision had been made by the Bureau already. I wonder if there are any items of sufficient importance to be worth mentioning at this time.

MR. RITER: Mr. Larson tried to pick up some of these mistakes as he went through it. For instance, the San Juan-Chama Diversion was charged to Colorado, and on revision to New Mexico. On the document I have penciled notes. Some one else has criticized the treatment of the Mexican treaty, we want to consider that more carefully. We want to consider all of these problems carefully I don't have anything pertinent, Mr. Shaw, that would upset any comments that you people have made.

MR. SHAW: Thank you.

MR. RITER: Incidentally, I think I distributed the first thing this morning Table 128-A, which is a summary that was presented yesterday on the long-time depletion of the Upper Basin. I think all you people have copies of it. If you have not, I have a few copies to make the report complete. It has not been checked by Mr. Larson, so take that tentatively too.

JUDGE STONE: May I ask Mr. Warne this question: You suggested the possibility of written comments, and that time might possibly be allowed to do that. What do you have in mind with respect to time and when that should be done?

Also it has been suggested that the members of the Bureau's staff would contact the various states. I believe that was called to your attention by Mr. Shaw, and it was agreed that that was advisable and you expected to do it. What do you have in mind as to the time when all those things could be done?

MR. WARNE: Well, I don't want to say anything that would indicate that we are trying to fix impossible conditions. I wish as many of you as can, if not, in fact all, would discuss your individual state's matters with these gentlemen, starting tomorrow afternoon, and running on until it is completed.

Now, with regard to the written comments, I would like to ask some of them how long they think it would take to prepare an adequate statement. Mr. Shaw?

MR. SHAW: It probably won't be adequate, Mr. Commissioner, but all we could expect to ask for would be, say, one week.

MR. WARNE: Can the rest of you do it in a week?

JUDGE STONE: Mr. Warne, that brings up very sharply a situation in Colorado. We produce a lot of this water. We have a lot of involved problems. We have many interests, some of them not fully worked out. We do have in this state an agency that is supposed to help to work out these problems. Mr. Delaney and I on this Committee are not in a position to make written statements. We certainly should not make an effort to make comments in writing except upon more study and review of the report, and except after the matter has been considered by our State Water Board, and the State Water Board has the responsibility of listening to all of the views and the judgment of all of these various interests. For us to present in a week's time a written statement without following that procedure would merely mean that we might give you the impression that what we say is correct, whereas what we say might merely bring over our heads a lot of criticism, objections and views quite adverse to what might be submitted by us. It is not the right procedure.

I realize that the Bureau of Reclamation cannot study and analyze and review all of the various and divers interests in a state such as Colorado. You must ask some agency or some group to do it. We want to do it, but we have got to do that with adequate study, and after an opportunity to discuss it with those different groups.

I do not think that we are in the fortunate position as Mr. Shaw says of California, that after a week's time we can sit down and give you something.

MR. WARNE: What do you think, Judge Stone, would be the minimum?

MR. WALLACE: When do you expect to go to the printers?

MR. WARNE: I had not expected to make a decision on that until after tomorrow.

(Discussion off the record.)

JUDGE STONE: Mr. Warne, in attempting to answer the question which you asked me, may I ask another question? Is this an ironbound rule that this all must be completed so that the Bureau may be in a position to print and release a report on January first?

MR. WARNE: At the risk of having the ship sink without a trace right here, I will say no, it is not an ironbound rule. I will have plenty of explanations

to make if we are not prepared by then to do it, but I think we probably could extend that date, if it was not an indeterminate extension, without causing anyone to get fired.

JUDGE STONE: What I had in mind, Mr. Delaney has talked to some of the interests here in Colorado, Mr. Patterson, and I believe Mr. Tipton and Governor Carr, and I want to assure you that we want to do it just as fast as it is humanly possible, but I think if we do it in the right way it would be more helpful to you than if we go half-cocked on something. It is the judgment of these men that it would run probably in the order of sixty days before we could do it, maybe a little longer, not to exceed ninety days, because here is what we have to do: we have to call in all these interests with the Water Board and just sit down and iron these things out, and it is going to be a tough job.

MR. WARNE: Could you do it in thirty days?

JUDGE STONE: Some of you folks are talking, and I don't know whether you have heard the discussion here. Have you heard the discussion, Governor Carr and Mr. Breitenstein and Mr. Tipton and Mr. Patterson and Judge O'Rourke and Mr. Dille and Mr. Vidal? Suggestions have been made as to time, and what time would be required in Colorado, and Mr. Warne has made inquiry as to whether we could do it in thirty days. I would like to have the comments of some of you.

MR. TIPTON: How many copies of the report would be available?

MR. WARNE: Well, we could have more copies run. It is going to take a few more days to do that.

MR. BREITENSTEIN: Judge Stone, I can say frankly I don't think thirty days would be enough time. As you well know, we have some other rivers in Colorado we have to consider on one of those, at least, we are going to have to do a lot of work, thirty to sixty days. I think we will want to have thirty to sixty days. I think we will want to have thirty days too for sure to compose all of our interests here in Colorado to give the Bureau a statement that is worth while.

JUDGE STONE: Mr. Merriell?

MR. MERRIELL: I have nothing to add.

JUDGE STONE: What do you think about the time?

MR. MERRIELL: I have nothing to add to that.

JUDGE STONE: Governor Carr?

GOVERNOR CARR: I represent just one organization in just a small part of the state. I have not been permitted to read this. I am anxious to do so. I could not attempt to do anything within thirty days which would be just to the people I represent. I think ninety days is closer. May I say this: I do not feel that the Bureau is justified in trying to hold us to any shorter time than that, because of the size of the proposition, because of the interests which are involved.

We are going to have to go over to the Gunnison and hold meetings with our Board. That takes time. We can't drive any more, we have got to hitch hike, I think ninety days is fair. If we can do it in ninety days we will perform miracles.

JUDGE STONE: Mr. Saunders?

MR. SAUNDERS: We can act more quickly than any other interests. I should say six weeks would be the minimum, and we undoubtedly are as quick as anybody you will run into.

JUDGE STONE: Judge O'Rourke?

JUDGE O'ROURKE: Of course, I do not need to tell you our situation down there. There are eight counties. I say with an area of eight counties it is going to be rather difficult to get over that in a short time. It is going to be necessary for us to consult with our people down there, and it not only involves southwestern Colorado but other sections as well. There are certain obligations, questions in connection with our sister states joining us in the Basin over as far as the San Juan Basin in New Mexico. Some of their problems have to be considered along with any suggestions that we might make in connection with this report. I doubt very much if we can do it in less time than Governor Carr has suggested. Certainly if it is goirg to take Governor Carr ninety days in the Gunnison area, it is going to take us at least that much time in the San Juan Basin. I do not think there is any possibility of touching this before ninety days.

JUDGE STONE: Now, I hope the members of the Committee will pardon me for trying to explore this Colorado situation, but it was quite necessary to do it, in view of the question. I don't know whether any others here want to add anything. If so, I trust we will hear from them. Mr. Tipton, do you have anything?

MR. TIPTON: I have nothing.

JUDGE STONE: I think now we should inquire of these other states. They are indeed fortunate if they can do this as quickly as California can, namely, a week's time.

I would like to ask Arizona how long they think they will require.

MRS. BUSH: I think we can do all that Arizona can get together--we don't ever hope to get everybody to believe the way we do, but the state has placed some confidence in the members whom it has sent. Therefore, I think the majority of Arizona will say, let's get the best we can. So I rather think Mr. Carson has stated Arizona's position. We will do it while we are here with the members of the Bureau.

JUDGE STONE: I did not mean to imply that the State of Colorado does not have confidence in Mr. Delaney and me, Mrs. Bush. However, I want to say this: We do have a big program and a lot of problems. I just have too much respect for the views of my people to rush this thing.

New Mexico.

MR. WILSON: Judge Stone, so far as we are concerned, I don't know what would be accomplished in ninety days or in six months. Of course, we expect to talk to the Bureau while we are here, and our problem is simply to get additional information on the projects already mentioned. Certainly we can't get that information in ninety days nor assurance of the Bureau in helping us get the information. So far as I am concerned, there is no written statement that we expect to make.

JUDGE STONE: Utah?

MR. WALLACE: Gentlemen, we will be here another week, and during that time, of course, we can have meetings. At home it will take us sometime, but if Colorado gets ninety days, we are all set.

JUDGE STONE: Nevada?

MR. SMITH: Nevada's comments will not be very extensive. We will be here for the Western States Engineers Association. During that period we will probably be so well occupied that we would not have time to do much with this. If we make any written presentation at all, I think we should have time to get home and look into it. It would probably take us about a month.

MR. WALLACE: I would like to say, Judge Stone, we can go home and within a very short period of time we can make a list of projects we hope can be constructed in the immediate future. I assume that is the sort of thing you would like to have, Mr. Warne.

MR. WARNE: We would like to have you express your views.

JUDGE STONE: Wyoming?

MR. ROLLINS: We might go over this report on the Green River Basin and get our report in within thirty days.

JUDGE STONE: May we have quiet in the room, please? There is so much discussion going on we cannot hear.

MR. ROLLINS: Within thirty days.

JUDGE STONE: Mr. Howard or Mr. Scattergood, anything about the power angle of it?

MR. HOWARD: Speaking for the power contractors, we can abide by Mr. Shaw's statement.

MR. WALLACE: I wonder if Mr. Scattergood will say a word or two about the power matter before we adjourn.

JUDGE STONE: Well, the Chair is going to ask that we dispose of this first.

MR. LARKIN: May I ask a question in connection with the power contractors? Do I understand the policy of the Bureau is to eliminate from consideration in this report the development of the power resources by what might be determined private capital or the states and municipalities? In other words, are they desirous of any suggestion from the power contractors as to the development of the Lower Colorado and the taking of power by other than federal agencies?

MR. ROLLINS: Mr. Chairman, --

JUDGE STONE: I believe there was a question. Let us have that answered.

MR. WARNE: I did not quite get the question. The taking of power or the development of power--

MR. LARKIN: The report, as I look at it, provides $192,000,000 for a grid system, to be built by the federal government. That is quite different than the Lower Colorado Basin. If the Bureau is interested in ideas which the power contractors might have with respect to development of the Lower Colorado as to power, it might take sometime to prepare such a report, and we could not agree with Mr. Shaw that we would have any report within a week; and I asked the question whether determination had been made by the Bureau that all power was to be taken into load centers by the Bureau, and if they were interested in ideas some of us might have with respect to power development.

MR. WARNE: Why, we are interested in any helpful ideas in connection with this development. The grid system is included here because we must be prepared to take this power away from the plants. We are dealing in quite large sums here.

MR. HOWARD: In making the statement I did I was operating on the theory that this document was to become an inventory of potential water developments, and that no attempt would be made to completely work out the power angle. If this is to be done, of course we have a different problem, but if it is merely an inventory of potential water developments, so far as my interests are concerned--I cannot speak for Mr. Larkin, except to hear him across the table--we can come within that time. There is to be no attempt, as I understand it, to work out the quantity of energy available from each source or what shall become of it, where it is to be transmitted, or how.

MR. WARNE: That is right. The study has got to go on from here.

MR. WILSON: In connection with what Mr. Howard said, I would like to ask the Bureau a question: Is it understood and is it true that this report is to be merely an inventory of possible projects, or is this in any way going to fix a plan of development? I would like to have that cleared up.

MR. WARNE: Why, I do not believe if each and every one of us spent the rest of our natural lifetimes on this report we could fix a plan of development on the Colorado River Basin in the sense of having an immutable plan. It can not be done. This report is an inventory, as we can present it, of a class of projects that are worthy of some consideration by the people of the Basin and by the people of the United States, from which it is anticipated that certain

projects can from time to time be selected for further refinement, brought to the construction stage, and the inventory itself undoubtedly will be reappraised at intervals, and I don't know when the final plan for the Colorado River Basin will be written, except, perhaps, in concrete and canals and transmission lines 200 years from now.

MR. WILSON: That answers the question. It is fully understood here among us that this is an inventory of possible developments. I am just wondering if you are going to present the plan to Congress and other people who might be vitally interested.

MR. WARNE: It is certain that Congress is not going to take the report and adopt it, approving it the very next day, and assume that it is an amendment to the Boulder Canyon Project Act or something that freezes it into the Project Act. We would not even recommend the report for authorization. What we hope to do is to lay out something that can be another stepping stone in the progress of the development of this Basin.

MR. ROLLINS: As I understand it, the Bureau has compiled this massive report in about five months. In view of the fact that after all this is not going to be the final word, I can't for the life of me see why it is going to take so much time to set forth the views of our states as to that report. I think, Governor Carr, even as slow as I am, I could crawl on my hands and knees to the Gunnison in ninety days and consult these people. (Laughter.)

GOVERNOR CARR: You see, I have two or three other clients. (Laughter.)

MR. ROLLINS: I know, but you can talk to each one personally in that time. I think it is unfair to ask the Bureau, in view of the fact that they have gone all-out, so to speak, in their efforts to have this report ready when asked for by their superiors. It seems to me it is hardly fair to ask them now to delay another ninety days. I think thirty days, if we can agree, something like that, or even forty-five days, should be fair to all of us.

JUDGE STONE: Mr. Rollins, Colorado has never taken a dog-in-the-manger attitude. I don't think another state has been as cooperative as our state. If you understood the problems in Colorado you would not talk about crawling on your hands and knees. We do have obligations to some of our people. We are called upon to act, and we don't propose to act without consulting with them, and without our knowing and understanding more about this report.

This state produces 74 percent of the water of the Colorado River Basin. We have the Continental Divide running through the middle of this state. We have taken constructive action in the past, and we are just as anxious as any state, or as the Bureau of Reclamation, to get these projects built as quickly as possible, but we do not want to be a party to creating turmoil in the Colorado River Basin that in the end will mean more delay than some reasonable time for consideration and reasonable time for this state to work out what appears to be our legitimate problems.

I am sure Mr. Rollins did not understand the position here, or otherwise

he would not intimate that we are asking anything unreasonable. We do not propose to ask anything unreasonable of the Bureau, but we would much rather have the report considered by Colorado after consultation than to have the report go to Washington and have everybody object to it. We should not, since we produce so much water, be controlled by Wyoming or any other state. I think you perhaps misunderstood my statement.

MR. ROLLINS: If this were going to be the final word, I could agree with you. You will have ample opportunity. Each project will be taken up by Congress, as you know so well, on its own merits. For that reason I cannot agree with you. If, as I see it, this was going to be the end of the thing, if we had to do the whole thing up now once and for all, I would look at it as you do, but it does not seem to me it is that important, because you will have plenty of time, when necessary, to make your statements before the proper people.

GOVERNOR CARR: The question of Colorado's fairness has been raised. I think in justice to Colorado people, because I am the one at whom this remark was aimed, that I should say this: Colorado in my contacts with this thing--and they started in 1926, and have kept up except for a short spell when I was out of the picture--Colorado has been at the forefront of the activities in connection with the Colorado River, this beginning with the writing of the Compact, as some of you may know.

There are those of us in Colorado who have had something to do with irrigation and have had to do with projects. We know that there are men and women in the hills and valleys of Colorado and on tributaries of the Colorado who are going to be called upon to answer the question of whether or not they are going to sign these contracts for the payment of a certain portion of the amounts of money that will be demanded in order to put the projects over. In fairness to those people, there are those of us who believe we should go and talk to them and present this proposition.

I do not want to charge the Bureau with unfairness. I have been trying to protect this Bureau time and time again from certain people who I thought would encroach upon them. Personally, I love them, and I claim the right to curse them.

Here is our proposition. This is something that has been in preparation over a period of more than ten years, according to the statement of the Assistant Commissioner. This is something that involves the lives of a great number of people of the United States of America. We, the representatives of those people, have never had a look at this report. We had a statement yesterday that it was involved, that the representatives of the Bureau would not take the time to go into detail and tell us about it.

Today the states have been talking. Questions have been shouted at the Bureau time and time again in those statements which have not yet been answered. Now we are asked to make a statement regarding a report, which up until now we have not seen, which is going to require not only the reading by the lawyers, but advice from the engineers, and although we do not know about it now, when we want more than thirty days we are charged with unfairness.

I don't think, Mr. Rollins, you meant that, and I am going to accept your silent apology on behalf of those who are here.

I like to fight when there is something to fight about. We are trying to cooperate. When I asked for ninety days I wasn't talking about cooling my heels. These people employed me, and there are people at this table who could probably tell you that I spend all of my waking hours working for and representing these people.

The Commissioner said it will be useless--futile, I think, was the word, to adopt it unless they have the support of the states. They want the support of the states to the extent that they can say the Colorado River States are in favor of this thing. If that is what they want, they have got to give us time to make an intelligent study of it.

We are going to Gunnison, we want the Board to get together with the people, we have got to talk to them. If you are going to get any support from people you have got to have these people talking.

Now, don't talk about us being unfair. We reason that we want to cooperate with you. We will give you the answers. You have never had a difficult time getting answers from us up to now. If we are for you, we will say it; if not, you will understand what we say, but we don't intend--and I am speaking now for the people I represent--we don't intend to answer--1928--it was, sixteen years ago--we are not going to answer that or commit ourselves to answer it until such time as may be needed to give an intelligent answer. If we can under ninety days we will do it. I said I think it would be a miracle if we did it under ninety days.

Investigations which were supposed to be made in connection with the Gunnison River where I am representing the people have not yet been made with sufficient detail to enable the representatives of the Bureau to answer questions. What the reservoirs over there--we won't talk about more than 400,000 acre feet of water you will take out of that river to be used in transmountain diversion. There isn't any way of knowing about what that means.

This morning my colleague asked the Bureau about what their attitude would be toward the propagation of fish, the protection of wildlife, and the increase of recreation. We have a river over there which needs development along those lines.

Mr. Whinnery told you he wanted me to talk about the forgotten man, the cattle man. Every man in the world has been forgotten, but there are some of those projects, as we see them, that may defeat the greatest industry in that part of the state, if carried out. The second greatest industry is our tourists, our fishing, our recreational life.

I did not intend to raise these questions, but now that it has come up, I think it is necessary to tell you that that is a great industry of that county in spite of raising cattle and raising feed for cattle. I think we are entitled to it.

Is there any reason why the Bureau should not say to me and say to the representatives from Gunnison now, so that they can say to their people what your attitude is, we are not going to be unfair?

MR. WARNE: I think you will find an answer to the question of recreation in the report.

GOVERNOR CARR: Well, I have not had the report, nor have my people nor my colleagues.

MR. WARNE: I know you haven't. You will find a discussion in there, I believe to be pretty high class, on that matter. You will also find a complete discussion, I think, on the aquatic uses of the water for fish life. There will be such a statement in the report. The Fish and Wildlife Service has been working on it.

GOVERNOR CARR: That is what I am asking for, what these men want. That is what Mr. Dutcher asked for this morning. I am talking from ignorance because I have not opened the report, I have not seen it. Maybe many of my questions will be answered if I can read the report. We would like to have a number of copies. Unless and until we do have, we are not going any farther.

MR. HOWARD: I think Governor Carr misinterprets, as far as California is concerned. I am sure Colorado may take all the time it needs for the purpose of studying the report. The thing I do want to comment on is the use of the word "commitment." In my understanding neither the Bureau of Reclamation nor the states are in any way committed by anything in this report. I don't want the record to be silent on that point, inasmuch as Governor Carr had indicated that he thought possibly Colorado interests might be committed by something contained in this report. If I am incorrect in my conception, if it does constitute a commitment on anybody else's part, I want to know it.

GOVERNOR CARR: Will you agree that the Commissioner made the statement that it would be futile unless they have the support of the states?

MR. WARNE: I think I said if the result simply caused a dog fight that ranged from one end of the Basin to the other. I do not anticipate that anyone will be committed to the support of all the details in this report, or any detail in the report, but I think, in the light of having spent two days of discussing the matter here, we should have some indication from you gentlemen as to specifically how we can improve this report to avoid as many as possible of the objections.

JUDGE STONE: Mr. Warne, you are entirely right about that. You are entitled to it. That is what we want to do, give you constructively and wisely those points we are raising.

MR. WARNE: I asked a question the better part of thirty minutes ago, what is the minimum time for Colorado?

JUDGE STONE: I think, Mr. Warne, it is only fair to state, and I am judging my statement from what I know of the situation and what has been said by

some of my colleagues, that we could do an adequate job, that we can explore the various interests of the state, and give you a statement which would be helpful and would be the kind of statement that you desire, a constructive statement, within the ninety days which has been mentioned.

MR. WARNE: That is, February 11, roughly calculated?

JUDGE STONE: Yes.

MR. WILSON: I would like to ask the Commissioner a question, if I may. Is it possible, Mr. Commissioner, in one district not mentioned in the report, investigations not having been made, that an inadequate report may be made and left open for a supplemental report to be prepared at a later date after the investigation has been made?

MR. WARNE: Surely.

MR. WILSON: If so, I would like at this time to request your men to do that in the Gila. State Engineer McClure some time past made efforts to get an investigation both of the San Juan and the Gila. Some years back in making a limited and brief report on the Gila and the San Juan, they prepared what data they had. They had biennial reports put out by Mr. McClure ten or twelve years ago, just a partial report, before the litigation with the Indian Service, before the entry of the Gila Decree involving New Mexico land and much Arizona land, before any of our problems arose. Supplemented by one telephone call of Mr. McClure that he made since that time, that is the extent of the investigation.

I would like to have a paragraph written on the Gila that will be submitted by letter dated after this investigation has been made, after supporting data is available, so that that could be added at a later time.

MR. WALLACE: Mr. Chairman, I don't like to tell a story, but once a man wanted to hire an office boy. He got a room full of boys and began to tell a story. He went to the basement and started after a rat, he wandered all over the place. Fianlly, he said, "Boys, what do you think of that?" A little boy in the southeast corner said, "Say, Mister, what became of that rat?" That is the boy that got the job.

The rat we have is the immediate construction of projects to put people to work.

I hope to go back to Utah and suggest to the Bureau certain other investigations we want. I think we can go home and in a comparatively short space of time say to the Bureau, "When you make recommendation to Congress for immediate construction, please include these projects." We certainly can not develop the whole river to begin with. We can work on half a dozen projects and people will go to work just as soon as we get the money from Congress.

I take it that what Mr. Warne wants is certain recommendations, that Congress immediately appropriate money for certain projects that will not interfere with the whole comprehensive plan of construction of other projects.

I think, with the consent of my colleagues, that is about what we will attempt to do.

MR. ROLLINS: I just wanted one final word. I guess I got my foot into it, but I want for the information of Mr. Carr to read from page 2, the third paragraph, to present what I was trying to make clear in my remarks that this is not final, that for that reason it is not so serious a matter. "This report does not present a final plan." It says that in that many words. "Many intrastate, interstate and international problems must be solved before a final pattern of development can be evolved. Extensive investigations have been made of certain projects. Much data have been assembled. Supporting data are to be found in the files of the Bureau of Reclamation. Before many of the projects can be authorized and construction undertaken, additional detailed investigations and studies must be made."

That is the thing I was trying to say. For that reason, maybe, I should not have used the word "unfair," however, I do not propose to make any signed statement retracting it. I do think, however, at least it would be far more helpful--maybe I had better put it that way--far more helpful to the Bureau to get some sort of a statement. I don't know whether a statement is necessary.

Mr. Carr said they asked for statements. I think we asked to make statements. The Bureau, of course, would be happy to get our viewpoints, but I really cannot see why it is going to take so much time. However, if Colorado's convenience is going to take ninety days or six months, we have gone along with them for quite a while. If that is their position, we are quite willing that they have all the time they want, but if Wyoming can't make up their minds in the Green River Basin in less time than that, then I am badly mistaken.

In view of the fact, as I said before, that there will be an opportunity later to make statements, it seems to me it would be helpful to these people to get what information we can give them as soon as possible, so that at least they can get within the deadline they are put under.

JUDGE STONE: Mr. Rollins, if we had only the Green River Basin, we could do it too, but we have got a number of them.

I want to call your attention to the fact I tried to make plain a while ago, we do not believe that when the report gets to Congress to consider it will be nothing but an inventory of projects. The arguments in the last two days indicate important principles which may be affected by this plan. We do not believe it is as harmless a document as has been indicated. If it is that harmless a document then it is not worth making. I can see the Bureau attempting to do a constructive job at the start, cutting the pattern for development of the river basin. Let's do it as well as we can at the start and not have a lot of mistakes.

MR. SCATTERGOOD: Mr. Chairman, Ladies and Gentlemen: The Power Contractors present, and their representatives on the Committee of Sixteen, are in full harmony respecting the report read into the record by Mr. Howard by way of comments and suggestions on the tentative report presented to us by the Bureau of Reclamation. Mr. Warne's talk here was very comforting and allayed much of the

fear or uncertainty in our minds. Speaking on my part, I shall endeavor to express briefly what have been and are my conceptions that have led to our report.

There are in the Colorado River Basin a great many projects that would pass all three tests that may be required thus ready for approval by the Congress, if not already approved, and therefore ready for construction and development immediately following the war. From this it follows that it is not necessary that all projects suggested in the tentative report before us shall be completely agreed to at this time in order that there may be a great construction program put into effect immediately following the war.

The three tests referred to are (a) that there has been sufficient engineering investigation to determine whether or not, in the judgment of the Department, it is feasible, or reasonably feasible and it can be so declared by the Secretary, thus bringing it within the realm of possible appropriations for construction under the present law; (b) whether or not the project is desired by the immediate section within which it lies, that is whether or not they would want to pay for it. It would seem plausible that such a project as is shown to be feasible would be desired but this may not be necessarily conclusive and (c) it is my understanding that a third test would be wanted by the Bureau of Reclamation and quite naturally so it would seem the test being as to whether the project is subject to or free from controversy as between states or between sections of a state.

I said "feasible, or reasonably feasible," because we do want construction in the West, even though there is some doubt about the 100 percent financial feasibility, thus giving the project the benefit of doubt.

My conception is, from expressions in the report, and by representatives of the Bureau of Reclamation at this conference, that as to the many projects about which there may be some question with respect to any of the tests, particularly the second or third test, there will be negotiations which should lead to the ultimate determination on some satisfactory basis with respect to those projects, or other projects, of which there are a great many as yet lacking in engineering study, which will prove feasible and may take the place of those in dispute or undesired for any reason.

With these conceptions and understandings in mind it would seem this report, setting out the hydrology of the Basin and suggestions outlining projects for a comprehensive plan in a preliminary confidential advanced form, should be of great value to all of us and of value as a basis of information for the Congress provided it is made clear to the Congress (a) that many of the projects are subject to further consideration and negotiation, (b) that the possible projects as a whole would require more water than will be available from the River System, (c) that other projects not included may prove more desirable and ultimately may be substituted for some of those mentioned in the plan as tentatively outlined, and (d) that many possible projects will have to be combed out for want of sufficient water.

Now, as to the power contractors: I understand from answers by representatives of the Bureau of Reclamation to questions asked here, that there is

no certainty about, for example, a diversion above the Boulder Project in the Lower Basin for irrigation purposes, and that no studies have been made for consideration given to the way such an undertaking might be related to the Boulder Project; which is an established project, with its power output, both primary and secondary power, contracted for under firm contracts for fifty years, which in turn carry guarantees of repayment of the cost of the project with interest. Also, contracts for conserved waters, such power and water contracts having resulted in expenditures of hundreds of millions by the contractors for transmission and utilization and in communities depending on water and power supplies from the Boulder Project. Communities have been and are being built up, in substantial part, based on such contracts which means a tremendous lot requiring consideration both economically and otherwise.

The power contractors presume that these things have been and must be given full consideration in conjunction with any such possible diversion above Boulder. We have had our relations with the other six states and with the water users in California; and this Committee of Sixteen was brought about that understandings might be worked out with respect, particularly to the Boulder Project but also other power projects, and Boulder Power revenue set aside for the Development Fund in the Basin. The Committee of Fourteen being confined to consideration of water problems strictly.

As previously indicated, this tentative inventory of water and power projects should be of great value to us all in our efforts toward bringing about an understanding between us and the Bureau of Reclamation and among ourselves, where necessary, and by the Congress; also showing the status with respect to the future availability of water in the river system versus the need for water for a more complete ultimate development. It seems, however, a large portion of these projects, especially some of the larger ones, are not ready to go to Congressional Committees with recommendation for appropriations under the three tests enumerated.

If my conceptions are correct, such of the projects will not be so regarded or recommended at this time. As I understand Mr. Warne, these things will be determined as best they may be in the future. We power contractors cannot very well take a definite position unless there is serious consideration, and we are not now so informed, of diversion above the Boulder Project and, in such case, we understand that the Bureau of Reclamation--from what has been said here--would, in conjunction with and concurrently with any such serious consideration, discuss the same with us as to how it may be related to the Boulder Project and the interests of those who have contracted for power and water and are paying for the project. Also that questions and plans relative to other power projects will be considered and developed in like manner.

With respect to power: Mr. Larkin has made reference to the fact that there may be conceived two classes of power users or contractors, broadly speaking, of which the existing power contractors of the Boulder Project are in one class, and there will be more of that class as more power is developed at other projects on the Lower River; and I should think the same will be true in the Upper River or Basin. Those of the first class are, generally speaking, large electric utilities with existing diversified power sources and distribution systems that can more economically build their own transmission lines

connected directly with the generating equipment, installed by the Bureau, but required for generation of power for such a contractor or contractors and so operated. The other class of smaller individual contractors of communities would constitute those to which delivery of power service over circuits installed and operated by the government would be more valuable.

There is nothing inconsistent between the idea well brought out here that the Bureau of Reclamation is sincerely interested in finding out the wishes of water users in connection with reclamation projects as a matter of procedure in the development and utilization of water, and the idea of like procedure in development of power projects and its utilization through negotiations with power contractors or users for the purpose of bringing out the most economical development and transmission plans satisfactory to the contractors, particularly from the economical standpoint affecting the wholesale cost of the power delivered at points of distribution. My understanding is, from what has been said here, that this will be followed by the Bureau of Reclamation with respect to power.

There is a great difference between these two classes of power consumers, that is a great difference in the economics and the worth of the power to the communities as the ultimate users. Similar procedure will be essential with respect to all important power development on the Lower River, and I should think on the Upper River also; including storage, affecting both power and water, at the Glen Canyon site. Storage is needed there with respect to development in the Lower Basin in addition to capacity required for the purposes indicated in the report affecting the Upper Basin. As already indicated, the power contractors are not in a position to make any very specific suggestions for the reason that the report is in an altogether preliminary stage being that of a mere inventory of suggested projects, subject to modifications, of course, in the words of the report.

It seems not necessary to suggest that the power contractors could make a report in 30, 60, or 90 days. We cannot make a report at all except as it is worked out as specific plans are developed, between the Bureau and the people interested.

I have felt, under the circumstances, it is necessary to make this statement of our conceptions and understandings that the report of the power contractors' representatives, which was read into the record yesterday by Mr. Howard, may be understood. I judge these conceptions as to the status of power are entirely in line with what Mr. Warne has said to us.

I thank you very much.

MR. RITER: All the problems Mr. Scattergood mentioned, of course, have to be met, have to be solved. He recommends they are beyond the scope of the immediate report. He recommends that, I judge from the tone of his talk.

I am afraid some of the questions Mr. Carr wants to ask us likewise will be found to be beyond the scope of this report.

The primary thing I am interested in in this report is to make sure that

we have not overlooked any projects, real honest to goodness projects. An awful lot of the details have not been worked out, an awful lot of the details we have not attempted to work out. We recognize the- must be worked out before the projects are sponsored for construction.

For my part I would like to get across the conception that the report is an inventory.

Mr. Carr, I am going to recommend that you do not wade through 394 pages. I know you won't be interested in all of it. After you read it over, come back and we will answer a lot of questions that we are not in a position to answer at this stage of the game, but when we get the detail of the projects you are interested in, then I think we can answer you; but we are concerned in including in the report some projects we may have overlooked, which you know about, which your Water Board knows about. With that in mind, I wonder if you still need your ninety days?

MR. WARNE: Why don't we settle it in this manner, that the Bureau will accede to the request of those here--some of those here, that they be permitted to make additional statements, and will hold the report open until February 10 if we can. If we can't, we will so advise you as much in advance of the closing date as we can, to give you any warning of it, and we ask you not to take the ninety days or any material part of it if you can avoid taking it and to advise us as soon as you can what period less than the ninety days will be sufficient.

Thank you.

JUDGE STONE: I think, Mr. Warne, your statement is very fair, and we simply wanted to let you know our problem. And I want to say to the other states that Colorado does not want to be in the position of breaking down what the others wish, but we are just trying to indicate our problem, and we want to comply with the suggestion made by Mr. Warne. We will survey this situation and advise you just as soon as we can. I think that is very fair, and I hope that if it does take us a little longer than seems reasonable to others it will be understood, because we are perfectly sincere in our desire to cooperate. We simply want to get into our situation further and be able to do that in a more constructive way.

GOVERNOR CARR: We will not take a minute longer than we need. I tell you, Mr. Warne, I will be on my hands and knees inside of a few days. (Laughter.)

MR. SCATTERGOOD: May I ask you whether or not my understanding of the procedure so far as it affects power, at least, is substantially correct?

MR. WARNE: It is. Nothing I said is intended to, and I think it does not negative anything anybody has said at this meeting. I was just attempting to clarify the situation.

MR. RITER: Those of us who have the heat on us again to get the report in final shape surely will appreciate any suggestions or statements you may get by reading it quickly. We would like to have them because we are working on it in the meantime.

JUDGE O'ROURKE: In view of Mr. Riter's statement he just made, it seems to me we of the San Juan Basin are not going to require as much time as we had anticipated, and I can assure him we will get our report in just as promptly as possible. We had a little different conception of the subject up until we heard your statement.

JUDGE STONE: You are referring particularly to what statement?

JUDGE O'ROURKE: The statement that Mr. Riter had just made about the nature of the report, the purposes.

JUDGE STONE: Now, I understand--if I am wrong, may I be corrected--each and all of the states expect to submit written statements to the Bureau of Reclamation.

MR. CARSON: No, we don't intend to submit any for Arizona. We think Mr. Baker can talk with Mr. Larson while he is here, and we will have no necessity to file any written statement. We want the Bureau to know, however, we do appreciate very much the work it has done, and we are behind its report.

MR. WARNE: I did not mean to ask, Judge Stone, that they necessarily submit them, but those that do wish to submit them, submit them on the schedule that we had stated. Several times during the discussion here, before the general discussion closed, requests were made that additional time be given to submit statements. Now, I did not mean to be understood that Arizona should submit a statement if she did not care to do so, or that anyone else should.

JUDGE STONE: I understood everybody had stated that they desired to submit statements. It stands this way: Those desiring to submit a statement will do so, and will do so as quickly as possible. Colorado will comply with the suggestion made by you.

Will it also be understood that where any statement is submitted by any states, that the other states be given a copy of it? Is that not the desire of the Committee?

GENERAL GILES: I so move.

JUDGE STONE: I do not think we need a motion on it.

GENERAL GILES: You have to have something in the record.

JUDGE STONE: All right.

GENERAL GILES: I move that that be the order of the Committee.

JUDGE STONE: Very well. Is there a second to that motion?

A MEMBER: I second the motion.

MR. SHAW: Does the motion provide for the distribution of copies among the representatives of the states on the Committee, or to furnish copies to

the Chairman for mimeographing and distribution? I don't understand which.

GENERAL GILES: Well, I think the latter is more expeditious.

(The motion was put to a vote, and declared by Chairman Stone to be carried.)

JUDGE STONE: Now, may I make this further inquiry, Mr. Warne? Several have asked if other reports will be available.

MR. WARNE: You mean other copies of this report?

JUDGE STONE: Yes.

MR. WARNE: Yes, sir. I hesitate to make a promise on that without consulting with Mr. Larson. I believe the mimeographing is done in Salt Lake City. How long will it take you to run another 150 or 200 copies?

MR. LARSON: Well, I don't know. The cutting of the stencils has been reserved, so that we can go ahead and make corrections, etc.

MR. WARNE: Can you get it done next week?

MR. LARSON: They are all distributed, the last two today.

MR. WARNE: Can you get it done next week, do you think?

MR. LARSON: We will make every effort to. We worked three shifts a day to get this out.

MR. WARNE: All of you who wish additional copies, please present your requests for the additional copies to Mr. Larson, and we will make each individual responsible. Each copy of the report will carry the confidential note.

MR. LARSON: And should we have something from the states as to who is going to get the copies?

MR. WARNE: I suggest we charge them out to the representatives of the states.

JUDGE STONE: That request is to be made to Mr. Larson?

MR. WARNE: To Mr. Larson, the first thing Monday morning.

MR. LARSON: By states.

MR. HOWARD: Will they be revised, or will they be identical, including the errors?

MR. WARNE: They will include all errors. We will make another copy some of these days that will not have errors.

MR. HOWARD: For practical reasons it would be better to have the new edition identical, although in some particulars you want to revise it.

MR. LARSON: It will be that way.

JUDGE STONE: Let us have an understanding. Mr. Warne, as I understand it, it is contemplated that all reports which have been distributed and those that will be distributed through the members of the states on this Committee are to be returned, and that those are to be returned, as I take it, after the statements have been submitted, is that correct?

MR. LARSON: That should apply to your reports too, that have been distributed. They have a lot of the factual data.

MR. WARNE: The purpose of that is to avoid some five years from now a half dozen versions of this report being in circulation. I think you gentlemen understand.

JUDGE STONE: I think we do. It is perfectly reasonable, and Colorado has gotten out some reports here which contain a resume. We will apply the same rule on that, as far as we can get them.

MR. WARNE: If you will give to Mr. Larson, who will be here Monday morning, the minimum number of copies you want, we will have the mimeograph machines running over in Salt Lake City as quickly as we can, and the copies should be ready in a few days.

JUDGE STONE: Very well. Now, gentlemen, there are a few other details to be disposed of.

The Chair has distributed this expense account. Is that committee ready to report?

GENERAL GILES: We are, Your Honor. The Committee has approved your report, with the revision made by the Chair with respect to that $20 item. The committee members have had the report in their hands and I assume you have examined it.

I now move the adoption and approval of the financial report.

MR. WALLACE: Without having read it, I second the motion.

(The motion was put to a vote and declared by Chairman Stone to be carried.)

JUDGE STONE: Now, I think you will note from this report that another year has gone by since an assessment was made the last time, and we have $2.72 in the bank. Are you ready to consider making the usual annual assessment?

MR. WALLACE: Is the usual one satisfactory?

JUDGE STONE: Yes, I think it should be adequate.

MR. WALLACE: I so move.

(The motion was duly seconded.)

JUDGE STONE: Motion has been made that the assessment heretofore made of $200 for each state be made. May I ask, Mr. Scattergood, does that apply to the Power Contractors?

MR. SCATTERGOOD: Yes, it does.

JUDGE STONE: Further discussion?

(The motion was put to a vote, and declared by Chairman Stone to be carried.)

MR. HAUSER: I assume, Mr. Chairman, we will get three bills, triplicate bills?

JUDGE STONE: One for the Power Contractors and one for the state?

MR. HAUSER: I want copies in triplicate.

JUDGE STONE: Now, there is another item. I assume that the Bureau of Reclamation would like to have the comments that were made orally as soon as possible. Would it be helpful to the Bureau if we secure from the reporter an additional copy of the minutes of the proceedings and submit it to you? Usually we need three copies for the Editing Committee. If that will be helpful, we can obtain an extra copy for your use.

MR. WARNE: That is, of your rough draft?

JUDGE STONE: That will be the stenographic report of these proceedings.

MR. WARNE: We would like to have a copy of that.

JUDGE STONE: Before it is edited? One copy will serve your purpose, will it?

MR. WARNE: Of the preliminary draft, yes.

JUDGE STONE: Mr. Shaw is the Chairman of the Editing Committee. Do you have any announcement to make about that, Mr. Shaw?

MR. SHAW: I will be glad to communicate with Mr. Carson and General Giles as soon as I receive the transcript, and we will arrange the date of meeting.

MR. WARNE: I said one copy would be sufficient of the preliminary draft.

JUDGE STONE: Now, before we adjourn, may I say on behalf of Colorado, we appreciate having you folks here, and we appreciate having this large group of interested people from the various states. It is very helpful to the Committee of Sixteen, and it is quite necessary that we have those who are interested in these matters meet with us.

I want to say to the Bureau of Reclamation that for seven years, Mr. Warne, we have had the finest cooperation on the part of the Bureau. Mr. Debler--you can look back in some of the proceedings and you will find that he outlined something of a plan some years ago, and he has kept us up to date. Mr. Riter has been pitching since he has taken the office over, and the others have given us splendid cooperation, and on behalf of the Committee I want to express our appreciation.

MR. WARNE: The Bureau appreciates very much the cooperation of the Committee of Sixteen and the Committee of Fourteen, and the people of each state. It is a relationship that we prize very much.

JUDGE STONE: Are there any other matters to come before the Committee? Do you have something, Mr. Larson?

MR. RITER: It might be helpful if we could get the numbers today, if the states are prepared today to tell us how many copies of the report they need.

JUDGE STONE: Arizona.

MR. CARSON: Arizona won't need any more copies.

JUDGE STONE: New Mexico.

MR. WILSON: Five for New Mexico.

JUDGE STONE: You have it for California?

MR. RITER: I have it for California.

JUDGE STONE: Nevada.

MR. SMITH: One.

JUDGE STONE: Wyoming.

MR. ROLLINS: Four for Wyoming.

MR. RITER: How many for Colorado, Judge?

MR. WALLACE: Utah desires three additional copies.

JUDGE STONE: Mr. Merriell, do you know how many additional copies it will take for Western Colorado?

MR. MERRIELL: No, I haven't one available.

JUDGE STONE: Mr. Larson, may I hand that to you sometime before Monday?

MR. LARSON: Yes. I want to get it over there so that they can get started mimeographing Monday morning.

(On motion, duly seconded and carried, the meeting adjourned at 5:50 p. m.)

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
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14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	**Y-1_pgs i-81**	32	BG, BH, BI

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RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

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NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

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SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

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UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME I

Record of Preliminary Governors' Meeting, and
for Commission Meetings No. 1-5, inclusive

UPPER COLORADO RIVER COMPACT COMMISSION

OFFICIAL RECORD OF MEETING NO. 3

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Grand Junction, Colorado	October 30, 1946
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APPEARANCES
UPPER COLORADO RIVER BASIN COMPACT COMMISSION

HARRY W. BASHORE, CHAIRMAN
Federal Representative
Mitchell, Nebraska

A. W. WATSON, ACTING SECRETARY
Salt Lake City, Utah

COMMISSIONER FOR THE STATE OF ARIZONA:

Charles A. Carson	Special Attorney for Arizona, 419 Title & Trust Building, Phoenix, Arizona.

COMMISSIONER FOR THE STATE OF COLORADO:

Clifford H. Stone	Director, Colorado Water Conservation Board, State Office Building, Denver, Colorado.

COMMISSIONER FOR THE STATE OF NEW MEXICO:

Thomas M. McClure	State Engineer, Capitol Building, Santa Fe, New Mexico.

COMMISSIONER FOR THE STATE OF UTAH:

Edward H. Watson	State Engineer, State Capitol, Salt Lake City, Utah.

COMMISSIONER FOR THE STATE OF WYOMING:

L. C. Bishop	State Engineer, Cheyenne, Wyoming.

ADVISERS AND OTHER PERSONS PRESENT

COLORADO:

Jean S. Breitenstein	Attorney, Colorado Water Conservation Board, 718 Symes Building, Denver, Colorado.

NEW MEXICO:

Fred E. Wilson	Special Assistant Attorney General and Attorney for New Mexico Interstate Stream Commission, Albuquerque, New Mexico.

UTAH:

Edward W. Clyde	Special Assistant Attorney General, Salt Lake City, Utah.
C. S. Jarvis	State Engineer's Office, Salt Lake City, Utah.
Wm. R. Wallace	President, Utah Water Users Association, Salt Lake City, Utah.
Thos. W. Jensen	Utah Water Users Association, Mt. Pleasant, Utah.

WYOMING:

Louis J. O'Marr	Attorney General of Wyoming, Cheyenne, Wyoming.
Ernest B. Hitchcock	Wyoming State Planning & Water Conservation Board, Rock Springs, Wyoming.
Emil C. Gradert	Compact Commissioner, Fort Bridger, Wyoming.
Norman W. Barlow	President, Green River Basin Development Company, Cora, Wyoming.
David P. Miller	Secretary, Green River Basin Development Company, Rock Springs, Wyoming.
Perry W. Jenkins	Executive Manager, Green River Basin Development Company, Cora, Wyoming and Salt Lake City, Utah.

Carroll R. Noble	Cora, Wyoming.
H. B. Carlisle	Sage, Wyoming.
Leoland U. Grieve	Asst. Inter-State Streams Comm., Savery, Wyoming.
John A. Reed	Asst. Inter-State Streams Comm., Kemmerer, Wyoming.
Platt Wilson	Asst. Inter-State Streams Comm., Kemmerer, Wyoming.
Orson N. Behunin	Burntfork, Wyoming.
Wm. McGinnis	Burntfork, Wyoming.
Joe L. Budd	Big Piney, Wyoming.
Don W. Jewett	Big Piney, Wyoming.
F. W. Tanner	Big Piney, Wyoming.
Carl Jorgensen	Pinedale, Wyoming
Melroy Luke	McKinnon, Wyoming.
Edward Davidson	Blacks Fork P. & I. District, Mt. View, Wyoming.
Roy C. Taylor	Mt. View, Wyoming.
Jesse Graham	Mt. View, Wyoming.
W. S. Tanner	Mt. View, Wyoming.
Oscar W. Dahlquist	Mt. View, Wyoming.
Orlen P. Packrell	Blacks Fork Canal Board, Lyman, Wyoming.
John W. Field	Lyman, Wyoming.
Van A. Rupe	Lyman, Wyoming.
Charles F. Guild	Piedmont, Wyoming.
Victor Fillen	Fort Bridger, Wyoming.
John J. Segar	Fort Bridger, Wyoming.
Felix Aimone	Fort Bridger, Wyoming.
Carl P. Dahlquist	Fort Bridger, Wyoming.
Milton L. Clifford	Fort Bridger, Wyoming.
E. R. Hamblin	Blacks Forks Canal, Fort Bridger, Wyoming.
J. H. Jacobucci	Green River, Wyoming.
Marshall Smith	

BUREAU OF RECLAMATION:

J. G. Will	Assistant Chief Counsel, Washington, D. C.
J. R. Riter	Hydrology Division, Denver, Colorado.
N. B. Bennett, Jr.	Branch of Project Planning, Washington, D. C.
J. Stuart McMaster	Counsel, Region 4, Salt Lake City, Utah.
Reid Jerman	Engineer, Region 4, Salt Lake City, Utah.
Palmer B. DeLong	Kemmerer, Wyoming.
Paul E. Morine	Salt Lake City, Utah.
A. A. Batson	Denver, Colorado.
E. H. George	North Platte District, Casper, Wyoming.

DIVISION OF LANDS, FOREST SERVICE:

Ralph V. Minges	Denver, Colorado.

SESSION AT ROCK SPRINGS, WYOMING
MONDAY, OCTOBER 28, 1946

The meeting was called to order by Chairman Bashore at 1:45 p.m., Monday, October 28, 1946.

THE CHAIRMAN: The meeting will now come to order. It is now a quarter to two. This is the third regular meeting of the Upper Colorado River Basin Compact Commission. At the last meeting at Santa Fe, New Mexico, the Commission decided that the third meeting should consist of a series of field hearings at points in the Upper Division States. This is the first of the series. The next one will be at Grand Junction, Colorado; the next one at Price, Utah; and the last one at Farmington, New Mexico.

The purpose of these meetings is to acquaint the people in the various states with the work of the Commission and to afford them the opportunity of expressing their opinions and ideas to the Commissioners in regard to the proposed Compact. It is the opinion of the Chairman that these meetings are very important because it gives an opportunity for an expression of ditch-bank opinion about this water allocation. If you don't understand what the Commission is doing you may ask all the questions you like. There are experts here who will try to answer those questions and I am sure the Commission will appreciate your advice and counsel in regard to these deliberations and negotiations.

Now as this meeting is in Wyoming, the Chairman now requests that Com. Bishop take charge of the meeting and explain the work of the Commission and call on anyone that he thinks might contribute something. So, Mr. Bishop, the meeting is now in your hands.

COM. BISHOP: Mr. Chairman and gentlemen, we have a Compact Commission that has been set up for the purpose of dividing 7,500,000 acre feet of water allocated to the Upper Basin States by the terms of the Colorado River Compact.

Is Mr. Norman Barlow here?

MR. BARLOW: Yes.

COM. BISHOP: Mr. Barlow, I am going to call on you first to make a statement of your understanding of the situation and all for the Basin here as President of the Green River Basin Development Company.

MR. BARLOW: Mr. Chairman, we had our annual meeting this morning of our Green River Development Company. I might say at the outset that this company is an organization that was formed several years ago to promote the development of the resources here in the Green River Valley in Wyoming. It comprises five of our southwest counties. We have a directorate of fifteen, three directors from each county, our officers and an executive committee.

We feel that our work in the past has been very beneficial, particularly in that we have been educating, we hope, the people in the Basin to reclamation and the needs of reclamation as we see it. Our meetings are becoming better attended and our meetings throughout the Basin that we have held during the years carrying on an educational program have been most beneficial to our company and to the people who are directly interested in the use of the water within our Basin here in Wyoming.

It was about two years ago, I think, that our Basin Company took official action in calling on our Governor to start a meeting for the negotiation of the water of the Upper Basin States. Our State Engineer advised the

Governor and the Governor notified the other Governors of the four Upper Basin States with not too much success. There seemed to be reasons why they didn't care to commit themselves at that particular time or there was no particular need or rush in getting started in this negotiation. We insisted and I think there was a follow-up letter. At any rate over the period of months we did get to where the four governors decided that they would officially start to negotiate and they had their first meeting last July, as you know, in Cheyenne.

We feel here in the Green River Basin in Wyoming that this is a most important thing to allocate our water particularly because we are anxious to develop, naturally, our resources here in the Basin. We want to develop them with Wyoming water. We want to develop them with Wyoming's share of this Colorado River water. We want to insure our future posterity throughout the coming ages that there will be water here for any resources that we may have to develop.

We know this, that until we decide among the four Upper Basin States what our liability is at Lee Ferry, that no one knows exactly what development may take place.

We had a meeting with the new Secretary Krug and Commissioner Straus at Laramie in June, our Basin Company, and we were encouraged at that time with the statement that Mr. Krug made in regard to the allocation of the water stating that while he was new in the Department, he was of the mind at that time to feel inclined not to urge further development until the four Upper Basin States did get together and allocate the water. It was something that we have been stressing and we were encouraged to have him make that statement.

We have had, as you have been told, preliminary meetings of the Compact Commission; and Wyoming's delegates on that Commission, I am sure, are willing to meet in a friendly attitude, in fairness to all the other states involved in getting this matter settled. We hope this afternoon in the discussion that may take place that we will do it in a sense of fairness, fair play for everyone.

We only want what belongs to Wyoming and we would like to get it negotiated at the earliest possible date.

COM. BISHOP: Thank you, Mr. Barlow. Mr. Miller, would you like to make a statement in addition to what Mr. Barlow has made?

MR. DAVID P. MILLER: I am the Secretary of the Green River Basin Development Company of which Mr. Barlow is the President. This organization has been in existence since 1938. We felt the need of some centralized organization which would help conserve the water of the Green River so far as Wyoming is concerned. To that end we organized this company, which is a non-profit organization with a representation from all the five counties of the Green River Basin in Wyoming.

We feel that we have a large interest at stake in this matter. It involves the irrigation of several hundred thousand acres of new land. It involves several large power sites. And it involves the use of a large amount of water for industrial purposes. There is just beginning to be developed in our area a new industry. A company has come in to a location which is about fifteen miles west of the town of Green River. They are developing the mineral they call trona. They are at present engaged in sinking a large shaft and they are going to make a large development. These people have told me that they intend if everything works out to have the largest

chemical plant west of the Mississippi River. This is a comparatively new development here in our community and one in which we have intense interest.

We feel that we are all on a sort of an uncertain ground pending the allocation of the water among the four Upper Basin States and as stated by Mr. Barlow, we favor that this allocation be made at the earliest possible time.

Now this morning we had a meeting of our company and we adopted two resolutions which I would like to present to the Commission. If it is appropriate I would present them at this time. Do you wish to have me read them, Mr. Bashore, and then they will be presented?

COM. BISHOP: I think you had better read them because a lot of the people would like to hear them. There are some people that weren't here at the meeting this morning. I suggest that you read them and give the secretary a copy.

MR. MILLER: There are six copies there and we will prepare others if necessary. The first resolution is a generalized one and I will read it as follows:

"WHEREAS: Negotiations have been commenced concerning the allocation of the waters of the Colorado River under the terms of the Compact, by the formation of the Upper Colorado River Basin Compact Commission.

"THEREFORE: Be it resolved that the Green River Basin Development Company is in entire accord with the aims of the Commission and urges that a Compact be ratified at the earliest possible time."

The second one:

"WHEREAS: The Secretary of the Interior has publicly stated that he is opposed to further construction and development in the Colorado River Basin until such time as agreement has been reached among the upper basin states concerning the division of the water under the terms of the Colorado River Compact.

"THEREFORE: Be it resolved that the Green River Basin Development Company in annual meeting assembled hereby endorses the position taken by the Secretary and hereby opposes all construction and development and in addition in order to make the recommendation equitable, resolves that whenever possible that disbursements of funds on existing projects be withheld until such time as a Compact is ratified by the upper basin states."

In other words, we are anxious to see this thing proceed and to this end our company has adopted this resolution.

COM. WATSON: Mr. Bishop, is a question in order?

COM. BISHOP: Yes.

COM. WATSON: Will Mr. Miller please explain to this Commission what the mineral trona is?

MR. MILLER: As I understand, Mr. Watson, it is a double carbonate; it is sodium carbonate and sodium bicarbonate mixed and in what proportion I am not able to say at the moment. Just to explain that a little further, we have another material in this area which is the mineral they call leucite and leucite is a silicate of aluminum and potassium; and without going into the details of this proposed process, I think it is contemplated that by the

combination of this material, leucite, with the trona, profitable development can be made in the chemical industry in this area.

COM. BISHOP: Are there any questions? We would be glad to have any of you ask questions. I wonder if there is someone here from the Lyman project who can tell us why it is going to be beneficial. Will one of you gentlemen do that? These gentlemen here would like to know some of the needs of you people in the Basin.

MR. E. R. HAMBLIN, FORT BRIDGER, WYO.: My name is E. R. Hamblin.

COM. BISHOP: You are a water user under the Lyman Project, are you?

MR. HAMBLIN: Yes, sir. I don't know what I could say. Most of us delegates down here represent quite a farming district up there, that is, a ranching district. Most of those are old ranches. They were originally farms and found out it was better to use them as ranches so they have been growing grass and steers since, and as the years go by, why, the water is being taken away from us.

I remember along about 1920 we went up with teams and scrapers and started some little reservoirs and started a rather large one and we had it completed to a certain extent. But it seems as though that was a nuisance to some of the bigger companies, that is, the railroad and the Standard Timber Company, and it interfered with their ties and they blew that up. So there were some small reservoirs built and we are using those, but they are not adequate.

Now we got our stock in off of the range and this year and other years we raised a fairly good hay crop, but our carrying capacity would have been almost double if we had had pastures to turn them in on. I think we should have had one more irrigation.

Now in asking for another irrigation for our land we don't feel that it is going to take a lot of water out of the Green River Basin because the run-off in recent years is getting bigger and bigger all the time out of the Valley back into the Blacks Fork. It increases every year. Well, if we just have one or two waterings, that will dry up and Blacks Fork will dry up, too, in a certain part of the year, dry up completely. That is just a natural consequence. Water seeks its own level and when we spread it out over that land, it isn't destroyed. It isn't gone. It keeps on coming down and finally gets down to Lee Ferry even if we do use a little of it.

Now most of those farms have long standing; they have been used a long time. My father came into that country because he thought that there was a plentiful supply of water, which there was at that time. But as the people began moving in and began to allocate the water, the water was being cut down all the time until finally his land wasn't worth so much as it was.

Now myself, for instance--this is just a little incident but it applies to a lot of the rest of my neighbors--I developed a ranch in the center of the Bridger Valley, not a very large ranch but a ranch just the same. When I started that ranch I did have a plentiful supply of water for my requirements at that time but they have been cutting me down all the time. So we saw the need of reservoirs. There were plenty of good sites. We started those reservoirs, but it seems as though the Government stepped in and says, "We will develop these for you." Well, that was fine with us, so we sort of let the Government take hold.

Well, there was so much red tape we formed a little group up there and made applications and the applications were approved, and now the water is being taken down to develop countries in the Lower Basin. We don't feel that is fair. We moved into that country in the early stage of development, spent our lives there with our families.

Now myself, for instance, I raised a rather large family and we contributed to the development of that land very sincerely. We made our home there. I raised some boys. The war came along. The Government took the boys, and of course those boys were really ranch raised. They were well educated. The people in that valley are education minded, and we, along with the rest of them--that was our main aim, to educate those boys. While they were in the University they took them away from us. It was all very well. We thought that was good. Now those boys have had a lot of experience, they had a good education and they have been practically all over the world, I might say, but their minds are still on the ranch and that is home to them.

Now if those boys have to come back to a dry country, what are you leaders going to say? How are you going to answer if they are taking their water away from them? We feel that that is our water and somebody, if it is taken away, has got to answer for it. You can make all the records you want but you have got to answer to those boys, and all we are asking is just our share of what really belongs to us.

COM. BISHOP: Would you mind telling us what this 160-acre limitation might do to the people over there?

MR. HAMBLIN: Yes, sir, I certainly would like to answer that. Our district is a rather high elevation, and true, we can raise lettuce and we can raise radishes, too, just as good as they can in Imperial Valley or any place else, but we don't feel it is profitable.

Now take one of my boys, for instance. He can operate a ranch of 320 acres most of the year around--most of the year--and he can develop a lot of good beefsteak and a lot of wool, more wool and beefsteak than the value of any radishes down in Imperial Valley, more value, and the Nation would gather more taxes, too.

And so we know that--you know too--that 160 acres for a ranching country is just out of the question for us. We contend all the time that that water isn't lost because we spread it out on those meadows. It isn't gone. And just 160 acres, why, if you confine us to 160 acres, you will kill the Bridger Valley. We might have a little oil later on but it will kill the beef and the wool.

COM. BISHOP: I believe I should explain for your information that the people of the lower valley haven't taken your water. The Colorado River Compact allocates 7,500,000 acre feet of water per year to the Upper Basin and to divide this water is what this Compact Commission was formed for. It is their business to divide this water and see that Wyoming gets its share. To date there is no one taking any of Wyoming's water. We have used all we can and they have used all they can in the Lower Basin and some 12,000,000 acre feet runs on into the Pacific Ocean.

MR. HAMBLIN: I grant you that but I understood from the conversation this morning it is also a fact that if we deliver 7,500--is it?

JUDGE FRED E. WILSON, NEW MEXICO: Seven million five hundred thousand acre feet.

MR. HAMBLIN: Well, anyway, it is more than we can deliver every year. We guarantee that? Is that a fact, we guarantee that much down there?

COM. BISHOP: We guarantee 75,000,000 in each continuing ten-year period.

MR. HAMBLIN: I don't believe we can do it.

MR. THOS. W. JENSEN, UTAH: Have you got that much in the Blacks Fork?

MR. HAMBLIN: Well, if we spread it out and were conservative we might have. (Laughter.)

COM. BISHOP: Would any of the rest of you from over at Lyman like to have something to say?

MR. CARL P. DAHLQUIST, FORT BRIDGER, WYOMING: I might add to Mr. Hamblin's statement concerning our water over there. It is a case over there of early runoffs. At the time we need our waters they are gone; and our only means of staying in that valley is to have some place to store the water so that we may use it when we need it. I believe that would be about all.

COM. BISHOP: Do you have something you want to say?

MR. OSCAR W. DAHLQUIST, MOUNTAINVIEW, WYOMING: Yes. I am like these other men; I think we need to conserve our water. Our water runs off too early in the spring and at the time of the growing season we haven't got any. We should have a place for it to be stored. And furthermore, if we have our water there, it gives our young men a chance to stay in the Valley and gives them something to build to.

MR. JOHN W. FIELD, LYMAN, WYOMING: I have had a little experience up there with the water and I would just like to say this: that when we first came there, as Mr. Hamblin said, there was water enough for the users that were there; but since that time appropriations have amounted to enough now that there is only half of the season or a fourth of the season that anyone draws water.

Of course there isn't any storage and as the water falls in the River, it runs off. This year there are somewhere around 600 feet in Blacks Fork appropriated and the River hardly supplied 300 feet, and a foot for every 70 acres in that sandy, gravelly country there will not irrigate it. It's just insufficient.

That's all I have to say. That's the condition, that there are only half of the people in that Valley now drawing water sufficient to make a crop. This year the crop fell down 50 per cent or better due to the early rise; of course, part of the crop was saved.

COM. BISHOP: I believe at this time it would be well for Mr. DeLong to explain what the plans of the Bureau are for this particular project.

MR. PALMER B. DeLONG, BUREAU OF RECLAMATION, KEMMERER, WYOMING: The plans for the Lyman Project as outlined in the Colorado River Report include the furnishing of supplemental water to nearly 21,000 acres of what we call Class 1 and 2 land. We have decided that a capacity of 30,000 acre feet in the Bridger Reservoir on Willow Creek would furnish enough water for this purpose. However, since the writing of the Colorado River Report, we have

continued our studies further on the Lyman Project and we hope this winter to come up with the detailed project report which may change that plan a little bit.

For example, we have since the Colorado River Report completed a detailed classification which will change the acreage of what we call Class 1 and 2 land and may change the setup a little bit. However, in considering the Lyman Project, we are considering it from the standpoint of a livestock economy and not from the standpoint of growing cash crops or lettuce or radishes, as Mr. Hamblin suggested.

I feel quite encouraged about the Lyman Project and I think that we are going to be able to work something out that will be satisfactory to the Lyman people as well as everyone else.

Are there any questions? Is there anything that you would like to discuss further, Mr. Bishop?

MR. HAMBLIN: Mr. DeLong, there has been some confusion about this classification of the land. Of course a lot of that valley is cobble rock, but it is growing good crops; and some of those meadows have been growing since 1822 and are still growing good crops.

COM. BISHOP: 1822?

MR. HAMBLIN: 1822.

MR. DeLONG: I believe according to our records that the first irrigation was in about 1860, Mr. Hamblin.

MR. HAMBLIN: What about the fort at Bridger, and Fort Supply? Of course, Supply was later.

MR. DeLONG: 1822 was pretty early.

MR. HAMBLIN: You will have to prove I am wrong.

MR. DeLONG: We agree that your meadow land, your pasture land there, has some very good soil. However, as I mentioned to you this morning, there is a restriction on that kind of land that forces us to throw it out of what we call Class 1 and 2, the lands that can be cultivated. For example, as you mentioned, it is full of cobbles on the surface and it is not possible to plow it.

However, we do recognize the fact that it is good soil other than that and can grow very good grass crops, and it is our responsibility to recognize the value of that grass, as you mentioned--your livestock, beef and sheep, and one thing and another--and we recognize the problem there in that way.

COM. WATSON: Mr. DeLong, the return flow on that type of land would be very large, would it not?

MR. DeLONG: Well, as they mentioned, the soil is fairly sandy and gravelly, and it requires a good diversion. However, the consumption is low, as you recognize from the altitude and the type of crop. The return flow is good, yes--some irrecoverable losses, but not many.

MR. VAN A. RUPE, LYMAN, WYOMING: You spoke about a revision; did you mean downward or upward in the acreage?

MR. DeLONG: If there is any revision in the Lyman Project it will be upward.

COM. BISHOP: You want to ask a question?

MR. HAMBLIN: Maybe I could give you an illustration. I don't like to take your valuable time, but I would like to give a little illustration.

I was President of the Uinta County Farm Bureau for sometime and at that time there was a lady who came from down in the lower Colorado River district, and of course she and her husband looked me up and stopped there over night. He was rather a livestock-minded man although he had been growing row crops. He had an investment of about $40,000 down there in that country in land besides his machinery, an enormous lot of machinery--I don't just remember how much.

But anyway, he helped me feed my cattle and do my chores. Then we went out the next morning on Farm Bureau business, and that night he was comparing my means of income with his. I didn't have quite that big an investment in my layout there, but he was pretty good at figures and he sat down and he figured for an hour or two. He figured all my income, what little I had off my ewes and how much I had off my cattle; of course at that time my wife and I weren't milking very many cows but we did have a little income on cows. And of course we had our chickens, too--my wife always has to have chickens whether we go behind on them or not. (Laughter.)

And so he was figuring on the income off of my investment. "Why," he says, "I have got almost double the investment you have got and my wife put in over two months hoeing beans." Well, my wife never did hoe beans. It is very few times she has milked. Anyway, he was comparing his efforts he put in, he and his wife, and the efforts of me and my wife, and then their income. He was a lettuce man and so on. "Why," he says, "you can produce more for the money invested than I can besides the effort we have to put in." So why send that water down to them? (Laughter.)

COM. BISHOP: Is there someone here from some of the other projects that would like to be heard? How about the Eden Project? Mr. McGinnis, would you like to be heard? Come up here where we can look at you and hear you.

MR. WM. McGINNIS, BURNTFORK, WYOMING: I am a very poor orator. I have lived in the Bridger Valley that I have heard Mr. Hamblin talking about here. I lived in Bridger Valley for several years. I moved from Bridger Valley to the Burntfork district and I have lived there 34 years. When I first went to the Burntfork district there was an abundance of water for the entire land but there was a new settlement that soon consumed the water and we have been more or less shy of water for a good many years.

I had a family of small children, worked various ways, and wanted to get out of it and my wife says, "No, we can't go with these children to a different place." I said, "We have got to get water." She says, "Go get it." I said, "How are we going to get it?" I began studying and spent a good many nights without sleep. Finally I decided to see what could be done so I go to Green River and see Mr. Evers. Bill Evers was Commissioner there.

I was getting poorer and poorer every year. Our altitude out there is 7,125. We raise wonderful stock. When we have moisture, the grass is good and the range is good. If we have water enough we raise an abundance of hay; we raise any amount of small grain. But when we haven't any water, our

holdings are absolutely worthless. Consequently I got in so I couldn't move away, bringing about almost separation with my family moving, so I began to hunt for water.

Mr. Evers and I talked together and he said, "I will help you out." He would do what he could. He takes me and we go to Cheyenne. We look around. At that time I don't believe there was scarcely any reclamation; such things as that were just getting started in places, but at least he stayed with me. He is a good Indian. And we worked that out and finally we have no place to build a reservoir, but eventually we found one where we could build one, but it is quite expensive. So we worked around until we got Government aid and we built a reservoir and we have had quite a little bit of trouble getting the amount of water that would suffice us to the reservoir. We are a poor lot of people and we couldn't quite finance those things.

But as to our location, we haven't water enough as there is more and more development and more land to be developed, that should be developed. We have the one reservoir now. That is a wonderful thing; there is no question about it. It is a wonderful thing. It has been quite expensive but then at the same time it is worth while, and yet we haven't water enough. We are shy on water.

But there is what they call the Big Basin, it is in Utah, and it will hold an awful lot of water; and through the development of that water from Henry's Fork, the Beaver Creeks and other tributaries, why, there could be a wonderful reservoir made and it would supply that country together with much arid land in the lower country, down towards the Manila country and in that country down there, and also a lot of it can be carried over to benefit those people in the Bridger Valley or around the arid lands in that country near Granger, and so on. If I am not mistaken, it has been allocated for 122,000 acre feet or something like that. Well no doubt it would take some time to fill all that but the runoff in the spring as a rule is immense.

Well this water goes down, it gets to where it goes to Lee Ferry or wherever somebody must get the benefit of it. But at the same time, the way I look at it, all stored waters in these upper regions, when they are utilized and used, they help to maintain and supply the demand at Lee Ferry and all lower areas.

Our country for raising stock, sheep and cattle, is hard to beat if you put the moisture on the ground, but without that that country isn't worth very much. Now I don't think that any other is as far as I am interested. I believe that if we could get the right support and get this into a reservoir that it would assist the people over in the Lyman area. It would irrigate an awful lot of arid land and supplement a lot of already water users. They would be successful. It would be a great country.

We have had some awful droughts out there. It was almost impossible to live through them unless you were pretty well financed, which I have never been. I have gone through it all, know just about how it is, and I think the entire community out there will bear me out that if we can get the amount of water that is needed it will also help maintain the resources and also build up a wonderful country. In dry years our arid grounds were no good. When we can put the water on them, we can raise grasses, hay, or anything. It doesn't make any difference whether it is a rock pile, where you can get the moisture you can get production in that country. I don't know about these lower countries. I have been down there, too, but I didn't live down there and cultivate them and so on.

I think a lot of our country and I want to see it supported. We have

additions there on both sides that I think should be supported. A reservoir like that would not only support that but it would make a wonderful difference in our building up of our wonderful West, which would give us all more land. The boys, the G.I.'s and so on, could many, many, many of them have homes and places to live where today, with the housing situation, it seems to me they are taking them all to the cities. What are they going to do when the cities are filled up? Where are they going to get their production from?

I am kind of lost; I am wondering what they are going to do. In all these cities they have plans going on but nothing doing to make production. I think the production is first and then we might have something to rely upon because we have got to have something to eat and wear.

COM. BISHOP: Thank you, Mr. McGinnis. Mr. McGinnis has been in a part of the country where he is very close to the Utah State Line where the Utah fellows have the "highority", not the priority, where they help themselves. Mr. McGinnis was water commissioner for a few years and he knows the situation over there.

MR. ORSON N. BEHUNIN, BURNTFORK, WYOMING: There is just a little I would like to add to that about our climate out there. We are 7100 feet and our country nestles under the leeward of the Uinta Mountains. We have one of the nicest climates in the world for that elevation. Very, very seldom in winter-time does our temperature reach ten below zero at night, and even those few nights that we get ten below zero weather, in the daytime the sun comes out warm and you can go out about your chores and feed your cattle without your coat on. Of course there are storms and we do get some cold weather, but it is very rare.

Therefore, our livestock doesn't require the feed that they do in some lower areas where they get the cold weather. The fog will settle down over this country and the temperature will run down to 30 below zero while we are sitting out there above the clouds without any cold weather, and we do have a very fine climate out there and we do produce some very good crops.

I think that we do need water awful bad. There is once in a while that one of us will get so mad we will strap on our gun and go up the river. We don't find our neighbor stealing water and we go home and put the gun away. We haven't killed anyone.

COM. BISHOP: You don't go over to Utah any, do you?

MR. BEHUNIN: We put one of those guys in the ditch, dumped him in three times in one day. (Laughter.)

MR. MELROY LUKE, McKINNON, WYOMING: There is just one more thing I would like to add; I don't know whether it will be beneficial or not.

Our country out there has an awful lot of slope from two ways into the Henry's Fork Creek part and although we have a lot of rocky formation underneath the surface in places and it takes a lot per acre for the surface, it sub-irrigates below, and as it goes on down the country, I don't believe it draws or holds back too much water out of the lower country or the Green River regular stream.

We have three reservoirs out there at the present time and all those reservoirs combined don't furnish enough water to irrigate the ground that is already under cultivation. As we get on down to this sub-irrigation, those fellows are getting more irrigation water through their lower streams than we people on the upper streams, so I don't believe that your irrigation c...

the upper part will deprive the people in the lower valley.

COM. BISHOP: Thank you, Mr. Luke. Mr. DeLong, I wonder if you would mind giving a short description of the Henry's Fork Project and the Big Basin Reservoir.

MR. DeLONG: The Henry's Fork Project as set up in the Colorado River Basin report includes 21,090 acres presently irrigated land to receive supplemental water, and 9,190 acres new land to receive a full supply. The regulation for this plan will come from the Big Basin Reservoir, as Mr. McGinnis mentioned, built to a capacity of 107,000 acre feet.

This reservoir is filled by a collection canal that picks up water from Henry's Fork, Beaver Creeks, and Burntfork, and delivers it to the Big Basin Reservoir. There are outlets in turn which come from the Big Basin Reservoir and return the water back to where these lands can be served.

In addition to that under our plan for ultimate development it is possible to construct a service canal 30 miles in length and about 300 second feet in capacity from the Big Basin Reservoir to the Lyman area in Bridger Valley to irrigate an additional acreage over there of about 7,160 acres of new land.

COM. BISHOP: Thank you, Mr. DeLong.

COM. STONE: Mr. Bishop, may I ask Mr. DeLong a question?

COM. BISHOP: Yes.

COM. STONE: Mr. DeLong, you are familiar with the Eden Project?

MR. DeLONG: Well, yes, somewhat.

COM. STONE: That is a W.C.U. project, is it not?

MR. DeLONG: That is right, as originally set up.

COM. STONE: What is the percentage of completion on that project?

MR. DeLONG: I believe they estimate officially about 16 percent complete.

COM. STONE: Is that the project for which an appropriation was made by the last Congress for its completion?

MR. DeLONG: I understand that is correct; however, perhaps Mr. McMaster can answer that definitely. Was there not an appropriation made in the last Congress for the Eden Project?

MR. J. STUART McMASTER, BUREAU OF RECLAMATION, SALT LAKE CITY, UTAH: There was some money made available for W.C.U. and some of it I understand was earmarked for the Eden.

COM. STONE: There were two projects?

MR. McMASTER: The Mancos and Eden.

COM. STONE: And as I understand it--I want to ascertain whether I am right in my understanding--the amount of money made available was available for the completion of that project and Mancos, is that correct?

MR. McMASTER: That is correct.

COM. STONE: And as I understand it, it is not yet decided whether that money will be made available under the executive restriction orders?

MR. McMASTER: That is correct.

COM. STONE: But the Eden Project will go forward this next fiscal year or the present fiscal year if that money is released?

MR. McMASTER: If the money is released and construction work is permitted.

COM. McCLURE: Mancos is a Wyoming or a Colorado project?

COM. STONE: Colorado.

COM. BISHOP: Are there any questions from any of those from other parts of the country? Joe Budd, can you tell us what might be done to help your part of the country?

MR. JOE L. BUDD, BIG PINEY, WYOMING: Mr. Chairman, Members of the Compact Commission, gentlemen: I am from up in the Big Piney area west of the Green River. Our primary interest at this time is construction of the Kendall Reservoir. We have holdings on the western slope of the Green River.

At the present time and for many years we have been very short of water for the irrigation of the land which we now have. There are also thousands of acres of land in that area that under reclamation can be put into production. At the present time this land is capable of grazing about one cow for each 20 acres. This same land through the application of water can be made to produce three to four tons of alfalfa per year, or any of the small grains, oats, wheat or barley.

We are very concerned. We have felt all through these years that the development of the Colorado River has sort of been in reverse. In developing our ranches we have always felt it is beneficial to apply our water on the upper reaches so that water can be reused on the lower reaches. We would like very much to see the Kendall Reservoir constructed. As that is at the head of the River, the water can be used many times by the people in all the different states.

One of our major concerns in that area is the 160-acre limitation. Our economy in the Sublette County area is based on much greater acreages. There seems to be a misunderstanding, a feeling that water shouldn't be given for greater acreage because it isn't supporting enough people. Regardless of whether the land is in one man's name or ten men's names this land is still supporting the same number of people. Families must be employed to take care of the land in either situation. I might mention at this time that most of the hired men are making more than the owners themselves so perhaps it would be better if it was in larger holdings.

We feel very fortunate that we people of the Upper Basin have been given the representation on the Commission that we have. We have great faith in the Commissioners and feel that you will recognize the difference in our climate, the necessity of more land, and also the benefits which will be derived in the Lower Basin through use of the water in the Upper Basin. Thank you.

COM. BISHOP: Thank you, Mr. Budd. Carl Jorgensen, how about you?

Can you tell us what the development might do for your part of the country?

MR. CARL JORGENSEN, PINEDALE, WYOMING: Mr. Chairman, ladies and gentlemen: The way I look at this development it should begin at the head of the River like Joe Budd stated and work down stream. If this development is made, the return flow in the high altitude will be enormous and other development can go on down stream.

I feel that with this development it will add a great lot of wealth not only to our state but to the Nation, and our economists say, the way I understand it, that where there is one dollar invested in land or agriculture, it will support seven dollars invested in other businesses, and with that it is certainly a big thing to our state. And I feel that those other businesses that this original investment is supporting should help pay for the original cost of construction, which I think is necessary on most of these large projects.

Now the 160-acre limitation--I have seen many men trying to make a living and they did exist on 160 acres. They raised a family but couldn't afford to educate them, at least not very well. They never could afford an automobile, and if they bought a piece of machinery they usually picked up something secondhand. You went to their homes; most of them just had an old camp bed they slept in, and coal oil lights. They never had running water; they never enjoyed a good bath tub. I think we should try to get that limitation increased so they could have decent homes and a decent living in this high altitude.

I think that is about all I have to say at the present time.

COM. BISHOP: Thank you, Mr. Jorgensen. Senator Grieve, will you tell us about the Little Snake River and what it might do for your part of the State?

MR. LEELAND U. GRIEVE, SAVERY, WYOMING: Mr. Chairman, our development seems to be pretty slow on the Little Snake River, but for a long time I have asked for exactly what is happening here today. I think I wrote the resolution asking for the division of the water, and of course the reason I did that was the fact that I live down on the Colorado Line where the River crosses that line sixteen times in eighteen miles, and I felt that if the West was going to develop its water, we ought to break down this attitude of indifference.

I think that now that this fine group of men have gotten together that we have broken down that attitude of indifference and that we are going to go a long ways in developing not only my valley but the other valleys and the other states of this western country of ours.

I am very happy to be here today. I haven't any interest in water; I have all the water I want. I am only here in the public interest and I am glad to see the rest of you gentlemen here and I know that your work will be successful.

COM. BISHOP: Thank you, Mr. Grieve. Anyone else that represents some other project now? I don't know all of you gentlemen.

MR. GRIEVE: Mr. Chairman, some of you gentlemen say, "Why don't you sell that place?" I built those reservoirs a long time ago with my own money and that's the reason I have got the water. (laughter.)

COM. BISHOP: Platt Wilson, how about telling us what the development would do to the Hams Fork area around Kemmerer?

MR. PLATT WILSON, KEMMERER, WYOMING: I might say our position over there is a good deal the same as with your other ranches, we have plenty of water in the spring and it peters out in the summer. You have heard that story and it is pretty much the same all over the country. I happen to come from the west part of the Valley. The creeks in our vicinity are the Labarge, Fontenelle, and Hams Fork.

We of course are interested in the development of the areas that can be irrigated in that vicinity. But as a businessman, I might say that I can speak for other businessmen as well as for the ranchers in my community in saying that we not only in our town but in Rock Springs and in Green River are interested in the development of the whole valley, the whole system as a whole. We want to see the development of the Seedskadee, the West Side, the East Side, the Lyman. We also want to see the Big Reservoir at the head of the River built so that we will have an economy out here in our country that will be stable and something that we can depend upon.

Now to get that, we have got to get together with the Commissioners of the other states and get an agreement as to the division of the water, and if we can hasten that agreement, we want to do that very thing.

We are not only interested in the development from an agricultural standpoint but we are interested from an industrial standpoint. My town happens to be a coal town as well as this town. We are interested in the future of coal, what can be made from coal not only as a fuel. We are interested in liquification plants. To have those things we must have water. If we are going to have industry in this part of the country to develop our natural resources, we must have water. So whatever we can do to hasten the division of water we want to do.

Now I don't know whether just telling you what our ills and our needs are helps you fellows to get together on the division, but that is what we want. The quicker you can get at it the quicker we will be getting some place, because as Mr. Krug has said and the Commissioner of Reclamation that they do not favor any further development in the Colorado River Basin until we agree, it is up to us to get together and agree on a division.

Now, you not only have to agree on a division among yourselves as commissioners, as representatives of the states, but the Compact has to be ratified by the legislatures of the different states. So I say that time is an essential element here. We want to get together quickly because it is going to take a long time at best. Most of our legislatures meet this next winter. I doubt very much if you gentlemen can form a compact that can be brought before the legislatures of the states in time for their meeting.

COM. BISHOP: Thank you, Mr. Wilson. How about you, Mr. Reed; would you like to say a few words about that same part of the country?

MR. JOHN A. REED, KEMMERER, WYOMING: I think, Mr. Chairman and Members of the Commission, that our ills have been pretty well aired. I think those of us who are primarily interested, perhaps, in the Green River Basin have a much deeper interest to the people of the State as a whole.

As you know, Wyoming has been pretty good to her sister states in the distribution of water. The Green River is about the only stream we have left with suitable area for development where we feel that we do have some water. And I think that we feel very deeply, I know I do, and my friends in this particular area likewise feel that we must have an equitable distribution of the Green River water.

Wyoming needs some development. Most of you are familiar with the area around Douglas, Wyoming, along the Platte River. There isn't a better agricultural area in the entire intermountain area, Colorado, Utah, or any other section, and yet look at it today. That is because we were perhaps asleep sometime or other with our development and lost our water or gave it away.

Now I don't think we want that to happen in this particular Green River area. I think there is enough water. Maybe we have been a little too liberal thus far below, which at this particular time makes it necessary for us to get busy and work out an equitable distribution of the water of the Green River. And that's all I think we are interested in and I think we have waited long enough because some of you have some development pretty well on its way and we in Wyoming feel that we are ready now, we want to go.

I don't agree with Platt Wilson. I think there can be an agreement reached between now and January when most of these legislatures meet so this can be taken care of. I think it should be. Two years, unless we go to the expense of calling a special session, is entirely too long to wait.

COM. BISHOP: Thank you, Mr. Reed. Mr. Jacobucci, would you like to say something about the Seedskadee Project? That is near your town.

MR. J. H. JACOBUCCI, GREEN RIVER, WYOMING: Mr. Chairman, thank you for the opportunity of saying something. I couldn't say anything new. I would like to emphasize more what Mr. Reed and Mr. Platt Wilson said about the necessity of hurrying up the division of water. As a farmer I can't give all the information Mr. Hamblin and these other fellows gave us.

I have a farm in Colorado and to that extent I kind of favor Judge Stone's activities in getting most of the water for Colorado. (Laughter.) However, I have been a resident of Wyoming for nearly forty years now and my principal interest outside of the electric utility and water utility business I am in has been in trying to get something for this valley outside of the railroading and coal mining we have, and we must try to develop something in the way of agriculture.

Since about 1916, our senators and congressmen every election come along and tell us how bad we needed the development of the Green River Basin and our lands up the River, how much useful land there was that could be irrigated and how soon we were going to get it. But after election it died down for another two years, and that has happened for more than thirty years.

I think we have come to the point where we just must assert ourselves with these Colorado and Utah and New Mexico people and must ask that some action be taken on the division of the water, and that's been the subject that we have discussed here at least the last four or five years. We have gotten in jams about it. We have gotten in a good many arguments with our state people and others, but we are still rather slow in trying to get at this division.

If I can give my opinion in front of these Colorado and Utah people, I think there has just been pretty much of a deliberate action on their part to defer the division of the water because fortunately, their good congressmen and senators and judges that they have have succeeded in getting nice appropriations of water and more water and appropriations of money to develop them; the nice, large Colorado-Big Thompson Project in Colorado, which Judge Stone has great credit for developing, is a credit to them and to Colorado, but we have nothing here in Wyoming yet.

They went along on the argument that they had to develop something when these soldiers came back. When they come back we have to have some land for them. We showed them we have 45,000 acres of the finest Class 1 land in this valley only a few miles up the River. It is lower than what these other people have spoken of, although I don't try to hold back their development, but the development we have on the Seedskadee Project is a development of forty-five or fifty thousand acres of first class land that can be irrigated at a cheaper cost per acre, can be developed and put in the hands of these soldiers we talk about.

You know all this lip service to the soldiers, what we were going to do with them when they came back, it was all beautiful. They just took all that to heart as if it were true. They have been back a year or year and a half and no soldier has much of an idea whether the Seedskadee Project is going to be developed in the next six months or next 75 years. It is a project that with a very small diversion dam can be developed and 400 families put on the project and make a living. There are soldiers and there are other people waiting to develop that land.

Now why all that delay I never have been able to see. One has one reason and one has another, but most of the reasons are just a matter of delay and delay. Let's get these Colorado and Utah people--and I don't know how much resistance there is in the New Mexico people--but let's get them together. Let's impress upon the people we have here today that the urgent thing is to divide this water among the states so we can go ahead with some development.

I didn't particularly like the resolution this morning. I think they are fooling the Wyoming people. I want to call that to the attention of the group here because we as a Green River Valley association were trying to expedite this division of water. I don't think we did that. I think the resolution that we passed approving Mr. Krug's idea of delaying things, delaying these developments until the division is made, is just all in favor of Utah and Colorado.

I think that the delay is only with these projects that haven't started. While we did put in the resolution that we favored stopping all projects, we know those projects that have appropriations, like Big Thompson and some of these others which have appropriations made to go on, they aren't going to stop. They are going on with that development. And naturally the more they go on with that development, the better it is to their interest in dividing the water of the Colorado among the four states.

So I would like to impress on our people here and the Commission that the urgent thing is to divide the Colorado River water among the four states so we can start in with our own development. Six months after this division is made and they let us go ahead we can have a project going on with just a small diversion dam and that 45,000 acres waiting to be developed and 400 families to get on there.

COM. BISHOP: Thank you, Mr. Jacobucci.

MR. W. R. WALLACE, SALT LAKE CITY, UTAH: I very much dislike that reference to the State of Utah inasmuch as I think the records will show that Utah proceeded and urged the division of this water before Wyoming did.

COM. BISHOP: Mr. Wallace, I don't want to argue with you on that point but I do disagree with you; but we won't argue that point. Anyone else?

MR. NORMAN W. BARLOW: Our Basin Company has an Executive Manager; I don't know whether you have overlooked him or not. I wish Mr. Jenkins would state his position as manager of our company.

COM. BISHOP: All right, Mr. Jenkins.

MR. PERRY M. JENKINS, EXECUTIVE MANAGER, GREEN RIVER BASIN DEVELOPMENT COMPANY, SALT LAKE CITY, UTAH: Gentlemen, I don't know just how to begin on this matter. I wish to say that I probably can speak for our people more or less as I have been here for 41 years and helped to bring upward of 15,000 acres under water and have seen this country grow.

Now with reference to the economy of the situation I will say that of the first 300,000 acres that have been watered in the State of Wyoming it has cost less than $10.00 an acre, and the returns upon that has been so much greater than any of these other places where the high cost per acre is accountable, that it just isn't worthy of mention.

Some years ago I was instrumental in creating a county that occupies the whole upper end of this valley. The border of that county runs right around the top of the catchment basin, so it is a very large, integral part of the Green River Valley. That was made a county in about 1922 and in the first ten years the valuation of that county grew until it was the richest county per capita in the whole Rocky Mountain area. I say that without dispute because you can look over the tax rolls. The per capita valuation for every man, woman and child in that county was $3,700. Can you beat it?

It didn't cost much to irrigate this land. We have thousands and thousands of acres that can be irrigated so cheaply that the returns are out of all comparison of these high costing properties. That is what these boys have been trying to tell you. It hasn't cost much and therefore we believe that we can take what water belongs to this state and we can create bigger returns on that than any other place in the Valley.

Now you people that sat in that old convention that adopted the Colorado River Compact, you don't know what it was done for. The states down in the lower reaches of the stream were being developed more rapidly and what did we have to do? We had to adopt a compact so we could stop priority. Why, if we could have developed up in this country of ours up here, these four upper states, as rapidly or more rapidly than they developed in California or Arizona, there wouldn't have been a drop of water go down the Colorado River because it would all have been used by prior appropriation. But we knew that California and those Lower Basin States had the jump on us; they had the power in Congress. They had climate. They had settlement. They had everything and Colorado, Wyoming, Utah and New Mexico had to wait its turn for power.

Now we cut off all priorities in the lower reaches of the stream by giving them a block sum as payment, not for claims--they didn't have a claim--but in payment to keep still.

Now we are coming up to another condition up here. We have some states that are perhaps more populous and are growing more rapidly than others. The same inequality is brewing right here and we have to appeal somewhere in order to save the development of Wyoming for the future.

Why, some fellow said, "Why don't they pick up the people from some of these projects and move them to a more favorable place?" Let me tell you, gentlemen, the time is coming when this whole state will be settled just like Sweden. We are not living in Finland, we are not living in Iceland, but there are people living there and the time will come when every acre up here will be

used to make homes for the people and then when that time comes, can they live there without water?

Now we have got to look into the future a little bit, gentlemen. We can't say that simply because we have got power to get the appropriation to transfer this water over to a given area where the power is, that we are going to take the water and forever stunt the state.

Do you people believe in the rights of states or do you want to monopolize this River? If you make it so impossible that we can get development in some near future, we will have to call upon the Federal Government to take a hand, that looks forward a hundred years in the development. I don't believe in that. I believe in the rights of states.

We have got a Constitution that says the water of the State being of easy diversion and necessary for the development of the State belongs to the State. I asked Dr. Mead, "What did you mean by that when you penned that?" He said, "I meant just exactly what I said here for every drop that falls upon the State of Wyoming, for every bit of snow that melts, that water belongs to the State and they have the right to use it forever and then if there is any more, they will pass it on to their neighbors." That was what Mead meant by the right of the State to the water.

But why is it that we lost that? Because of priority. Somebody away down used it first and then the courts decided it must go down there. Now if we adopt a compact that divides this water and Congress acts upon that compact, priority no longer will exist. It will be a state priority, and that is what we want. We want the priorities in the states.

I don't want to take anything from you people that belongs to you. All we ask is that we have our own, and don't point a finger of scorn and say, "In frozen Wyoming they don't need it," and so on. Oh, I have lived around in some of the other states; they have their drawbacks. Up in Wyoming we can produce more money for the investment than any other state that I know of. We don't have any poor. Why up there in Sublette County we only had three people--before the W.P.A. came in and brought people in from all over the country and dumped them on us--we only had three that were supported in any way by the County. We believe in letting each one have a little bit to live on and that is what we ask. Don't look upon us as grasping.

Here is a thing for you to understand: We can't ask for more water than is produced in this state. How would we get it here? We are just out on a limb. You fellows are going to shake it? Oh, no, you have a bigger heart than that. If we were to say that we needed more than so much to develop our state, we couldn't run a canal up in here and carry the water from way down there. We have to be content with what water our state produces, and so we feel that you ought to have a heart and not steal our ewe lamb--I won't explain that story, you all remember that Biblical story, the ewe lamb.

Gentlemen, I want to say that what we want first--now I am talking for the water users--what we want first is storage capacity in each of the states to be able to supply in case of deficiency our obligation at Lee Ferry. I can't say how much water we want because I don't know how much you are going to say we have to deliver at Lee Ferry. I can't say that we will be satisfied with a million acre feet of water and then find out that in the turmoil and in the end you have taken it all and Wyoming has to furnish 8,250,000 acre feet. We can't tell how much water we need until you have settled the question. It is going to be up to you to settle the question, on what basis shall we divide the obligation.

We are all alike in this. We have signed a promissory note. Wyoming, Colorado, New Mexico and Utah have signed a promissory note that we will deliver 8,250,000 acre feet of water at Lee Ferry. And John Reed will tell you what a promissory note is without any trouble: The fellow that defaults, he doesn't pay anything; the next fellow that defaults, he doesn't pay anything; but the last fellow that has anything, he foots the bill.

We don't want any promissory note of that kind, so, gentlemen, let's first decide upon how much we have to pay at Lee Ferry: How much New Mexico will have to deliver and how much Colorado will have to deliver and how much Utah will have to deliver down there, and then we will begin to talk to you how much more water we can use up here.

Now I don't want to talk longer. I just wanted to say that I felt I really had a right to present some of these facts. But here is a thing that startles me, and I don't know, possibly you. I waited rather impatiently until the first ten years of the delivery of water was measured at Lee Ferry. Up to date the Federal Government hasn't provided a bit of water in the State of Wyoming. We don't have any projects, none at all.

We have got up there in the Cora county where my neighbors live a project which I superintended. It impounds 30,000 acre feet of water. It costs us $2.00 per acre foot. And we built it ourselves. The Government didn't help us. We taxed our own people and built a dam that impounds 30,000 acre feet for $22,700, and we paid for the cost of the dam when we got through with the contract. You see what we can get out of the water. We can get an acre foot of water for an acre for $2.00. Can you imagine?

Now don't say that water is useless in this high altitude. That is at 7,000 feet above the sea. Joe Budd just talked to you. I just happen to know that he contracted the sale of four steers--oh, they will weigh possibly a thousand pounds--at 25 cents a pound. Just think of it! Four steers raised up there in that God-forsaken country, he gets 25 cents a pound and they weigh a thousand pounds apiece. I say you people can't match it. Tom, you can't match that.

COM. McCLURE: What did he get for them in 1933?

MR. JENKINS: Why, we have a way among these ranchers, we have a way that we spread our profits and losses over a period of years. We will have our lean years and we will have our flush years. If Joe can spead his sales over the lean years when we had W.P.A., P.C.A., and all that sort of thing--if he will spread that over you will find that Joe makes just a fine profit every year.

Now I am not going to say any more.

COM. BISHOP: Thank you, Mr. Jenkins.

MR. MARSHALL SMITH, WYOMING: I would like to direct your attention to the samples of grain grown in Eden Valley at higher altitudes than any other development in the Green River Basin. We had plenty of water.

COM. BISHOP: Anyone else like to tell about what development might do to their part of the State? This is the time to speak up, gentlemen.

MR. DAVID P. MILLER: I don't like to take up a lot of time but I wish to call the attention of the Commission to certain remarks that have been made about the Burntfork and Bridger Valley. I have been an administrative official for the State of Wyoming for quite a number of years and I am rather in

a position to know where these shortages exist and how it affects the economy of these people.

This northern slope of the Uinta Mountains from whence these streams arise is rather deficient in snowfall and these people are short of water almost every year. We have made a determined effort through the Bureau of Reclamation to develop work on the Lyman Project and to a smaller extent on the Burntfork Project. But I wish to impress once again the urgent necessity of early development upon this particular area because these people have suffered more and suffered longer than any comparable area in this part of the State of Wyoming.

COM. BISHOP: Thank you, Mr. Miller. Anyone else?

MR. DeLONG: In regard to the Lyman Project, we are just completing some water supply studies that are quite revealing; I would like to mention them for your information. In the period from 1925 to 1945, the average shortage for 40,000 acres at Lyman is about 45,000 acre feet. Some years, for example 1934, that went up as high as 80,000. There is possibly a 12-,000 acre-foot diversion requirement.

COM. BISHOP: Thank you, Mr. DeLong. Mr. Hitchcock, would you like to say something? You have been active in trying to promote these projects.

MR. ERNEST B. HITCHCOCK, ROCK SPRINGS, WYOMING: Mr. Chairman, I don't have a great deal to say. I have attended all these Compact meetings to date. I feel as John Reed from Kemmerer does, we want development in Wyoming and the quicker we can hurry up the Compact the better off we will be.

I know when we started off the meetings, the goal was to be to have something to deliver by the 1st of January so the state legislatures could take it under consideration. Progress hasn't been too fast. We are hoping there will still be a possibility. Nobody knows, of course.

But the main thing we are interested in in the Green River Basin is to get this Compact formulated so we can get some authorization and eventually some construction. That is about all I have to say, Mr. Chairman.

COM. BISHOP: Anyone else?

MR. PLATT WILSON, KEMMERER, WYOMING: I have been to a number of water meetings and they nearly always wind up in a fight, a disagreement. I think the main reason is because every other fellow mistrusts the other. He is afraid he is going to get away with something he is not going to get.

Now what water meetings I have attended in the Basin have been small ones along individual streams among ourselves. This is probably the biggest one I have ever been to but I imagine the same trend of thought is in our minds here that would be in our minds if it was out on Fontenelle to divide up that water.

Let me say this, that while we are in a hurry to get a compact, I think we want to do it as quickly as possible, but it is absolutely necessary to get a fair compact because if you don't get a fair compact it will never be a compact because each legislature has to pass on the compact before it becomes a compact. Now if it is unfair to Colorado, the Colorado legislature will not ratify it, and so it is true with all the rest of the states.

I urge you fellows to get together and put your cards on the table

and be as fair as possible so you can prepare a compact that will pass.

COM. BISHOP: Thank you, Mr. Wilson. Anyone else? If none of the rest of you have anything to offer I would like to read a portion of my last memorandum to the Governor with reference to the Bureau of Reclamation report. I am quoting from this memorandum:

"We desire to emphasize our remarks with reference to the Initial Construction Program proposed in the 1945 Draft of the Colorado River Report; Pages 13 to 17 inclusive mentioned in our Memo of December 14, 1945.

"We believe this program is sound and that it should be included in the final draft of March 1946. In any event we endorse the Initial Construction Program mentioned therein as our definite recommendations for Initial Projects for Wyoming. Specifically these projects and the ultimate depletion contemplated by them are:

"SUBLETTE PROJECT:

West Side Unit - 29,050 acres of new land.	
Estimated depletion at 1.4 acre feet per acre	40,670 AF
37,000 acres supplemental supply	
Estimated depletion at 0.7 acre feet per acre	25,900 AF
Daniel Unit - 5,160 acres of new land.	
Estimated depletion at 1.4 acre feet per acre	7,224 AF
Elkhorn Unit - 134,030 acres of new land.	
Estimated depletion at 1.4 acre feet per acre	187,642 AF
Seedskadee Unit - 40,830 acres of new land.	
Estimated depletion at 1.4 acre feet per acre	57,162 AF
Total Estimated Depletion for Sublette	318,598 AF

Kendall Reservoir - We also recommend construction of Kendall Reservoir in the initial program as its storage will be needed for some of the Units of the Sublette Project.

"EDEN PROJECT: - 20,250 acres new lands.	
Estimated depletion at 1.4 acre feet per acre	28,350 AF
"LYMAN PROJECT: - 3,100 acres new land.	
Estimated depletion at 1.4 acre feet per acre	4,340 AF
20,910 acres supplemental supply at 0.7 acre feet per acre	14,637 AF
"LITTLE SNAKE PROJECT: - 8,240 acres.	
Estimated depletion at 1.4 acre feet per acre	11,536 AF
10,320 acres supplemental supply estimated at 0.7 acre feet per acre	7,224 AF
"Total estimated depletion - new lands	336,924 AF
Total estimated depletion - supplemental supply	47,761 AF
Total estimated present depletion	374,000 AF
Total estimated depletion to include Initial Program	758,685 AF."

(That amounts to 10.1 per cent of 7,500,000 acre feet.)

"A Committee of Representatives of Water Appropriators from the Green River Basin approved the first draft wherein it pertained to the Initial Construction Program, and we want the proper officials in Washington to know that this proposed program meets our approval; and at this time we respectfully urge that you call attention of the Bureau of Reclamation through the Secretary of Interior to this Memo and our other Memos mentioned herein.

"All of these Memos should receive their consideration in connection with the Comments of Wyoming on their report."

That's all I am going to read of that.

I didn't hear anything from the Bureau officials and I don't know whether they have incorporated that and the 149,000 acres of land that they didn't consider at all. I don't think they have given us very much consideration on that.

Here are some figures that I would like to read just for the benefit and information of the people of the Green River Basin present here. It is information that most of these gentlemen on the Commission are acquainted with because they have studied these problems. This information was taken from the report of the Bureau of Reclamation.

The virgin flow of the Colorado River at the Mexican Boundary, 17,720,000 acre feet. Now, gentlemen, that is the amount of water we have to play with. Used in the United States according to the Bureau's estimate, 7,120,000 acre feet. Used in Mexico, 1,500,000 acre feet. Left for use in the United States, 9,100,000 acre feet.

The virgin flow of the Colorado River at Lee Ferry, 16,270,000 acre feet.

That is all of the important information that I care to read into the record.

Are there any more of you fellows who have something to say?

MR. WM. McGINNIS, BURNTFORK, WYOMING: Mr. Chairman, has there been anything done or any appropriation, any exhibition of any kind, estimate--anything on the Big Basin in the southwest part of the Valley here? It is just over the Line in Utah and benefits Utah and Wyoming both. Is there anything that has been done? I didn't hear you mention anything of that kind. I would just like to know if there is anything pertaining to that.

COM. BISHOP: Mr. Miller, would you care to answer that?

MR. DAVID P. MILLER, ROCK SPRINGS, WYOMING: Well, Mr. DeLong answered that partially. It is within the Bureau's plan that a development will be made in the Big Basin. Isn't that true, Mr. DeLong?

MR. DeLONG: That is right. There is a provision for Hams Fork in the plan and there is a cost estimate.

MR. MILLER: The way I understand that, the Big Basin contemplates a storage of about a hundred and some thousand acre feet of water which partially may be used on the Lyman and also may be used for new lands in the Henry's Fork Basin. It is within the Bureau's plan.

Incidentally, in this area in which Mr. McGinnis is interested there have been two small reservoirs built within the State of Utah with the fine cooperation of Mr. Watson's office. One is the Beaver Meadows Reservoir which serves the people around Mr. McGinnis, and Hoop Lake Reservoir, which Mr. McGinnis was instrumental in, which stores 3900 acre feet for the lands around Burntfork. Those reservoirs have done signal service saving the crops from total loss in that area, showing what can be done with an assured water supply in an area such as exists in the southwest corner of our county.

COM. WATSON: Mr. DeLong, you spoke of shortages on the north side of the Uinta Mountains, especially in the Lyman area. Do you recall what the total average runoff is of Black's Fork and Henry's Fork over, say, a 20-year period?

MR. DeLONG: I couldn't tell you over a 20-year period--perhaps Mr. Riter can. In a 10-year period, Henry's Fork had 84,000 runoff--if I am wrong Mr. Riter can correct me there. That is all included, I believe, in the Report. The total runoff of Black's Fork, as I recall, for that same period, including Hams Fork, is about 100,000. I am quoting those figures from memory and they might not be correct. I would be glad to look them up for you.

MR. PERRY W. JENKINS: Mr. Chairman, I was a little surprised that our State Engineer didn't tell something of what a little cost and a little water carried across South Pass could do in that valley. The Platte Valley is lacking so much water. We can very easily use in Wyoming all the water that you let us have. We have got thousands of acres of splendid land that can be taken out in gravity flow and carried to that land although we feel that it's cheaper to turn it out on adjacent lands, but it can be carried over there with gravity flow.

By topping all these streams of Green River and storing in the lakes that you see on the map there, they could carry over at least one third of the water that is flowing in Green River. I don't like to mention that; that sounds bad. But other states are talking about it. They are thinking about it, and our engineer should have said, "We have got use for all the water you will let us have."

COM. BISHOP: Mr. Jenkins, of course the Chairman here, Mr. Bashore, cautioned me to not get off the beam and talk about anything outside the Basin. I don't hesitate to talk about the proposed transmountain diversion and the fact of the matter is very little transmountain water will be needed in the long run over there, and if it is ever taken out it will probably be taken out the first years of development when it is not needed over here, and if it is taken out there will be plenty of protection to the people in the Basin.

I didn't see any particular reason for bringing that up as the Chairman asked me to stay within the Basin and I have been trying to do as he requested.

The proposition of the development of the land at such cheap prices, you know as well as I do the time is long since past when we can develop these $2.00 per acre-foot reservoirs.

I notice the gentlemen from the Bureau of Reclamation very cleverly or cautiously or something avoided talking about the cost. It runs up into hundreds of dollars per acre for supplemental supply; yet we consider it is practical and necessary.

MR. PERRY W. JENKINS: There are a great many acres that can be developed for $10.00 an acre. It is a long call between $2.00 and $400.00.

COM. BISHOP: I don't believe there are any $10.00 ones.

MR. PERRY W. JENKINS: I can show them to you.

COM. BISHOP: I really don't think you can.

MR. CARL JORGENSEN, PINEDALE, WYOMING: I would like to ask where the Reclamation got the figures you quoted. Was that one year's measurement of the stream, 16,000,000 acre feet at Lee Ferry, or was that an average of ten years?

COM. BISHOP: That is the long-time average, isn't that right, Mr. Riter?

MR. J. R. RITER, BUREAU OF RECLAMATION, DENVER, COLORADO: Forty-four years' average.

MR. JORGENSEN: Forty-four years. Thank you.

COM. BISHOP: Well, gentlemen, if none of you have anything more I thought I would ask Judge Stone to make a little talk for us and tell us his ideas about what we should do. He has had a lot of experience in compacts, and with your permission I will call on Judge Stone. Judge, do you mind giving us a little talk about the Compact and your idea of what we should do?

COM. STONE: Mr. Bishop and Chairman Bashore, I didn't come here to express my views. I came here to listen to the people from the Green River Valley. I happen to be a member of this Commission representing Colorado and as such Commissioner, I feel that it is my duty as well as the duty of the other Commissioners, to inform ourselves as much as possible concerning the facts and conditions pertaining to a compact in every part of the Basin.

I had the pleasure and the opportunity a number of years ago to learn something of the Green River Basin. Some years ago I went over that Basin with Mr. Jenkins. In later years I have had the opportunity of discussing it many times with Mr. Bishop.

There is one point which has been emphasized here today on which I fully agree--not that I didn't agree with many others, too. You speak of the possibilities of the livestock development, the livestock type of agriculture, in a basin such as that of the Green River. I happen to have grown up in a valley just like that and I know something about the livestock business. I am fully appreciative of the great possibilities of the livestock type of agriculture. That is what it has got to be in this area. You aren't going to grow row crops; that wouldn't be the profitable thing to do.

But after all, if it is a mere question of where this water can be most economically used, then California, for instance, might have an advantage over these Upper Basin States. It isn't so much a question of the economics of where you can raise the cheapest crops; the question is: What is each state's equitable share of this water? That is the question this Compact Commission has got to determine as I see it.

Perhaps in some state, in some area in the Upper Basin, it could be shown that the water is worth more per acre than in the Green River Basin, but in my judgment that is not an argument. You are entitled to your equitable share of this water here in Wyoming, and then after that is determined, it is for you and Wyoming to determine what you are going to do with it. It

seems to me that is no business of this Commission and these hearings which we are conducting now are not to arrive at any conclusions as to internal affairs in any one state. That is the affair and the concern of the State of Wyoming, cooperating and working with the Federal agency engaged in designing a plan for the utilization of your water supplies.

Now there are just one or two other matters. Mr. Wilson, I think, made a very wise remark when he said, "Much as we desire to get a compact as soon as possible, we must be sure that we get a compact that is fair and equitable and one which can be ratified by the legislatures of five states." We may feel that we have got a compact that is ever so good and yet if any one legislature decides that it is not fair to the state that that legislature is speaking for, then it may refuse to ratify and our labors will be in vain. Accordingly, it indicates at least, we should proceed cautiously and understand the facts with respect to the Colorado River. These facts go into many avenues, sometimes avenues of speculation, and we must eliminate as much as possible speculation and make our negotiations on the basis of the facts as near as we can find them to be. No good lawsuit was ever tried without first ascertaining the facts and acting and agreeing upon the facts if possible.

Now that is one thing that this Commission has done. It has appointed an Engineer Committee made up of the best minds we could find in each state. The purpose of that Engineer Committee is to make a study of the facts and to agree as far as possible on those facts in order that the Commission in attempting to arrive at an equitable apportionment of the water may be acting upon facts and not upon speculation. That will require considerable time.

Another matter we should not forget. This Commission and you, who are the people for whom we are working trying to do a good job, must remember we are not doing this job for next year or the next ten years; perhaps we are doing it for all time. Therefore, we and the legislatures that act upon our work must remember that we are setting the pattern for years to come, perhaps for the next generations. That indicates, too, we cannot act too carefully or too cautiously if we are to write an instrument that does not breed further trouble.

Another point which this Commission I feel must keep in mind--some of you have mentioned it briefly: We have two phases to our work. One is to apportion the 7,500,000 acre feet of water allocated under the Colorado River Compact to the Upper Basin. We, of course, must seek to apportion that water among the Upper Basin States. But there is another phase which is just as important and maybe even more important, and that is to determine the respective obligations of these states of the Upper Division to deliver water at Lee Ferry in accordance with the terms of the Colorado River Compact.

There is one other thing which was mentioned here, the fears of some --sometimes it seems to be almost a suspicion--over the activities of other states. In this Compact Commission it seems that we ought to work in unanimity and in fairness all the way through. If we begin to cast suspicions, if we in one state cast suspicions against another state, we will not get very far. One thing we do need to preserve the highest utilization of water in the Upper Basin is a solidarity of action on the part of all of these states. We must not forget that we have a common interest. It is not an interest of one state; it is a common interest.

I note the reference in your resolution to no development until a compact is made. I think you ought to weigh that pretty carefully. We, all of us--and I will pledge that for Colorado, too--Colorado will do its utmost to aid in securing a compact at the earliest possible date. There will be no disposition on the part of my state to delay this compact, but we will strive to

arrive at one cautiously and carefully based upon the facts. However, no one here today knows how soon we may have a compact which can be ratified by the legislatures of the five states.

In the meantime, for one, I do not want to see a project in the Green River Basin or any place else held up if that project clearly would fall within the equitable apportionment of water to that state until a compact is signed. The first thing we know we will make a record we will use as an excuse to do nothing in the Upper Basin until we get a compact. I am certain there are projects in the Green River Basin that are clearly within Wyoming's share of the water. I would venture to guess that most of them are And if you get a project of that type there authorized and ready to go--most of them are comparatively small, we have a number of those small projects in Colorado--why in the name of heaven should you wait and speculate on when we are going to get a compact done? That project should go forward.

You have the Eden Project. Your representatives in Congress this last year obtained an appropriation to complete that project. If this Executive freeze order which has been made is released so you can complete that project, certainly you ought to complete it at the earliest possible date, and we in Colorado would want to help you to get it completed. Why should any state in the Upper Colorado River Basin object to the completion of these small projects? It is entirely different as to the large projects which have not been authorized and where their construction may exceed the state's share of the water.

And as I understand the report that is submitted by the Bureau of Reclamation it does not say that no project can go forward until a compact is made. It specifically says on the contrary that any project that is clearly within a state's equitable share of the water may proceed if the Congress authorizes it.

I want to say on behalf of my state that we have no designs on any of your water. We are striving desparately to utilize our own water and what we believe to be our share of the water. I wish that we could carry out what our friend Mr. Jenkins said, that all of the water which arises in a state belongs to that state and we should be able to use it. I think it is generally understood that on the basis of records available Colorado produces on the average 11,700,000 acre feet of water a year at Lee Ferry. I wish to call your attention to the fact that thus far my state has beneficially, consumptively used about 1,000,000 acre feet of that 11,700,000 acre feet. In addition we now export from the Basin an average of 136,000 acre feet each year. The Colorado-Big Thompson Project when completed will export from the Basin each year an additional 310,000 acre feet. And after all of the projects which are authorized are constructed in Colorado--and there aren't many of them, but including the Colorado-Big Thompson--we will have utilized only 1,738,300 acre feet, leaving 9,961,700 acre feet of water. That is on the long-time average.

So, gentlemen, don't be suspicious that Colorado is trying to grab this water. We desire to recognize your equitable interest. We recognize there are many factors to be considered in determining equitable apportionment and we want to be fair and we expect to be fair.

I can't see any reason why the large majority, if not all these comparatively small projects in the Green River Basin--and we have a lot of them in our river basins within the Basin--can't be built.

Now there is just one other thing. I didn't expect to say very much but Mr. Bishop has called on me to mention some of these things. There

is one thing I should like for all of the Upper Basin States to understand with respect to Colorado. The large amount of irrigable land in Colorado is in eastern Colorado and the water supplies, the supplies that are now available and not over-appropriated, are in western Colorado. Colorado, I think is the only state that has established by law, and such policy has been accepted by the Bureau of Reclamation, a definite procedure and policy with respect to transmountain diversion. No other state so far as I know--someone may contradict me if I am wrong--has definitely established such a procedure by law or as a definite state policy. We have done it in this way: The Colorado-Big Thompson Project and any future transmountain projects must be so designed and operated so as to protect the present and prospective uses of water within the natural basin. Necessary replacement storage and other provisions must be made to accomplish that purpose.

I think, Mr. Bishop, that's all that I have to say, but I want to emphasize the necessity of a united action and a solidarity of interest and a lack of suspicion among these Upper Basin States because we cannot protect our common interest unless we fully appreciate that interest and that we are all in this game together to try to do a fair and honest job for each and all of the states. (Applause.)

COM. BISHOP: Thank you, Judge Stone. I might tell you at this time that our Basin Development Company has established a policy similar to yours and we figure on following that same policy if and when any water is taken out of the Green River Basin.

The State Engineer of New Mexico is here. He is quite a bashful fellow and he said if I called on him that he wouldn't talk over thirty minutes. Tom McClure.

COM. McCLURE: Mr. Bishop, Mr. Chairman, gentlemen, I am going to give back a whole lot of the time Mr. Bishop has given me to talk. I think Judge Stone has outlined the Commission's duties in the Basin and so on, how they plan to try to allocate this water.

The only comment I have is that the discussions that have taken place today have been of deep interest. I am always glad to hear the troubles of someone else because we have plenty of them in New Mexico. Our dear friend there, Perry Jenkins, says there have been no projects developed in Wyoming. He is a little bit ahead of us; we haven't even got the investigations on them down there yet!

But there is one thing that that brings up. It has been mentioned here and we have been accused of the same in New Mexico, that we have given away water rights in the past under compact or under agreement or court decisions or what have you. Now that statement, I think, goes back to the early days--oh, not so early, 15, 20, maybe 25 years ago--and they did not have the facts at the time these cases were tried or at the time these agreements were reached. Now this Commission sits here in negotiations with a report but no seer can determine what the needs will be in a hundred years from now.

Mr. Jenkins made the statement that Wyoming would be settled like Sweden. Now if it is, it is the duty of this Commission to allocate water that will take care of a condition like that. We are going to have to look into the crystal ball or something and arrive at a compact and an allocation in that compact of something that is going to last in perpetuity. We are not planning for the next ten years or the next fifteen years. If we were, it would be simple. We could sit down here and say, "Well, we will split this four ways," and I think probably we would be pretty well satisfied for the next ten-year development, but I don't think Colorado would be satisfied. I am doubtful if some of the other states would.

COM. BISHOP: We will be satisfied.

COM. McCLURE: Well, I think we might be, too. We are not talking about the other states. And that is the thing, that regardless of how expedient it is to reach a compact--I would like to sit down here and write one this afternoon if it was possible, I realize that--but on the other hand, if we don't base it on the facts and if we don't get these facts before us to base this compact on, twenty years from now you are going to hear your boy or somebody else up here complaining that we got all your rights down the River. So the people probably thought they were arriving at an equitable distribution on the facts placed before them, and no doubt the courts thought they were giving equitable decisions based on the facts presented.

That is the thing we have got to be cautious about. In other words, I want to reiterate the statement that Judge Stone made that we do want the facts and we want to base this allocation on facts so that 20, 25, 30, or 50 years from now, based on those facts it will still be an equitable distribution among the states. That is about all I have to say. (Applause.)

COM. BISHOP: Thank you, Tom. Now, Mr. Ed. Watson, State Engineer of Utah. We have some problems with Utah on the Burntfork River, which Mr. Watson doesn't want to talk about because our Chairman has cautioned us to stay on the beam, but we do have some problems on the Burntfork. They help themselves to our water and dry up our people and all that. We have a compact commission over there that is not very active, I am sorry to say. The activity has to come from the people and the people don't seem to be calling on the Water Commissioner and our office. Mr. Watson, will you say a few words?

COM. WATSON: Regarding the Burntfork country, I know that there is difficulty there in administering the water. It's an interstate proposition. We have had some little difficulty there with the handling of the reservoirs, but I think that matter can be ironed out all right.

At the present time serious effort is being given to determining stream flows on the north side of the Uintas in order that we may properly distribute them, and also ascertain the various states' contributions to the Green River Basin.

I believe that every concerted effort will be used to carry out the equitable method of distributing that water. I am especially pleased with the goodwill that has been expressed here by the various commissioners, that we are all willing to cooperate and do the best that we can in arriving at a proper conclusion. I feel that we must get the facts but I am particularly pleased with Judge Stone's attitude in this way, I think it is very constructive and very statesmanlike.

I have nothing more to say, Mr. Bishop. (Applause.)

COM. BISHOP: Thank you, Mr. Watson. There isn't any representative here from Arizona, is there?

THE CHAIRMAN: No.

COM. BISHOP: Now you gentlemen have heard these fellows from the other states and if any of you would like to ask some questions, I am sure they will be glad to have you do so and they will try to answer them.

MR. DAVID P. MILLER, ROCK SPRINGS, WYOMING: I want to mention one further thing about the compact. It is out of line but I would suggest we

have a number of people here, and with reference to the statement that the activity has to emanate from the people, I think the people have done the best they could with it.

COM. BISHOP: Is there anything else, gentlemen, that you would like to bring up at this time? This is your meeting. I am doing the best I can to give you all a word if you want it.

MR. EMIL C. GRADERT, FORT BRIDGER, WYOMING: Has the committee of engineers handed in a report as to the division of the water?

COM. BISHOP: No, they haven't. Mr. Gradert, wouldn't you like to say something about this?

MR. GRADERT: No, I think it has been pretty well thrashed out. I would just like to see the report.

COM. McCLURE: I would like to comment on that, Mr. Gradert. The impression may be that the engineer advisers are going to submit a recommendation. Now that I don't think is the idea of your engineer advisers. The engineer advisers have certain studies of certain basic fundamentals they are to assess on the River and they are going to try to compile and correlate all of that information so that we can sit down then and take that information and try to arrive at some equitable allocation. All they are to do is to furnish us the information. They won't make the recommendations or anything to the Commission. I think that is right.

COM. STONE: I would like to back up what Mr. McClure has brought out. It certainly is not the purpose of this Engineer Committee to recommend the division of the water. They are furnishing basic facts upon which the Commission will act in arriving at a compact.

You asked whether they have made a report. This Engineer Committee is working hard. Mr. Riter, who sits over in the corner, is the chairman of that committee. Since the committee was set up on the 17th of September, they have had three meetings. They had one just day before yesterday.

The committee is doing, I believe, an excellent job and they are working hard at it, but the report is not now available and so far as I know no one knows yet just how soon they will be able to complete their work. They are going to complete it as soon as possible. There is another meeting--when is it?

MR. RITER: November 21st.

COM. STONE: Their next meeting is November 21st. They aren't going to tell us, "We recommend you divide the water so-and-so." They are going to give us the basic facts and it is the job of the Commission to decide on the division, and I might add also, the deliveries at Lee Ferry.

COM. BISHOP: Mr. Riter, will you say a few words?

MR. J. R. RITER, BUREAU OF RECLAMATION, DENVER, COLORADO: Mr. Chairman, the Engineer Committee felt that since we are dividing up water that one of the first things the Commissioners would want to know would be where that water comes from. Then another job we are going to try to thrash out is how we can level off or how we can regulate the stream to make the water available to us.

Now Mr. Bishop has quoted some figures which the Bureau put in the

report which was on the long-time average. Over a period of better than 44 years, the average undepleted flow at Lee Ferry has been something in excess of 16,000,000 acre feet. Well now we know that in a ten-year period, from 1931 to 1940, there has not been anywhere near 16,000,000 acre feet at Lee Ferry. So that if the Upper Basin is going to realize the use of 7,500,000 acre feet of water, some schemes have got to be devised so that water will be available to us and still meet the obligation at Lee Ferry.

Now they are the two principal objectives. Of course, there are other matters involved. For example, water that Wyoming releases at the State Line will not all arrive at Lee Ferry. The committee is trying to analyze the losses along the main stems. Similarly, we assume that Colorado will have some share of the obligation to deliver water at Lee Ferry. That means if a given quantity of water is delivered at the Colorado Line, that is going to be reduced in transit through Utah along the main stem to Lee Ferry and also along the San Juan River to Lee Ferry. And similarly, any obligation that New Mexico will have to meet, her share at Lee Ferry will be reduced in the channels.

Now in the past there has been very little information available on those main stem channel losses. The committee is trying to evaluate those losses because we feel that is one of the facts the Commission should have in front of them before they divide the water up.

Getting back again to this origin of water we find there are many tributaries that aren't measured. We have good records at the key stations, that is, the main stem of the Green River near its mouth. We also have good records up here at Green River, Wyoming, good records near the State Line between Wyoming and Utah.

We have good records on the Colorado River near Cisco, Utah, which is very close to where the Colorado River discharges from Colorado. We also have records along the San Juan, the main stem, and we have records on many tributaries but there are also many tributaries which are not measured. For example, the southern tributaries of the San Juan River in New Mexico we know practically nothing about. We are trying to analyze and make estimates as best we can, using the information we have available, so that Tom McClure, for example, and also Ed. Watson over in Utah can know what their contributions are to the stream.

Now I very foolishly at Santa Fe stuck my neck out and said we could do that in 36 man months. I don't know whether we can or not. Where we have to make estimates, we have to apply judgment, but engineers also differ. The fellows who are working with me, the representatives of the states, have ideas and they are all very cooperative. They all have an attitude of trying to get at the facts.

I don't want to promise at this time when that report is going to be submitted. I personally made one study which I submitted to the Engineer Committee at the meeting we held Friday of last week. Well, that study was rejected, I was thrown for a loss, and it has got to be done over again, and the reasons for rejection are fair and reasonable. I was willing to back up and reconsider.

I feel that when the study is completed that the particular phase of it which I promised to work out will be acceptable to all concerned. After all we have got to agree on the facts we are going to use for the basis of the compact.

That is about all I have to say, Mr. Chairman. (Applause.)

COM. BISHOP: Gentlemen, would any of you like to ask Mr. Riter questions? He has made a study of the details of this project probably more than anyone else and if he can't answer them, I believe Mr. Delong can. Norm, how about it? Wouldn't you like to ask some questions about the water supplies or anything?

MR. NORMAN W. BARLOW, CCRA, WYOMING: I don't think so. I will be very interested when they get the report and I think we ought to give them an opportunity to assemble that data and then make their report.

COM. BISHOP: Gentlemen, anything else that any of you have on your mind? (No response.) If not, I am going to turn this meeting back to the Chairman and let him give us a talk. You heard what has been going on and so I will just turn the meeting back to you, Mr. Bashore, the Federal Representative of the Upper Colorado River Basin Compact Commission and the Chairman of the Commission.

THE CHAIRMAN: The Chairman wishes to thank you, Mr. Bishop, for your able conduct of this meeting; and on behalf of the Commissioners, the Chairman extends his thanks and appreciation to all of you for your attendance at this meeting, for your participation in the discussion and your remarks.

There was one question brought up here which I wish to touch on just a little bit because I believe some of you have the wrong idea concerning it, and that is the matter of the 160-acre land limitation. That land limitation is a perplexing question to the Bureau of Reclamation. A year ago at a National Reclamation Association convention at Denver we had a hot time discussing it. We got into a big argument about it. My friend Judge Stone, Judge Sturrock of Texas, Roland Curran of California, and others were on one side of the question and the then Commissioner of Reclamation, your present Chairman, was on the other side of the question and I had some help from some of the people in Wyoming.

The question was: Should the Association go on record for the complete elimination of the 160-acre limitation? We had a good time arguing it. I am very thankful to say that I am no longer an official of the Bureau of Reclamation and don't have to worry about that question, but it is a perplexing question. At the last meeting of the National Reclamation Association in Omaha the matter was again considered and I think a very intelligent resolution was passed in regard to it which provided for a committee to work with the Bureau of Reclamation in an attempt to work out a solution for the 160-acre limitation.

Now that doesn't bother you folks so much in Wyoming, in my opinion, as it does people interested in irrigation in Texas and in California where there are real large land holdings. I believe some of you have the idea that the 160 acres applies to land whether it is irrigated or not. It applies only to the lands that receive water. You can have 5,000 acres of range land under the Reclamation Law or any other law but if you got 160 acres of irrigated land, that is all you can receive water for under the Reclamation Law.

Now just one word more on that subject and I am through with that. You naturally want to have land for your sons to farm, but you must remember that this is Federal money that is being used for the benefit of all the people and you must not lose sight of the fact that it is necessary to provide opportunities for other men's sons who may wish to farm irrigated land.

I am very hopeful a sensible solution will be worked out, and don't forget this, that that limitation has been reiterated all through reclamation laws and your own Senator from Wyoming in the Warren Act had that same

provision inserted in regard to land limitation. That is for the disposal of supplemental water from reservoirs which were built that had excess capacity. So I don't think you need to worry about that.

I wanted to mention that to clear the atmosphere just a little and to assure you the officials of the National Reclamation Association and the Bureau of Reclamation will attempt in the coming year to work out something that will be sensible and at the same time not destroy the basic principles in the Reclamation Law.

Now I want to call the attention of the Commissioners to the fact that they have some work to do and I think they should start on it this evening, and that is the correction of the transcript of the Santa Fe meeting. The Chairman has had opportunity to scan it hurriedly and certainly it needs a lot of polishing up.

Before we conclude this series of meetings it will be necessary for the Commissioners to decide on the place of the next meeting, and in the opinion of your Chairman, leaving open the time of the next meeting, which is contingent on the availability of the report of the Engineer Committee.

The Chairman would like to have an expression from the Commission as to working on this transcript this evening.

COM. BISHOP: Mr. Chairman, I will volunteer for one to work with you or anyone else.

COM. STONE: Mr. Chairman, wouldn't it be advisable for each Commissioner to use this evening or such other time as the Commissioner may have to review the transcript and then have another meeting before we get through with this series of meetings to make the corrections? It seems to me we will save time that way.

THE CHAIRMAN: Judge Stone, ordinarily that would be a very sensible procedure but it seems doubtful to your Chairman that that can be successfully done with this transcript. Unfortunately Miss Price didn't report the last meeting.

MR. WM. McGINNIS, BURNTFORK, WYOMING: Mr. Chairman, gentlemen, I would like some information on this 160 acres of land. I have a perfect right--

THE CHAIRMAN: Wait a minute. You want this on the record or not?

MR. McGINNIS: I would like to.

THE CHAIRMAN: On the record?

MR. McGINNIS: Yes.

THE CHAIRMAN: All right.

MR. McGINNIS: I would like and I am able to show the fact that different localities and different portions of land require more for the support of one family or one man even than others. Our country is a stock-raising country principally and I doubt very much that very many stock, enough to support a family, can be raised on 160 acres in this country.

THE CHAIRMAN: Irrigated land?

MR. McGINNIS: Irrigated land. I have tried it pretty successfully, and it's a very poor living at least if they do, a very poor way to provide. There are portions of land and places that less than 160 acres would provide a substantial income for any one family, but there are portions of it that would not. And as far as the arid lands that have no water, there are years when they are absolutely worthless.

So I would like some information on that 160 acres and I would like to get facts regarding the establishment of that. I don't take it as a very sound fact unless it would be in accordance with the ground to which it was applied.

THE CHAIRMAN: Well, Mr. McGinnis, that is a question which is entirely beyond the purview of this Commission. That will not come into consideration by the Commission in its deliberations. And about all I can say about all I can say about that at this time is that the committee which will study the matter will probably come out with some sort of an alternative to the present Reclamation Law. Now there is nothing wrong, Mr. McGinnis, if you have four or five boys, if each one of those boys has 160 acres of irrigated land, but it is limited to 160 acres in one ownership.

MR. McGINNIS: Well, we will see after the committee thrashes it out.

THE CHAIRMAN: All right.

COM. STONE: Mr. Chairman, may I correct the impression that the place of the next meeting of the Commission has not been fixed? On page 23* of the record of the Santa Fe meeting a resolution was adopted authorizing the calling of the meeting when the engineers were ready to report at Denver, Colorado.

THE CHAIRMAN: Thank you, Judge Stone. The Chairman is glad to be corrected.

COM. STONE: Mr. Chairman, I move that the Commissioners together with the Acting Secretary convene in Room 114, which is the room of the Chairman, tonight at eight o'clock for the purpose of reviewing and editing the record of the meeting held at Santa Fe, New Mexico, on September 17 and 18, 1946; and that after the transcript is thus edited, whether completed tonight or later, the Secretary of the Commission, as was true with the other transcripts, be authorized to put it in final form as corrected.

COM. WATSON: Second the motion.

THE CHAIRMAN: Any discussion? (No response.) (Thereupon a vote was taken and the motion of Com. Stone carried unanimously.)

THE CHAIRMAN: The meeting is adjourned.

(4:40 p.m., Monday, October 28, 1946, meeting adjourned until 10:00 a.m., Wednesday, October 30, 1946, at Grand Junction, Colorado.)

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* Page 46 of edited record Santa Fe meeting.

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Official Record of Meeting No. 3

Session Held

October 30, 1946

at

Federal Building

Grand Junction

Colorado

APPEARANCES
UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Membership as listed at Rock Springs, Wyoming, Session (Page 1)
Chairman, Acting Secretary, and all Commissioners present.

COLORADO:

Jean S. Breitenstein	Attorney, Colorado Water Conservation Board, 716 Symes Building, Denver, Colorado.
R. J. Tipton	Consulting Engineer, Colorado Water Conservation Board, Denver, Colorado.
H. L. Potts	Engineer, Denver Water Board, Denver, Colorado.
Glenn G. Saunders	Attorney, Denver Water Board, Denver, Colorado.
Charles J. Beise	Southeastern Colorado Water Users Ass'n., First National Bank Bldg., Denver, Colorado.
Frank C. Merriell	Secy-Engr. Colorado Water Conservation Board, Grand Junction, Colorado.
Silmon Smith	Colorado Water Conservation Board, Grand Junction, Colorado.
Paul L. Littler	District Judge, Grand Junction, Colorado.
Herbert W. Fritz	City Manager, Grand Junction, Colorado.
Carl M. Bennett	City Engineer, Grand Junction, Colorado.
C. J. McCormick	Colorado River Water Conservation Dist., Grand Junction, Colorado.
James D. Bradley	Grand Valley Irrigation Company, Grand Junction, Colorado.
Wm. J. Sullivan	Grand Valley Irrigation Company, Grand Junction, Colorado.
Percy J. Gates	Grand Valley Irrigation Company, Grand Junction, Colorado.
Robert F. Rockwell	Congressional Representative, 4th District, Paonia, Colorado.
Archie B. Toner	Southwestern Water Conservation District, Fort Collins, Colorado.
Dan B. Hunter	Southwestern Water Conservation District, Dove Creek, Colorado.
Carl R. Smith	North Fork Water Conservation District, Hotchkiss, Colorado.
Charles R. Neill	North Fork Water Conservation District, Hotchkiss, Colorado.
Harry W. Gueno	Attorney, Paonia Project, Delta, Colorado.
D. L. Williams	Southwestern Water Conservation District, Norwood, Colorado.
Wm. J. Dodd	Uncompahgre Valley Water Users Association, Delta, Colorado.
B. H. Jorgensen	Colorado River Water Conservation District, Gunnison, Colorado.
E. L. Dutcher	Gunnison Watershed Conservation Committee, Gunnison, Colorado.
Manny Diel	Arkansas Valley Water Users, Pueblo, Colorado.
J. M. Dille	Northern Colorado Water Conservation District, Greeley, Colorado.

Hume S. White	Colorado River Water Conservation District, Eagle, Colorado.
John Henschkel	Pres., Colorado River Water Conservation District, Glenwood Springs, Colorado.
Mrs. Wakefield	

NEW MEXICO:

Fred E. Wilson	Special Assistant Attorney General and Attorney for New Mexico Interstate Stream Commission, Albuquerque, New Mexico.

UTAH:

Wm. R. Wallace	President, Utah Water Users Association, Salt Lake City, Utah.
Thos. W. Jensen	Utah Water Users Association, Mt. Pleasant, Utah.
C. S. Jarvis	C. E. with State Engineer, Salt Lake City, Utah.

WYOMING:

Emil C. Gradert	Assistant Compact Commissioner, Fort Bridger, Wyoming.

BUREAU OF RECLAMATION:

J. G. Will	Assistant Chief Counsel, Washington, D. C.
J. R. Riter	Chief, Hydrology Division, Denver, Colorado.
N. B. Bennett, Jr.	Branch of Project Planning, Washington, D.C.
E. O. Larson	Regional Director, Region 4, Salt Lake City, Utah.
J. Stuart McMaster	Counsel, Region 4, Salt Lake City, Utah.
F. M. Warnick	Gunnison, Colorado.
C. H. Jex	Grand Junction, Colorado.
T. L. Sundquist	Grand Junction, Colorado.
Alan McDermitt	Grand Junction, Colorado.
George T. Finlinson	Gunnison, Colorado.
John C. Shepherd	Gunnison, Colorado.
John J. Hedderman	Durango, Colorado.
Ben F. Powell	Pueblo, Colorado.
A. A. Batson	Denver, Colorado.
J. H. Knights	Denver, Colorado.
A. N. Thompson	Amarillo, Texas.

SESSION AT GRAND JUNCTION, COLORADO
WEDNESDAY, OCTOBER 30, 1946

The meeting was called to order by Chairman Bashore at 10:20 a.m., Wednesday, October 30, 1946.

THE CHAIRMAN: It is now 10:20, all the Commissioners are present, our Acting Secretary, Mr. Alonzo Watson, and our reporter.

At the last meeting of the Commission held at Santa Fe, New Mexico, the Commissioners of the Upper Colorado River Basin Compact Commission decided that the next regular meeting, Meeting No 3, of the Upper Colorado River Basin Compact Commission would consist in part of a series of field meetings or hearings to be held within the watershed of the Colorado and within the Upper Basin States. This is the second meeting of the series. The first one was held at Rock Springs day before yesterday. The next one will be at Price, Utah, and the last one, Meeting No. 4, will be held at Farmington, New Mexico.

The purposes of these field meetings or hearings are to allow the people to become acquainted with the Commissioners, the work of the Commission, and to offer suggestions and criticisms which may be helpful to the Commissioners in their consideration of this compact. The Chairman hopes that you will all feel free to say whatever you may have on your minds.

Following the practice which we followed at Rock Springs, the Chairman will now ask Com. Clifford H. Stone of Denver to take charge of the meeting here at Grand Junction, Colorado. Judge Stone.

COM. STONE: Mr. Chairman, Members of the Commission, it seemed to me appropriate to introduce the Members of the Commission to our Colorado people.

The Chairman of our Commission--he has already spoken but I wish the privilege of introducing him to those of you who have not met him--Harry Bashore, was appointed by the President of the United States to represent the Federal Government in the negotiation of an Upper Colorado River Basin Compact and is Chairman of the Commission. Mr. Bashore formerly was Commissioner of the Bureau of Reclamation. He is very much a Western man, having spent most of his active years in the Reclamation Service in the West. We were all pleased that he was selected as the Federal Representative.

Thomas M. McClure, Commissioner for New Mexico. Mr. McClure has long been engaged in Colorado River matters.

The next man is Charles A. Carson, Commissioner for the State of Arizona. Charlie Carson likewise has long been engaged in Colorado River matters. He is one of those men in the Lower Basin who works for the entire Basin and has a broad viewpoint for the best interests of the entire Basin.

The next gentleman is L. C. Bishop, Commissioner for the State of Wyoming. He is the State Engineer of that State, who likewise has had many years of experience in Colorado River matters.

The next gentleman is Ed. H. Watson, Commissioner for the State of Utah. He is the State Engineer and for many years has been functioning in the interests of Colorado River matters.

Now I should like to introduce some of those who are helping us in this work. The Commission at its last meeting selected Miss Price from Utah to serve as its reporter. It is her function to put down what we say in these meetings and it isn't too easy a task. However we found that she did her work

so well at our organization meeting in Salt Lake City that we have selected her to do this work.

The Secretary of the Commission is the Attorney General of Utah, Grover A. Giles. Someone tells me on the side that Grover finds himself in the midst of a busy election campaign. The man who is pinch-hitting for him is Mr. Watson from Utah. He is the Acting Secretary.

Then we have other men here who have been selected to function in various capacities in this work. Mr. Riter is the Chairman of the Engineer Committee. He is of the Bureau of Reclamation. You will hear from him later on.

We have a man here who has come all the way from Washington. He is the Legal Adviser to the Federal Representative, Mr. J. G. Will.

There are some others who have been prominent in Colorado River matters and who are serving in various capacities in connection with their respective states. I should like to introduce some of them.

Mr. Fred Wilson of Albuquerque, New Mexico, is the attorney for the Interstate Stream Commission of that State and is the legal adviser to Mr. Thomas McClure.

Then I think all of you know that no work on the Colorado River could be properly accomplished without the advice and the assistance of a man who for many years has been identified with the Colorado River. He participated in the original Colorado River Compact. I feel quite certain most of you know him. I should like to introduce him, William R. Wallace of Salt Lake City. (Applause.)

We have here a number of representatives of the Federal Government. I assume later Mr. Bashore may have the opportunity of introducing them. I should like to introduce my legal adviser, a man who has been accompanying me on this trip and who is the attorney for the Colorado Water Conservation Board, Mr. Jean S. Breitenstein.

We are here in Western Colorado where there is one man who conducted the hearing in Western Colorado on the Colorado River Compact and who through all these years has been working for the best interests of the development of Western Colorado. He will speak to you later but I should like to introduce him. Mr. Frank C. Merriell.

Now there are of course others but they will speak later.

As the Chairman explained to you, as the Commission holds these meetings in various states, it is the job of the Commissioner from the particular state to conduct a hearing with the aid and assistance of those representing the local people. We have prepared a definite program for this Colorado meeting. Later we shall introduce Mr. Silmon Smith, a member of the Colorado Water Conservation Board from Western Colorado, who will act as moderator for the Colorado presentation. We shall introduce him later but I think he ought to stand up for a moment.

The Chairman said it would be my function, first, to explain the reason for the compact negotiations in the Upper Colorado River Basin; and to also review briefly the manner in which the Commission is proceeding. These meetings have a two-fold purpose: to make the explanation which I have mentioned; and, second, to afford the local interests, people from Colorado in this instance, to make such statements and offer such comments as seem advisable.

First, as to the reason for these negotiations: It has been suggested for some years that the time would soon arrive when it would be necessary for the states of the Upper Colorado River Basin to negotiate a compact for two purposes: First, to apportion the water allotted to the Upper Basin by the Colorado River Compact among those states; and, second, to determine the respective obligations of those states to make deliveries of water at Lee Ferry in accordance with the Colorado River Compact.

Now this thought was implemented by the recent report of the Bureau of Reclamation. That report sets forth an inventory of proposed project development and contains pertinent data for a plan of comprehensive development of the Colorado River Basin. The report reveals the fact that before we can proceed much further in the development of the Basin, the states must assume certain obligations and must accomplish certain things, and among them is the determination of each state's share of Colorado River water.

That conclusion is obvious. We are now proceeding to a stage of development wherein the projects are large in many instances and will require a lot of water. It is the conclusion of the Bureau that until each state's share is determined, such projects should not be authorized for construction.

It is the view--my view at least--and I believe is, if I may say so, the correct view, and it is supported by the report of the Bureau itself, that does not mean that no project may proceed prior to the making of a compact. It means that large projects may not go ahead. But if a project is clearly within a state's share or what may be a state's share of the water, it may go ahead even prior to the consummation of a compact.

Now I think it should be said, although perhaps most of you know it, that the Colorado River Compact apportions to the states of the Upper Colorado River Basin 7,500,000 acre feet of water. That means that much water for consumptive use, burning it up, if you please, within a period of one year.

The states of the Upper Basin are five in number. Often we think of the four Upper Basin States. Arizona has a comparatively small area in the Upper Basin and therefore participates in these negotiations. The term, "the States of the Upper Basin," must be distinguished from "the States of the Upper Division." The Colorado River Compact provides that the States of the Upper Division are Colorado, New Mexico, Utah, and Wyoming. Arizona, which is also a Lower Basin State, is entitled to its equitable share of Upper Basin water but it is not required to make deliveries at Lee Ferry under the Colorado River Compact. The four states of the Upper Division are required by the Colorado River Compact to deliver 75,000,000 acre feet of water at Lee Ferry in succeeding ten-year periods. Therefore it is obvious the job that we have is to take care of the apportionment of that 7,500,000 and the obligations to deliver water at Lee Ferry in accordance with the Compact.

At a meeting at Cheyenne held on the 22nd day of July of this year, the five governors of the states of the Upper Basin agreed to initiate compact negotiations. There was created at that time what is known as the Upper Colorado River Basin Compact Commission. This Commission organized at Salt Lake City, Utah, on July 31st of this year. Prior to that time these Commissioners who have been introduced to you were officially designated by their respective governors as the representatives of the participating states.

At the Salt Lake meeting we determined the basis upon which we were proceeding to compact. We appointed a temporary committee to set up a program of engineering studies. The reason for that is obvious. In compact-making as in the trial of a case before a court, it is first necessary to understand and know the basic facts with which we are dealing; and it is also advisable that

so far as possible we agree as states upon those facts. That saves a lot of time and often much argument.

At Santa Fe, New Mexico, on September 17th and 18th we held the second meeting of the Commission. At that time the Engineer Committee brought in a program of study which was accepted by the Commission. The Commission then set up a permanent Engineering Advisory Committee to conduct and carry out these studies. That Committee is headed by J. R. Riter, who was selected by the Commission as the Chairman. That Committee has been very active since that time, having held three or four meetings. It has a big job to do. Before we conclude today we have on the program a statement from Mr. Riter respecting the nature and the work of that Committee.

Much has been said about expediting the negotiation of a compact. All of the Commissioners I believe desire, and it is certainly the position of Colorado, that we should expedite as much as possible the negotiation of a compact. On the other hand, we fully recognize that we have a big job to do and that we must proceed cautiously. After all, if we allocate all of the 7,500,000 acre feet of water in the Upper Colorado River Basin, we are setting the pattern of development not only for this generation but for generations to come.

The compact cannot be too carefully made. If it is made without an adequate appraisal and understanding of the facts and if it is not made fairly and justly, considering the rights and interests of all of those states, then in the end we may be breeding trouble rather than establishing peace on the River; and the compact should establish peace for all time to come.

It should be understood in this hearing, and I believe it was explained at the Rock Springs meeting, that here today we are not concerned with internal questions within any particular state; we are concerned with the rights and the interests of each state on a state unit basis. When this water is finally apportioned it will be a mass appropriation to each state and each state will then proceed together with the Government, and with the advice and cooperation of the Government, I am sure, to determine the best use of the share of water apportioned to each state. This is no place to air, either in this meeting or the other meetings, any internal matters within a state. As has often been expressed by Mr. Merriell, we shall do that in our own backyard.

This Commission cannot say at this time how soon we will conclude our work, but we are going to work as hard as possible while at the same time as cautiously as possible to do the job.

There is one other thing which should be understood. The Commission is not engaged in perfecting a compact which has, as the product of the Commission, binding effect. The Commission has been asked to negotiate a compact. That compact will not become binding on all of the states or any one of the states until it has been ratified by the legislatures of all of the states and approved by the Congress of the United States. It is clear, then, that in negotiating this compact in each state, we must be very careful that we keep in close touch with our own people and that we act in such a way that we may have reasonable assurance that after we have completed our task, the state legislatures will ratify it and the Congress of the United States will approve it.

I can only call your attention to the Republican River Compact in this state when we worked a long time to get such a compact with Kansas and Nebraska and then although it was approved by Congress, it was vetoed by the

President. We had to do the job over. There are other instances where states have worked hard and the negotiators brought forth a compact where it was not ratified by the legislatures.

So it is a big undertaking and one where in our processes of government the people, acting through the legislatures and finally through the Congress of the United States, must finally put their approval on whatever this Commission does.

Now that I have explained the task we have to perform and the method by which we are proceeding, I wish next to call upon Frank C. Merriell. He has a statement to make and will introduce Silmon Smith, who will act as moderator for the State of Colorado in this meeting. Mr. Merriell.

MR. FRANK C. MERRIELL, GRAND JUNCTION, COLORADO: Mr. Chairman and Members of the Upper Colorado River Basin Compact Commission:

If we were standing on ceremony it would have been attempted to invite the Governor of Colorado here to welcome you, but he, like yourselves, is a busy man, and we hope that you will accept your welcome from us, with the assurance that while less official it is none the less sincere. We are sorry that the urgency of your business will not permit you to see more of our country and of the uses we make of the Colorado River just as we are sorry that we cannot in the ordinary courses of our affairs see more of the uses you make in your states. Your trip from Rock Springs, the trip you will make to Price tomorrow morning and your later trip across the San Juan Basin will, however, afford you some idea of Colorado's lack of development and of the need for irrigation projects in the more sparsely settled parts of our state. You will recognize that the greater part of our development lies east of the route you will follow, is directly connected with the livestock industry, and raises such specialty crops as late potatoes and sugar beets.

We are glad to welcome you, not only to Western Colorado, but to Grand Junction, its largest city, and to this meeting place as well. Twenty-four years and seven months ago yesterday, on March 29, 1922, the Colorado River Compact Commission held a meeting in this same room. It was the only hearing that commission did hold on the River and it held only one other in the Colorado River Basin, at Phoenix, Arizona. It seems to us that you are making a much more realistic approach to your task in the series of hearings on which you are now engaged, by getting first, the views of the people actually so vitally concerned in the work you are to do.

It is hard for any of us to appreciate the difficulties that first Commission faced. It was the beginning of new thinking on interstate problems, and the idea was not cheerfully received by anyone in the Upper Basin with whom the Commission came in contact. In those days the information, such as stream flow records, records of areas irrigated, estimates of consumptive use and all the particulars so greatly needed in making a compact were almost entirely non-existent. The lack was so great that the original intention to allot water by states had to be abandoned and the allotment of water by basins was the best that could be accomplished. You are here today, as part of your mission, to carry forward the work then so ably begun. In the light of the information they had, it has seemed to many of us, over the intervening years, that the first commission did a very remarkable piece of business, and we predict that your work, since you have a more complete knowledge of the facts, coupled with a better understanding by those affected of the purposes of a compact, will bring forth a more specific and usable result.

Two points of view regarding the Colorado River Compact which were original with Delph Carpenter, the Coloradoan who first advanced the compact

idea, have remained with many of us in Colorado who have tried to follow in his footsteps. He strongly felt that the terms of the Colorado River Compact applying to matters other than the actual division of water between the basins were the greatest assurance of fair dealing between the states that could be obtained by the states of the Upper Basin. The waiving of priority of power rights, the making of actual use the measure of demand, the provisions that a large reservoir on the lower river would automatically liquidate lower river claims into it, such provisions as these were, in Delph Carpenter's mind, the essence of that Compact.

He foresaw much of the difficulty that would be made by one of the Lower Basin states over its fancied large needs, but since his idea was founded on the doctrine already announced by the Supreme Court of the United States that rivers must be used under an equitable apportionment between the states affected he felt sure that the Compact would endure, because it was the expression of the states themselves as to what equitable apportionment should be. Much has been said over the years about the possibility that the Compact may not endure. Those who say this and those who hope it may not, seem to forget that behind the Colorado River Compact is the essentially fair idea of the Supreme Court that equitable apportionment of water must govern, whether that apportionment is made by the states themselves, as the Court prefers, or whether it is made by the Court. Certainly in the making of the present Compact, which is an extension of the original one, we owe it to ourselves so to plan that the states of the Upper Basin and of the Upper Division cannot be accused of any act that would tend to weaken, or fail to comply with the terms of the original Compact.

Following that original compact hearing in this room, at which I conducted the local appearances, I have attended many Colorado River meetings. This one seems typical in that it appears to have drawn irresistably, so many people from outside the Colorado River Basin. When the seven states have met it was usually true in most meetings that all the representatives of the states taken together were generally outnumbered by those from one California city -- Los Angeles. Here today we people from Western Colorado are almost in a minority as compared with the delegations of our friends from Salt Lake and from Eastern Colorado. However, we welcome them and the representatives of all the Federal agencies to Western Colorado and to this meeting. Mr. Chairman, we find the solicitude on the part of our out-of-basin friends touching--in fact, it seems to us a foretaste that because of their anxiety over our problem we shall be deeply touched in the future. We can only hope that their interest goes along with ours in the preservation of the original compact and in its being made more workable and strengthened by the compact upon which you are engaged. We bespeak from them the same earnest intention to carry out the terms of the original compact that have been our aim through all the years. If all the Upper Basin States have this first consideration as their aim we expect a very valuable compact to result from your deliberations.

Mr. Chairman and Members of the Commission, we ask that you feel free to call upon any of those present whom you feel can contribute to explain the ideas of Western Colorado regarding this compact. In order, however, to conserve the time we have designated a local moderator who in addition to what he may contribute will call upon those who have indicated that they have anything to say to you. He is, I think, known to you all, not only as a prominent member of the Colorado Bar, but as one who has taken for many years a strong interest and a leading part in Colorado River matters. Mr. Silmon Smith was prominent in the first organized effort to bring about understanding between Eastern and Western Colorado, that of the Western Colorado Protective Association. He was an influential member of the body from both parts of the State that drafted the famous Senate Document 80 of the 75th

Congress, relating to the Colorado-Big Thompson Project. He has almost since its inception served as a member of the Colorado Water Conservation Board, which has set up the policies of Colorado with relation to all its water problems. I am sure he can inform you how Western Colorado regards this proposed Upper Basin Compact and I bespeak for him and those upon whom he may call your kind and considerate attention. Thank you. Mr. Smith.

MR. SIMON SMITH, GRAND JUNCTION, COLORADO: Mr. Merriell, Mr. Chairman, gentlemen of the Commission, friends: I am very proud that that passive word, "moderator", has been bestowed upon me. I think that I have attended sessions where "referee" or "umpire" would be much more appropriate, but let's leave it at "moderator."

I remember some ten or fifteen years ago attending a meeting on the Colorado River in Salt Lake City. It was fashionable during that period to ride the State of Arizona. The riding was rough that day and I remember as a last resort, one of the representatives of Arizona got up and said, "Now you boys from the Upper Basin States be kind to me. This isn't anything to what you are going to get when you start dividing the water in the four Upper Basin States."

We become a little more peaceable as the years go on, I think, because we have been getting a little better acquainted and it is this lack of acquaintance with each other's problems that accounts for most of the difficulties.

Now in order that these people of Colorado for whom I am acting as a sort of liaison officer may know that probably these gentlemen on the Commission are human beings, I want to say first that my friend, Charlie Carson, has given most of his life's effort to the study of the Colorado River, but he was an ordinary human being once and he attended college at the same place and at the same time I did, and he is a very fine fellow. He has represented the State of Arizona most admirably for many, many years. But Charlie Carson is a reasonable human being and you ought to be proud that he is a member of this Commission.

Now of course, Tom McClure over here, I don't know so much about McClure. The only intimate detail is that he and Dan Hughes of Montrose used to occupy the same jail at the same time when they were in the first World War, and during the years I have learned he is a very fine, sensible gentleman.

I don't know anything about Mr. Bishop or Mr. Watson except they stand high in their own states. I hope to get better acquainted with them.

We might refer for just a moment to the lack of understanding that existed in a couple of places even in Colorado. Eastern Colorado craved some Western water. Western people were a little jealous of that idea and eventually it got so we could mingle in the same room. And finally they got so friendly that one of these Eastern people came over and said to the Western people, "How are your cherries this year?" He wanted to be very friendly; he wanted to know about our cherries. We were cold to him; we didn't have any cherries. We told him, "We don't raise cherries; we have peaches." He didn't know that. But when he found out about us and we found out about him we found out we were all fine people.

In the division of this water we are going to confront primarily two problems, the fact that there isn't enough water to take care of all those plans which have been made by the Bureau of Reclamation--and that doesn't purport to be all of the plans either; and we are too prone, probably, to think about the amount of water that we are going to use and are perhaps not sufficiently advised of the fact that we are going to have to be responsible to this Lower Basin.

Judge Stone referred to this 7,500,000 acre feet--which is more accurately 75,000,000 acre feet distributed over each succeeding ten-year period--as though we had that water. Not so. That is the second 7,500,000 acre feet out of the River. The first 7,500,000 acre feet is allotted to the Lower Basin. Now if there is 7,500,000 acre feet left and if we aren't required to use some of the 7,500,000 acre feet to supply the Treaty obligation to the Republic of Mexico, then we can talk about this 7,500,000 acre feet that we are going to divide up. We have it only secondarily.

I am under the impression that when this Colorado River Compact was first made it contemplated considerably more water than we have subsequently found out flows down this river. Now whether this is a temporary situation or whether it is more water than we are going to have in the future or whether it is less water than we are going to have in the future, nobody knows.

But the obligation to deliver the first 7,500,000 acre feet, on an average, is a real obligation in the eyes of those of us persons here who live along this branch of the Colorado River--which we like to think is the main branch of the Colorado River--and when we can walk across it up here below Palisade without getting our low shoes wet, we wonder whether or not that obligation isn't a serious proposition. There used to be a time in the pioneer days here when nobody ever thought of all the water in that river being used. Now we wonder if there is going to be enough water for the immediate future.

So that in the division which will be worked out by this Commission they are going to be confronted with an equitable, I take it, division. The same kind of a principle that would apply if a court were dividing the water will probably apply to the division made by the Compact Commission.

They are also going to be confronted with the division of this obligation. After deciding how much water each state will be entitled to they will have a complementary question, how much water will that state be obligated to furnish to the Lower Basin?

In working out this consecutive ten-year rule, it will undoubtedly be necessary to build certain mid-river reservoirs for the purpose of impounding water during the lush years to carry over during the dry years. Now those reservoirs are not without disadvantages because every impoundment of water that is made is going to result in so much evaporation. Before those mid-river reservoirs are constructed there is going to be necessarily a lot of study as to the amount of water that those rivers flow during the lush period as well as the lean periods and the amount of water that is evaporated while this storage is being carried on to bring us over the low point.

In Colorado we have enacted a few rules which we believe are good rules for us as well as for other people. For example, we now have a law to the effect that any irrigation district or conservancy district which may be formed for the purpose of entering into a construction contract with the Bureau of Reclamation must provide, first, that it is subject to obligations of the Colorado River Compact and the Boulder Canyon Project Act, and also that it must protect not only the present but the future uses of the water in the basin from which it may be taken--that is to say, the future use of the water that that basin may in the future need for its development. We feel that that rule, which is also incorporated in the Senate Document No. 80, would be a proper rule for the other Upper Basin States to inculcate in their thought.

We have another rule in Colorado to the effect that no water may be taken from the State of Colorado, that is, the diversion may not be made in the State of Colorado for the use in some other state. That is a statute which will undoubtedly be overridden by this Compact Commission when our compact is drawn up and after it has been ratified by the various states that law will probably go into limbo. We feel in Colorado that those sister states who may find occasion to make their diversion in Colorado for use in their state must charge themselves with that water as a part of their division or part of their use of the River. The mere fact that the diversion may be made in Colorado should be no charge against the State of Colorado.

That is going to present difficulties because we are going to have power developed at the point of the reservoir, at the point of the dam. That dam may be in one state and the irrigation part of the water may be used in another state.

We are going to be confronted with another thing and which in my opinion is one of the most serious. Up to this present time, the projects that have been built have been constructed with the idea that they would be repayable, that they are economically feasible. Now if you enter into an obligation to repay everything that you spend, you enter into that with serious thought and consideration. We have a couple of pioneer projects in this area, two or three of them--including Mr. Dodd's who came in here a moment ago--as the primary, original projects. We are paying the cost of those projects.

Now then, the Reclamation Act has been amended on the theory that most of the economically feasible projects have already been constructed, has been amended to take in certain other elements. First they took the revenues from power and then the benefits from flood prevention. And then the idea has been growing on the other hand, that even though the projects may not be repayable on that theory, they are of eventual benefit to the country at large and that they will be subsidized to a certain extent. That brings us into the proposition where we get something for nothing.

Now everybody is anxious to get something for nothing. That is going to make the deliberations of this Board more difficult than it otherwise would be. If we build only the projects in these four Upper Basin States that we can pay for, possibly there will be enough water if the Lord is a little more generous than he has been in the past few years and we may not meet this 25 per cent deficiency of water that the Bureau study now indicates.

This Bureau study, of course, is not a complete study. It is a very fine analysis of the situation and it contemplates that there will be other appropriations made--probably small ones but in the aggregate they may be considerable--from this River in addition to these projects that have been set out in the Bureau report.

Colorado expects to carry out its obligation under this Colorado River Compact and its compact and Treaty with the Republic of Mexico. It also recognizes its obligation to the Indian tribes. And we assume that the other states are going to be just as anxious to do that as Colorado.

One other thing we believe will be worthy of mention, it will probably be the idea of Colorado that after a certain amount of this water has been allotted to it by this Commission this water then will be administered by the State of Colorado. Our water we expect to administer. I am not sure that that will be a unanimous idea on the part of the four Upper Basin States, but it seems to us that upon the theory upon which we have always appropriated water that we will undoubtedly expect to administer that portion of the water which will be allotted to Colorado.

We think that it will be contemplated by this Commission that perhaps in the immediate future or as rapidly as possible, some division will be made of this water between the states so that the projects most feasible, most necessary, can go ahead. But it may not result that all of the 7,500,000 acre feet will be divided at this time. That may go into sometime in the future, but we do feel that the Compact Commissioners should divide up the responsibility of furnishing the first 7,500,000 acre feet.

My province is going to be in this meeting to ask those persons from Colorado to make such expressions to the Commission as seem to them appropriate. I think a little bit later probably we will call upon our Western Colorado Congressman, the Honorable Bob Rockwell, but I think in justice to him we should let him have a chance to get his feet on the ground and perhaps call on him after some of you people have expressed your opinions. If we call upon him now, I think I would be deeply grieved if someone had done that to me when I came in.

You people who live in the Colorado area are met here today in order that the Commission may get acquainted with you and you get acquainted with the Commission. This Commission is going to try to do justice between these four Upper Basin states. They don't know you too well. They want to hear what you think about this. And when one of you gets up, a good many of you are going to be at a great disadvantage because unless you have lived with this river fifteen, twenty, thirty years like Mr. Wallace has, there is a lot of past history--water that has gone over the dam--that you are not familiar with. But don't be afraid to express yourself nevertheless because this Commission is only made up of human beings. They don't think there isn't any chance you are going to overlook something. You may have the rights and equities of this situation and the necessities of the case that may be of help. In other instances you may express something they have heard a thousand times. Don't let that worry you.

We have men here from Southwestern Colorado, Western Colorado and Eastern Colorado. You all recognize that under the terms of the Colorado River Compact it was contemplated not that this water should be divided between the natural basins of the seven states, but that it should be divided between the seven states in order that it might be used in and out of the Basin. If it wasn't for the fact that the transmountain diversions, transbasin diversions, had become so simple and apparently practicable, we would not have this deficiency of water problem, but we have it, had it since 1922 when this Compact was first drawn up and we are not expressing any thoughts between basins today. This is just in order that the Commission may have the thoughts of the Colorado people in the division of this water between these five states. Arizona takes advantage of a portion of this water; primarily it is four Upper Basin States.

With that explanation, Mr. Chairman, may I call on some of these people, or would you prefer they act spontaneously?

THE CHAIRMAN: Just as you like, Mr. Smith.

MR. SMITH: I don't know whom to call on first but the closest man to me, who is a good exponent of his position, is Mr. Ed Dutcher. Ed Dutcher is a member of the Colorado Water Conservation Board. He is an attorney in the City of Gunnison. He will have some ideas with reference to this River and we might just as well start with him at the top of the mountain.

MR. E. L. DUTCHER, GUNNISON, COLORADO: Mr. Smith, Mr. Chairman, Members of the Commission, I hardly knew that I was going to be called on to start out this morning. I don't know that there is anything particularly

to be said on behalf of the Gunnison watershed.

We of the Gunnison area have been watching the proceedings of this Commission very carefully. We are much impressed with the manner in which they have proceeded and are going to proceed in the future. I want to say this with emphasis, and that is that we have implicit confidence in the Commissioner of Colorado, Judge Stone, who happens to be a representative of our area. We know that with Judge Stone sitting on the Commission the Western Colorado people are not going to be sold short when it comes to the drafting of this Compact.

I think I can conclude these few remarks with this one suggestion, and that is that in dividing the water among the various states in the Upper Basin, we should keep in mind and always be mindful not only of the present and the prospective uses, but I feel as though we should take into consideration, at least, prospective uses that are not now known in the division of this water.

In other words, we have projects that have been planned for us by the Bureau of Reclamation and other agencies which are classed in the category of known projects which are potential users of water. There are, however, certain projects that might come up ten to twenty to thirty years from now that are not known to any of us at the present time. I remember approximately a year ago we presented to the group in Denver at the time the first Colorado River Report was presented by the Bureau of Reclamation this one suggestion, and that is: Because of the fact that the Forest Service and other grazing agencies have been curtailing the allotments on the range, that some of the cattle users and the stockmen felt that the time was ripe to ask for water for pasture purposes on the hillsides. Now that is a new use of water. It's a new use because it has never been done before. That suggestion met with very favorable response.

I feel that there may be other uses in the future for this water in the various states, and particularly in Western Colorado, that are not now known to any individual or any group of individuals. And in dividing this water, I think that we should try to agree upon an arbitrary figure and percentages of water for the various states which might cover these potential uses which are not known by mankind at the present time.

After all, this compact is going to affect our grandchildren. It is going to affect our children in future generations and we want to try to protect them as well as protecting ourselves.

MR. SMITH: I am going to spot around this River more or less and I think we might well hear next from a man who lives pretty well up what we like to call the main branch of the Colorado River, Judge Hume White of Eagle, who is a member of the Colorado River Conservation District. Judge Hume White of Eagle on the main stem of the upper river.

JUDGE HUME S. WHITE, EAGLE, COLORADO: Mr. Moderator, Chairman, Members of the Commission: I might say that our moderator has told you a good deal about the members of this Commission that he knows, particularly Tom McClure and his time with Dan Hughes, but I think he forgot to mention State Judge Hannett, Tom, and he isn't here. We miss him. I won't go into details on that because that was when we were trying to get together and know each other to find out whether we had cherries or what we raised.

You gentlemen have got a job before you and you know it. Nobody has to tell you that. It is a big job. First you have to agree among yourselves and that has got to be referred back to the states. Then it has got to be ratified in the state legislatures and then I believe by Congress, is that right, Judge?

COM. STONE: Yes.

JUDGE WHITE: And finally signed by the President of the United States, is that right?

COM. STONE: Yes, approved.

JUDGE WHITE: Approved, not vetoed. Now it occurs to me that this Commission first will have to determine the facts and there are many, many facts. I think that is largely an engineering question. I don't think it is a question for a layman; it certainly isn't a question for me.

And speaking of that I want to say that I have had a great many years now, in and out, trying as well as I could and still making a living, studying water and water conditions in the Western States, the Upper Basin particularly. Occasionally I have had a good deal to do with the Lower Basin.

I remember many, many years ago when I was first admitted to the Bar in the State of Colorado. I was studying water law. A lawyer came up to me, a good one, and says, "Why are you reading that? Why," he says, "it's all codified. You have got a code," he says, "all the water law, that is there. All you have got to do is read your code and a little procedure and you have gotten all the water law." That was a good many years ago, about 1913.

Since that time with all my studies and attending meetings and trying to remember as much as I could, I find now that I know practically nothing about water or water law or anything else. It is changing. And I think this Commission will have to realize that and understand that; and then secondly, get the facts, the known facts, and if they can, as much of the unknown facts as they can.

That is going to be a big job. It can't be done over night. It can't be done, perhaps, as quickly as the Commission would like to have it done and the United States Government. Now you can do a thing and do it fast and get something through, but after you have done all that work if it isn't ratified by the state legislatures and the different powers that be, you have wasted your time and you have wasted your work, haven't you?

Now I am a believer in state rights, and I think the water laws and the rules and regulations of the different states it should be understood by this Commission are not in harmony in each state. I think each state's code and the rules and regulations and the things they have set up for their own protection should be understood and thoroughly understood, and before any compact is finally prepared by this Commission for the ratification of the different states, you should have that in mind. I think that is essential.

There are many uses, as Mr. Dutcher has told you, that are now a there are going to be others discovered and used for the use of water. It isn't all the little irrigation ditch that we have now. There are many oth uses for it.

I don't think we understand the value of this water to the state and to the basin and to the Nation and to the Republic of Mexico. Nobody can put a value on it.

Now we have years of drouth and then we have years that we seem to have more water. Delph Carpenter was mentioned here today. I knew De

Carpenter very well in 1922, particularly in the year 1923. He assured me at that time, and he meant it, that we were certainly protected in the Upper Basin States by agreeing to furnish only 7,500,000 acre feet at Lee Ferry. With the figures today, I think the engineers will find that maybe Delph Carpenter was mistaken at that time and it is going to be a job to furnish that amount of water or ten times that amount of water averaged in the ten-year period.

If that is true, we have got that compact, we have got to carry that out, we have agreed to it, that is done, that's true. I think this Commission should think very seriously where that water is coming from, who is going to deliver it down there, and how it is going to be delivered. That is a serious question. How you are going to do it, I don't know.

But Silmon Smith has outlined this thing to you most thoroughly and Dutcher and others and you people I know know more about it, Mr. Chairman, than I do. I am just calling attention to the few facts that occur to me.

I do think that an equitable--and when I say that I mean "equitable" --agreement can be arrived at because you are reasonable men, you are going to use reason, and you are going to meet around the table when you haven't got a crowd and you are going to try to work these things out. Each one of you have a lot to learn; you know that. If you will do that and work hard and get your facts, I believe an equitable agreement can be arrived at with the advice of your engineering staff and the advice of your legal counsel and with your good common-sense as Commissioners, arrive at an agreement that will be equitable to all of the states--not any one taking it all, being the hog, the dog in the manger.

If that can be worked out you have taken a step forward that will make history not only for our generation but for our children and our children's children and their children--goes down the line--unless in the meantime we have a revolution in this country and everything is thrown up and gone. And unless these things are worked out that way that very thing could happen and it is a serious question.

We have every confidence in Judge Stone. He knows this problem better than anyone I know and the problems generally. I know Tom McClure has had a great deal of experience and you other gentlemen I am not so well acquainted with. But I do believe that you can work out such a compact and I believe you will but it must be just, it must be equitable and the rights of the states must be safeguarded, and unless those things are done, state laws recognized, Senate Document 80--unless those things are done, you can prepare a compact but watch out when you meet your state legislatures and try to get it confirmed.

Now I thank you and I have taken up more time than I intended.

MR. SMITH: Thank you very much, Judge White, and I hope you will permit me to correct one thing you said. You mentioned beginning the study of irrigation law in 1913; if I recall it correctly, you started about 1911 because I think I was doing it with you.

JUDGE WHITE: That is right. I graduated in 1911.

MR. SMITH: And I would like to correct the Commissioner speaking of our friend, Judge Stone, as from Denver. I intended to enlarge on that sometime ago. We have never admitted Judge Stone belongs in Denver. He is a resident of the City of Gunnison, temporarily messing around over in Denver and Boulder. That is one reason that we like this Commission so well, because Colorado has such a good representative on it.

Now in dodging around this group I want next to call on Mr. Dan Hunter. Mr. Dan Hunter lives down in the southwestern part of Colorado. He and some of his friends are here and unfortunately Judge O'Rourke was unable to attend. Judge O'Rourke represents that part of Colorado on the Colorado Water Conservation Board. He isn't here but he has a splendid understudy in Mr. Dan Hunter.

Mr. Hunter, will you come up here and express yourself, please?

MR. DAN B. HUNTER, DOVE CREEK, COLORADO: Mr. Moderator, I feel that I am not equal to the occasion to stand before this august assembly and offer advice to the gentlemen who have gathered around this festive board this morning. But I represent the Southwestern Water Conservation District and we people of the eight counties of Southwestern Colorado feel a deep interest in the waters of the Colorado River from the fact that we supply practically 40 percent of this water from the streams that arise in the southwestern part of our state and flow into the Colorado River.

My people say I have "water on the brain" and I presume that's right. But this morning, in my little town of Dove Creek, we have begun the installation of a water system. Necessarily we have to have water in order to supply our users at Dove Creek, and I am vitally interested in an equitable and a fair division of the waters of the Colorado River. I feel perfectly sure that the gentlemen gathered around this table will be fair and will give us an equitable distribution of this water among the four Upper Basin States and Arizona included. With the advice of the Chairman and the engineering forces, Mr. Bier and others, and the consultations of the various attorneys within the five states, I feel sure that you gentlemen can and will work out an equitable and a fair distribution of the waters of the River of the Colorado in such a way and in such a manner that it will meet with the approval of the legislatures of the various states that are represented.

I feel perfectly sure that you Commissioners will work toward that aim and I feel that you have a sufficient amount of intellect and intelligence to the effect that you will not introduce anything toward the allocation of these waters that you have a doubt would not comply with the free and full consent of the legislatures of the various states represented. Thank you.

MR. SMITH: I think I would be remiss and inappropriate if I postponed any longer calling upon the Honorable Robert F. Rockwell, Congressman from the Fourth District of the State of Colorado, a resident for many, many years of the area up on the North Fork of the Gunnison. I think he claims Paonia as his post office address in case you want to write for some seeds or something.

Bob Rockwell is probably as familiar with water in Colorado as any man in the room. The Honorable Robert F. Rockwell, Congressman from Colorado.

CONGRESSMAN ROBERT F. ROCKWELL, PAONIA, COLORADO: Moderator Smith, Former Commissioner Bashore, Members of the Commission, I am deeply interested in the success of this series of meetings that you gentlemen are holding. I have happened to have followed this program almost since its inception because I happen to have been the Lieutenant-Governor of the State presiding over the Senate at the time that Colorado approved the Colorado River Compact in 1922.

As I recall, at that time Secretary of Commerce Hoover sent a special Secretary out and he met with a group of us in Denver and we went over this problem very carefully. I knew Delph Carpenter very well--his name has been mentioned a number of times. We thought at that time that

this 7,500,000 acre feet of water that was set aside for the use of the four Upper Basin States would be all that we could possibly use.

Time has shown us many problems, many reasons why that was not correct--probably as fair as could be agreed upon--but is not protecting these Upper Basin States; however, we thought they would be protected. As Mr. Will I see over there recalls, and Mr. Carson--I think Commissioner Bashore had withdrawn at that time--and I may say it was with deep regret that the members of the Irrigation and Reclamation Committee in the House of Representatives, of which committee I have been a member the last five years, saw him resign. He was a man who understood the position of Director of Reclamation and a man with whom we worked very carefully, and it was with great regret we saw him withdraw from that, although he has taken this very important position of Commissioner in charge of the division between the states.

But as a result of these hearings that were held there--Mr. Carson attended representing the State of Arizona and a group from California--it became very apparent that in the last sixteen years we have had a considerably lesser flow of water down the Colorado River than anybody ever thought possible. If I remember correctly we only had a flow of a little over three and a half million acre feet of water whereas we have guaranteed seven and a half million acre feet. And it also became apparent when the Reclamation Service went around to decide upon the potential projects in these Upper Basin States that there were several million acre feet of water less than we needed for feasible projects. It leaves a problem here before you gentlemen that is going to require a great deal of careful thought and attention.

I realize as I didn't before these hearings that we are going to have to agree on something pretty soon in the division of these waters. As Mr. Carson knows, California is objecting to Arizona using any more water until there is a division between the states as to how much water each of these seven states is going to be allowed and while, as Mr. Dutcher said, no one knows at this time what the future demand of water is going to be.

Up in the territory that he speaks of, in Gunnison, where I run cattle, they have found that the irrigating of pasture land maybe gives ten times the amount of feed on those pastures that we get just from natural rainfall. It is feasible and up until shortly before 1920 we thought that we could develop that as we wished. If I remember correctly, 70 percent of the water of the Colorado River comes out of the State of Colorado and we thought that all of these hundreds of thousands of acres of land that we have, we could use this water as we saw fit as long as it was within our borders.

Now as a result of this Supreme Court decision which changed the rights of states to the water within their borders, we realize the difficulty of how we are going to develop in Colorado and Western Colorado as we feel is feasible and necessary and still be fair with the other states of the Upper Basin and the Lower Basin.

As a member of the Irrigation and Reclamation Committee in the House of Representatives I want to say that this is a matter that is of the utmost importance. It means the future welfare of all of our Upper States as well as the Lower Basin States because, as Dan Hunter mentioned, in the southwest part of Colorado we have an empire down there that needs development. Potential projects for dams are in the making. But we want to know how much can be done under this compact.

So I just want to present that little picture to you because this situation has changed greatly from 1922, the viewpoint, due to the fact that we realize there is not enough water in that river to satisfy all the development

that we want to make in these upper states, and I urge you to be, as I know you will be, very careful.

I want to say just this in conclusion, that I very much approve of this way of getting at the division of this water. I do not think that any one agency of the Government, even though it may be the Reclamation Service, can come in and divide this water to the satisfaction of all these states. You representing these upper states should agree on what should be done and then it will go before your legislatures and finally before the Irrigation Committee in Congress, and then after that we can hope to get the appropriations to build these dams and development.

But this is probably the most important job that you men ever undertook and I know you will do it as Judge Hume White said, with great care and consideration and fairness. But it is a problem that I don't envy you your responsibility and I hope that you will be able to work something out that will be satisfactory to both the Upper and the Lower Basin States. Thank you.

MR. SMITH: Thank you, Mr. Congressman. Up to this time I have called, I think, upon four men who get their rights from Western Colorado. In order that we don't show any favoritism or distinction between the various parts of Colorado, I am going to call on some gentlemen from Eastern Colorado. I have a number of others that I want to call on later from Western Colorado.

I hope that as these various representatives from the State of Colorado give their talks they try to be of assistance to the Commission. If you have any idea as to how this water should be divided between these four states, express that idea. The Commission doesn't have to adopt it but they would be glad to listen to it.

Now in Eastern Colorado--we used to hate all those birds but we have learned that there are some very fine people up there. I have been astonished what a nice country they have and what good people they have in it, and the man I have been in closest touch with and admired the most and respected greatly--don't get excited, I just picked out one man--this man is a very able person. He is a member of the Colorado Water Conservation Board. He sits right next to me. I am always proud to vote the way he does and always hope he will vote the way I do.

I want to call on Mr. John Dille of the Colorado-Big Thompson Project in Northeastern Colorado. I think he is a member of that project.

MR. J. M. DILLE, GREELEY, COLORADO: Mr. Moderator, Chairman, Members of the Commission: Thank you very much, Silmon, for your remarks.

I don't know I have anything to say that will help this board yet. I am not certain in my own mind the problems you will have to meet in deciding how this water should be divided. Perhaps the best thing I can contribute just now is going back to the days when I first met Mr. Smith, Mr. Merriell, Mr. Delaney, Judge White, and others, when we people from Northern Colorado first began to dream about bringing water over to take care of our shortages in Northern Colorado.

As you all know, this Colorado-Big Thompson Project, which is now under construction by the Bureau of Reclamation, is the largest transmountain diversion--not yet in existence but it is apparently pretty well along in construction after eleven or twelve years. But sitting here this morning I was thinking about some of those meetings we had over here when we were

trying to get acquainted with each other as Mr. Smith spoke. I want to say that we in Colorado over in there feel very proud of the friendships we have worked out among those over here. We want to do everything we can to work along with them and help work out these problems on the Colorado River for the development of the part of Western Colorado here which they are interested in.

I might explain a little bit perhaps--I could to those of you who don't exactly know how that was--what our setup is. But of course, as Mr. Smith mentioned, they were quite perturbed at least when we first proposed taking some of their water, which we hope will be an average of 310,000 acre feet annually out of the 7,500,000 that we may possibly have.

But out of all the meetings and conferences we had and getting acquainted and learning each other's problems and trying to see the picture from the other man's side, we worked out the Delaney Resolution first at the meeting in Denver, I remember, and then it was all finally incorporated in the Senate Document 80--Mr. Merriell speaks of it being a famous piece of paper--and later on incorporated in the Conservancy District Act, which was passed by the Legislature of Colorado, primarily for the purpose of setting up the Northern Colorado Water Conservancy District, which, as you know, contracted with the Government for the construction of the Colorado-Big Thompson Project.

But in the whole plan there I think that we can say that our people in Northern Colorado tried to do anything we reasonably could to be fair and work the thing out on a mutually beneficial basis.

As some of you know, one of the main features of the project is the replacement reservoir, we call it, on the Blue River which has a capacity of 152,000 acre feet of which 52,000 acre feet is dedicated to replacement and protection of the irrigation along the main part of the Colorado River. That feature the Bureau of Reclamation have completed. It has been in operation and the power plants there have been producing power for about three and a half years now. It has worked out very well during the war period in taking care of the power around Denver.

We took over other obligations--I mean, the Senate Document 80 and all the other official documents set up the principle that this diversion is to be attained without any interference with present or future uses of the water of the Colorado River. Furthermore, we took over the obligation of compensating Grand County to the extent of $100,000 for the interference that there might be with their tax revenues on account of using some of their branches up there for reservoir sites.

Beyond that there is another clause in a paragraph of Senate Document 80--I just happen to remember--which provides if it should ever develop--which we hope it won't--the Upper Colorado River States are called upon to take care of a deficiency in the delivery of water at Lee Ferry, the diversion of the water to the Eastern slope will have to be shut off before any of the present or future uses on the Colorado River will be affected.

So I just mention those things to indicate to you what the situation is about these transmountain diversion projects which we are trying to work out in Colorado on a mutually beneficial basis such as our Colorado-Big Thompson in Northern Colorado. I think the Bureau of Reclamation, the people here, Mr. Larson, this district along with our district, are trying to work the whole thing out to get the best thing we can for Colorado, of what we are entitled to as the uses of Colorado.

Beyond that, as to the problem of how this water will be divided, we want to keep informed as to how the matter is working out, and we of course

depend largely on Judge Stone of our Water Board to guide us on these things. and we will try to keep posted ourselves and give the best that we are able to in helping the Commission work out these problems. Thank you.

MR. SMITH: Thank you, Mr. Dille. I like to think of this Colorado-Big Thompson as an example of what can be done when folks get around the table and try to work out something to their mutual advantage. I think the same principles can be applied to the division of this water in the four states.

I made one terrible mistake in the early stages of the Colorado-Big Thompson Project. They had not yet made up their mind they could do this when Mr. Dille came over one day and I showed him a little country. I used to have a ranch by Palisade across the river on a high promontory that looks down on the river. It happened to be early spring when there was a high flood. I took him over there and let him look at the river. He didn't know there was that much water in the river. It was a mistake; I shouldn't have let him know about it. Unfortunately it doesn't run very long.

I am going to call on Mr. Glenn Saunders, who is the Assistant District Attorney for the City and County of Denver, who is very much interested in water, attends all meetings. I have never seen him when he didn't have an idea to express. Mr. Saunders.

MR. GLENN G. SAUNDERS, DENVER, COLORADO: Mr. Moderator, Gentlemen, the City and County of Denver of course has a very large stake in the development of Colorado, the whole state. It is the capitol city and the welfare of Denver is intimately tied with the welfare of every section of the State. In a sense, Denver is, we may say, a parasite as all cities are. Cities do not produce the wealth upon which we live; cities distribute that wealth. And unless the portions of the State which produce wealth prosper, Denver as a distributor will not prosper either. Therefore we are anxious that the welfare of the whole state be conserved.

When the appointment of a commissioner for Colorado for this work was up, a number of names were suggested as we all know. The thought that there might need to be several commissioners was brought out. The people in Denver had so much confidence in Judge Stone, knowing full well his antecedence, the possible bias on behalf of the Western slope, we had so much confidence in his honesty and fairness, we joined with others in recommending that he be made the Commissioner from Colorado. We have full confidence in his integrity and his intelligence and ability to execute that integrity by fairly representing Colorado here. Therefore I believe that the large population centers which are in Eastern Colorado, represented by Mr. Dille's group, the group from which I come, will back the actions of this Commission recommended by Judge Stone because we have great confidence in him.

Now their confidence in Judge Stone might also be an indicator to you on the Western slope that we have confidence in your fairness, too. As Silmon Smith has said, we have gotten better acquainted in more recent years and some of the antagonism that used to exist we are dissipating because the Western slope will prosper, too, as Denver prospers and the Eastern slope prospers. We all win or lose together.

Now as to this particular meeting here, I would only emphasize this fact: The pre-existing rights to water, which I haven't heard yet mentioned, must be protected at all hazards. The City and County of Denver is utterly dependent not only for its future growth but the continuation of its present existence upon the diversions of water it makes from the Colorado River. Approximately one-third of our present uses come from this river.

From the standpoint of the national defence, Denver is becoming a more and more important military center. Because of our inland condition it is recognized that the Arms Plant, the Chemical Warfare Plant, and the West Point of the Air which is being developed at Denver, the Air School, are permanent military installations essential to the protection of this country. I think none of us is so naive as to believe that the millennium is yet here. We are talking about working for international peace. It hasn't yet arrived. For many years to come our greatest protection we all know is going to be in our ability to defend ourselves against aggression. Denver is a key unit in that.

A great plant has been built for chemical warfare at Denver. That plant alone when operating to its fullest extent will require one-third of all the water that Denver uses. Now it has never operated to full capacity. It means that the demands on our Denver water system for national defense may be greatly multiplied at sometime. These are not theories; they are actually existing conditions.

These waters that we now use must be protected. We have no other source of water than the Colorado River. We expect to develop this water and use it in a manner which will not be injurious to the Western slope of Colorado. Mr. Potts, our water rights engineer who is present here, jokingly told Mr. Merriell he still had 300,000 acre feet in his reservoir. The reason is that that is water Denver has impounded for use when demanded by the Western slope and not a credit, which will bring the greatest possible benefit to the Western slope.

We wish to point out to the Commission that we in Colorado in the case of the Grand Lake Project and in the case of Denver's present diversions are quite able to work out our internal problems satisfactorily and will do so. We have great need of water for not only present uses but our future development. We have fullest confidence in our Commissioner, will back him to the fullest extent, so we hope you will listen to him and realize that he is truly our representative and expresses our wishes.

MR. SMITH: Thank you, Mr. Saunders. Mr. Commissioner, may I call upon one man before you adjourn for lunch? I think it would be appropriate at this time to call on Mr. Harry Potts, Water Rights Engineer--did you say, Mr. Saunders? I think that is the official title. Mr. Potts and I used to view each other with alarm--at least I viewed him with alarm. I don't know whether he was responsible for the whole idea that Denver would require a lot of Western slope water, but we couldn't agree. However as time goes on we have seen more of each other and I would like to hear Mr. Potts' expression.

MR. H. L. POTTS, DENVER, COLORADO: Mr. Moderator, I am surprised to be called upon to make any remarks.

MR. SMITH: I am paying you an honor.

MR. POTTS: Thank you. An engineer is naturally more or less at a disadvantage when he attempts to speak before a collection of attorneys and judges and other representatives of the profession.

I have had the pleasure, I will say, of meeting with many of the Western slope men since the City of Denver began diversion of water through the Moffatt Tunnel in 1936 and our associations have been very pleasant. For many years I have known that you didn't raise cherries down here in the Grand Junction District although I have lived over on the other side of the Hump most of my life. I know that you raise peaches down here and the only thing that I might say is that I wish we could get more of the first grade peaches in Denver

and you didn't ship so many of them East. I think they send us most of the cuts.

The last two or three years through Mr. Merriell and your Division Water Engineer, we have been fortunate enough to be able to make some substantial deliveries of water to the Colorado River to help top out and furnish some supplemental water to the orchards in this district. And as Mr. Saunders told you, we feel perfectly safe in having a resident, I believe you said, Mr. Smith, of the City of Gunnison, as a representative of the entire State of Colorado. We feel that in approaching this division of the Colorado River it must be done with a full spirit of cooperation, and I can assure you that we are ready at all times to cooperate in any way possible.

I think that I might say that there is no real necessity for viewing with alarm the river flows in the last few years. If we can believe the studies which some of us have carried on we find that on the Eastern slope at least, we entered into a drouth cycle in the year 1923 and we have yet to come out of it. I know by comparison of my tree ring studies with those of more competent men down at the University of Arizona, that the records of the South Platte follow very closely the records of the Rio Grande and also the records on the Colorado River. We now have a record over there of some 650 years where there have been various periods of drouth during that time. But the old law of averages is bound to bring the other extreme at some time or other, and I do not feel that we are facing any calamity because we have had a few years of drouth.

MR. SMITH: Mr. Commissioner, at what time do you wish to adjourn? Shall we proceed now or--(Confers.) Suppose we proceed for another half hour if that is agreeable. You are too late to get to the first table now anyhow.

I would like to call on Mr. C. J. McCormick at this time. Mr. McCormick has for some ten, fifteen, twenty years had the Orchard Mesa Irrigation District on his soul and conscience. He has been secretary during that period. He is one of these people who know what it is like when the water runs out because that District feels a water shortage. It is easier for him to look to the time when the well runs dry than it is for you fellows to where it is only high water. Mr. McCormick.

MR. C. J. McCORMICK, GRAND JUNCTION, COLORADO: Mr. Moderator, unfortunately I am not like Mr. Smith and some of the others. He tells about his friends who were in school with him and various things of that kind. My mother was rather old-fashioned and she had the idea that only the weaker ones, the ones who couldn't do very much manual work, should be sent to school. My brother was kind of delicate so he got the schooling. But one day he was sick and Mother had the idea that school was like a threshing machine crew, you had to have a full crew or else you couldn't do any work, so she sent me to school that day.

Being brought up on a farm, when I came to Colorado I thought maybe I could reform, but I wasn't able to do it. I had to still stay on the farm. However, the neighbors over there sort of concluded that I was a good goat, so they put me on the Irrigation District Board because the District was bankrupt and they knew it and I didn't. So like a chump, you know, I started to straighten it out. My hair was pretty dark then and I had a lot more of it than I have now. But I found out we were bankrupt after a while when we couldn't get money to pay our bills. So eventually we prevailed upon the Bureau of Reclamation to come in and take away some of the things we had in order to give us a little water.

Now I can't give you very much advice. Being a farmer I diversify the farm. I plant some corn, some sugarbeets and some onions and a number of other things that grow very successfully here. But it seems to me that our problem might be similar to the farmer's problem.

The farmer has a definite expense. He must pay his taxes and he must pay for his help. We have a definite charge or expense in delivering so much water at Lee Ferry.

Now if the farmer can produce money from his different crops, he naturally is going to take from those crops a percentage to pay his definite expenses. If he had four fields it would seem to me that he would figure that the products from those four fields should share in the definite expense that he has to bear. So that as I look at this, the products of these Upper Basin States should share in this definite debt which they have on some basis which probably is proportionately or something of that kind.

In my farming experience I try to have left a little money over my definite expenses. I am just like the rainfall; I have those periods of drouth. I had them a few years ago. Just recently I have had the other kind. I don't know how long it will last; of course we hope it will last indefinitely, but they haven't in the past and I don't look for it in the future.

But one thing that I would just like to leave with these Commissioners is that we produce water. My fields produce crops that I sell and I take a proportion of those crops to pay my definite expenses. What I have left over I divide up among the family. Of course the wife gets the most of it because she does the most of the work. But that's the only problem that I see for these Commissioners is to determine how much water each one of these states must deliver at Lee Ferry. Thank you.

MR. SMITH: Before going up into the Montrose and Delta area I am going to call upon Mr. William Sullivan at this time. Mr. Sullivan is Superintendent of the Grand Valley Irrigation Company, which used to be written up in the books as the most successful irrigation project in the West. It is a pioneer. Ever since it went through its first bankruptcy it has been one of the best systems anyone has ever known of.

Mr. Sullivan has worked upon that from the beginning and has directed it during the last few years and is more familiar with the peculiarities of the Colorado River, I imagine, than any of the rest of us. He has seen this river when it was so big you couldn't do anything with it, and he has seen it when there wasn't any of it. And it is those thoughts that impress upon us this obligation which correlates this division of water. I am sure Mr. Sullivan can give us some worthwhile thoughts.

MR. WILLIAM J. SULLIVAN, GRAND JUNCTION, COLORADO: Mr. Commissioner, I have been on the Grand Valley ditch some forty years--I am not going to take up much of your time--but on this dry circuit of the water, up until some fifteen years ago we weren't bothered at all about getting water out of the River. Some fifteen years ago we had to put in a diversion dam and since that time every year, I believe, there has been no water going down the River below our headgate.

I think Mr. Merriell would be in a better position to tell you of our water troubles than anybody as he is our consulting engineer. I think that is all I have.

MR. SMITH: Thank you, Mr. Sullivan. I am going to call on Mr. Bill Dodd at this time. Mr. Dodd--William Dodd I think they call him--is the

President, I believe of the Uncompahgre Water Users Association, is that correct?

MR. DODD: Yes.

MR. SMITH: He is very much a citizen in the upper middle Gunnison River. He attends all the important meetings. I have sometimes thought he was a New Dealer--I am not sure he is. I have learned better. But wherever they need a man of ability they generally call on Bill Dodd. He demonstrated that beyond any peradventure of doubt by putting all his farm equipment on rubber, the first man to do it.

MR. WILLIAM J. DODD, DELTA, COLORADO: Moderator Smith, gentlemen of the Commission, and gentlemen: I am not very much elated over that introduction. After all, when I heard Mr. McCormick called on, I rather thought that I wasn't entirely alone. I am only a farmer and a stockfeeder. I very rarely attend such gatherings as this and so thought a while ago that I was only a farmer amongst judges, attorneys, and engineers. I thought I was out of place and I am still pretty much out of place.

I talked to Dan Hughes this morning. He probably could have assisted this Commission and given some advice which they might have carried into their deliberations with some effect. But I spend most of my time in the fields and around the corrals. I am sorry to say that while I have read much concerning the problem of the uses of the Colorado River water among the seven states, I haven't studied it very carefully. When Mr. Merriell wrote me concerning this meeting, I had thought only of coming down here and learning what was in the offing.

While sitting here during the past few moments--having gotten here a little late and missed some of the earlier talks that may have been of benefit to me--I am impressed that this is probably a greater problem for these gentlemen than I had in my mind anticipated before as things were brought up. Of course, this obligation to deliver so much and take what is left makes your problem greater than it would have been if you were dividing the water in the river only. Of course, assuming that our existing rights in all these states under our water laws will be protected, then of course you are dealing with a problem for future uses only.

While I can't give any advice, I could just picture that probably in going at that, in the solution of the matter between the states of its division of what remains, is rather a visionary thing in that you haven't too much tangible stuff except what has been worked up by the engineers and the imagination of what uses will be in the future. That contemplates, of course, not only probably our irrigation and domestic uses as we see the same today, but you get the picture of twenty-five, fifty, a hundred years from now, other uses that will develop, will come about. Probably then you will be consulting these visionary fellows who are necessary to us, such as architects, of the future in any field.

So while it is very clear to me that we should get at this thing and, since it is important to our states here that we know to what extent we each share within the bounds of the water above what we must deliver below and current uses depleted, we shouldn't delay this matter any longer than is necessary to get the job accomplished. However, I can believe it will probably take some two or three years or more.

It is very important because there are two factors that in my mind are somewhat conflicting, that will ever more be in your minds, or will be when it gets back to the states for consideration. That is, of course, the

uses that you will ascertain that the different states have of whatever apportionment is made to that state. And on the other hand, of course, the developed communities in each state are interested in their maintenance and increased use, as mentioned by the gentlemen from Denver, because of our interest in the community. Each one of us back in our separate areas are interested in its development. Our total expense, taxes and all, is thus tied up and either decreased or levelled somewhat by its enlargement and better development. There is always that human element amongst us, the consideration that the all-important thing is our relationship among peoples, their status in the states interested.

I don't know that there is any advice that I could give; only such rambling present thought ideas. I haven't prepared for any remarks on the subject.

MR. SMITH: Mr. Commissioner, may I at this time call upon Mr. Harry Gueno, a prominent attorney of the Delta-Gunnison River area, and an attorney, I think, for the Hotchkiss Project, is that right?

MR. GUENO: The Paonia Project.

MR. SMITH: Mr. Gueno, Mr. Dodd was complaining a little because we weren't putting in enough lawyers. I am going to change that now by calling on Mr. Gueno, who customarily deals in "fairness and equity", and perhaps he can tell us how we can equitably divide this river among the four states.

MR. HARRY W. GUENO, DELTA, COLORADO: Thank you, Mr. Smith. Gentlemen of the Commission: I am impressed today and I think some of us should voice the debt of gratitude we have to the lot of the gentlemen here who have done the pioneer work in carrying out these projects and in preserving the rights of the State of Colorado and the other states in the division of the water of the Colorado.

I think I, like most of the citizens, have just let it rock along believing that the water was there and we had it. We all know that that is not the case and that there must be some equitable distribution of this water to the different states involved. And in that connection I believe the people of the Western slope are perfectly willing to carry out their contract to furnish at Lee Ferry their proportionate part of their water. In fact, the agreement is made and the Compact entered into and I don't believe that the people here will crab about carrying out their obligations.

It seems to me that the most concrete advice that has been given this Commission today is by the man who claims that he doesn't have much education, Mr. McCormick. When he says that he apportions a part of his revenue from his farm for the payment of taxes, for water assessments and overhead expenses, why, we all know that. Those are things he has got to do.

And it would seem to me that this Commission in apportioning the water to the states, the representatives of the several states, will realize that obligation and will apportion or contribute their proportionate share of the water that arises in the several states to the Lower Basin States. What your job is going to be, of course, is to determine what is equitable apportionment.

I am wondering, listening to this problem, hearing the comments on this problem, whether Cliff Stone here is not going to be up against a kind of a proposition that Secretary Byrnes is with the United Nations. Now I hope, Cliff, your job won't be quite as tough or that you won't have any Molotovs to deal with.

But in conclusion I just want to say that I am sure the Western slope approves of the work of this Commission and we are all behind Judge Stone one hundred percent. Thank you.

MR. SMITH: Thank you. Mr. Commissioner, I think that it might be advisable to adjourn at this time until two o'clock. There are a number of gentlemen whom I wish to call upon and I hope you will all come back and bring others with you.

During the noon hour, Members of the Commission, undoubtedly some of these men will figure out whether to tell you to divide this 7,500,000 acre feet by four as equitable or whether to divide this 7,500,000 acre feet by the share each state produces of this water or by the share that each state wants to assume to supply the 7,500,000 acre feet at Lee Ferry. After dinner they probably will enlighten you.

THE CHAIRMAN: Gentlemen, before we adjourn the Chairman would like to make one or two observations.

I believe the speakers pointed out the hurdles this compact will have to jump. As I recall it, it was not mentioned that after it is ratified by the legislatures of the states it will have to be signed by the governors and any governor can veto.

Mention has been made of a shortage in the Colorado River and I believe Congressman Rockwell intimated that he and Delph Carpenter and others overestimated the capacity of the River at that time. We must bear in mind that the projects which were contemplated by those men at that time were projects feasible under the then existing reclamation laws. It makes a vast difference when you consider a project that is feasible under the Reclamation Law as it existed at that time and projects that we are talking about today. We are talking about Basin-wide developments of large magnitude not necessarily feasible under the Reclamation Law, similar to those in the Missouri River Basin.

Just one other thought and I am through: You have heard and read a lot about the authority idea in the United States. I don't suppose many of you people here in this room are in favor of the authority idea; perhaps some of you are. One of the best arguments used in favor of the authority idea is something like this: that the states are very jealous of their water rights, they are very proud of their jurisdiction over their water rights; but that when any forward movement takes place for the development of those rights and they get together, they don't do anything but squabble and bellow and kick up the dust and fight and don't agree on anything. As a consequence of that fact the only way you can get these large river basin developments is to have an authority which does not have to pay any attention to state lines but can go right ahead and develop.

You say that isn't going to happen in this Colorado River Basin, people are not going to accept such a theory as that; but in the humble opinion of your Chairman, not as Federal Representative but simply as Chairman of this Commission, the sentiment of the people can eventually turn to that unless these compacts are equitably worked out.

We will now adjourn.

(12:32 p.m. Noon recess.)

(2:10 p.m. Hearing resumed.)

THE CHAIRMAN: The meeting will now come to order. Mr. Stone, you may proceed with the hearing.

COM. STONE: Mr. Smith will proceed as Moderator.

MR. SMITH: Mr. Commissioner, gentlemen, with your permission we will proceed where we left off at lunch. I think we might hear with advantage at this time from Mr. Charles R. Neill of the Paonia Project. I believe he is the secretary of the--you tell them, Charlie, what you are secretary of.

MR. CHARLES R. NEILL, HOTCHKISS, COLORADO: Mr. Moderator, Mr. Chairman, Gentlemen of the Commission: I think I have a fair comprehension of the magnitude of this job that you are confronted with from two angles: One, it was revealed at the Omaha meeting of the Reclamation Association; the other, it was my privilege as a reserve officer to be called up on active duty in 1942 and assist in the developing of the largest army the United States has ever had and an army the size and magnitude of which had never been visualized. I want to say that it was a job.

I have for the past twenty-two years been Secretary-Treasurer of the Fire Mountain Canal and Reservoir Company of the so-called Paonia Project; for the last ten years, Secretary-Treasurer of the Overland Ditch and Reservoir Company also in the so-called Paonia Project.

To digress slightly, last summer a brother-in-law of mine who lives in Philadelphia was out for a visit. After he left my wife related this incident: She said Emerson asked what this country needed most and said she laconically replied, "Water." I guess I have had water on my brain--mind, what have you--for a number of years, and to me water is more than H_2O.

Our primary problem in the north part of the valley of the Gunnison River is supplemental water. These twenty-five years, twenty-two of which I have been definitely connected with them in the matter of developing, preserving the rights, the financing, liquidating the obligations--they have had and do experience many years in which the natural flow has been insufficient to produce a crop the proceeds of which were sufficient to pay operating costs, debt retirement, and such items. With us supplemental water is the thing that will--shall we say--make or continue to hold down to our present level our particular area.

I think perhaps it is known that we have a project before the Reclamation Bureau in the making. This particular year has cost us in our crops a tremendous sum of money, not merely by reason of the--shall we say--fabulous prices received this year, but on a normal yield, a tremendous percent of our apples have not made size by reason of the lack of water. A large area of our hay land did not yield the usual or a normal amount of hay by reason of the lack of supplemental or late water. That to us is the thing that is going to hold us as is or permit our going forward.

We have a large area under either of the two projects of just as fertile land as there is in the State of Colorado or in the West. Much of it is in a raw state yet. Much of it is suitable for the production of grain crops that can be matured with one irrigation in the spring, flood water. Flood water we normally have plenty of, but it is the late stored water that is essential to a further development.

Someone mentioned cherries this morning. I might say that in our valley we produce cherries second to none in the United States, as we do all

other fruit crops. Water is the one thing that is now necessary for the further development of our immediate area.

I have a very clear concept of the magnitude of the job you gentlemen of the Commission are confronted with. To restate some of those statements made this morning, I feel very confident of your impartial ability to arrive at a conclusion that will be written into a compact sustained by the various states, governors, Congress, and the President. Thank you very much.

MR. SMITH: Thank you, Mr. Neill. Your colleague, Mr. Carl Smith, President of your District, asked me not to call upon him for a speech; he said he preferred to listen. But, Mr. Smith, if there is something you subsequently want to say, let it be known and we will listen.

MR. CARL R. SMITH, HOTCHKISS, COLORADO: Mr. Smith and Members of the Commission, I don't believe I have anything to say. I am really interested in learning what is going on here and I don't feel that anything I could say would be worth the time.

MR. SMITH: If you change you mind, let us know.

MR. CARL R. SMITH: Oh, I will, thank you.

MR. SMITH: I would like to call on Mr. Archie Toner at this time. Mr. Toner is Director of the Southwestern Colorado Water Conservation District, is that right, Mr. Toner?

MR. ARCHIE B. TONER, FT. COLLINS, COLORADO: That is right.

It has been a great privilege and pleasure to me the past fourteen months to travel the State of Colorado; and in my travels, while it wasn't in line with the work I have been doing, because of my interest in water and the various problems it may bring up, I have been spending a lot of my own time and maybe a little of somebody else's time in going over these different reclamation projects and the areas that they service.

I have been over every section of the State regardless of how small. I have been up all your valleys and all of the remote areas, been over those, and some of those I was over twenty years ago when they were deserts. Today they have water on them and some of our best farm lands are in those desert lands that I have seen in the past.

There is one thing, though, that I would like to take issue with some of the speakers here that have been trying to claim our State Director, Judge Stone. I don't like to think of him as having a home anywhere except in Colorado. He is a Colorado man. We all believe in him and we all trust his judgment because in our long acquaintance with him we have learned to know that he is fair and just in all his decisions and he is working for the State of Colorado.

In the Southwest, as Dan Hunter said this morning, we produce 40 percent of the water that flows down the Colorado River, and we have guarded it, some of us rather religiously, and perhaps sometimes a little bit biased and narrow-minded. After traveling the entire state as I have done the last few months I have taken a different viewpoint.

The turn of world affairs has brought us together. We have learned through our world conflict that the world is small. We must live together and here in the United States we must learn to live together as one unit. We cannot be biased as far as our own states are concerned. We like to see our

states develop and all that but we have got to think in terms of mankind and what developments are going to mean the most to the United States a hundred or two hundred years from now.

We want to see our Colorado State develop to its utmost, but if I am talking to some of the people in my own home town, they see a large amount of water flowing down that river there and they can probably never believe that there ever will be a shortage of water. After this compact is ratified by the legislatures and the governors and the United States Congress, if I can say to those people, "That river only belongs so many percent to you," it will mean a lot to me and to everyone else that is interested in water.

Now you fellows here, the Commission has got one of the greatest problems or perhaps the greatest problem that you have ever had confront you against you right today and God be with you. We all trust you and we know that out of this Commission here will come something that will go down in history as the solving of one of the greatest problems we have had. I thank you.

MR. SMITH: Thank you very much, Mr. Toner. At this time I would like very much to hear from Senator Lou Williams, Montrose County--former County Commissioner as well as State Senator. He is very much interested in Colorado water. Senator Williams.

MR. D. L. WILLIAMS, NORWOOD, COLORADO: Mr. Smith, the Commission, gentlemen: I don't believe that anything that I can say can add anything to what has already been said. I doubt if anything has been brought out here that the Commission didn't already know, and I prefer to just stop there and let them go ahead at whatever they are doing. I believe they know everything that has been brought out.

I come from the River Basin over there, the only one in the Colorado River Basin, I believe, that hasn't had a survey, the San Miguel River Basin. We are in need of quite a bit of development there but it is very small in comparison with a lot of the other developments, and there isn't much you can talk about in the San Miguel area until there has been a basin report made on that river. That is all I have got to say.

MR. SMITH: Thank you, Mr. Williams. We have with us Mr. Sundquist, the manager of the Grand Valley Reclamation Project. I wish you would come up here and tell us how this Commission should divide this water among the four states.

MR. T. L. SUNDQUIST, BUREAU OF RECLAMATION, GRAND JUNCTION, COLORADO: If I could I would be glad to tell them.

MR. SMITH: That is fine. You go ahead.

MR. SUNDQUIST: I haven't anything particular to say. I haven't studied this too much. I can kind of compare my job with the job you gentlemen on the Commission have. We happen to carry water for three or four projects through our canal, and I know when the water is scarce how each project thinks they ought to have so much water. What a job you fellows are going to have in allotting this water to the various states!

Mr. Smith said he could step across the Colorado without getting his feet too wet. I think this summer for about a month you could have sat on the apron of our diversion dam and taken a sunbath without getting wet at all. At times we are pretty short of water.

I can see the importance of allotting this water and the importance

of knowing how much water we need for the projects we have already. When the years are dry our farms are dry and demand more water, they need more water. I have nothing further that I can give.

MR. SMITH: Thank you, Mr. Sundquist. I think said just the right thing because I was next going to call on Charlie Beise. Charlie Beise is the attorney for the Arkansas Diversion Project and I wanted him to hear what you said about that dry river before I called on him. Charlie, can we hear from you? Mr. Charles Beise, attorney for what?--the Arkansas Transmountain Diversion?

MR. CHARLES J. BEISE, DENVER, COLORADO: You name it, Silmon. It is a long-winded name. The name is Water Development Association of Southeastern Colorado--not that that means anything because there isn't too much in a name. I might give you a little bit of an idea of what that project is all about. You see the name in the paper, Gunnison-Arkansas, frequently, and I think maybe it wouldn't be amiss to give the Commission and yourself just a little idea of what we are trying to accomplish.

The association for which I am attorney represents the water users between Leadville and the Kansas Line on the Arkansas River. The proposed project if constructed to the scope and size of the report released by Region 7 to date would mean it was about three times the size of the Big Thompson, roughly twice the size of Denver, perhaps half again the size of the Central Utah, three times as big as the San Juan-Chama. It is roughly 900,000 acre feet of water. That goes into an area in which there is now irrigated in excess of 300,000 acres of irrigated land, one of the richest farming sections--I won't get in an argument with John Dille--but it is one of the richest farming sections of the State of Colorado in which there are critical shortages of water for irrigation.

In that same valley are the second and third largest cities in the State, Pueblo and Colorado Springs. Colorado Springs may potentially get water, possibly, from the City of Denver's project. But Pueblo at times in years past has gotten down as low as a 24-hour water supply. They are in desperate need of water and there remains no water to be developed on the Eastern slope. So this association represents the attempt to encourage the investigation of that project.

Mr. Ben Powell here is the man who has charge of that work on the Eastern slope, and Cliff Jex has been doing the work on the Western slope for Mr. Larson.

Aside from that I think I have a little bit unique position here, Mr. Smith, in that I cu' my teeth over in the San Juan. My position was attorney for the Pine River, Mancos and La Plata projects. Then I was with Stu McMaster over in Salt Lake City four years and he taught me what I know about the Government's position in these matters. Now you see I am on the Eastern slope and probably Bob Rockwell will tell you I am a little bit out of line.

MR. ROCKWELL: I do.

MR. BEISE: Yes, sir. Then I heard Taylor's position and it is hard for him to take any other position. So I see this thing in a number of different lights. I see them from the Western slope viewpoint. The Eastern slope wants your water; you want to protect ample water for your now need and what you think you are going to need in the future.

That future equation--I wasn't here this morning to hear any

discussions but it all seems to me that the uses of water are pretty well established. If there are future developments on the Western slope beyond what can be now seen, the same thing is true of the Eastern slope. If there is going to be a future need on the Eastern slope that we don't know about, there will also be on the Western slope, but we are anxious to speed the work of your Commiscion.

I think that the only comment I can make in passing that would be of any assistance is that in the Colorado River report itself, while it was none of the immediate worries of this Commission as such, transmountain projects seem to be neither visionary nor factual in that report. I think your Commission here, you men, should take into consideration that probably the largest projects in all of the states of the Upper Basin will be transmountain or transbasin or some other type of project taking water out of the watershed. I think that is true in Utah, Arizona, New Mexico, and Colorado, and I think it is, Mr. Bishop, probably in Wyoming even.

So you do have a difficult problem, indeed, and you must consider not just the Basin itself but the states as a whole. You probably are going to have to take a semi-judicial attitude and not the attitude of an advocate before you men are able to agree between yourselves on any semblance of a decree in one sense that can be entered for the use of water.

I am sure all people here wish you every success and I am sure they are all willing to cooperate in any way possible. Thank you very kindly.

MR. SMITH: Thank you, Mr. Beise. If you hadn't told us how many times you had been fired we never would have known part of it. The way he speaks about 900,000 acre feet of water so casually I think we should get back from fancy to fact and I am going to call on Mr. John Heuschkel, who lives on the River. Mr. Heuschkel is a member of the Colorado River Water Conservation District, a former County Commissioner, and for many, many years interested in the water of the Colorado.

MR. JOHN HEUSCHKEL, GLENWOOD SPRINGS, COLORADO: Mr. Chairman, Gentlemen of the Commission, as I understand this it is the division of water among the Upper Basin States. And I feel--I wish to state that--that each state should contribute their fair share towards the water furnished to the Lower Basin States in its division.

I came into Western Colorado, or my folks brought me here, almost 59 years ago in a basket, before the railroad. I made my home here in Western Colorado, and all I have heard and a big part of what I have tried to do is protect the use of water.

One thing we mustn't overlook: There is going to be a lot of individual development along the rivers and creeks in Western Colorado and I think those should come first. While the reclamation projects are a wonderful thing and are going to be a great thing, but the number that are listed in the report --I wonder sometimes where all the water is coming from. I think that is going to be our greatest problem, to find water for all these projects.

There is a good deal of lost water through seepage in the different rivers and sometimes there will be projects, probably, to take care of that. Another thing, there is a good deal of water wasted through all of our states which will have to be overcome. But I do believe that the individual development should be protected first and then the reclamation projects as they come in the various states should be taken care of. I think need and demand possibly should govern a great deal of that.

I don't know as I have a lot more to say, only I know you gentlemen have a real job on your hands and you have my sympathy. Thank you.

MR. SMITH: Thank you, Mr. Heuschkel. Mr. Commissioner, I would like to make a short explanation. Judge Paul Littler, Judge of the Seventh Judicial District, who is with us and came in only a few moments ago--may I explain, Judge Littler, that we are endeavoring to be of assistance from the standpoint of Colorado in this Colorado hearing on the division of the Colorado River between the four Upper States and that portion of Arizona coming within the Upper Basin. Judge Littler has been familiar with water matters in Colorado for many years, a keen student of water. I hope you will be able to give the Commission some suggestions, Judge Littler, that will be helpful to them. This is one of the few times I can tell the Judge what I want him to do and get the best of it.

JUDGE PAUL L. LITTLER, GRAND JUNCTION, COLORADO: Mr. Smith, I have lived in Colorado most of my life and have been more or less interested in farming and irrigation. I didn't expect to be called on here. I haven't anything particular to add except what we all know, that water is the life of our country and Colorado produces much of that vater.

We in Colorado feel that we have some priority in our claims, while we also realize that all of the states below likevise depend upon that water and we must be broadminded enough to share that water with the Lower States. We feel that all vator should be put to beneficial use so far as possible and no water that can be put to beneficial use should be allowed to go to waste. I think that will be agreed on by everyone. I assume that it is the problem for the gentlemen here to provide some equitable apportionment between the states which can use the water from these streams.

There is a great acreage in Colorado that is not irrigated that is subject to irrigation by irrigation projects and developments, and we believe that we should look somewhat to the future and allot a certain portion of the water to future development. Thank you.

MR. SMITH: Thank you. Now I am about to give up this job as moderator but before doing so, is there anyone here from Colorado, East, West, or otherwise, who has not had the opportunity to express himself? (No response.) Mrs. Wakefield, would you care to make a talk to this Commission? You have listened very diligently.

MRS. WAKEFIELD: I came only to listen and to learn.

MR. SMITH: Is there anyone that I have overlooked? (No response.) Judge Stone, I have the honor to turn the meeting back to you.

COM. STONE: Silmon, I first wish to express on behalf of the Commission our appreciation of the manner in which you have handled the presentation for Colorado and also to express to all who have spoken our appreciation of those statements. As was said in the beginning, it is the effort of the Commission at these open hearings to ascertain the views of the people within the five states--in this case it is the four states since we are holding no meeting in Arizona--with respect to matters which have to do with the making of a compact. As I sat here listening to your words of sympathy for the Commission and the job we have to do, I became somewhat apprehensive, and yet I believe that we shall be able to do a job--at least we are willing to attempt it.

At the Rock Springs meeting it appeared to me that one of the most helpful presentations, helpful I am sure to those who came to the meeting, was

the explanation of the work of the special Engineer Committee. That Committee is made up of representatives appointed by the Commission and the Federal Representative, Mr. Bashore. The Chairman of that Committee is J. R. Riter.

I should think, Mr. Chairman, it would be appropriate at this time to call on Mr. Riter for an explanation of the task which that Committee is attempting and the manner in which the work is being done, and if that is agreeable, Mr. Chairman, I should like to have Mr. Riter do that at this time.

MR. J. R. RITER, BUREAU OF RECLAMATION, DENVER, COLORADO: Mr. Chairman, ladies and gentlemen: The Engineer Committee was appointed by the Compact Commission and we work under their direction. As has been explained, a representative from each of the states met in Cheyenne, Wyoming, late in August and worked up a program of work to be performed and then our report was presented at the last meeting of the Commission, which was held at Santa Fe on September 17. The Commission adopted the report and told us to get to work.

You might be interested in some of the members who are on that committee. Representing the Federal Government as the adviser to the Federal Representative of the Compact Commission, I was appointed to be his adviser and the Committee saw fit to ask me to be Chairman of the Engineer Committee. The member from Arizona is R. Gail Baker. Mr. Baker is not present today. Mr. Baker is of the staff of the State Land and Water Commissioner of Arizona.

From Colorado, your Commissioner felt that due to the vast interest which Colorado has in the development of the water resources of this state Colorado should have three engineering members and these are: Mr. C. L. Patterson, who is Chief Engineer of the Colorado Water Conservation Board; Mr. R. J. Tipton, who is a consultant for the Colorado Water Conservation Board; and Mr. F. C. Merriell, who is Secretary-Manager of your Colorado River Water Conservation District, who lives in Grand Junction and who in my opinion has more intimate knowledge of the Colorado River than any one of us, that is, from the standpoint of Colorado.

From New Mexico the engineer is John H. Bliss, who is the engineer adviser to the Interstate Streams Commission.

From Utah the member of the Committee is Fred Cottrell, Deputy State Engineer.

From Wyoming is Mr. H. T. Person. Mr. Person during nine months of the year teaches school at the University of Wyoming. He is also consultant for the Wyoming Compact Commission.

Now we don't limit ourselves to these members. There are other people working with us. For example, in the Denver office of the Bureau of Reclamation pursuant to instructions from our Commissioner, we have one engineer full time and then we have as many assistants as he can use officially. Our Regional Office at Salt Lake City, which has charge of planning and investigations in the Upper Colorado River Basin, has assigned some of their men to work with us on this problem. Through the cooperation of the Salt Lake City Office we also draw upon the services and experience and the records of Mr. Jex, who is located at Grand Junction; Mr. Heiderman, who is located at Durango; Mr. DeLong, who has offices at Kemmerer, Wyoming; and such other help as they are able to give us.

There is present with us today Mr. Jarvis, who has been employed by the State of Utah to assist in carrying out the studies, and there are other engineers assigned by the states as they can make their services available to us. Now so much for the personnel.

One of the first studies to be undertaken is to determine the origin of the water by states. The Engineer Committee felt and the Commission agreed that before the Commission could start dividing up water they must first have factual information on the water that is available and where it comes from.

There have been several discussions here today about the work of the Commission which negotiated the Santa Fe Compact about 1922 and it was stated that they were hampered by lack of records. As a result of the work of that Commission, many key gauging stations have been established on the Colorado River. For example, records were initiated at Lee Ferry on the Colorado River, which is the point of division between the Upper Basin and Lower Basin, in 1922, and those records have been collected continuously since that date.

As a minor detail you might be interested to know that the gauge itself is called Lee's Ferry, which is above the mouth of the Paria River, and then there is also a gauge at the mouth of the Paria River. To determine the flow at the Compact point called Lee Ferry we have to add the discharge record of the Colorado River at Lee's Ferry with the discharge of the Paria River.

The gauging stations have been maintained for a number of years by the Geological Survey at certain key points along the Colorado River and its tributaries. For example, we have a long record of the Green River at Green River, Wyoming, which goes back to the beginning of the century. We have a record on the Green River near the Green River, Utah State Line, which does not extend back quite as far as the Green River, Wyoming record does, but there is a fairly long record there. There is a long record at Green River, Utah, which is near the mouth of the Green River.

The Yampa River, which is one of the principal tributaries of the Green River, which drains a large proportion of Colorado and also some area in Wyoming, has been measured for a good many years.

We have the record on the Colorado River at Grand Junction, that is, near Grand Junction, since sometime in 1890 as I recall--it is about 1895. Of course that measures runoff from the Colorado River which is entirely a Colorado stream at that point.

We also have records of the Gunnison River near Grand Junction for a long period of time. We have a record down at Cisco, Utah, which is one of the key stations on the Colorado River, which has been maintained since about 1922, with several scattered years of earlier record.

On the San Juan, which is a very important stream both from the standpoint of Colorado and New Mexico, we have records, not continuously, however, except in recent years, at Farmington, at Shiprock, and at Bluff.

There are in addition to the main stem stations, so-called key stations, records of varying lengths of time on the tributaries of the Colorado, the Green, and the San Juan.

It seems in more recent years since the states have been thinking about compacting and looking forward to compacting, effort has been made to establish gauging stations near the State Lines. Apparently the States had in mind at sometime a compact would be formulated and as a basis of that compact they wanted to ascertain the runoff from each of the states. However, there are still a large number of important tributaries which are not gauged.

For example, some of the southern tributaries of the San Juan River which drain from New Mexico into the San Juan have not been measured. Many of the tributaries which enter the Green River and the Colorado River from Utah have not been measured. So our job then of determining the origin of water involves a number of studies.

In the first place, we will have to assemble and tabulate all the available discharge records at key gauging stations and on the tributaries near the State Lines. Then the next job will be to extend those records by estimates, that is, we will have to compare them with other stations which have a longer period of record and prepare an estimate.

As has been explained here today, the River is not a constant stream. It does not run the same year in and year out. Some years when we have had high floods we have had as much as 25,000,000 acre feet down at this point of Lee Ferry, which is the outlet of the Basin. And then as has also been pointed out, there have been years when it drops down to less than one-fifth, in other words, less than 5,000,000 acre feet in one year. Therefore, to get a representative sample, we desire to base our study on as long a period as is possible to do so. We are attempting to extend all records back to about 1914.

In the Bureau of Reclamation report which you people have discussed and will have opportunity to discuss and submit your comments on, we attempted to extend the Lee's Ferry record back to 1897. But after examining the records that are available, we felt if we could extend them back to 1914 we could get a fairly reliable period of study. That will be a long-time period. That will be over thirty years, and generally speaking we feel we can make fairly reliable estimates back for that period of time.

Then after we have extended the records at the gauging stations we have, it will then be necessary to make estimates for the unmeasured tributaries. While we don't know precisely how much came from each individual tributary in Utah, we do have records on the main stem above those tributaries and we also have records at Lee's Ferry. Making use of those control points and comparing records at the tributary gauging stations and at Lee's Ferry, it will be possible to have some measure of control on the estimate.

In making those estimates we are planning to attack the problem from a number of approaches. We know basically the runoff originates from rainfall. We are compiling all of the rainfall records available within the Basin and will attempt to find a relationship between rainfall and runoff, or an indication of a relationship. Mr. Jarvis, who has been working in Utah where that problem is particularly acute, has developed some preliminary relationships which indicate that there is an indication. That is one approach.

Another approach, we will attempt to estimate the runoff from the unmeasured tributaries by comparing with other tributaries which are measured, and we will attempt to compare the physical characteristics of the two watersheds.

Then after we have the records built up as to the amount of water there historically, we will have to correct that to determine the amount of water that would have been there before irrigation development was made. In other words, we do know from experience that as you irrigate land, regardless of where it is in the Basin, part of the water that is used to grow those crops is consumed, is used up consumptively by transpiration losses from the plants.

The Bureau of Reclamation in our studies for the purposes of that Colorado River Basin Report has made some estimates of what the present and past uses have been. That is an estimate which is based on the opinion of the Bureau

which is based on our judgment and our observations from carrying other similar projects. The Committee before they adopt that, if they adopt it, wish to investigate further the method used by the Bureau in determining present uses and past uses.

Once we have agreed among ourselves on what we will use we will then apply those past uses to the historical flows and determine how much water on the average and by years flows past, for example, the Colorado-Wyoming Line; how much discharge past the Wyoming-Utah Line; and how much water came out of Colorado into Utah and into New Mexico at the State Line, and also the amount of water that originated in New Mexico and the amount of water that originated in Utah.

After we have determined that we still haven't completed our job because we know, for example, that if a certain quantity of water should be in the stream at the Wyoming-Utah Line, that all of that water will not get down to Lee Ferry. We know that there are heavy losses on those stream channels due to evaporation, due to consumptive use of vegetation growing along those streams--I think those are the principal sources of losses. During times of flood also we have reason to believe that some of the water will be entrapped in channels or some of it will sink into the ground and then after the flood has receded and the streams come down to a low level, some of that water will not return and be evaporated from the ground.

Work has been under way on these studies following the Santa Fe meeting when we received the assignment from the Commission to go ahead. We arranged a meeting in Denver early in October and divided up the work. The job of determining the runoff at the respective State Lines was assigned to the representative of each of the states. We thought that would be the best and fairest way to arrive at that, with all the work to be reviewed, of course, by the Committee as a whole.

There is one job that we have not yet assigned which involves a study which must be made. Reference has been made here, and it has been emphasized in this meeting, about the necessity of meeting our obligation at Lee Ferry under the Compact and Mexican Treaty. As I recall the obligation under the Compact requires 75,000,000 acre feet in any ten-year period of consecutive years to discharge at Lee Ferry. How much of the obligation the Upper Basin will have to bear in connection with the Mexican Treaty I don't think we know precisely, but we recognize the possibility that additional water may have to be released. That is a matter we will have to study and determine.

But in any event, the point I am trying to make is this: On the long-time average nearly as we can estimate at this time, approximately 16,000,000 acre feet on the average pass Lee Ferry under virgin flow conditions, that is, 16,000,000 acre feet before any depletion was made in the Upper Basin. We know we have depleted the stream flow to a certain extent as of present day conditions. So that under present day conditions, the long-time average probably would be in the neighborhood of 14,000,000 acre feet.

In a series of years such as we have actually experienced from 1931 to 1940, inclusive, there was only 10,000,000 acre feet at Lee Ferry--that is an average, a rounded figure. Well, now, 10,000,000 acre feet recorded flow, say we are using 2,000,000 of it now, that represents what is left after using 2,000,000; and then if we have to pass away 8,000,000 down the River to meet the requirements in the Lower Basin and the Mexican Treaty, it doesn't leave us much water because that is all the water we had.

To my mind it doesn't seem fair that the Upper Basin would be restricted to the amount of water we can get in that ten-year period without regulation. I believe that all states will agree that in order for the Upper Basin to meet its obligation at Lee Ferry and still have for its use 7,500,000 acre feet annually, there must be huge reservoirs constructed on the main stem and a number of those have been investigated and shown in the Bureau's report. The primary function of those reservoirs will be to impound excess water in years of high runoff and hold it over for release during periods of low flow such as 1931 to 1940.

We also know that the minute you construct reservoirs there is going to be a heavy toll on that water due to evaporation losses. So the Committee has undertaken the job of conducting a reservoir study of the main stem holdover reservoirs to determine the extent to which we feel, from an engineering viewpoint, it would be practicable to construct holdover storage and utilize it for the purpose of permitting use of the water in the Upper Basin and still meet the obligation at Lee Ferry.

Work is under way on these studies. We had a meeting Friday of last week in Denver at which progress was reported. Additional assignments were made and some of the studies that had been completed were passed out for each of the Commissioners to review and then we will meet again on the 21st of November in Denver to again check up the status.

I can't predict the time limit on this work. I attempted to do it at Santa Fe, but after all we have got to be fair and we have got to consider the viewpoints of everybody. All states are represented. And while it is true that we are working with facts, some of those facts are measured but some of them we have to apply judgment. We have to draw upon the experience of the engineers. And we find that in this group of eight engineers plus the helpers that we have, our judgments don't always jive. There aren't serious conflicts because we do have actual measurements to tie us down, so we don't go far afield. Nevertheless it is our intention and it is our aim and desire to give the Commission the very best facts and as a result the very best engineering judgment we can in carrying forward these studies.

COM. STONE: Thank you, Mr. Riter. I believe that is a very good explanation of the task which the Engineer Committee has on its hands. These Commissioners are indeed fortunate in having men capable of doing this work and of conducting the study for the advice of the Commission. We only hope as Commissioners that they will agree quite largely so we won't have much to quarrel about so far as the facts are concerned.

Mr. Chairman, it would seem to me at this time quite appropriate to call on the Commissioners from the other states for such statements or remarks as they care to make. May I first call upon Mr. McClure, the Commissioner for New Mexico?

COM. McCLURE: Judge Stone, you gave a very detailed analysis of what we hope to accomplish and I don't know that I can extend it any or add to it. I know the importance of the job that we have to do and I also realize that the time element is imperative and I think the other Commissioners feel the same way. However, we do have to approach this problem cautiously. There are worlds of complications to it.

We have to keep in mind that projects will be brought forward in years to come after we have passed the present phase of development on the River, of the feasible and easy to construct projects. Any compact that is negotiated, ratified by the legislatures, and approved by Congress will become the law of the land and presumably will be an agreement in perpetuity. I don't believe

any of us have any crystal ball gazing facilities so we can look into the future with any degree of certainty. We can only review the past, and be guided by experience.

There were statements made back in the early days when we first made surveys on this river predicting that anybody who took a look at it would forget it and have nothing to do with it. Well, of course time proved that statement extremely false.

It is a big job, and, as I say, we must approach it cautiously if we plan to take care of the states in their present, prospective and future uses. It's a problem that must be given full consideration and long consideration as I see it.

I don't believe there is anything else that I can add to what Judge Stone said this morning. We realize the problems that we have and it is in meetings like this that we get what you might call a ditch-bank view of the line of thought the people who are the actual users have in mind, so that in our deliberations we can keep those facts and problems in mind.

COM. STONE: Mr. Charles Carson, Commissioner for Arizona.

COM. CARSON: Judge Stone, gentlemen, I think we realize the seriousness of the task we are undertaking and the responsibility which rests on us. As I see it, the Colorado River Compact did divide the water between the Upper and the Lower Basins, and all of us desire to live up to in all respects and respect the Colorado River Compact, but that Compact did not undertake to divide the water between the states of the Upper Basin nor between the states of the Lower Basin. However, through the years by a series of acts of Congress and the California Limitation Act and contracts, the water allocated to the Lower Basin has in my judgment been effectively divided as between the states of the Lower Basin. That leaves then this task which this Commission undertakes to apportion the water between the states of the Upper Basin.

The Upper Basin, of course, has not used its apportionment or anywhere near used its apportionment. I would like to emphasize that the Upper Basin States altogether have now used somewhere in the neighborhood of 2,000,000 to 2,500,000 acre feet of the apportionment to them of 7,500,000 acre feet. So that when and if apportionments are completed between the Upper Basin States and projects developed, we of the Upper Basin--and we are part of the Upper Basin in Arizona, a small part of Arizona is in the Upper Basin---can look to an expansion of use in the Upper Basin of probably three times the present use.

Now taking the Basin as a whole, it is one area, interrelated, and what is good for part of it is good for all. If we can work out fairly this Upper Basin Compact so that the development of the use of water in the Upper Basin as well as in the Lower Basin will go forward, this area of the Colorado River Basin can use, as I say, nearly three times the water it is now using and support three times the population and three times the wealth. We can bring it about if we work together and that is the spirit with which this Commission is going to work, trying to work together for the benefit of all to apportion water equitably and fairly with injury to none and benefit to all.

COM. STONE: Mr. L. C. Bishop, Commissioner for Wyoming.

COM. BISHOP: Mr. Chairman, Judge Stone, I prepared my statement and had it written so I won't have to ramble around so much.

To date Wyoming has received no allocation for construction of irrigation works in the Colorado River Basin. We have only received a minor portion of our share of investigational work by the U. S. Bureau of Reclamation. We are on record as advocating the stoppage of all construction work in the Upper Colorado River Basin until a compact is agreed upon for division of the 7,500,000 acre feet of water allocated by the Colorado River Compact to the states of the Upper Basin. We have reason to believe that the percentages of water produced by each state as being compiled by our engineering committee is not a fair basis for equitable division of the water and of consequence we favor division of the water by this Commission with the factual information contained in the Colorado River Report of the U. S. Bureau of Reclamation and other available information. We object to states with much larger congressional delegations than we have securing allocation of funds and with these funds building projects that use water for which they establish a priority by use. This plan, if continued, will result in our State receiving no water at all.

Being located on the extreme headwaters of a principal tributary of the Colorado River we have priority of position but we know how the courts rule on prior use as against position and we are quite anxious to establish a priority by compact to use our share of this water at such time as we can secure funds to build the projects.

In all, we have more than a million acres of irrigable lands in the Colorado River Basin in Wyoming and about half of it is suitable for development. If potential development is used as a basis for the division of the water we should have more water than it is physically possible for us to use. We are not going to be unreasonable in our demands for water and we do hope the other states will also be reasonable and that this Commission can complete the negotiations within a reasonable time. Under our Constitution we are entitled to all the water within our borders but we are willing to divide with our neighbors on an equitable basis.

Frankly, we are deeply concerned about the large transmountain diversions being built in Colorado and proposed in Utah. We propose some in Wyoming but are very willing to agree to discontinue their use in case of a shortage at Lee Ferry. I believe Colorado has agreed to this with the people of the Western slope in that state and in the legislation authorizing and making appropriation of funds for construction of these transmountain projects. If the other states will subscribe to such a proposition I predict that there will never be a call for other water to supply any of the obligations of the Upper Basin States at Lee Ferry.

According to tree ring studies made on the entire Colorado River watershed by the University of Arizona the Green River Basin in Wyoming is the only part of the entire Colorado River watershed that has not experienced an exceptional drouth in the past 400 years. We do not intend to assume any obligation for delivery of water at Lee Ferry that we cannot meet under any and all conditions.

In conclusion, we sincerely urge this Commission to complete these negotiations at the earliest possible date in order that the compact may be placed before the legislatures of our respective states at the 1947 regular session.

Thank you, Judge Stone.

COM. STONE: Mr. Ed. Watson, Commissioner for Utah.

COM. WATSON: Mr. Chairman, ladies and gentlemen, it is with a sense of responsibility that I assume the burden to do my share in serving on this

Commission. I realize that the job will be long and that it will make decisions that will last for many years.

I am particularly impressed, however, with the caliber of men that I have been asked to work with, both the Commissioners and the advisers. I am pleased with the corps of experts that have been assembled to analyze the engineering data. I believe that we cannot go far afield with such men at the helm.

I am impressed with the fairness of expression of many of the individuals here this day at this hearing, and feel that there has been present the real true spirit of democracy that we think we have. I believe that in the long run we must arrive at a conclusion that will give each state a fair opportunity to develop itself. In other words, as one of our exponents of the Colorado River has said, ". . .to develop the River concurrently as far as each state is concerned." I believe that justice will be meted out by that method.

I realize also that the compact that will be entered into will supersede all state laws. It will be of the order of a treaty, which is the supreme law of the land.

I feel that much has been said here to enlighten the Commission and much has been expounded by experts to inform the water users. I feel that we have a big job before us and that we will all work constantly and assiduously to perform it.

COM. STONE: I appreciate the remarks of my brother Commissioners. This presentation constitutes the program except I feel that in all fairness to our Colorado people I should explain that at Rock Springs, Wyoming, I, as Colorado Commissioner, took the position that none of us know at this time how long it is going to take to consummate a compact. It is the desire and intention, I am sure, to expedite the work and to accomplish the job as soon as it can be done under all the circumstances. And in that effort, Colorado, I am sure, will not shirk its duty because we realize as well as anyone else that we shall all be in a better position to accomplish the development in our respective states when each state knows the size of the block of water which we have to deal with in the future.

However, I am firmly convinced that none of us should take the position that no development of any kind can proceed within the Colorado River Basin until we arrive at a compact. If we do that we are going to stalemate unnecessarily Upper Colorado River Basin development and we know that in the past the Lower Basin has gone forward much faster than the Upper Basin.

Our Colorado representatives have attempted to express here the idea, and as Colorado Commissioner I appreciate it, that we want to be fair and recognize the rights and the interests in all of the other states, but it goes even farther than that. We must recognize a solidarity among these Upper Basin States. We must recognize a common interest. We must fully appreciate that only insofar as we can act as a unit may we do the best job in providing for the effective utilization of that share of Colorado River water which has been apportioned by the Colorado River states to the Upper Colorado River Basin.

We in Colorado do have some projects under construction. We have other projects authorized for construction. None of those projects, in my judgment or by any possible stretch of the imagination, can exceed what will prove to be Colorado's equitable share of the water.

As an example, in this very area where we are now meeting today we have an authorized project known as the Paonia Project, storing 18,000 acre feet of water. When you consider that Colorado produces 11,700,000 acre feet of water and that we are now utilizing only approximately 1,500,000 acre feet of that water, that little Paonia Project is not going to hurt anyone and I can't see any reason why the position should be taken by anyone that that project should be put on the shelf until we arrive at a compact.

And I want to say to the other Commissioners and do it frankly in the spirit of cooperation that the threat or proposal for stopping of development is not going to bring about our agreeing on a compact. We are not going to agree on that basis. We are going to agree on the basis of what is fair and right and what constitutes in our judgment an equitable apportionment, and we are going to be willing to recognize the rights and interests of other states.

When we have completed in this state every project which is either authorized or under construction we shall be using then only about 1,700,000 acre feet of the 11,700,000 acre feet that this state produces. We know, too, that the amount of water produced by a state is not the sole criterion or factor in determining a state's equitable apportionment. That is only one factor. There are many factors.

It seems to me that we must proceed here on the basis of arriving at a compact at the earliest possible date consistent with all of the--you might say--difficulties that are ahead of us. We must attempt to surmount those difficulties. I think that nothing would please the Lower Basin--and I am not referring to Arizona--any more than for us to say to the Congress and to the Lower Basin that we do not propose to do anything in the Upper Basin until we arrive at a compact.

I should like also to get in the record again that the report of the Bureau of Reclamation did not place a stop order on the development within the Colorado River Basin. It said that any development during the time that a compact was being made must be clearly within what would prove to be a state's share of the water.

It is also true that very many projects which will require a large amount of Colorado River water are under investigation. Obviously with respect to large projects which would divert a large amount of water, we must await the time until we do have a compact because they might well exceed the state's share of the water.

I have always been impressed that if there is one thing which we should do in the Colorado River Basin that is to recognize the many small projects and get them built as soon as possible. I had the privilege as I have often had, and also the pleasure, of working with Senator O'Mahoney of Wyoming in urging appropriations for project development. Just this last spring we found that he had a project in his own state in the Colorado River Basin which was in the same category as one in Colorado. His project was the Eden Project; ours was the Mancos Project. Both of them were under construction, construction which was delayed during the war. Those appropriations are now available subject to the Executive Order of the President.

I certainly do not want to see the Eden Project put on the shelf with an appropriation available to complete it; neither do I want to see our project put on the shelf with an appropriation available to complete it. If those little projects are going to interfere with Wyoming's share or Colorado's share of the water, then we are a long ways from the right attitude if we are to consummate a compact. We cannot afford to pull the curtain down on Colorado River

development where such development is clearly within a state's share of water.

If we knew that we could arrive at a compact this fall or next summer it might be different. I hope we can and I pledge myself to work toward the earliest possible date of completion of such a compact. But we are looking into the crystal ball, certainly, if we say that we are going to accomplish something immediately. All we can do is to express the desire and work toward that end and do it conscientiously and that Colorado will do.

Mr. Chairman, I thought that ought to be said in fairness to the position which I took at Rock Springs, Wyoming, and in order that our people may be informed of that situation. Unless there is someone else from Colorado, and Mr. Smith has asked if there are others who have anything to say respecting this matter, we now turn the meeting back to you.

COM. BISHOP: Judge Stone, could I have just a word at this point? You may be right in all you say and still the fact remains that Wyoming produces 1,700,000 acre feet per year and has got nothing.

COM. STONE: Whenever you have a project, Mr. Bishop, we are going to be behind you to get it.

COM. BISHOP: I am not saying you won't.

COM. STONE: It is my guess that every project that you have mentioned can be built and still be within your share of the water. But we don't feel that it is approaching this problem on the right basis to pull down the curtain on every project, particularly if a project is clearly within a state's share of the water.

COM. BISHOP: You know quite well, Judge, our position isn't going to stop the projects.

COM. CARSON: Mr. Chairman, may I say just one other word? I thought I understood here this morning that there might have been some misapprehension that any compact made would override state water law or would affect state water law.

I think it is clear in all our minds that any compact made if one is made by this Commission would merely apportion to the states specific quantities of water, and that the administration of that water and the water rights and the priority of those rights would then be determined by the respective state laws. So that nothing this Commission can do will at all disturb the respective water laws of the respective states.

Then I want to say further that I agree with Judge Stone that if any projects are clearly within the prospective share of water to be apportioned to any one state, they should not be stopped and should proceed. And I say that for this further reason, that it seems to me that the chance for the development of the Colorado River Basin and appropriations and authorizations by Congress is now, and we don't know whether or not that condition will continue.

COM. WATSON: I should like to announce to those present here that the hearing to be held in Price tomorrow at two p.m. will be held as scheduled and those who desire hotel accommodations for that tomorrow night may have them at the Mission Auto Courts.

THE CHAIRMAN: Gentlemen, some of you may have the notion that the

work of this Commission is all engineering work. So far not much has been said about the legal end of this work. But as you will observe, we have two lawyers on the Commission and four engineers including the Federal Representative, and so far as conversation is concerned, I think it just takes about that much to balance it. (Laughter.)

Don't be uneasy. We will have our lawyers at work we hope soon to use the proper words to make this compact understandable or otherwise.

We have a gentleman with us today who attends all these water meetings; in fact, he has been attending water meetings since some of us were boys. He is a retired, successful businessman. I will not make the mistake of saying that he is from Salt Lake City and subject myself to a verbal chastisement like I did in the case of Judge Stone, but will say that he is the foremost conservationist in the West and has been preaching the value of water for Western development regardless of whether it is in the State of Utah or in any state.

I now call on the Honorable William Wallace to give us a few words. Mr. Wallace has all these years of experience but he still does not live in the past but in the present and in the future. Mr. Wallace. (Applause.)

MR. WILLIAM R. WALLACE, SALT LAKE CITY, UTAH: I like that phrase, "in the future."

Mr. Chairman, ladies and gentlemen, I would like to make just one or two remarks and one of them is that all of this water is in the United States of America.

In my opinion we can agree upon a division of this water now for submission to the next session of the legislature upon a basis in which no state will be seriously hurt and certainly upon the basis that all of it will be used in the United States of America.

Thank you very much, Chairman Bashore. (Applause.)

THE CHAIRMAN: Do any of the Commissioners have any further business which should be transacted at this time? The Chair feels that before we finally disperse at Farmington the Commission should go into executive session on some matters and you will please bear that in mind.

Mr. Carson, do you have any further business for the Commission's consideration?

COM. CARSON: No, sir.

THE CHAIRMAN: Mr. McClure?

COM. McCLURE: No, sir.

THE CHAIRMAN: Mr. Bishop?

COM. BISHOP: Nothing.

THE CHAIRMAN: Mr. Watson?

COM. WATSON: No.

THE CHAIRMAN: Judge Stone?

COM. STONE: Nothing, unless--I think we ought to inquire of our

moderator whether he has anything further.

MR. SMITH: No.

COM. STONE: Frank Merriell?

MR. MERRIELL: No.

THE CHAIRMAN: The Chair neglected to thank you, Judge Stone, and you, Mr. Smith, for your masterly conduct of this meeting and to thank all of you who have attended this meeting and participated in the discussion and those of you who have only come here to listen.

MR. SMITH: Might we introduce the three gentlemen who just came in so everyone will know them?

THE CHAIRMAN: Yes, indeed.

MR. SMITH: If I may have the privilege, Mr. R. J. Tipton, Consulting Engineer of the Colorado Water Conservation Board and practicing engineer.

I have only known this boy since he was born--Mr. Carl M. Bennett, City Engineer of Grand Junction.

And Mr. Herbert Fritz, City Manager of the City of Grand Junction. Thank you.

COM. STONE: I think we ought to hear from Mr. Fritz before we get through.

THE CHAIRMAN: Mr. Fritz, would you like to make a few remarks for the benefit of the Commission?

MR. HERBERT W. FRITZ, GRAND JUNCTION, COLORADO: It was somewhat less than a year ago, Commissioner and friends, my friend Silmon Smith made a facetious remark about my coming from the Middle West where the per capita consumption of water is more than it is here, and in the intervening period I have learned the wisdom if not the facetiousness of that remark. I won't say that ninety percent of our thinking is water here in Grand Junction, but a substantial percentage of it is.

We are trying to solve our local problem that conforms as completely as possible, and I would like to say completely, with the program of the Colorado Water Conversation Board, in a manner that will best serve the interests of the Grand Valley, the City of Grand Junction foremost of course, and at the same time will fit into the overall program of the Colorado River.

I have nothing to contribute to this meeting other than to say the City of Grand Junction is making every effort to fit the pattern that is being set up now and I can assure you that we will continue to work in that direction. I can say that unwittingly we selected an engineer who does take seriously those principles you people are setting up, first for the Colorado Conservation Plan, and second, for the whole Colorado River. We are happy we are able with that ground work to go on from there and plan our own work and it will tie in. We will take fullest advantage of the water used and leave enough for the fellow downstream too. We think it will work out.

THE CHAIRMAN: Off the record. (Remarks off the record.)

COM. McCLURE: Mr. Chairman, I move the Commission thank Mr. Silmon Smith and all these gentlemen who have appeared before us and the other interested parties attending this hearing.

COM. CARSON: Second the motion.

THE CHAIRMAN: Any discussion of the motion?

(The question is called for. Thereupon a vote was taken and the motion of Com. McClure carried unanimously.)

COM. BISHOP: Mr. Chairman, I move that we adjourn until two o'clock tomorrow at Price, Utah.

COM. McCLURE: Second the motion.

THE CHAIRMAN: Motion has been made and seconded--you heard the motion. Any discussion?

(Thereupon a vote was taken and the motion of Com. Bishop carried unanimously.)

(3:38 p.m., Wednesday, October 30, 1946, meeting adjourned until 2:00 p.m., Thursday, October 31, 1946, at Price, Utah.)

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	**17**	**Y-2_pgs 82-167**
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Official Record of Meeting No. 3

Session Held

October 31, 1946

at

City Hall

Price

Utah

APPEARANCES
UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Membership as listed at Rock Springs, Wyoming, Session (Page 1)
Chairman, Acting Secretary, and all Commissioners present.

COLORADO:

Jean S. Breitenstein	Attorney, Colorado Water Conservation Board, 718 Symes Building, Denver, Colorado.

NEW MEXICO:

Fred E. Wilson	Special Assistant Attorney General and Attorney for New Mexico Interstate Stream Commission, Albuquerque, New Mexico.

UTAH:

William R. Wallace	President, Utah Water Users Ass'n., Salt Lake City, Utah.
John A. Widtsoe	Utah Water Users Ass'n., Salt Lake City, Utah.
Thomas W. Jensen	Utah Water Users Ass'n., Mt. Pleasant, Utah.
C. S. Jarvis	C.E. with State Engineer, Salt Lake City, Utah.
Blair Richardson	Metropolitan Water Board of Salt Lake City, Salt Lake City, Utah.
Gerald Irvine	Utah Power and Light Company, Salt Lake City, Utah.
Raymond Hammond	Tooele County Water Users Ass'n., Grantsville, Utah.
J. Bracken Lee	Mayor, Price, Utah.
Wallace G. Grange	Price, Utah.
Robert Sundwall	Tribune-Telegram Publishing Co., Price, Utah.
William Campbell	Carbon County Commissioner, Price, Utah.
George M. Miller	Price, Utah.
H. F. Putnam	Price Div. Utah Coal Prod. Corp., Price, Utah.
Irvin Gerber	Price River Cons. District, Wellington, Utah.
Rex Mathis	Price River Cons. District, Price, Utah.
E. E. Peirce	Price River Cons. District, R.F.D. No. 1, Price, Utah.
Therald N. Jensen	Price River Cons. District--Carbon Water Cons. District, Price, Utah.
Wm. P. Maack	Independent Coal & Coke Co., Kenilworth, Utah.
C. E. Beveridge	Utah Railway Company, Helper, Utah.
J. A. Theobald	Secretary, Carbon County Associated Industries, Price, Utah.
Dr. F. R. King	Price, Utah.
Byron Howard	State Senator, Huntington, Utah.
Russell Allred	Cleveland Canal Company, Huntington, Utah.
L. E. Thorderson	Cleveland Canal Company, Huntington, Utah.
Bert J. Stillman	Grand County Water Users, Green River, Utah.
C. N. Wakefield	Emery County Commissioner, Huntington, Utah.

Frank Robbins	Emery County Rancher, Huntington, Utah.
E. S. Larsen	Board Member, Cotton Wood Creek Irrigation Co., Emery County, Utah.
O. W. Sitterud	Secretary, Cotton Wood Creek Irrigation Co., Orangeville, Utah.
Joseph J. Jensen	Muddy Creek, Utah.
Ervin Wimber	Emery County Commissioner, Castle Dale, Utah.
Edward G. Geery	Emery County Water Users Ass'n., Huntington, Utah.
Peter McElprang	Huntington, Utah.
Mrs. Mayme Jameson	Deseret Lake, Utah.
Frank J. Hatt	Green River, Utah.
Wilford J. Humphrey	Orangeville, Utah.
J. W. Gillman	Provo River Water Users Ass'n., Orem, Utah.
Mark Anderson	Mayor, Provo, Utah.
Elmer A. Jacob	Provo Utilities, Provo, Utah.
Vasco M. Tanner	Provo City Utilities, Provo, Utah.
Thomas H. Latimer, Jr.,	City Engineer, Provo, Utah.
J. Earl Lewis	Provo City Commissioner, Provo, Utah.
B. H. Stringham	Mayor, Vernal, Utah.
Robert F. Livsey	Deseret News, Vernal, Utah.
H. L. Allred	Roosevelt, Utah.
Francis Feltch	Vernal Lions Club, Vernal, Utah.
Alma Preece	County Commissioner, Uintah County, Utah.
Leon P. Christensen	Uintah Basin Water Users Ass'n., Vernal, Utah.
Leo Calder	State Representative, Uintah County, Vernal, Utah.
Jos. C. Price	Ashley Upper Irrigation Co., Vernal, Utah.
Ronald Preece	Rock Point Canal Company, Uintah County, Utah.
John Madsen	State Representative, Duchesne, Utah.
Mitchell Melich	State Senator, Moab, Utah.
J. F. Harrington	Moab, Utah.
M. C. Cole	Delta, Utah.
Dudley Craft	Delta, Utah.
Archie O. Gardner	Millard County Water Users Ass'n., Delta, Utah.
Harold R. Morris	Delta, Utah.
W. C. Andrews	Chairman, County Commission, Juab County, Utah.
Reeve G. Richardson	Nephi Irrigation Company, Nephi, Utah.
Tom McCoy	Municipal League, Salt Lake City, Utah.

WYOMING:

Emil C. Gradert	Compact Commissioner, Fort Bridger, Wyoming.

BUREAU OF RECLAMATION:

J. G. Will	Assistant Chief Counsel, Washington, D. C.
J. R. Riter	Chief, Hydrology Division, Denver, Colorado.
N. B. Bennett, Jr.	Branch of Project Planning, Washington, D. C.
E. O. Larson	Regional Director, Region 4, Salt Lake City, Utah.

A. A. Batson	Acting Regional Director, Region 7, Denver, Colorado.
A. N. Thompson	Assistant Regional Director, Region 5, Amarillo, Texas.
J. Stuart McMaster	Counsel, Region 4, Salt Lake City, Utah.
L. E. Mathews	Salt Lake City, Utah.

UNITED STATES GEOLOGICAL SURVEY:

M. T. Wilson	District Engineer, Salt Lake City, Utah.

SESSION AT PRICE, UTAH
THURSDAY, OCTOBER 31, 1946

The meeting was called to order by Chairman Bashore at 2:00 p.m., Thursday, October 31, 1946.

THE CHAIRMAN: The meeting will now come to order as it is two o'clock and all of the Commissioners are present. Our Acting Secretary, Mr. Lon Watson, is just appearing on the scene.

At the last regular meeting of the Upper Colorado River Basin Compact Commission, Meeting No. 2, at Santa Fe, New Mexico, the Commissioners decided that in connection with the next regular meeting, Meeting No. 3, a series of field hearings should be held, one in each state of the Upper Division. That means four meetings. These meetings were to be held in Rock Springs, Wyoming; Grand Junction, Colorado; Price, Utah; and Farmington, New Mexico. The two meetings at Rock Springs and Grand Junction have been held and this is the third of the series.

The purpose of these meetings is to acquaint the people within the Upper Basin with the work of the Upper Colorado River Basin Compact Commission and to give you an opportunity to express your ideas and offer suggestions which may be helpful to the Commissioners in their deliberations in connection with this proposed compact. Every one of you should feel free to say what you have to say. It is not expected that you will deliver a finished oration but your suggestions and remarks are welcomed.

The Chair believes that at this time he should introduce the members of the Commission and I will start with the gentleman on my left, Mr. Charles Carson, Commissioner for Arizona. (Applause.)

On my right, Mr. Ed. Watson, Commissioner for Utah. (Applause.)

Next to Mr. Watson is Mr. Thomas M. McClure, Commissioner for New Mexico. (Applause.)

The next is Judge Clifford H. Stone, Commissioner for Colorado. (Applause.)

The next is L. C. Bishop, Commissioner for Wyoming. (Applause.)

Then Mr. Lon Watson, our Acting Secretary today. (Applause.) Mr. Watson is acting in the absence of Attorney General Grover Giles.

And the efficient young lady who reports our meetings is Miss Price of Utah. (Applause.)

Following the procedure which we have used in the two previous hearings, the Chair is now pleased to turn over the meeting to the Commissioner for Utah, Mr. Watson. Mr. Watson will conduct the meeting from this point on and will call on anyone and run the meeting according to his own ideas. The only thing that the Chair would have to offer is that we hope that the remarks will be directed toward the work of the Commission, that is, let's keep within the Basin if we can because that is a subject that is plenty large. Mr. Watson.

COM. WATSON: Ladies and gentlemen, a few remarks introductory to your various reports may be in place in order for you to have an understanding of what we are trying to do and why we are trying to do it.

In midsummer of 1946 the Governor of Wyoming called the Governors of the Upper Colorado River Basin States together and laid the foundation at Cheyenne for the organization of a compact commission so that ultimately a compact could be negotiated for the division of the water of the Colorado River that was apportioned to the Upper Basin by the Colorado River Compact. This was a preliminary meeting and was followed about ten days later by one held in Salt Lake City at which the Upper Basin States were all represented. So it was that the Upper Colorado River Basin Compact Commission was organized. A resolution was also passed for the appointment of a subcommittee of engineers to investigate basic data and make certain recommendations to the Commission.

The next meeting of the Commission was held about the middle of September in Santa Fe, New Mexico, where a preliminary report by the Engineer Subcommittee was made. This subcommittee is composed of competent men. Mr. J. R. Riter of the Bureau of Reclamation is Chairman and each state is ably represented. The assignment of the subcommittee comprises a study of streamflow, reservoir operation, evaporation and channel losses, and other engineering data that may be necessary to determine what the Colorado River does and what it is capable of doing.

As Chairman Bashore has said, the third meeting of the Commission consists of a series of public hearings now being held in the states of the Upper Basin.

I believe that since there are some here who may not understand the general principles underlying the Colorado River Compact and who may have some mistaken ideas about it, a short discussion of historical events may not be out of place. I shall attempt to do that very briefly for your benefit and for my own as well.

You all know that at the beginning of this present century--I think it was 1906--there were floods on the Lower Colorado River and that parts of the Imperial Valley were inundated with great property loss. The people of California cried out for help, but it took a long time for constructive forces to get organized. Finally the United States Government said to the states of the Colorado River Basin, "You get together, compose your differences, agree upon a plan to divide the water, and we shall try to get some action." The people of California were entitled to flood control. They were also anxious to have Boulder Dam but before the Boulder Dam could be built an agreement or compact had to be entered into by the States of the Colorado River Basin. After much discussion and long delays the Colorado River Compact was finally signed by six states of the Colorado River Basin, Arizona, the seventh state, preferring not to sign the document.

We in the Upper Basin have seen the Colorado River at its flood and also when it runs dry. We know something of its habits. We knew that we were not prepared to utilize the River's water and that through our failure to use it, we might lose our rights and forfeit them to the Lower Basin States who could put the water to use before we could do so. It was, therefore, to our advantage to have an agreement to protect us against our nonuse. On the other hand the Lower Basin States wanted flood control, storage for irrigation development and hydroelectric power.

The men who were in charge of the work at that time--President Hoover, then Secretary of Commerce, was the Chairman representing the United States Government--were sincere men and they did the best job they were capable of doing. They didn't have as complete records of streamflow as we have at the present time. They had records of rather abundant years to refer to, but they didn't know that the lean years that commenced in 1931 were just ahead. They assumed that the River produced about 16,000,000 acre feet annually that could

be safely apportioned and about 5,000,000 acre feet surplus subject to division at some later date. So, on the basis of the information they had they negotiated a compact. It is doubtful if at that time the amount of water to be divided between the Basins was given very serious consideration inasmuch as the River was considered amply large.

The Upper Basin States gained the advantage of being protected against their nonuse of the water, and in having navigation and power made subservient to irrigation. The Compact was advantageous to the States of the Lower Basin because it gave them adequate flood control, converted their primary flow rights to guaranteed storage rights and provided hydroelectric power, the revenue from which would pay for the dam.

Previous to the writing of the compact some of the states had spent large sums of money in lawsuits with surrounding states over interstate water rights with results that were not satisfactory to any of the parties. You all know if you win a lawsuit you are the loser. It was therefore decided for the benefit of the people the best thing that could be done was to settle interstate difficulties by compact and not in the courts.

Boulder Dam was completed in about 1935. In 1931 the lean years commenced and there were ten of them that followed consecutively. We now have evidence that causes us to believe that the River is not as large as these gentlemen thought it was. It's a case of hindsight versus foresight. True, we have better instruments to work with and we have the advantage of accumulated knowledge. For instance, this last water year, ending October 1st, the Colorado River flowed at Lee Ferry somewhere around 8,000,000 acre feet. Assuming about 2,000,000 acre feet consumptive use, the virgin flow of the River would be about 10,000,000 acre feet at the Ferry.

Before entering into the Compact the States first tried to divide the water among themselves as individual states; however, they soon found that was impossible. A gentleman from Colorado by the name of Delph Carpenter conceived the idea of establishing a point midway in the course of the River and dividing the water between the Lower group and the Upper group. This point was chosen near Lee's Ferry. Lee's Ferry is the old Ferry we know of, a geographical location. Lee Ferry is a point just below the mouth of the Paria, below Lee's Ferry, at which the waters are divided. It is merely a point established by an agreement but is known as Lee Ferry in contradistinction to Lee's Ferry.

In drafting the original Compact the drafters knew that the Colorado River didn't terminate in the United States, that it flowed into Mexico and traversed about fifty miles of that state before entering the Bay of California. Mexico had rights to the water of the River and she also had large tracts of good land. Down there the River flows along a ridge and the good land slopes off to the north into the Salton Sea, 240 feet below sea level. It was possible for Mexico to utilize the River's water on her own lands--either the Mexicans themselves or Americans from the States. The original Compact provided that in case a treaty should be made with Mexico, the Upper and Lower Basin States should divide equally the responsibility of providing Mexico with the amount of water that might be agreed upon.

During the last few years efforts were made to negotiate a treaty with Mexico. As I remember, Mexico asked as her portion 3,500,000 or 3,600,000 acre feet of water. Finally the State Department got the figure down to 1,500,000 acre feet from any and all sources. That means that the return flow is included in the 1,500,000 acre feet. Hydrographers who have studied the Colorado River assert that in a developed river there will be a

substantial return flow, 900,000 to 1,000,000 acre feet. It is estimated that a total of 600,000 acre feet may have to be provided equally by the Upper Basin and the Lower Basin.

And let me say to you here, gentlemen, that if the Colorado River Basin States had not negotiated the Mexican Treaty that sovereign powers across the boundary could have put the water to use and worlds without end we never would have got it back--it would have been Utah's, Colorado's, New Mexico's, Wyoming's and Arizona's water. I stood on the diversion dam of the All-American Canal a year or so ago and saw the Canal running 15,000 second feet of water, its total capacity. But in spite of this diversion there was a great river running over the spillway down the river and into the sea. And whose water was it? It was largely Upper Basin water. If that water could be put to beneficial use in Mexico, we would never have a chance to develop the Upper Basin. So, in the signing of the Mexican Treaty the old adage probably runs true, "better a half loaf than no bread". The amount of water given them amounted to placing a ceiling on their use and saved for the Upper Basin its future development.

Ladies and gentlemen, we must face the facts. This Commission has been authorized by the states of the Upper Basin to negotiate a compact for the division of the water apportioned by the Colorado River Compact to the states of the Upper Basin.

Now the Upper Basin agrees not to deplete the River at Lee Ferry more than 75,000,000 acre feet in any consecutive ten-year period. In other words the Upper Basin guaranteed an average yearly flow of 7,500,000 acre feet at Lee Ferry. It was considered that inasmuch as rights to the primary flow of the River had been established in the Lower River that these primary rights would have to be changed to storage rights and guaranteed. The Compact apportioned 7,500,000 acre feet to the Upper Basin for exclusive beneficial consumptive use and 7,500,000 to the Lower Basin for the same purpose and under like conditions.

I believe when the River is regulated that we will have a substantial portion and perhaps, over a long period of time, our share--our just share--of the water. However, at the present time we must bear in mind that we are dealing with a river that is not as large as it was once thought to be.

In dividing these waters among the States of the Upper Basin there are two schools of thought: One is to divide the water on a minimum basis and the other is on a total basis. Shall we consider the River as it now is and take an absolute minimum at Lee Ferry that we are sure we can divide without any question and leave the balance for future division? Or, shall we divide it all at the present time? Those are burning questions and there is difference of opinion on them.

Utah, according to figures that have been recently worked out by one of our competent engineers, produces about, we think, 18 percent of the River. And we also have in addition to what we produce, the storage reservoirs in the main stem of the River to hold that water. If you should go into a restaurant and ask for a cup of coffee and they tried to deliver it to you without a cup or container the chances are you wouldn't get any coffee. So these containers, these great reservoir sites down at Dark Canyon, Rattlesnake, Split Mountain, and even Glen Canyon, although the damsite is over in Arizona, just over the line--these sites are all great factors to be considered in saving this water so we can deliver our share to the Lower Basin States and still retain enough for ourselves.

I wish to mention one or two projects that we would like to have in

Utah and then I shall turn the meeting over to you gentlemen and you will be entitled to express yourselves freely. There is a project that we have here in this state that is a very desirable one. At the present time there is a reservoir northerly from here known as the Strawberry Reservoir. Its elevation is 7,600 feet. It is as high as Yellowstone Lake and that is considered one of the highest lakes in the country. That reservoir produces water for some excellent farms, and it produces power that pays the cost of the operation of the water system. In fact, I am told that a year or two ago this project, known as the Strawberry Project, made a profit of $50,000, which paid all of the O. and M. and put money in reserve. Now Utah would like to build a feeder canal out along the south flank of the Uinta Mountains in order to pick up the surplus water and store it in that reservoir which could be enlarged by building a higher dam and finally utilizing the water on more land. That is an important and desirable project where we could use our share of the Colorado River water without hurting anybody. Then there is the Gooseberry Project which deals with transmountain diversion of water in small amounts into Sanpete County where it could irrigate some very rich land. Some of you will explain this as we go farther.

In the Lower Basin there is the Virgin River area where the land is very rich and the elevation is only 2,500 feet. Semi-tropical crops can be grown there. The Virgin River yields surplus water to the Lower Basin and we are informed by the Commissioner from Arizona they will cooperate with us in the development of the Virgin River Basin by means of the Hurricane Reservoir site and the site on the Santa Clara.

Then we have over in the Uinta country the sites of Stanacker Draw and Tyzack, which are desirable. Most of these could be constructed in a reasonably short time, as a great deal of the engineering data has already been collected.

I think Utah's viewpoint will develop in our discussion and I now wish to call on you people here. We have the Mayor of this fine little city with us and we would like to hear a few words from Mayor Bracken Lee. (Applause.)

MAYOR J. BRACKEN LEE, PRICE, UTAH: Mr. Chairman and visitors, I don't feel as though I ought to say very much at this time, Ed. I came here, I think like a great number of these gentlemen, to learn, and I am sure I am going to learn something.

But inasmuch as you have asked me to say a few words I would like to say that the City of Price is flattered to have such a fine, distinguished group of visitors, and we certainly welcome every one of you. I would like to compliment the Commission on deciding to hold public hearings because certainly no harm can come from letting the public in on what we are doing and a lot of good, I am sure, will come from it.

I notice from looking around this group that we have representatives here from all over this end of the State. I don't think there is a county that is not represented. I see even Mark Anderson, who is the Mayor of Provo, over here. I can't understand what he is here for unless he wants some of Carbon County's water. (Laughter.)

I am sure the Commission is trying to do the right thing and, of course, Ed., if they fail, I hope you put some Republicans in to help straighten it out.

COM. WATSON: We have some very good Republicans that are working with us and they are doing excellent work.

MAYOR LEE: I couldn't resist that little dig at Ed., forgive me for it. Anyway, I think you ought to get on with your meeting and perhaps by the time I learn a little bit more about this water business I can say more about it. The experience I have had here in Price is that the more I know the less I know. It is certainly complicated, and even a little irrigation ditch here in Price involves a lot of complications.

So I in a way feel sorry for you gentlemen who are endeavoring to try to straighten out the Colorado River with all its complications.

I believe you had better proceed with your meeting and we will see if we can't bring something up that will really be of benefit to everyone. (Applause.)

COM. WATSON: We would like to hear from Leon Christensen, an engineer who lives over in Ashley Valley and who is well acquainted with the problems of that Valley.

MR. LEON P. CHRISTENSEN, VERNAL, UTAH: Mr. Chairman, ladies and gentlemen, I like Mayor Lee came here to listen and not to talk.

Of course we are over in Uintah County. We live right on the banks of the Green River, which of course is the largest tributary of the Colorado River, and are naturally extremely interested in any development there is in the Colorado River Basin and especially in our section.

We have a number of projects in that district. We have just outside of Vernal the Echo Park Project which, of course, would have to be a regulatory reservoir. It holds under its present plans, 5,500,000 acre feet, and would be in our estimation one of the first projects that should be constructed on the Colorado River for the reason that it is near the head and has the water supply available.

The Bureau of Reclamation we feel has done an exceptionally good job of listing our projects and working them up. As was stated by Mr. Watson, most of the projects in that vicinity have been investigated and a great deal of the engineering work has been completed on the Echo Park, the Vernal Project, the Jensen Project, and several of the other small projects.

We feel that about all we could say at this time is that we approve the projects as they have been listed by the Bureau of Reclamation and are willing to abide by their report and hope that work can be commenced on some of the projects in the near future. (Applause.)

COM. WATSON: From that same area we have Mayor Brient Stringham of Vernal. We would like to hear a few words from him.

MAYOR B. H. STRINGHAM, VERNAL, UTAH: Mr. Watson, distinguished people, I will only take a minute of your time. All I can do is verify what Mr. Christensen said. I might inject one more thought into that and I hope I don't offend our fine neighbors who live right next door to us. But we have in mind one other thing--you told us to unload anything we might have?

COM. WATSON: Get it off your chest.

MAYOR STRINGHAM: That is the fact that we over in the Basin--excuse me, Bracken--live in a potential wonderland. We have potential resources surrounding us on all sides such as gilsonite, asphaltum, and we are keenly interested in this from another angle. We believe we should take care of the Basin first with these waters and then if there is surplus water, let these other

valleys have it. And in transferring this water across to the other basin, this diversion canal, there will be power sites which we need badly to develop these potential resources we have just over the ridge from our good friends here at Price.

Now we think, you people of the Commission, that should be a consideration in dividing the water and that is what you are here for, is to try to get on a basis for dividing the water. The fact that Utah has all these resources and that they can be developed not only for the State's good but the National good, that should be one of the considerations, industrial development, when you are dividing this water up.

And so coming back selfishly to our little basin over there we certainly stand first for the Echo Park Dam so that we may get busy there and develop those resources that lie within that area. (Applause.)

COM. WATSON: We have Mr. Horace Allred who lives out in that area, Uinta Basin. He is a director of the Utah Water Users, and has been very active in our water development. Mr. Allred, will you say a few words?

MR. H. L. ALLRED, ROOSEVELT, UTAH: Mr. Chairman, gentlemen, after Briant and Leon Christensen got through--I have been telling them all day what to say--I don't think I have very much left to say.

I think Mr. Stringham touched on a point that will interest us all in the State whether we live in the Colorado River Basin or any one of these four Upper Basin States. I believe you men are all interested in making this Colorado River water do the best job possible, and the type of lands we have, cost of developing, water charges for these lands, will exclude a lot of our lands if we think only of irrigation, which a lot of us have been thinking about in the past.

In line with Mr. Stringham's thought, I think in arriving at an allotment of water out of the Colorado River for Utah that that should be given some consideration, a lot of consideration, the value of the water that we might use for the development not only of our agriculture but of our great industries which we hope to be able to develop in Utah. These things will take some transmountain diversions. These people here that live in the Colorado River Basin are naturally jealous of the water that we in the Basin say is ours, and we want to develop all the good irrigation projects we have. I think there is water here for all the projects we will have and there will be a lot to go over the mountain to help build these industrial units that will be over there. I believe that you men when you get this allocation problem far enough along will agree with me that they should be worthy of a lot of consideration in allocating water to the State of Utah. Thanks, Ed. (Applause.)

COM. WATSON: We have with us Mr. John P. Madsen from Duchesne out in the Uinta Basin country. Mr. Madsen is a representative in the Legislature and also a member of the Colorado River Committee in the Legislature formed to study the potentialities of the River. Mr. Madsen, will you say something?

MR. JOHN P. MADSEN, DUCHESNE, UTAH: Mr. Chairman, gentlemen, I come from a country where we have water to spare and we are sparing it down the Duchesne River every year. We are very anxious out there to get the Duchesne and its tributaries so set up that we can appropriate and put that water onto our lands. It is going to require a good many reservoirs which when built can water the entire Basin and then have plenty for Central Utah, that is, when you put the Green back of it, to push it over into the Strawberry Reservoir.

There is one beautiful thought that comes from my section of the country: It will act as a natural reservoir for the return flow into the Colorado River. Every bit of that country drains right back into your Colorado River system and all the water you put there that doesn't evaporate will come back some day into your Colorado River. We are very anxious and very concerned about the return flow because we feel that should be taken seriously into consideration when division of this great and mighty Colorado is taken into consideration.

We have a lot of valuable land out there, some of the finest in the State of Utah. So say your Government agencies and also your state agencies that have gone over that land--it should be under cultivation. There are 15,000 acres in one tract. Four hundred or five hundred returned veterans could go onto that land and make themselves a good living because it is productive soil.

The State Engineer sometime ago cancelled our water filings to that land. We feel it was unfair to us and we are going to fight to get those filings reinstated because we feel we are entitled to those filings.

I made a statement on the floor of the House in the last session that the Colorado River was already overappropriated and if we weren't careful, some day California would come up here and regulate our headgates. They smiled at me but I believe they say now I am right because there is not water enough in the Colorado River to go around if they want to take that into consideration.

So the Upper Basin States must get busy and see that we have our portion of that water and furthermore, as Mr. Krug, Secretary of the Interior, said, those who make beneficial use of that water are the ones who are going to hold it. Our State law tells us the same thing. So I think we here in Utah have a problem to solve and that is to get busy right now and see to it just as fast as we possibly can we make beneficial use of this water.

I don't feel we should go out and take advantage of the other states. I think we should work harmoniously together with every state interested in the Colorado River, each one to receive his proportion. To do that I feel it would be wise and wisdom for each state now to set up a certain project they want to put over, one certain project, and then all go to work. If we try to outdo each other, outrun each other, outflank each other, there is going to be a lot of confusion, a lot of disagreement, a lot of contention. Therefore, let's work harmoniously together. For after all, the mighty Colorado belongs to us, that is, what is left of it, and let's make use of it. I thank you. (Applause.)

COM. WATSON: Mr. Leo Calder is here, is he not, State Representative from Uintah County? Mr. Calder, will you come up and say a few words?

MR. LEO CALDER, VERNAL, UTAH: Mr. Chairman, ladies and gentlemen, I guess you will begin to think now that everyone that is interested in the Colorado River comes from the Uinta Basin. Well, maybe that is not so, but so far all of us have been from the Uinta Basin.

We are vitally interested in this Uinta Basin water and in the water that we can spare for somebody else because all this water runs through our Basin. We would like to see particularly the Echo Park Dam put in, which is on the Green River east of Vernal. It will mean in power alone much to Utah and the development of our industrial resources, our natural resources that are lying right there in the hills. For instance, the phosphate that is there north of Vernal would be developed today if the proper power was available. There are companies waiting right now to establish plants there that would absorb a good

share of the power that would be available from that source. No doubt it would bring into Utah so much more development along an industrial line that the taxes and everything else would increase in proportion to the population, which undoubtedly could increase a whole lot.

Mr. Stringham mentioned some of the great resources that are around there close and he left out oil. Some day we are going to develop a lot of oil and that too will be a great source of industry. Already our town, through the Colorado development that is just across the line and is coming closer to Utah hourly--our town has more than doubled in population in the last year or two.

It only shows that if you have the stuff you can get the people and you can get the money and we can live together and utilize those natural things that we have right here in our state and utilize the water, or our share of the water, that is here flowing down to California. It is our purpose to push this thing and get it to going as soon as possible. Thank you. (Applause.)

COM. WATSON: Mr. Alma Preece, County Commissioner from Uintah County, is he present?

MR. ALMA PREECE, UINTAH COUNTY, UTAH: Mr. Chairman, ladies and gentlemen, as County Commissioner my thought along this line has been a little different. Without giving you the background like the other men have, it has been along the line of organization. Here a few years ago it was the responsibility of the County Commissioners to perfect an organization and we have worked in Duchesne and the neighboring counties along this line, and Carbon, in placing such men as Mr. Allred and some of the other men here, working along in this organization. We think that we have selected some very good help and we as Commissioners are working together harmoniously without any conflict in any way in selecting the help for this work.

Speaking of transmountain diversion, I don't think anyone could be opposed to it if their needs are supplied. We have a lot of water, as has been mentioned, over here in the Uinta Mountains Basin, and if we could be supplied there and better, which we could be, by an exchange of water, it would be a big benefit to us. We have a lot of water go by us there in the flood--not this last year but ordinarily--and then we dry out the rest of the year. We can't grow proper row crops and we could add to our wealth in that section.

I think we are all on the right track. I think there is a great deal of development being done in the State organization and I compliment these men that are working hard along these lines, and I think success will crown their efforts in the future. Thank you. (Applause.)

COM. WATSON: Is Mr. Joe Price of the Vernal Drug present? (No response.) We have with us from Huntington a former Senator who is a great student of water and a booster for this country. We would like to hear from him, Mr. Byron Howard. (Applause.)

MR. BYRON HOWARD, HUNTINGTON, UTAH: Mr. Chairman, ladies and gentlemen, I am certainly glad to hear from that Uinta Basin that they have got lots of water and got lots to spare because, brother, we are plenty short in our country and all the water that is in our country we have potential places to put it. Along the Wasatch Range here, running south along this Valley for sixty, seventy-five miles here, every drop of water there that originates in those mountains we have places to put if we just had a few more storage facilities to take care of it.

We are absolutely against, gentlemen, any transmountain diversion from this part of the country and south of here, transmountain diversion anywhere, because we have places to put all that water and we need it all. Not only that, all the water that is used, as Mr. Madsen so adequately stated--all the water that is used in the Basin is a potential chance of a return flow to be taken into consideration when we produce our water at Lee Ferry for the Lower Basin. That is one of the greatest reasons why in our part of this section of the country we are absolutely against transmountain diversion of any water.

Now I feel and all of our people feel that this Bureau of Reclamation in their Comprehensive Report have made a very good job of it. They have made an impartial report, I think, of the matters as far as we are concerned. The only thing we object to in their report is that on every one of our streams over there they claim there is a chance for tunnels to be built and take that water over to the Great Basin, and we certainly object to that because we know we can use and handle and need every drop of water that is over there.

When this matter is taken into consideration of the allocation to the different states, the four Upper Basin States, we wish you to take that into consideration, gentlemen, that this water along the Wasatch Plateau from here south is all adequately needed for our own use and will be a benefit to you if it is left on this side because there will be a return flow for Mexico and California and the Lower Basin.

Now around the Green River and on the lower part of the Green River, I feel that there is plenty of good land down there, gentlemen; there is just as good land down there as any one part of the state. You people talk about the good land in the Great Basin; there is a lot of good land over there but there is a lot of good land over here, too. It might not be in as nice a valley and there might not be as many bankers over there and politicians, but there is some good land there and we feel where water is the civilization will be.

You people are pretty well built up there; you have about as much as you can have without more water. Give us a chance over here and lay off the transmountain diversion until we get ours built up over here a little. Thank you. (Applause.)

COM. WATSON: Is Mr. E. E. Peirce, President of the Price River Water Conservation District, Price, Utah, present?

MR. E. E. PEIRCE, PRICE, UTAH: Mr. Chairman, gentlemen, this is a surprise to me. I didn't expect they would be so far down the line as to call on me to talk.

We are maybe more fortunate than some of you people. Our project is complete, we have our dam built, but we are willing to get behind the wheel and give the rest of you a boost. If we can help somebody else get their project over we will be glad to do it.

But I believe Mr. Howard touched on a very vital point and it concerns us here as well as it does the people in Emery County. We have a place for all the water we can find. This last year we got by by a pretty close squeak. Of course it was the first year we used our new dam and we didn't have the advantage of much of a runoff last winter. But we second Mr. Howard's speech, and I thank you. (Applause.)

COM. WATSON: We will hear from one other individual and then we will take a few moments' recess to give our reporter a little rest. Senator Mitchell Melich from Moab is here and we would like to hear a few words from

him. He has made a study of the Colorado River.

MR. MITCHELL MELICH, MOAB, UTAH: Chairman and Members of the Commission, the thing that is so vital to me in connection with the development of this River is this:

When I settled on the River some twelve years ago down at Moab I had heard about all of these projects. I grew up in an area where we weren't so concerned about irrigation because I was born in a mining town and all we were interested in there was mining copper, lead, and zinc. And I was told that these projects were to be built in the near future. But I have been down there some twelve years now and to my knowledge we have built hardly any in the State except some of the large projects which I guess they have been fighting for for forty or fifty years.

Now the thing that I have found in my study and in travelling around the country on projects is that the only way we are going to develop them is to push this Compact that these Commissioners are now trying to arrive at. That Compact is the first thing that must be prepared and submitted to our respective legislators and legislatures that meet in January or shortly thereafter. Whether this Compact can be prepared by then and ratified by the states within the next few months, of course, is a matter which this Commission will have to decide. But the one great problem to me is this Compact because we were told that the projects on the River will not be constructed, that is, any projects of any size, until the Compact is ratified or the waters at least upon some basis are allocated among the various states.

I am going to appeal to our people of Utah to cooperate in a complete development of the River. We cannot be selfish in this thing because we have in our small section of Southeastern Utah here some projects which we know must be built if we are to survive in this area. There are other large projects in the State which must be built. The question of transmountain diversions, of course, has got to enter into this picture.

I have found that the cost of these small projects is prohibitive upon the average farmer. He can't afford to pay for them and the only way they can be paid is by tying them into larger projects which can assume the largest burden of the cost. In other words, you can't saddle upon a "mill creek" project in Moab $2,500,000, which is the estimated cost, and expect the people down there of a population of 2,000 to pay for it under the present Reclamation Law. It just can't be done. We must work out some system in this State either through our Legislature or the Federal Government, how these projects will be paid for because somebody has to pay for them; they aren't going to be given to us.

So I appeal to our people in Utah, let's look at this thing not from a purely selfish standpoint, but let's look at it from the standpoint, "How are we going to develop our State?" We are told now, due to the influx of industry in Utah and because of the tremendous growth on the Coast, we might expect 1,300,000 within five years in this State. If that is going to come, we must all work together and not work apart, and I think that has been one of our weaknesses in the past.

I am also going to say to our sister states, the Compact Commissioners here, you face the same problem we do. We ought to work out our projects in all the states together and see if we can't convince the Eastern Congressmen we need some money out here to build them. Otherwise we are going to be travelling along and I am going to be so old, like Rip Van Winkle, that I won't see any built, and my little boy is going to have to wait to see

them built like I have for the last fifteen-twenty years. I want to see them and I know a number of you do. They haven't been built.

I think this is the first move I have seen toward the construction of these projects, the Compact we are attempting to work at now. If you gentlemen will go out and see some of the projects you will find that there must be in some instances multiple purpose projects because the cost must be divided up, and you certainly can't saddle it onto the farmer because if you do he can't pay for it. (Applause.)

COM. WATSON: We will take a five minute recess.

(3:05 p.m. Recess.)

(3:10 p.m. Hearing resumed.)

COM. WATSON: Ladies and gentlemen, it was my original intention to call on all of the water users in the Colorado River Basin first, but I think I will depart from that and call on many of them later. We would now like to hear from a member of the Metropolitan Water Board in Salt Lake City, Mr. Blair Richardson. (Applause.)

MR. BLAIR RICHARDSON, SALT LAKE CITY, UTAH: Mr. Chairman, gentlemen, I am sorry you didn't call on Mr. Gillman, President of the Provo River Water Users Association--

COM. WATSON: He will get it next time.

MR. RICHARDSON: --of which Metropolitan is a subsidiary--we are a stockholder.

I want to call the attention of the Commissioners to the fact that in building the Deer Creek Project and the aqueduct that goes into Salt Lake, about a third of the supply necessary to make that a success will have to come over from the Colorado side, and we hope you will give that full consideration in making water allocations to the various units that you will have to.

I have nothing else to add at all. If there is anything we can help you on, you will ask for us of course. But frankly, Mr. Watson, I don't know of anything else to offer at this time. (Applause.)

COM. WATSON: Mr. J. W. Gillman, President of the Provo River Water Users Association.

MR. J. W. GILLMAN, OREM, UTAH: Mr. Chairman, Members of the Commission, first I am from Utah, not any particular spot. I am interested in the entire State and its development. I have had water on the brain for a long, long time. Some folks tell me if I don't get some of it off I will be headed for the State Mental Hospital, and that applies to my family.

I am interested in transmountain diversions. Utah can't go without some transmountain diversions. We haven't sufficient water within the confines of our little state to do the job. If we are given a portion of the Colorado River, we only want our fair share of it, but we must have that if Utah goes where it ought to go.

That little project, the Provo River Project, will serve when completed more than 50 percent of the population of this State with a supplemental supply of water, especially for culinary purposes. The Bureau of Reclamation has that tunnel into the Duchesne River about half completed and the war came

on and the stop order was issued and it is dead. The balance of the project is going forward.

Now I am interested in bringing the water into the Strawberry Reservoir. I hale from Utah County and I live neighbors to Juab and Sanpete Counties and what not, and they all need some water and if our population is taken care of, water is the life's blood of it. We began to talk about it in my early days and such men as William R. Wallace--

MR. WILLIAM R. WALLACE: Before you were born.

MR. GILLMAN: --Joseph R. Murdock, Dr. John A. Widtsoe, and I could mention others, with whom I served on the Storage Commission of this State some years ago, spent hours and days around the table devising ways and means to develop this State as far as water supply was concerned. We ought to pay tribute to them and never forget their efforts in our behalf.

So I say I am from Utah first. I am a director in the Echo Project in Weber, have been for about fifteen years, and I have seen what that project has done for us. We are already reaping our benefits from our Deer Creek Project on the Provo River and we appreciate them very much.

Gentlemen, if there is anything that the men on our Board can do to assist our State Engineer in this matter, I am sure they would be glad to do it. I realize you have a job on your hands. I would hate to be a member of this Commission. I wonder in my own mind what the basis for dividing the River will be, if it is contribution from our watershed, if it is on a proportionate basis, and then when you get that all done, I wonder, as Mark Anderson said, after that is done how are we going to divide it among ourselves. Thank you.

COM. WATSON: Mayor Mark Anderson of Provo, we would like to hear from you.

MAYOR MARK ANDERSON, PROVO, UTAH: Mr. Watson, Members of the Commission, ladies and gentlemen: This is a rather big subject for me to have anything to say about. I knew it was complicated and the more I listen the more complicated it becomes.

We over in Utah Valley have always felt that we were going to be on the receiving end of this Central Utah Project, but it diminishes a little bit when I listen to the possibilities of using this water over in the Uinta Basin. I thought out there in the Uinta Basin, after I went on a pheasant hunt, that the Indians had most of the good land out there, practically all of it, but they didn't have a great need for additional water, but I will admit I only covered a small area around White Rock.

I was just thinking here, it seems that we are talking about acre feet and second feet; I wonder why this division couldn't be made on the basis of percentage or proportion. It looks like that would be better. That is the way we do with our irrigation water, as I understand, throughout the State in most cases. It is a proportionate thing.

I wanted to say just a word in praise, though, of the Reclamation Service in spite of all the opposition to Bureaus. I think we have some that have made a great contribution to this State and the Reclamation Service is one of those bureaus. They have been very thorough. They have been plugging away for forty years. They have gathered information and they have followed a continuous policy in a way I think that no state or group of states could, and now we are waiting for them to give us the word on this Central

Utah Project. We all seem to be for it but the Reclamation Service hasn't said yet, I don't believe, whether the project is feasible or not feasible.

Now we would really be embarrassed if the Reclamation Service comes out after we have boosted for this thing and tells us that the project is not feasible. I don't know. Have they given us any answer on that?

MR. WILLIAM R. WALLACE: It's feasible.

COM. WATSON: Was that a question?

MAYOR ANDERSON: If it isn't all feasible, is a part of it feasible?

COM. WATSON: Did you wish that question answered?

MAYOR ANDERSON: Yes.

COM. WATSON: Mr. Larson, have you or Mr. Riter anything to say about that?

MR. J. R. RITER, BUREAU OF RECLAMATION, DENVER, COLO.: That is for Mr. Larson.

MR. E. O. LARSON, REGIONAL DIRECTOR, REGION 4, BUREAU OF RECLAMATION, SALT LAKE CITY, UTAH: We are just completing the Bonneville Basin Report the same as the Colorado River Basin Report for submission to the Commissioner of Reclamation, the Secretary of the Interior, and later to the states and to Congress. That report isn't available to the states yet, probably soon will be. And because of the project being in the Bonneville Basin, its feasibility and everything is discussed in that report and not in the Colorado River Basin Report.

As to feasibility, it is like a number of other projects. We give the cost, present day cost, power that will be produced, lands that would be irrigated, and then the feasibility depends on what law you are talking about or what law you are trying to get passed, and so on. So I don't think that is a matter that needs to come up yet.

It is in about the same category as a large number of other projects that are not one hundred percent repayable by the lands on which the water is being used. It is a multiple purpose project and it depends on how it is set up, just like a number of projects in the Colorado River Basin.

MAYOR ANDERSON: Thank you. We feel, of course, in Utah Valley--no doubt it will affect the entire State--that this project will aid us greatly, not only to help agriculture but to contribute also to the industrial development that is taking place in our locality, and we hope that that same development, of course, will be throughout the State.

I do hope that the Commission can work out a Compact at the earliest possible date because I read sometime ago in the paper that any development of any consequence would be impossible prior to reaching an agreement between the Upper Basin States. Thank you. (Applause.)

COM. WATSON: While we are over on the other side of the watershed, we have Mr. Elmer Jacob here, an engineer with Provo Utilities. Come up, Mr. Jacob, and say a few words.

MR. ELMER A. JACOB, PROVO, UTAH: I came to listen today and to learn rather than to try to instruct anybody about what I happen to know. As a matter

of fact, the more I study the water question--I am like one of the other speakers--the less I know about it because it is very complicated.

There is one thing, though, that I think we should agree on here today, if we can agree, in the presence of the Commissioners and the men who are studying the projects in the various states of the Upper Basin, and that is to be together in our idea of developing all of these areas, that we may go together. One project may come ahead of the other if it is feasible, seems more attractive, but I don't think we ought to have any hammers out in the way of limiting full development of any of these projects that are determined to be feasible.

The purpose of water development is to increase both development of agriculture and the development of our power resources. And the white water, the white power, is generally the cheapest power that we can develop. Now in this coal area here at Price, I realize there is a point of view that you men have that are mining coal. I would just like to say one word with reference to that.

There always will be coal-burning equipment in any industrial plant or fuel-burning equipment as auxiliary to any development of hydro power; I think, in this area that would be true. Our population increase is roughly proportional to industrial development. The maximum industrial development in the area here will be realized when we make the maximum use of our water resources, both for industrial and irrigation purposes, and with the development of that increased population, we will have concomitant development of our coal uses through use of the population, through use of standby power, ultimately through extraction of fuel oil and gasoline and gas from our coal products in this area.

That will be the ultimate end of the coal business and there isn't any question in my mind that the development of that population and our industry going along with it we are going to have a development of the coal resources and more intensive mining in the future than we have had in the past. (Applause.)

CHM. WATSON: We would like to hear from a member of the Utah Water Users Association and one who was present at the writing of the Colorado River Compact, Dr. John A. Widtsoe. (Applause.)

DR. JOHN A. WIDTSOE, SALT LAKE CITY, UTAH: I have been listening with a great deal of interest to the remarks made today. So many problems have been set up for us to think about. I have been trying to think them through. Like all the rest of you I am somewhat baffled.

However, I believe attacking every problem mentioned today is of secondary importance. That whether we have a transmountain diversion or not is not a primary question. Whether the water originated in Utah, Colorado, or New Mexico is a secondary question; whether the water has to be lifted or flowed by gravity to the farms is not really vital. I think the question that is of most importance hasn't really been touched upon and I want to give you my point of view.

I believe in the development of this country uniformly. Are we going to give every state a chance, an equal chance? Shall we make this Western country one country? Colorado would be in a very unhappy condition if she were surrounded by deserts; Utah would be equally unhappy.

This Commission, if I sense the proposition properly, is up against that problem. It may involve the elimination of a certain amount of human

selfishness, but this body should rise above selfishness. It takes courage--not easy to do.

So if I would express my feeling it is simply this: that at this time we stand before one of the most important problems of the West, the effects of the solution of which will be felt in the years to come as we know, that is of making one whole West. State Lines are made by man. Nature made the real lines for us. And while we are composed in this country of a number of states, we are one.

I believe that is a big problem. If you settle transmountain diversions in terms of that problem and origin of waters in terms of that problem, we will come to a solution that we will all be happy about and it will bless us and bless our children.

I had the privilege of sitting through all the meetings and all the hearings of the original Colorado River Commission, and I saw selfishness, saw it and heard it paraded before the people. There was no peace in that Commission. There was no possible solution until the Commission began to understand they were working for one great country, a great Western Empire. It would have been very easy in those days for the Upper Basin States to have said to California, "You can't have all this water." But at last they thought in terms of the development of the West.

I am not here to tell the Commissioners how to solve that problem but that is a problem that has to be solved. I hope they may solve it well. (Applause.)

COM. WATSON: The gentleman who is President of the Utah Water Users Association and who himself has had many years of actual experience in water matters and who is the Dean of our group, Mr. William R. Wallace. (Applause.)

MR. WILLIAM R. WALLACE, SALT LAKE CITY, UTAH: Mr. Chairman, ladies and gentlemen: The tremendous amount of wealth that can be made from the application of our waters is well illustrated by the experience of the project on the Weber River. When the Echo Project was built, this condition had existed: Prior to that building of that reservoir, the gross income from that area was two million dollars. Last year it was thirteen million dollars. And the making of wealth, curiously enough, is probably almost the most important earthly job that a man can be engaged in.

If you go back to the ancient times, the time of Pericles in Greece, or the time of the Roman Empire or the time of the Renaissance in Italy, or England under Elizabeth or under Victoria, or the United States of America, what is the first thing you have got to have? It's wealth, because upon wealth is based leisure and upon leisure is based education, culture, and refinement.

So if we can take these waters and put them to the highest possible beneficial use, we will reach a civilization such as the world has never seen. That is a great objective.

People go very far in order to protect a water right. We have all heard about California, the very earnest efforts they are making to protect their situation for their future growth. I recently had a luncheon engagement with some important men in San Francisco who were insistent upon the statement of their belief that California by 1960 will have thirty million people. I agreed to give them twenty million but I couldn't stand the thirty million. Some of the people in Los Angeles estimate that California will have twenty million people by 1953.

Now changing the subject for a minute I would like to say a word or two about coal. The thing that built the German Empire and that permitted them to make the tremendous strength that they have exhibited for a long time is the Ruhr Basin and that is based on the coal. The thing that built the British Empire was the fact that they could establish their great industries there and that the British Empire practically was built on coal.

We have in this area or within not many miles of where I stand probably ten percent of all the coal known on earth. That is a pretty big statement, but the amount of coal is tremendous. Now as the years go by, you are not only going to use coal in the ordinary way for fuel, but you are going to produce gasoline and all the various elements that can be taken from coal, and they are countless in number--even the finest of medicines. So we certainly have an opportunity in this country that I think is almost beyond compare on the face of the earth.

I spoke of the fact that communities will pay tremendous sums to protect a water right and I don't think it would be amiss to tell you about the Metropolitan Water District of Southern California. Those people spent $190,000,000 to bring the water from the River into Los Angeles and associated communities, but they had to borrow that money. By the time that plant was built to part capacity, they spent $34,000,000 in interest, so the cost was $224,000,000. They have a right on the River to 1,100,000 acre feet of water and the capacity of their plant as now built is 495,000 acre feet. The tunnels, however, are large enough for the entire capacity of 1,100,000 acre feet.

Their last report I have seen was up to June 1945. That year their operations went behind $671,000. In addition to that they paid $9,000,000 in interest. Now the interest had accumulated until at that time the cost was $267,000,000. It isn't likely that they will use the entire capacity or get it in balance so their income is as much as their outgo for ten or fifteen years, so it is entirely likely that Los Angeles and the associated municipalities will have a total cost of more than $300,000,000 before their income and outgo in any year are in balance.

I am just saying that to you because it is illustrative of the importance with which California looks upon having what might be called a standby water supply, a water supply that will protect them in their future growth.

I would like to go back to this Compact with which Dr. Widtsoe worked in 1922. The decision was made to divide the waters between the Upper and the Lower Basin States, giving to the Upper Basin the right to 7,500,000 acre feet consumptive use, the Lower Basin 7,500,000 acre feet of consumptive use plus the right to use an additional 1,000,000 acre feet, leaving what was supposed to be a surplus. At that time Representative Hayden--now Senator Hayden--of Arizona addressed a number of questions in writing to Secretary Hoover, and one of the questions was concerning the amount of the runoff, the annual runoff, of the River. Mr. Hoover replied that there were four to six million acre feet surplus, and the suggestion was that we might call it 5,000,000 acre feet. Sixteen million acre feet allocated would make the suggestion that the River contained 21,000,000 acre feet.

Take the two decades, 1922 back to 1912 and 1912 back to 1902, and in those two periods it is probable that Mr. Hoover was about right. But the estimate now is that the virgin flow at the Mexican Boundary is a little more than 17,000,000 acre feet, the virgin flow at Lee Ferry a little more than 16,000,000 acre feet.

What happened after the signing of that compact and the ratification of the compact and the contracts were made for the building of Boulder Dam? There was an attempt to tie up that surplus. The surplus, if any, in the River was supposed to be set aside and in 1963 an analysis be made of that and by the consent of all the states it could be divided. But an attempt was made to tie up that surplus and I think I may say without fear of successful contradiction, Mr. Arizona, that the Lower Basin States now feel that they are going to obtain all of that surplus and that there will be no possibility of the states of the Upper Basin dividing that surplus in 1963.

What I am arriving at is this: Our Chairman suggested that there are two thoughts concerning the division of this River, one of them being that this 7,500,000 acre feet should be divided now in part and leave a surplus to be talked about in the future. I object to that as strongly as it is possible for me to object to anything. Utah cannot wisely and efficiently plan her use of her share of that water until the basis of ownership is absolutely set, until it is definitely established, a certain amount of water or a proportion of that water in perpetuity.

If we don't do that we will have the same condition existing in this Basin that is existing in the Lower Basin, that somebody, some state, will do everything possible to put up a plan that will call for the use of that what we might term a surplus and will have the contention in this Upper Basin that they are now having in the Lower Basin.

When you come to the matter of getting in detail all the data influencing the division of this water you are asking for something that is impossible to obtain. Time will change data. And, Dr. Widtsoe, it is a delight to me to hear the statement you made that this is the United States of America. In the statement I made yesterday I made exactly that same statement, that this is the United States of America and that all of this water will be used in the United States of America.

Therefore, I am making this plea, and I believe in this I have the support of my associates, that this organization having in charge the making of a plan for the division of this water will agree upon the wisdom of dividing it upon a basis that we may go to the next session of the legislature with the understanding that we are to receive a certain amount of that water.

I have heard the suggestion that it be divided in percentages. Well, we had that matter up when we divided with Mexico, giving them a percentage. How would you like Mexican officials to be coming in each year to see if they got their percentage? It just simply will not work.

Now it's a fact that this is the greatest country in the world and I think there is no wisdom anywhere greater than that in the minds of the American people. But we can see what they are quarreling about, great things, all over the world, and surely we ought to set an example and this matter of ours ought to be placed on the table in such a way that all of these gentlemen in their wisdom can study it carefully and bring forward for consideration of the legislature a plan that will be acceptable.

We are not by any means upon an equity in the development in the Upper Basin. I speak very frankly about it. I think Mr. Bishop makes the statement that they have had no great project in the State of Wyoming. I know Mr. McClure of New Mexico has great project difficulties down there because he has a lot of Indians and the Indians apparently have a first right. The State of Colorado has been fortunate in this that they have one great project that is being constructed now. Our other three states have no such projects.

Now we would like to go ahead upon this kind of a basis: Granting that we have agreed upon the division of this water, what do we want to do next? In my opinion we should have an organization so strong and so influential that it can go to the Congress of the United States and say: "Here are four states. Each of these states wants a great project, the controlling project in the development of its water. We ask that these projects be approved at the same time and that the money be appropriated so that they may be builded at the same time." And if we have the water divided and our great construction works are builded at the same time, I am sure we will avoid much trouble and our relationship between and among these four states and the United States will be as nearly the right kind of relationship as it is possible for us to have.

I don't know there is anything else I have to say. I am proud we have in the State of Utah a group of men working cooperatively and as earnestly as they can. They recognize absolutely the rights of every other state and want to work just as harmoniously as it is possible for them to.

One other thing I went to say and that is this: We are peculiarly located in the State of Utah. The United States Government spent $500,000,000 on the Wasatch front because of its relationship to the Pacific Coast and the defense of the United States. In addition to the coal which I have spoken of we have tremendous iron deposits, and because of the coal and iron deposits we have a $200,000,000 steel plant. Based upon that steel plant we are going to have many, many subsidiary industries and we are going to have a tremendous growth. That growth is dependent upon water supply.

Incidentally, it might interest you speaking again of the Ruhr, with all the tremendous destruction over there, the coal mines were not destroyed and right at this moment the change in the Ruhr district is said to be almost a marvel, that there are right now a thousand industries working in the Ruhr district.

Gentlemen, we are looking forward in Utah to a development of that kind and we would like to say to this Commission that we would like to have every share of water to which we are entitled, but we don't want any more, and we feel very confident that wisdom dictates that the division of this water should be agreed upon now.

Let me stop to say I appreciate the value of water. There isn't any question about it, 50,000 acre feet of water is worth at least one hundred thousand dollars a year, and I would hate to give up 50,000 acre feet of water to any other state. But I do recognize the fact so emphatically referred to by Dr. Widtsoe that this is the United States of America and we can go ahead and divide this water and so far as the United States is concerned, it can be put to the highest beneficial use to the benefit of all. Thank you, gentlemen. (Applause.)

COM. WATSON: Mr. Thomas W. Jensen of Mt. Pleasant, Utah, Field Representative for the Utah Water Users Association and for the Civic Clubs of Southern Utah.

MR. THOMAS W. JENSEN, MT. PLEASANT, UTAH: Mr. Chairman, ladies and gentlemen, all I want to say is "Amen" to what Mr. Wallace has so ably presented here. Getting speedy action on the division of these waters within these states and a fair and equitable division is what we are interested in.

I also represent the water users of Sanpete County, a little county in the center of this State that used to be known for many years, Dr. Widtsoe,

as the granery of Utah. But the last few years, on account of drouth, freezing and a few other obstacles to the producing of crops, Sanpete County has been forced to ship in annually millions of bushels of wheat and corn from other states and other parts of the State of Utah. We have had a project there which we are anxiously waiting to get built which will help supply supplemental water for some 25,000 acres of land. Our project will be held up. It has been passed, the engineering data, the reports and all, are complete. At one time prior to the war it was placed on the desk of the President under the Case-Wheeler Act to be constructed. The war came along and stopped that.

We are praying for some immediate help in Sanpete County. The farmers there have built up a civilization, they have their homes there, and we need water. Even though Senator Howard has stated that they don't want to see any transmountain diversion, I want to say to Senator Howard we don't want one drop of water in Sanpete that they can use beneficially in his area, but we do want it used in Utah.

I appreciate the job that you gentlemen are confronted with. I have listened to the hearings in Rock Springs and Grand Junction. I know the other states' problems are parallel to our problems, but let's get the job done and get it done so that we can present something to our several legislatures this coming session and get this River going under control so that we can use the water for our valuable lands. I thank you. (Applause.)

COM. WATSON: We wish to give everybody a chance to speak that chooses to speak. We should, however, I think at the present time have an engineering report from one of the members of the Bureau of Reclamation so that we can bring a lot of these facts together and understand them. I will call now on Mr. J. R. Riter, who is Chairman of the engineers of the various states that have been chosen to analyze this problem for the benefit of this Commission. Mr. Riter. (Applause.)

MR. J. R. RITER, BUREAU OF RECLAMATION, DENVER, COLORADO: The Engineering Committee of which I am a member works under the direction of the Commission. At the Salt Lake meeting late in July when the Compact Commission was organized, they directed that a representative of the Federal Government with a representative of each of the five compacting states meet together and formulate an engineering plan of study, the study that should be made to give the Commissioners factual information on which they can work. In other words, when you go to divide up a river, you just don't go arbitrarily and say, "You take so much, you take so much, and you take so much." We don't know what we are dividing.

One of the starting points is water, its origin, how much, what becomes of it. Pursuant to the instructions received at the Salt Lake meeting, the Engineer Committee met at Cheyenne, Wyoming, the last two days in August and prepared a report which was submitted at the Santa Fe meeting of the Commission in September of this year. The Commission adopted the recommendations and appointed a permanent Engineer Committee to work out the problems.

You people have met the Commissioners and you might be interested in knowing the members of the Engineer Committee. I was asked to be Chairman by the Federal Adviser and the Commission appointed me in that capacity. From Arizona Mr. R. Gail Baker is the engineer representative on the Committee. Mr. Baker has had considerable experience in analyzing water in Arizona. His position in that state is one of the engineers on the State Board, Land and Water Commission.

From Colorado we have three members on the Committee. Colorado produces a considerably great share of the water of the Colorado River and they have

many diverse problems so they asked for three members on the Engineer Committee. We have Mr. C. L. Patterson, who is Chief Engineer of the Colorado Water Conservation Board; Mr. Royce J. Tipton, who is a Consulting Engineer and who has had considerable experience in analyzing water and has studied the Colorado River for a good many years. Mr. Tipton was at one time employed by the Bureau of Reclamation. At the present time he is consultant for the Colorado Water Conservation Board. At one time he was consultant for the International Boundary Commission, and Mr. Tipton has had considerable experience in analyzing the Colorado River. The third member from Colorado is Mr. Frank C. Merriell, who lives at Grand Junction. Mr. Merriell worked with the Bureau of Reclamation at one time during the construction of the Grand Valley Project near Grand Junction, and he has had considerable experience and is intimately acquainted with problems on the Colorado River.

In New Mexico the representative is John H. Bliss, who is the Engineer Adviser to the Interstate Streams Commission.

In Utah the official representative is Fred Cottrell, the Deputy State Engineer. Most of you know Mr. Cottrell and know his work and his ability.

From Wyoming the engineer representative is H. T. Person. Mr. Person is professor of engineering at the University of Wyoming and is consultant for the Wyoming Compact Commission.

I won't attempt to try to tell you all the problems but the chief problem that we felt the Commissioners would want to know is the total amount of water. During the presentation that has been given here today I think the statement was made that in 1922 the original Compact Commission didn't have too much information on the flow of the Colorado River. It is true, of course, that there was a gauging station near Yuma, Arizona, which had been maintained since the early part of the century.

There were also gauging stations on the Green River at Green River, Wyoming; on the Green River at Green River, Utah; on the Colorado River near Cisco, Utah; on the Colorado River near Grand Junction, Colorado; and on the Gunnison River near Grand Junction, Colorado. They were the stations on the main tributaries. There were also some available records on the San Juan River.

The original commission used such information as they had but they were unable to divide the water among the states. They did recommend that Lee Ferry be the point of division. As a result of their work, the Geological Survey now operates a station on the Colorado River at Lee's Ferry and on the Paria at the mouth. Those stations have been operating since 1922. The sum of the two stations represents the flow at the compact point, Lee Ferry. I think Mr. Watson has explained that to you.

Now we do have fairly good records. As the states became water conscious, arrangements have been made to measure the streams. Many of the streams have been measured for varying lengths of time. All of them don't have thirty or forty years of record; some of them only have one or two years of record.

So in determining where the water comes from, our job is to try to find out the amount of water that originates in each state. Of course that involves a number of processes. The first thing we have to do is to tabulate the water at the existing gauging stations and then extend those records by comparison with other points in the watershed where measurements have been maintained for longer periods of time.

We will next have to estimate the runoff from various unmeasured tributaries. In Utah you have a number of tributaries which enter the Colorado River and the Green River which have not been measured. In some cases we might have a very few years of record. We will have to estimate the total runoff from those tributaries in order that the Commissioners can determine the amount of water that originates in each state.

Well, now, we know that irrigation development has been underway for a number of years. At the present time there are over a million and a quarter acres irrigated in the Upper Basin. We also know that water is used in transmountain diversion out of the Basin. In Utah you are all familiar with the Strawberry Project, you are familiar with the Sanpete Project, both of which were built by the Bureau of Reclamation. And you are also familiar with other transmountain diversions, small ditches that have been privately constructed.

So the next job then, we will have to analyze how much of the water is now being used and how much has been used historically in order to correct the flow to determine how much water would have originated from each state and how much water would have been at Lee Ferry under virgin conditions. After all, the 7,500,000 acre feet which has been allocated for use in the Upper Basin must include present uses.

We have another problem after we have determined where the water comes from, and that is what becomes of it. For example, in these main channels there are tremendous losses. So far no one has attempted to analyze how much those losses are along the main channels. That is important because the Upper Basin has an obligation imposed on it by the 1922 Compact of delivering at Lee Ferry for use by the Lower Basin 75,000,000 acre feet of water in any ten-year period. Naturally Wyoming wants to know how much water--that is, we presume that one of the terms of the Compact would be that each state will have an obligation to share in the delivery of that water at Lee Ferry. In order that they may know how much their obligation is they must know how much water is going to be lost from the time it turns it out at the State Line until it arrives at Lee Ferry.

Another question that will have to be answered and will have to be studied is the matter of reservoirs along the main stem. Mr. Watson mentioned in his opening speech that you have the coffee cup--I think he referred to; I don't know why he mentions your coffee cup in Utah, I think he should have said the milk bottle--but in any event you have to have the containers to hold this water.

The studies that the Bureau of Reclamation have made as the basis of our Basin Report which was recently submitted show that over a long period of years the so-called undepleted flow at Lee Ferry will average about 16,000,000 acre feet. Well, now, you people who are familiar with rivers know that a river is not constant every year.

For example, in a year such as 1909 you had in the neighborhood of 25,000,000 acre feet at Lee Ferry. On the other hand, you take a year like 1934 or 1940, the flow is less than 5,000,000 acre feet. Then if you take a ten-year period balancing your obligations against the water that you have, you take a ten-year period such as 1931 to 1940, the historical flow at Lee Ferry averaged 10,000,000 acre feet in that ten-year period. That is what actually happened with present-day uses.

Well, now, if we try to analyze, if we are going to restrict ourselves to the water we get in the lowest ten-year period, there isn't much room for future development. Projects have been started in the Upper Basin. Take the Colorado-Big Thompson in Colorado, the Provo River Project that has been referred to in Utah, those projects have been started. We know they are going to

take some water out of the stream.

By the time you subtract from the 10,000,000 acre feet which was there historically the uses that have been what you might say already encumbered, we have already obligated ourselves to make those additional uses; then we subtract the obligation of the 1922 Compact to deliver water to the Lower Basin at Lee Ferry; and also subtract the Upper Basin share of the obligation to deliver our share of the water to the Mexican obligation, there won't be very much water left if we restrict ourselves to the flow available in ten years such as 1931 to 1940, bearing in mind that over a longer period the average original supply is in the neighborhood of 16,000,000 acre feet.

That simply means, as I see it and as the engineers of the Committee see it, huge reservoirs must be constructed in order that those reservoirs will impound the flood water, the surplus water in years of high runoff, and then release those waters in years of low runoff. By that means the Upper Basin will be permitted to expand its development and at the same time meet our obligation to the Lower Basin and to the Republic of Mexico.

Immediately when you start building reservoirs you lose water by evaporation. So one of the problems that we must study is the reservoir capacities we need, and that involves also consideration of silt. These streams by the time they get down to where the reservoir sites are, particularly down at the end, are not clear mountain streams as you well know. They are heavily laden with sediment. We have to make an analysis of the extent the reservoirs will be impaired by sediment in the future. All these studies are necessary in order to determine the capacity of the reservoirs. We don't know the answers but it is a problem we must study.

Since the engineers received the assignment we have held two meetings--one in Santa Fe in August which I don't count; that was just merely to spread out some of the assignment. Early in October we had a meeting in Denver to report on the progress and receive additional assignments. We had another meeting last Friday in Denver. At that time we had received reports from some of the engineers who had been given assignments and they were passed out so the other engineers of the Committee could review the work of each other.

In other words, in this Engineer Committee we are trying to be absolutely honest and aboveboard to analyze the facts. One man can't do the job; it is going to take the united effort of all of us.

I don't know how technical this discussion has been, Mr. Watson, but those in brief are the problems that the engineers are working on, they are the facts that we are trying to dig up and the engineering opinions that we are trying to arrive at in order to give the Commissioners some factual information that you may have in your deliberations on how you are going to divide the water up in the stream. (Applause.)

COM. WATSON: Mr. Raymond Hammond, Utah Water Users Association Board Member from Tooele County, Utah. Will you say a few words, Mr. Hammond?

MR. RAYMOND HAMMOND, GRANTSVILLE, UTAH: Mr. Chairman, Members of the Commission, ladies and gentlemen, I and some others came here today for the purpose of learning. Up to the moment I have learned a lot.

I come from and live in a section of the country directly west from Salt Lake City. I heard one gentleman make a statement here this

afternoon that in his particular locality there was a tract of land comprising 15,000 acres that was badly in need of water. I would like to take this group into Tooele County, Rush Valley, Cedar Valley, Skull Valley, and show them 200,000 acres of the finest land that ever could lie outdoors waiting for water.

And I remember, Pres. Wallace, some twenty, twenty-five years ago there was a little land boom in that section of the country. It was reported--and some surveys were made--the waters of the Colorado River were going to be brought into that section of the county. Of course, it wasn't long before that bubble burst because it was found that there were no waters to be brought in because the State of Utah had no title. Those lands are lying there at the present time and we people from Tooele County are, first, as has been remarked here today, Utahns. We are for the development of this State.

We are on the last leg, perhaps, of that great project down there. There may be some water in the final for us; there might not. That isn't going to hold back our effort to promote the interests of the State of Utah.

I want to say this that if there isn't enough water and we don't get any--we know where this water is going to be applied or feel we do--perhaps you can prevail upon a Kind Providence to give us a little more rain because we only get nine inches of that. (Applause.)

COM. WATSON: Five minutes' recess--have a chance to stretch a little --and then we will start again.

(4:15 p.m. Recess.)

(4:20 p.m. Hearing resumed.)

COM. WATSON: Gentlemen, we have some water users here that have travelled a long ways to get over here and we will not hold them any longer. Let us give them a chance to say a few words. A group from Millard County is here. We would like to hear from Archie Gardner, County Commissioner and President of the Millard County Water Users Association. Mr. Gardner.

MR. ARCHIE O. GARDNER, DELTA, UTAH: Mr. Chairman, ladies and gentlemen, I came here like a lot of the rest of you, to hear something and learn something. I am just a dirt farmer from Millard County.

I am like the man from Tooele; we have at least 150,000 acres of very fertile land if we had the water on it. And we are willing to cooperate any way we can to get this water over into our State and some of it down into our county, we hope. Thank you. (Applause.)

COM. WATSON: Mr. W. C. Cole, Water Commissioner on the Sevier River. Will you make a few remarks, Mr. Cole?

MR. W. C. COLE, DELTA, UTAH: Mr. Chairman, ladies and gentlemen, I have learned considerable here today and I am very glad that I came. I am from the same area that Mr. Gardner is from. We are from over in Millard County where we have lots of land, some years lots of water.

We have 150,000 acres of land that could be supplemented by water if it comes to us. We have another fifty, seventy-five thousand acres of land that are now idle that could be put under cultivation. A lot of it would be very productive land, fruit land, orchards, and so forth, along on the benches.

I hope this Commission goes ahead and does what it can do. I think the Millard County people are willing to take what we can get, and we hope that

they solve these problems as they come to them and everything works out all right. Thank you. (Applause.)

COM. WATSON: Mr. Dudley Craft, prominent water attorney living in Delta.

MR. DUDLEY CRAFT, DELTA, UTAH: Mr. Chairman, ladies and gentlemen, those of us from Millard County of course, are greatly interested in the development of any of the resources that can be made here in Utah, and particularly the water resources.

Every time we get out there in that big flat, which is the biggest valley in Utah, and look across the prairie of thousands and thousands of acres of good land that is not under cultivation or in development, it hurts us to hear Mr. Watson say he was down there and saw those thousands of second feet of water running into the Pacific Ocean not doing anyone any good. If there is any feasible way to utilize that water for the development of our country or any other part of Utah we would like to see it done.

We are down there where we are water conscious. Those people in that valley have done something that probably no other people in Utah have done; by their own efforts and their own development they have utilized all of the water resources down there. They built the largest artificial reservoir by far in the State of Utah. They capture and utilize every drop of water that comes down there. The thing is there is that vast amount of land that could be put under cultivation if additional water was available. (Applause.)

COM. WATSON: Prior to hearing from the Juab delegation, which has come a long distance, we would like to hear from Mr. J. A. Theobald from Price. He is Secretary of the Carbon County Associated Industries. Mr. Theobald.

MR. J. A. THEOBALD, PRICE, UTAH: Mr. Watson, Members of the Commission, ladies and gentlemen, coming from Price and representing the Carbon County Associated Industries, naturally we represent one of the big industrial sections of the State. Primarily we are interested in water. I think the more water we can get the better business we are going to enjoy and the better our industry is going to be.

I think when Senator Howard spoke earlier this afternoon with reference to diversion his thought was that we people in this area, on account of the geographical situation of Carbon and Emery Counties, cannot hope to lose any of the water we have. We really need every bit of the water that is originated in this particular section. True, we are losing a lot of it now, and if our neighbors feel that they would want the water we are losing, we are losing it because we don't have the facilities for saving it. If we would have the developments of reservoirs in this section that have been promised to us for years and years, we would be using that water and would have plenty of chance to use it. In any allocation of water Utah may get, we need much more water than we are getting at the present time.

Getting back to the other question that our good friend Mr. Wallace spoke of--and I am certain there is not a person in that part of the State or any other part who doesn't appreciate the wonderful efforts that Mr. Wallace has put forth for water. The argument that comes in all the time, the cost of the development of power--one of the reasons we can't develop power with the big beds of coal that we have is the fact that we don't have water for condensation. We have to have water with this, got to prepare it where the water is. If we had more water we could develop power, cheap power.

Another thing, our counties down here are unfortunate because they are in the area that carries the great part of the water we are talking about today. The Colorado River runs through Grand and part through Emery County. The tributaries that furnish some of that water come through Carbon County, and still with all of that water, we have not a chance to use any part of it.

We heard a lot about the return flow of the water. We could benefit by the return flow of the water if we had the opportunity of doing it. But we are situated right in here between two ranges so that no matter what is developed on the other side, we are not going to benefit by it.

True, as Mayor Stringham said, they have industries over there. We recognize those industries, and they are important to our own industry in this part of the country, and we want the development in that section. But in doing that we don't want to see a development brought out that may be injurious to any other section. But as has been said here from time to time, the prime purpose of this meeting is to go to work and allocate this water, allocate to Utah her just proportion and allocate to all the other states.

When this Board gets through with those studies, the thing they are going to have to determine, then when that is done, it is time enough for us people to find out and argue and quarrel how we are going to use that water here. But just keep in mind that the central part of this State, Carbon County, Emery County, and Grand County can use four or five times as much water as we have right now if they take away the water that is flowing down past us in the other part of the country. (Applause.)

COM. WATSON: Mr. Reeve G. Richardson, Nephi Irrigation Company, Nephi, Utah.

MR. REEVE G. RICHARDSON, NEPHI, UTAH: Mr. Chairman, ladies and gentlemen, I represent an area of Utah--I don't suppose it is particularly peculiar to that one county, we are not asking for water to create any large development to create an influx of population--what we need is additional water to serve the population we have there and their project. We reached our economic limit of development about fifty or sixty years ago because we were utilizing all the water that was available. We made reservoirs and did work to increase that supply and have been unable to. The only source of supply we would have would be transmountain diversions from the Green River.

At the time our resources were limited and our development stopped, our children whom we raised and educated left our country and followed the Colorado River water to California. There they have had to go to get a living.

Now we are asking for enough water to utilize the lands we have under cultivation to their full economic limit and to increase or give us an opportunity for industrial development, which is finally started there. You people have probably heard that the Thermoid Rubber Company is building there. We are having one awful time to stretch the water to give those people the acre foot and a half of water they will need. And with that in mind, when they are built and that acre foot is supplied, we have no room for further development unless we can get a little more water. And as I say, the Green or the Colorado is the source of that water and we want some of it. (Applause.)

COM. WATSON: Mr. W. C. Andrews, County Commissioner, Juab County.

MR. W. C. ANDREWS, JUAB COUNTY, UTAH: Mr. Chairman, Commissioners, ladies and gentlemen, Mr. Richardson has very vividly spoken in regard to our location. We have all the troubles of Tooele County and Millard County, and we are between those two counties. We have practically the same arid country to be developed.

As Mr. Richardson said, we have now come in on the industrial side of it. I was just informed the other day that they are now attempting to expand the Thermoid Company to two shifts of 600 men on the two shifts. Now they contemplate a city of 2500 growing to 6000 people within the next three years. I will just illustrate.

They thought the great thing was power with them and we fought it out against other cities and at last we got the Utah Power in there. They never thought of the water until they asked us to send a stream of water down so they could settle the dirt in order to put in their cement. Well, water--we couldn't furnish water to them. They come from New Jersey and Atlantic City, from the Atlantic Coast, and they couldn't understand why we couldn't furnish the water to settle the dirt before putting their cement in. That is the condition we are in.

The City has built a million gallon reservoir there. We have simply got to take the water from the farmers for culinary purposes. Water has raised from $50 a share capital stock up to $300 and we haven't any water to deliver for $300 and yet people are coming in that have heard of the Thermoid plant. A number of people are coming back from California, and there we are. We must have water, ladies and gentlemen. We must have water in Juab County. (Applause.)

COM. WATSON: Bert J. Sillman, Grand County Water Users, Green River, Utah.

MR. BERT J. SILLMAN, GREEN RIVER, UTAH: Mr. Chairman and gentlemen, I want to speak briefly on account of the lack of time. The people in the other counties have no monopoly on a lot of land that could be irrigated profitably.

The project I want to speak of is located in the Green River Valley on both sides of the river at Green River town and has been surveyed by the Reclamation Service. There are 15,000 acres readily available which could by a higher lift be increased. We are greatly interested in that. It is primarily a hydroelectric proposition.

We are greatly interested in the Dark Canyon Project about 85 or 90 miles south. It would seem that would not be a project in controversy between the Upper and Lower States. It would be mainly storage and power and a place to deposit silt.

Mr. Melich represents the eastern part of Grand County and he has told about Mill Creek above and what projects those people desire greatly. (Applause.)

COM. WATSON: Mr. Peter McElprang, Emery County, President of the Huntington Canal Company, Huntington, Utah.

MR. PETER McELPRANG, HUNTINGTON, UTAH: Ladies and gentlemen, Mr. Watson, I didn't come here to speak. I am a poor speaker. There is no use me telling you Commissioners anything.

We are over there in a little place, a bunch of poor people. We have got plenty of water in the spring of the year but in the fall, people are burning up. All we ask is a little assistance to let us build a few little reservoirs there to take care of what water we have got. People, we need it. We are all paying taxes now but if we can't store this water, it will be impossible and we will have to go on relief or something else. Thank you. (Applause.)

COM. WATSON: Mr. Clifton Wakefield, County Commissioner, Huntington, Utah. Is Mr. Wakefield here?

MR. C. N. WAKEFIELD, HUNTINGTON, UTAH: I haven't happened to listen in on the last two or three speeches that have been made here, but we in the Emery section, we have four rivers running through Emery County and each river has quite a runoff in the spring of the year but in the late summer, our streams dry up and we are terribly in need of water for the late crops. We can't raise anything in Emery County but hay and grain--row crops are impossible--because of the late water. It has been proven that we could raise sugarbeets, potatoes, crops of that kind if we had the late water.

Some of the associations are trying to build reservoirs themselves, spent a little money, not asking for any help, but we definitely need reservoirs on every creek in Emery County. If we can get that we will be satisfied. (Applause.)

COM. WATSON: We will now hear from County Commissioner Will Campbell, Carbon County.

MR. WILLIAM CAMPBELL, PRICE, UTAH: Mr. Chairman, gentlemen, I haven't made much of a study of this. I have today gotten more information than I have altogether in the years that I have been here. I don't believe I have anything to say that will be of any value or interest to you people here. Thank you. (Applause.)

COM. WATSON: We would like to hear from Attorney Gerald Irvine of the Utah Power and Light Company, who is here. (Applause.)

MR. GERALD IRVINE, SALT LAKE CITY, UTAH: We can't develop the State of Utah with the waters of the Colorado River flowing down into the Pacific Ocean. To develop the State and bring new industries into the State and develop our cities we have got to find some way to put the water to work, and the only way we can put it to work, as Mr. Wallace has said, is to obtain title to the water so that the Federal Government will be willing to assist us.

Naturally we are, as all of the rest of you are, very much interested in development of the State of Utah. We have watched Mr. Wallace for a number of years and Dr. Widtsoe in their very fine effort in this behalf, and we are very much interested in the projects and of course endorse what has been done here today. (Applause.)

COM. WATSON: We would like to hear a few words from Tom McCoy of the Municipal League.

MR. TOM McCOY, SALT LAKE CITY, UTAH: Mr. Chairman, my purpose in being here is to learn what your problems are and I am very happy to be here but I don't believe I can add anything to the meeting at this time. Thank you. (Applause.)

COM. WATSON: I would like to introduce one gentleman who has done excellent work and is known nationally, one of our engineering advisers who has contributed considerable to our engineering work, Mr. Clarence S. Jarvis. (Applause.)

MR. C. S. JARVIS, SALT LAKE CITY, UTAH: I heard somebody say that his friends had accused him of having water on the brain. Well, I was associated with Joseph R. Murdock and they used to say that about him. He is a grand old man. He would go after water wherever he found any trace of it and I was his engineer for some years on the Provo Reservoir, Utah Lake irrigation, Union

Reservoir--that is a development of the lakes at the head of the Provo River. And finally I had something to do with the enlargement of the Sevier Bridge Dam.

I have had practical experience with the Chief of Engineers in Washington and especially in the last unpleasantness. And I should say that it will take the application of all the experience that has ever been stacked up in trying to find the way to solve this Colorado River problem, and I am with you on that. (Applause.)

COM. WATSON: I had overlooked one name that I was just reminded of, Mr. Ervin Wimber of Castle Dale.

MR. ERVIN WIMBER, CASTLE DALE, UTAH: Mr. Chairman, Members of the Commission, ladies and gentlemen, I have been very interested in water development throughout Southeastern Utah for many years. I feel like a good many other gentlemen expressed themselves here today, that these waters in this State of Utah are the life blood of the State.

Before we can carry on or go on for any future developments in industry and agriculture and all the way through, I think we have got to have this water developed. As far as transmountain diversion is concerned I feel that it would be a fine thing inasmuch as power developments I think would go along hand in hand with coal developments. I don't feel that the power interests would hamper the development of coal in this section at all, although I feel that our small reservoir projects throughout this Southeastern Utah should be guaranteed and that we should have a right to develop this water along with the rest of the waters of this State. (Applause.)

COM. WATSON: I should like to hear a few words from Dr. F.R. King.

DR. F. R. KING, PRICE, UTAH: Mr. Chairman, ladies and gentlemen, I came in a little bit late but I will venture to say there was quite a little accurate information distributed before I came in if we are to judge from what I have heard since I did come in.

And nothwithstanding the fact that I have been living in this state a good many years, I learned a few things today. The title of the water is paramount, as our friend Wallace advises, and of course that is the object of this meeting, to get an equitable division of that water. After that the problems that arise can be settled as they come along.

I don't think I could add a thing to what has already been said and I don't think I have any information in addition to the information that you gentlemen have. Thank you. (Applause.)

COM. WATSON: Ladies and gentlemen, I wish to compliment you on making your remarks brief and to the point. You know words are like the rays of the sun: When they are dispersed they don't burn but when they are focused they have power.

Now there may be a few I have overlooked and I wish you to forgive me for overlooking you personally, but if you are here and wish to say anything, you now have the opportunity to volunteer.

MR. WILLIAM R. WALLACE, SALT LAKE CITY, UTAH: Mr. Chairman, I am afraid you might overlook me. There is just one little statement that I would like to put in that record for the benefit of your group. The State of Utah covers 54,000,000 acres; 300,000 acres is the limit of the watered

lands in the State of Utah that have a full season water. We have 1,300,000 or in that neighborhood that we are trying to irrigate, but 1,000,000 acres of this 1,300,000 have a deficient water right.

Nothing could be more impressive than that statement in proving to you the necessity for our having our full and equitable share of the waters of the Colorado River. (Applause.)

COM. WATSON: Are there further remarks anyone wishes to make?

MAYOR B. H. STRINGHAM, VERNAL, UTAH: Mr. Watson, if you are about to close I think we should go on record as giving the Commission a vote of thanks for this fine, democratic opportunity for expressing ourselves. May I so move? (Second.)

COM. WATSON: It has been moved and seconded that we thank the Commission for this democratic opportunity of expression. (Thereupon a vote was taken and the motion of Mayor Stringham carried unanimously.)

MR. WALLACE: Off the record. (Remarks off the record.) I think every man here ought to have a word to say.

COM. WATSON: Every men has an opportunity.

MR. J. EARL LEWIS, PROVO, UTAH: I have been intensely interested in this fine opportunity that we have been extended by the Commission this afternoon. It is needless for me to say that we are interested in getting more water in Provo and in Utah County; that has been previously said. But we are not the only county in the State. Every county in the State and every vicinity in the State has the same problem and should have an equal opportunity for development.

Last week I had the privilege of attending a convention in San Francisco, a water works convention. At this convention there were representatives from California, Southern California especially, and Arizona. And I came here with a firm conviction that unless we in the Upper Basin States work unitedly and work now we are going to lose some of our water to California and to Arizona. It is time for us to move and to move rapidly right now.

In this State we are a large, homogeneous lot. We don't have selfish interests of any particular area in the State. We can't isolate ourselves. But we are so knit and united together that we should ever act jointly for the benefit of this State and for the good of this State expend united efforts to obtain for Utah its just share of the water.

And we urge this Commission to be fair in what they do and give us just our just share. We are not asking for any more, not a drop more, only our just share. Then we who sit here strategically located in a fine spot where agricultural development may be had and industrial development may be had, then we will have the means for that development and it will accrue to the benefit of the United States. (Applause.)

COM. WATSON: I understand that Vasco Tanner of Provo is here. We would like to have a few words from him.

MR. VASCO M. TANNER, PROVO, UTAH: Vasco M. Tanner, Vice President of the Public Utility Board, Provo City; also connected with Brigham Young University.

We in Provo feel keenly the need of additional water as has been said

by our Mayor and Commissioner and Mr. Jacob, who is the Superintendent of our Utilities. We are especially anxious to have water for one reason, that of developing hydro power. We have great need for cheap power in Utah County and we believe that by bringing water from the Green River or some tributary of the Colorado River, bringing it over the Wasatch and developing power from it, and then diverting it into agricultural areas, that we can greatly enhance that part of the State of Utah and in turn enhance this Western area. Thank you. (Applause.)

COM. WATSON: We wish to hear from Mr. Harold R. Morris of Delta. (No response.) We have a lady present, Mrs. Mayme Jameson; it would be a shame to adjourn without calling on her for a few words. Mrs. Jameson. (Applause.)

MRS. MAYME JAMESON, DESERET LAKE, UTAH: Mr. Watson and Commissioners, I am very interested in water. I found out last summer that my land wasn't worth two bits an acre without any water on it. We had 125 acres of beans planted and in the early part of the season we could put on 30 or 40 rows of water; it went down to 20, then 10, then one or two, and I went up the creek and there wasn't a drop of water and we went the rest of the summer without any water.

We want to have Emery County water developed. We feel that we have water there if we can take care of it, but we don't want Sanpete to tunnel through the mountain and take our water that is up around the mountain. (Applause.) If you can take it from the Colorado River and up through Provo and scatter it through Sanpete we will be glad to see it. Any water that runs from Emery County down into the Colorado River, they may have that. And we will appreciate anything you folks can do for us. Thank you. (Applause.)

MR. WILFORD J. HUMPHREY, ORANGEVILLE, UTAH: Some of the gentlemen from Delta and down in that country say their boys go to California. You saw Mr. Wimber going by. For lack of water he went to the coal mines and he lost his leg; most of our boys lose their lives. If we don't get more water through Emery our boys have got to go to the coal mines. We haven't asked for much water but we would like what water goes by stored in our reservoirs. (Applause.)

COM. WATSON: We are going to get everybody. Who else hasn't spoken? Mr. Thomas Latimer, City Engineer from Provo, is here. He and I used to go to school together. I believe he will say a few words.

MR. THOMAS H. LATIMER, JR., PROVO, UTAH: You have got me on the spot, Ed. As it has been stated, Provo's interest is very much in the way of production of power and we want to get what we can but we don't want to get it to the detriment of anyone else. We are Utahns and we also are Americans. Thank you. (Applause.)

COM. WATSON: Mr. Feltch.

MR. FRANCIS FELTCH, VERNAL, UTAH: We would like to have our first say and get in toward the end also.

There is just one point that I think the boys from our section didn't mention. No doubt you people know all about it but in the Echo Park Project, which we feel is the key to the Central Utah Project, there is just a little bit in Colorado and we would like to have our Commissioner from Colorado know that there is going to be a lot of surplus power and water for their section of the state. (Applause.)

MR. C. S. JARVIS, SALT LAKE CITY, UTAH: Wouldn't it be in order to have introduced to this assembly Mr. Wilson, who is in charge of water measurements, which is so important as we develop this project?

COM. WATSON: Mr. Wilson in charge of the U. S. Geological Survey stream measurement. Mr. Wilson.

MR. M. T. WILSON, U.S.G.S., SALT LAKE CITY, UTAH: You want me to say a few words?

COM. WATSON: Yes.

MR. WILSON: There isn't much that I could add that wouldn't be a duplication of or supplemental to the report that Mr. Riter has just made. Some of you may not be entirely familiar with the place of the Geological Survey in this water development. Geological Survey is responsible for collecting the basic information, for operating these gauging stations which Mr. Riter has explained to you in working up the water supply for the different sections. He has covered in considerable detail the water supply in the Colorado River Basin and some of the difficulties. You may be interested in some of the recent work that the Geological Survey has been doing.

He mentioned the fact that our streamflow measurements are lacking in many localities--I am speaking principally for the Utah section because the work we handle out of Salt Lake City covers Utah and Nevada and our work is in cooperation with Mr. Watson, the State Engineer, and the other Federal agencies in collecting this basic information.

Prior to 1941 we were operating in cooperation with the State of Utah only 20 gauging stations in the Colorado River Basin. That of course has been greatly increased since that time in Utah. At this time we are operating 60 gauging stations in Utah and many of those have been installed at the request of the Bureau of Reclamation.

Some very recent work that we have been doing, a boat trip was just completed on the Colorado and Green Rivers. A party of four with two boats left Linwood, Utah, at the Wyoming-Utah State Line and travelled down the River all the way to Lee's Ferry, measuring all the tributary inflow to the Colorado and Green Rivers. In addition we measured the main stem at strategic points between 50 and 100 miles apart. When this boat party reached Green River, Utah, one boat was taken overland to the Colorado-Utah State Line and continued from there down to the junction meeting the first boat and then continued on down to Cataract Canyon and Lee's Ferry.

Those measurements have just been tabulated but they have not been analyzed. To give you a brief picture of some of the possibilities of this work: In a section of the River Linwood to Taylor Ranch, for a distance of 50 miles, the tributary inflow measured was 60 second feet. The measurement of the River at the State Line and the measurement of the River at Taylor Ranch showed a difference of 11 second feet. In other words, we lost by evaporation, probably by evaporation and transpiration, 49½ second feet in that reach of the River. That is a solution to some of the problems that will be faced in this Commission.

In the next reach of the River down to the mouth of the Lampa there was an apparent loss of 7.6 second feet. That is some of the work that the Survey is doing at the present time in cooperation with the State of Utah.

It has been mentioned here that the silt problem in the Colorado River Basin is a very serious one. The Geological Survey is maintaining base gauging

stations on the Green River at Green River, Utah, and on the Colorado River below Cisco and on the San Juan River at Bluff, where in addition to the streamflow measurements we are obtaining considerable information as to the silt carried in the Colorado River, and that work is also being accomplished in the Lower Basin.

The silt suspended in the Colorado River passing Lee's Ferry is really surprising. The average silt is one-half million tons passing the Lee's Ferry gauging station! The silt records kept on the Green River, Colorado River, and San Juan River accounts for 60 percent of that silt. The other silt contributed comes primarily from the area between these stations and Lee's Ferry, which we know very little about. Last fall in cooperation with the State Engineer we established gauging stations on the lower Price River, on the San Rafael, on the Dirty Devil, and we are now starting to collect silt samples at those stations which will help us determine where our silt is coming from.

UNIDENTIFIED VOICE: Half a million tons for how long?

MR. WILSON: The average silt passing Lee's Ferry is a half million tons each day. Thank you. (Applause.)

COM. WATSON: I wish to say this, ladies and gentlemen, that the State Engineer's office cooperates with practically all Government agencies and that cooperation has been very, very profitable and very pleasant. There has been no evidence of this so-called bureaucracy we read of in the papers at all. Everything has been thoroughly cooperative and the state laws have all been kept. So as far as I am concerned in the State of Utah, I know nothing about this claim that the newspapers make of bureaucracy. In fact, I think the bureaucrat is a job that someone has that a guy on the outside doesn't have and wants to get. Our association with the Bureau of Reclamation, the U.S.G.S. and all the agencies have been very pleasant.

Now, Mr. Larson, have you or anyone in your group anything to say?

MR. LARSON: No.

COM. WATSON: The Chairman will call upon the Commissioners so I will now turn the meeting over to the Chairmen of the Commission.

THE CHAIRMAN: On behalf of the Commission the Chairman extends thanks to each and every one of you that has appeared here today and for the contributions that you have made in the way of suggestions. I want to compliment those who have spoken on the brevity and yet to-the-point remarks. These meetings seem to become more interesting the farther we go. Tom, we are expecting great things at Farmington.

Before I call on the Commissioners to make a few remarks I want to refer to the matter of feasibility of projects which was brought up here today by several speakers and very well explained by Mr. Larson. It is a very difficult thing today to say what is a feasible project. Your Chairman is speaking now as an individual and not as Federal Representative or even as Chairman. But costs have risen on these projects and I am wondering if there is a project that is feasible at all under the present Reclamation laws in the Colorado River Basin.

So it would seem that if you expect to have development in the Colorado River Basin it will be necessary for complete unanimity and agreement and to secure something like the authorization and approval that was obtained in connection with the Missouri Basin development on which Commissioner Stone,

Commissioner Bishop, and my legal adviser, Jeff Will--and I would like to have him stand up at this time (Mr. Will stands)--worked with me in securing authorization. I think we are all rather proud of our accomplishments on that but it took great effort and great work and a united front, and the Missouri Basin was authorized as a result of that.

The fundamental principle of reclamation was kept in that authorization in that the farmers are required to pay what they are able to pay.

That is a special authorization and in my humble opinion you will not get these great developments on the Colorado until this Compact is consummated and until you can present a united front for concurrent construction in these various states. You will all have to be agreed on it and go forward together.

At this time the Chairman wishes to call on Commissioner Carson of Arizona to make any remarks that he wishes to make.

COM. CARSON: Mr. Chairman, gentlemen, I think that I should explain, perhaps, briefly why Arizona is represented on this Upper Colorado River Basin Compact Commission. You have thought of Arizona always as a Lower Basin State, which is our primary interest. But we also under the definition of the Upper Colorado River Basin made by the Colorado River Compact are an Upper Basin State.

We have some 6600 square miles of Arizona which is in the Upper Basin so that in the apportionment of the Upper Basin water, that 6600 square miles is entitled to a share. It will not require much water for that. Most of it is on the Indian reservation and our engineers say that it is not possible to divert water from the San Juan River or the main stream of the Colorado back up onto that Indian reservation land. So that it will share in any compact negotiated only to the extent of the water that falls on it which cannot be used in any other Upper Basin State, which will be small in quantity; and there will be a very small quantity from the Paria River and that will be the extent of our participation in the water of the Upper Basin.

But now on account of some other remarks that were made I would like to speak briefly for Arizona as a Lower Basin State. Arizona is a part of the Lower Basin. The division of water of the Colorado River system between the Upper Basin and Lower Basin is made by the Colorado River Compact. Arizona is a party to that Compact and Arizona respects her commitments and agreements, and Arizona does not now or at any time in the future intend to infringe in any way upon the water of the Upper Basin which we have agreed that you may beneficially consume. We are not a party to any of the California attempt to block any development in the Upper Basin or to claim any part of the Upper Basin water. We are in fact ourselves in a fight with California in our attempt to utilize our share of the water apportioned to the Lower Basin, which California is apparently determined to block if possible.

So our battle is not with the Upper Basin at all. We have agreed with the Upper Basin as to their use and as to our use in the Lower Basin, but we do have a battle with certain California interests who propose, apparently, to block our effort to use our share of the Lower Basin water, and I believe also to block any effort of the Upper Basin to use its share of the Colorado River water.

It seems to me that insofar as that situation is concerned, we and the Upper Basin have a common interest to promote the development of the use of water in the Upper Basin which is apportioned to the Upper Basin and that part of the water of the Lower Basin which by California Limitation Act is effectively apportioned to the State of Arizona.

In approaching the Upper Colorado River Basin Compact I want you to know that I, and I think all of these Commissioners, realize fully the tremendous task and responsibility which we are undertaking. We are approaching it as carefully and as painstakingly as possible because we know that the thing that we do must be ratified by the legislatures of the various states and when and if so ratified will affect the development and progress of every state of the Colorado River Basin for many years to come. So we want to be careful. We want to be as careful as we know and as fair as we know.

The function of the Commission, however, is merely to apportion water between states as states. It cannot apportion water between projects within states. As I view it when the apportionment is made and becomes effective, then the state law will take charge of the share of the state water and will govern its utilization and administration. Thank you. (Applause.)

THE CHAIRMAN: Commissioner Bishop, do you have a few remarks to make?

COM. BISHOP: Yes, Mr. Chairman, I might make a few remarks. Ordinarily I come last on account of "W" being the last letter of the group. I appreciate being called on ahead of my turn.

First, ladies and gentlemen, I want to say that I am glad to be with you and I am glad to go to these meetings and listen to the problems of the people of the other states. Your problems in all of the other states are much the same as our problem. In Wyoming we have over a million acres of land that can be irrigated from the Colorado River. More than half of that land is desirable, irrigable land. We too have great industrial possibilities and we need lots of water. We probably need more water than our equitable share. I realize that is one of the problems this Commission has got to solve. I for one am glad to sit in and help to solve that problem. I know it is a difficult problem to solve. The record of yesterday shows concerning matters that I wished to go in the record and I will not go as far today as I did yesterday.

Regardless of the basis used by this Commission for dividing this water, we believe our needs will be fairly considered. As I stated yesterday at Grand Junction, I hope to see this Commission go ahead and complete the negotiations and not wait for completion of the work of the Engineer Committee. Regardless of the accuracy of their work it is agreed by most of us that their findings will not be used as a basis for division of the water; it will merely be a factor among its considerations.

I will conclude by saying that I believe in all of the states the supplemental needs in the Basin should come first in the Basin--I want to stress that. This is a matter to be considered in each state and is of no concern to the Commission once the water is divided; but as a member of the Commission I pledge first consideration to these supplemental needs whenever called to my attention. I thank you. (Applause.)

THE CHAIRMAN: Commissioner Stone of Colorado.

COM. STONE: Mr. Chairman, ladies and gentlemen, the principal purpose of our appearing here today is to obtain the views of those who are primarily and directly interested in the utilization of the Colorado River waters. It is therefore a privilege and a pleasure to come and meet and hear so many speak and so many explain the great need of and their interest in the development of the Colorado River.

I enjoy always coming to Utah where you have an outstanding citizen, not only of Utah but of the entire Colorado River Basin, a man who for many years, ever since the Colorado River Compact, has worked not alone for Utah--although he has done a good job there--but for the interests of the Colorado River Basin and particularly for the interests of the Upper Basin. I refer to our good friend, William R. Wallace. (Applause.)

I had not known personally another gentleman in Utah but perhaps he does not know how well we know of his work in Colorado. Some of it was almost pioneering work in developing some of the details of water utilization. We had the pleasure of meeting him this morning, Dr. Widtsoe, and we were so glad to have him with us. (Applause.)

Here today, as is perfectly natural, we have heard much about the apportionment among the states of that block of water which was allocated to the Upper Basin by the Colorado River Compact. That allocation to us for beneficial consumptive use carried with it an obligation and, if you please, it was an obligation under a solemn compact. I refer to the obligation of making deliveries from the Upper Basin of water at Lee Ferry. That must indicate to you clearly that difficult as the tasks may be for this Commission to allocate water, it becomes even more difficult when we must determine the respective obligations of these four states of the Upper Division to meet our requirements under the Colorado River Compact at Lee Ferry.

We became signatory to that Compact and I believe that I speak for all of the states when I say that we mean to carry out the agreements which we made under the Compact. If we make a compact here--and I sincerely trust that we shall--then it must be a compact which will be not only ratified by the states but one which the states will sincerely as sovereign states carry out after it is ratified and approved by Congress. We cannot emphasize too much in approaching and carrying out the job we have assigned to us, the importance of determining the just and equitable obligations of these states which are placed upon us under the Colorado River Compact. When we think of the benefits through allocation of the waters we cannot in this Commission forget the obligations.

Some of the other speakers have emphasized this point but I wish to touch upon it briefly, namely, the primary obligation in making allocations to the respective states of the Upper Basin. Our job is tough enough in determining what is equitable and fair so far as each state is concerned. I might say that we should thank God that we don't have to determine the internal problems within each state. That is the job which you of Utah and which we of Colorado must determine ourselves when we know how much water constitutes our share of the Colorado River.

We heard some remarks here today about transmountain diversions. That too is your problem. I might only remark that we have the same problem in Colorado. However, we have established in Colorado by common agreement a definite formula upon which we believe transmountain diversion can be carried out and without injury to the basin from which the water is taken. It is the established policy in Colorado that no water shall be taken from the natural basin for exportation to another basin except that we protect in such exportation the present and the prospective uses, if you please, within the basin. Where there is additional water supplies over and above what can be used beneficially within the basin, then we believe that to the extent that it is within the state's equitable share, we would rather use it without the basin in Colorado than permit it to flow down the river for the use of some other state. In that way only can we accomplish the use of all of our share of the water.

Just one other question: You were presented here an explanation of

of the work of the Engineer Committee. For one I deem that of extreme importance. It has been said here today, and in other meetings, that those pioneers who wrote the Colorado River Compact did not have as much information as we have today. It has been intimated perhaps the compact would have been different as approved by the states if that information were available. Likewise it has been said here today that we are more fortunate, we have more studies, we have more data, we should do a better job. However, we shall be derelict in our duty if we do not make full use of that data through the engineering committee which the Commission has set up. We may even breed trouble in the future unless in determining the allocations we have the basic data not only available but fully understood and analyzed.

It has also been my observation in making other compacts that in working out the basic data, in appraising the physical facts, we resolve amicably many questions which otherwise would lead to controversy. It is just like anything else, no man wants to proceed and speak with respect to the rights and interest of his neighbor or a neighbor state unless he knows whereof he speaks; particularly is that true when we are looking so far into the future.

I think it was so well brought out here that we have a common interest. These five states constitute an empire. We must grow together. We must develop together. Likewise we must be fair and fully recognize each other's interest in making an equitable apportionment. That word "equitable" is the important thing. Sometimes we call upon the courts to determine "equitable apportionment." Here we are attempting to do it as has been done in other cases, by amicable relations and the working out of amicable adjustments, and determine just what is equitable. It is easy to use the term but it is not so easy to apply it.

But we must keep in mind that we have a common interest and if we show our capacity to take care of our common interests, to that extent we retain some of those rights for which as states we have been fighting for so many years. We cannot enjoy those rights without assuming at the same time the obligation of showing that we can use those rights and exercise them in an equitable and fair way on interstate streams.

It has been mentioned here that this compact must be ratified. That cannot be too fully emphasized. The Commission does not make a compact. It is engaged in negotiating a compact. That compact is made by our respective legislatures when they ratify it and even then it must be approved by Congress. If we proceed cautiously, if we can go before our legislatures and sustain our action by the facts, if we proceed with a full knowledge of the far-reaching effect of what we do, then I think we have a reasonable chance of obtaining ratification by our several legislatures. That is the democratic way, That is the way by which our people through the legislatures appraise our work; and a careless job I fear will not be appreciated. We should proceed cautiously and we want to do a fair and equitable job.

I assure you that within those limits the State of Colorado will attempt to expedite the making of a compact. (Applause.)

THE CHAIRMAN: Commissioner McClure of New Mexico.

COM. McCLURE: Mr. Chairman, ladies and gentlemen, I don't believe there is much I can add to what has been said by Com. Carson and Judge Stone. I think we all fully realize the problems that we are going to have to meet in these negotiations.

The only thing I wish to do is to thank the people of Price and the various counties who have appeared here. Their observations and views in regard to their various projects have given us a better viewpoint from which we can realize each state's needs, which will help us in arriving at an equitable allocation of these waters, which is our duty. I believe that is all. Thank you. (Applause.)

THE CHAIRMAN: Commissioner Watson, as you gave such an interesting historical recital and conducted this meeting so ably, I will not impose upon you by requesting any further remarks unless you wish to make them.

COM. WATSON: Thank you very much.

THE CHAIRMAN: Now you all realize that this Commission has a tremendous job, but your Chairman is very happy to say that we feel we can work the matter out.

Your Chairman is not a complete stranger to Utah. In fact, there is one man here that I think I have known longer than I have any of you. Consulting Engineer Jarvis and I were in the University together and I always looked upon him with great admiration and respect because as I recall he was the honor man of our class. I am very happy that we are going to have his assistance in working out this problem.

Another man, Dr. Widtsoe, I think I have known for about twenty-two years, and I knew of him before that by reading his articles and his books. I am very happy to have Dr. Widtsoe here today. We have kept up our acquaintance from time to time. He used to visit the Commissioner of Reclamation in Washington and I was always happy to see him.

Mr. Wallace is another old acquaintance of mine and I have known of his works longer than I have known him; but the longer I have known him the more I have admired him for his wisdom and his counsel.

With that same spirit of cooperation in all of these states and with the best technical help and experience I am sure that this can be worked out. Your Chairman realizes it is a tremendous job as well as anyone else. The President appointed me Federal Representative in July 1946. That was after I had retired from the position of Commissioner of Reclamation and I had made up my mind I was through with Government work. I didn't want anything more to do with it, I thought. But when Commissioner Straus called me up on the telephone one day and said the President was thinking about making the appointment and wanted to know if I would accept it, I just couldn't resist it because I thought here was an opportunity to render a real public service.

I have followed this reclamation work for about forty years and I am thoroughly sold on the benefits of reclamation. I assure you that I am going to do all I can to ride herd on the Commissioners, crowd them along, help them if I can, and work out the job in a thorough, fair manner.

I don't know if there is any further business to come before the meeting today. If anything has been overlooked we will be glad to have our attention called to it. (No response.)

If not, a motion for adjournment is in order.

COM. STONE: I so move.

COM. WATSON: Second the motion.

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If not, a motion for adjournment is in order.

COM. STONE: I so move.

COM. WATSON: Second the motion.

THE CHAIRMAN: It has been moved and seconded that we adjourn.

(Thereupon a vote was taken and the motion of Com. Stone carried mously.)

(5:35 p.m., October 31, 1946, Price, Utah, meeting adjourned to a.m., November 2, 1946, at Farmington, New Mexico.)

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Official Record of Meeting No. 3

Executive Session Held at

8:00 a.m.

November 2, 1946

at

City Hall

Farmington,

New Mexico

APPEARANCES

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Membership as listed at Rock Springs, Wyoming, Session (page 1)

Chairman, Acting Secretary, and all Commissioners present except Thomas M. McClure, Commissioner for the State of New Mexico, Commissioner McClure appearing by Fred E. Wilson

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ADVISERS

TO THE CHAIRMAN:

J. G. Will — Assistant Chief Counsel, Bureau of Reclamation, Washington, D. C.

J. Stuart McMaster — Counsel, Bureau of Reclamation, Salt Lake City, Utah.

TO THE COMMISSIONER FOR COLORADO:

Jean S. Breitenstein — Attorney for Colorado Water Conservation Board, 718 Symes Bldg., Denver, Colorado.

TO THE COMMISSIONER FOR WYOMING:

Emil C. Gradert — Compact Commissioner, Fort Bridger, Wyoming.

EXECUTIVE SESSION AT FARMINGTON, NEW MEXICO
SATURDAY, NOVEMBER 2, 1946

The meeting was called to order by Chairman Bashore at 8:00 a.m., and discussion was had off the record.

COM. STONE: Mr. Chairman, I move that the Commission create a Legal Advisory Committee consisting of one member designated by the Commissioner for each signatory state and one designated by the Federal Representative; that Charles A. Carson, the Commissioner for Arizona, be the member for Arizona and the Chairman of the Committee; and that the Legal Advisory Committee be authorized and directed to make studies respecting the necessary clauses of the compact now being negotiated and all legal questions that may be referred to it by the Commission.

COM. WATSON: Second the motion.

THE CHAIRMAN: Any discussion? (No response.)
Whereupon a vote was taken and the motion of Com. Stone carried unanimously.)

THE CHAIRMAN: Com. Stone, will you designate the Legal Adviser for Colorado?

COM. STONE: Jean S. Breitenstein for Colorado.

THE CHAIRMAN: Com. Bishop?

COM. BISHOP: Louis J. O'Marr for Wyoming.

THE CHAIRMAN: Com. Watson?

COM. WATSON: Mr. Chairman, I would like to take this matter under consideration and report at an early date to Mr. Carson, the Chairman of the Legal Advisory Committee, and to the Secretary of the Upper Colorado River Basin Compact Commission the name of the Legal Adviser to the Commissioner for Utah.

THE CHAIRMAN: It is the understanding of the Chair that the Commissioner for New Mexico desires to confer further with his prospective appointee to the Legal Advisory Committee and after so doing will notify the Chairman of the Legal Advisory Committee and the Secretary of the Commission.

The Chairman suggests that Mr. Carson, the Chairman of the Legal Advisory Committee, correspond directly with Mr. Will, the Assistant Chief Counsel of the Bureau of Reclamation, who will see to it that a Legal Adviser of the Federal Representative will participate in such studies.

Is there anything further?

COM. WATSON: Move we adjourn.

THE CHAIRMAN: Do I hear a second?

COM. STONE: Second.

THE CHAIRMAN: Any discussion of the motion? (No response.)
Whereupon a vote was taken and the motion of Com. Watson carried unanimously.)

(9:40 a.m., November 2, 1946, meeting adjourned to 10:00 a.m., November 2, 1946, at the Masonic Hall, Farmington, New Mexico.)

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Official Record of Meeting No. 3

Session Held

10:00 o'clock a.m.

November 2, 1946

at

Masonic Hall

Farmington

New Mexico

APPEARANCES
UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Membership as listed at Rock
Springs, Wyoming, Session
(Page 1)

Chairman, Acting Secretary, and all Commissioners present except Thomas M. McClure, Commissioner for the State of New Mexico; Commissioner McClure appearing by Fred E. Wilson, Special Assistant Attorney General and Attorney for New Mexico Interstate Stream Commission, Albuquerque, New Mexico.

COLORADO:

Jean S. Breitenstein	Attorney for Colorado Water Conservation Board, 718 Symes Bldg., Denver, Colorado.
D. W. Sexton	Secretary, S. W. Water Conservation District, Durango, Colorado.
J. R. Williams	Deputy State Engineer, Durango, Colorado.
Archie B. Toner	Southwestern Water Conservation District, 1407 South College, Fort Collins, Colorado.

NEW MEXICO:

I. J. Coury	N.M. Interstate Streams Commission, Farmington, N. M.
Ed H. Foster	New Mexico Reclamation Director, Farmington, N. M.
A. J. Neff	Farmington, New Mexico.
Paul B. Palmer	Hammond Project and Navajo Indian Rights, Farmington, N. M.
Wm. P. Longhurst	Hammond Project, Farmington, N. M.
Lui Casazza	Animas Project, Farmington, N. M.
N. H. Knight	Farmington, N. M.
J. R. Cunningham	Farmington, N. M.
Orval Ricketts	Press, Farmington, N. M.
Joe B. Christy	S. C. S., Farmington, N. M.
Mather M. Fakes	LaPlata Conservancy District, Farmington, N. M.
Robert L. Maddox	Natural Gas Producer, Aztec, N. M.
Johnston Jeffries	Attorney, Aztec, N. M.
C. A. Ransom	Retired Real Estate Dealer, Aztec, N. M.
Joe Mangum	Hammond Project, Bloomfield, N. M.
M. L. Feverino	Bloomfield Irrigation District, Bloomfield, N. M.
John C. Bergin	Bloomfield, N. M.
Dave A. Martin	Secretary, Bloomfield Irrigation District, Bloomfield, N. M.
N. W. Strand	La Plata, N. M.
A. H. Greenwood	La Plata, N. M.
John E. Harris, Jr.	La Plata, N. M.
W. Carlos Powell	La Plata Conservancy District, Santa Fe, N. M.
H. F. Thatcher	Farmington Lions Club, Farmington, N. M.

UTAH:	
William R. Wallace	Pres., Utah Water Users Ass'n., Salt Lake City, Utah.
Thos. W. Jensen	Utah Water Users Ass'n., Mt. Pleasant, Utah.
C. S. Jarvis	C. E. with State Engineer's Office, Salt Lake City, Utah.
WYOMING:	
E. C. Gradert	Assistant Compact Commissioner, Fort Bridger, Wyoming.
BUREAU OF RECLAMATION:	
J. G. Will	Assistant Chief Counsel, Washington, D. C.
J. R. Riter	Chief, Hydrology Division, Denver, Colorado.
N. B. Bennett, Jr.	Branch of Project Planning, Washington, D. C.
E. O. Larson	Regional Director, Region 4, Salt Lake City, Utah.
A. A. Batson	Acting Regional Director, Region 7, Denver, Colorado.
A. N. Thompson	Assist. Regional Director, Region 5, Amarillo, Texas.
J. Stuart McMaster	Counsel, Region 4, Salt Lake City, Utah.
John J. Hedderman	Durango, Colorado.
A. I. Gabardi	Durango, Colorado.
F. A. Anesi	Durango, Colorado.
R. C. Brown	Monte Vista, Colorado.
D. M. Forester	Monte Vista, Colorado.
John L. Mutz	Albuquerque, N. M.
U. S. GEOLOGICAL SURVEY:	
Berkeley Johnson	Santa Fe, N. M.

SESSION AT FARMINGTON, NEW MEXICO
SATURDAY, NOVEMBER 2, 1946

The meeting was called to order by Chairman Bashore at 10:10 a.m., Saturday, November 2, 1946.

THE CHAIRMAN: The meeting will now come to order. It is now ten minutes after ten and we would like to proceed with the work of the Commission.

At the Santa Fe meeting, Meeting No. 2, of the Upper Colorado River Basin Compact Commission, the Commissioners decided that in connection with the next meeting, Meeting No. 3, there should be held a series of field hearings or meetings within the Upper Colorado River Basin States, one meeting to be held in each state. The Commission has held three meetings, one at Rock Springs, one at Grand Junction, one at Price, Utah, and this is the fourth meeting, and so far as the Chairman is aware, it will be the last field meeting to be held by the Commission.

This field meeting is first and last and primarily to give the people that are interested in the development of the Upper Basin an opportunity to have their say, to give the Commission any advice that they may feel should be given and to furnish any information that they think would be valuable. And so if you don't take part in these meetings, it's your own fault; you are afforded the opportunity. Any remarks that you make will be welcomed by the Commission because we are here to learn the wishes of the people. I don't know of any better way to do it than to just go right out in the field and hear what the people have to say.

The Commission is working as expeditiously as possible. This morning the Commission decided to put the lawyers to work. So far it has been all engineers getting data together and the lawyers have had a relatively easy time. But the Commission decided this morning that it would put the legal advisers to work so that no time would be lost in the negotiations in the formulation of the Compact.

Following the procedure that has been followed at the other meetings, the Chairman desires to turn the meeting over to the gentleman who is this morning acting for Commissioner McClure from New Mexico. We now call on Judge Fred E. Wilson to take charge of this meeting. Judge Wilson is better acquainted with you folks than I am, some of you at least, and he will call on you and we hope you will feel free to say whatever you have to say. We don't expect finished orations. Express what you have to say in your own language and it will be welcome. Judge Wilson.

JUDGE FRED E. WILSON: Mr. Chairman, Members of the Upper Colorado River Basin Compact Commission, and gentlemen: At the request of the Chairman of the Commission and also at the request of Mr. McClure, Commissioner from New Mexico, I have agreed to act as chairman of this meeting. As all of you know, I assume, Mr. McClure is in Farmington quite ill in the hospital and can't be here today.

The Chairman has made a very clear statement to you as to the purpose the Commission had in mind in calling these field meetings within the Basin. As he explained to you, the first meeting was held at Rock Springs, Wyoming, last Monday; followed by a meeting at Grand Junction, Colorado, Wednesday; and a meeting at Price, Utah, Thursday; and this is the last of the series the Commission decided to hold in the field.

I think that the people of New Mexico and of San Juan County in particular, appreciate the fact that the Commission decided to hold these

meetings. As stated by the Chairman, the Commission desires to hear first-hand from some of the citizens of New Mexico and San Juan County just what your interests are in the San Juan River, and to make whatever suggestions you may have on your mind as to the solution of the problems of an equitable allocation of the use of the water among the five states.

I am not going to take much time but briefly I want to say that as most of you gentlemen know, our rights to participate in any allocation of the waters of the Colorado River system are based upon the Colorado River Compact which was signed in Santa Fe in 1922. In that Compact there was an allocation made as between the states of the Lower Basin and the states of the Upper Basin.

Roughly, there were 7,500,000 acre feet per annum allocated to the Upper Basin and 7,500,000 acre feet allocated to the Lower Basin with the right of the Lower Basin to appropriate an additional million acre feet later. In other words, they contemplated and understood and believed at the time that there were about 16,000,000 acre feet of water to be dealt with, and that a quantity of water of 7,500,000 acre feet per annum could be divided equitably among the Upper Basin States.

As stated last night, the State of Arizona, although a Lower Basin State, participates in these negotiations because it has an interest in a portion of the Upper Basin along the northern part of the State of Arizona where the San Juan flows out of New Mexico. Under the same circumstances, New Mexico and Utah are both Upper and Lower Basin States. New Mexico has an interest in the allocation made to the Lower Basin on account of the Gila and its tributaries; and Utah on account of the Virgin River.

There are many problems involved in making this allocation--it is no easy matter. But it is a job that must be done and under the leadership of Chairman Bashore an earnest and sincere effort is being made to arrive at a conclusion at the earliest possible time.

Now, of course, New Mexico is vitally interested in whatever allocation may be made. If an allocation is made, this Commission doesn't make it finally. The members of this Commission will come to some conclusion as to their opinion of what a fair and equitable allocation among the four states and Arizona is. They will put that in the form of a compact and it will be submitted to the legislatures of each of the five states, and it will not become effective as an agreement binding upon the states until each legislature has ratified it, the governors have approved it, and Congress has also approved it. So there will be ample time for any people who are interested to inform themselves as to the provisions of any compact or agreement that may be reached and it will be our problem then. If the Commission thinks that they have arrived at an equitable apportionment, the people in New Mexico, in San Juan County, will be informed and you in turn, if satisfied, will have to inform the Legislature. If you are dissatisfied, you will make your objections to it. So it has quite a road to travel.

So far as Mr. McClure is concerned, I am sure his purpose and object has been to join in these negotiations in good faith and expedite them as much as possible. However, he has had in mind that if a permanent compact is made and the division and allocation is made to last in perpetuity, it's a matter we must approach with a great deal of care and thought and consideration and not agree upon until we know all the basic facts. And with that attitude, we are thoroughly willing to cooperate and arrive at a conclusion at the earliest date possible.

Now just another word or two: Most of you have seen the report that has been made by the Bureau of Reclamation on the Colorado River. It has been variously referred to as an inventory of projects or a report or a plan of development. We appreciate very much the splendid work the Bureau has done in making this study of the Colorado River and we appreciate the value of that report. But this Commission itself will not be bound by any suggested allocation of water that is contained in that report although the facts set out in the report will be, I am sure, carefully considered by the Commission. I say that because if a permanent compact is to be negotiated at a very early date, we in New Mexico are entitled, I believe, to consider not only our present uses of water but our potential uses. And so far as the facts in the report the Bureau of Reclamation has put out affect New Mexico, they are incomplete.

I feel that Mr. McClure and I or anybody representing New Mexico would be derelict in his duty if he just agreed to an allocation that didn't fully consider the full potential possibilities for the use of the waters of the Colorado River in the State of New Mexico.

I believe it is unnecessary to go further. As the Chairman said, he wants you gentlemen here to talk and express your own ideas, primarily going to the point of an allocation of the water among the four states. But also if you desire, I am sure the Commission would like to hear any description you may desire to make of the projects you have in your own mind, how you think water can be used in San Juan County and New Mexico, and what our future dreams and ambitions are. And when you have done that, I am sure that we have done all that we can do and we appreciate the opportunity to do that.

Now I would like to introduce Mr. I. J. Coury, who is a member of the New Mexico Interstate Streams Commission, a man who has attended many meetings in the Colorado River Basin States where water problems have been discussed and a man who has always been zealous in advocating and contending for the rights of San Juan County particularly and the rights of the State of New Mexico in general. Mr. Coury, will you take charge of the meeting and call on various individuals whom you have in mind?

MR. I. J. COURY, FARMINGTON, NEW MEXICO: Thank you, Mr. Wilson. Mr. Chairman, Members of the Commission, I guess probably to start this meeting off it may be well to have Mr. Hedderman, the Area Engineer of the Bureau of Reclamation at Durango, briefly give us a report on what his findings have been up to date, and after we hear from him, we will carry it on from there. Mr. Hedderman, will you give us a report on your findings?

MR. JOHN J. HEDDERMAN, BUREAU OF RECLAMATION, DURANGO, COLORADO: Mr. Chairman and Members of the Commission and friends, we have been working quite some time on the various projects in the San Juan Basin, which of course involves New Mexico and Colorado. About April, or the latter part of April, this year, we started surveys on what you folks call the South San Juan Project. We started field surveys from the vicinity of Dulce. That would be a canal line or conduit running toward Cuba, which would service the area south from Bloomfield to Cuba. We have a survey party working in that vicinity. We have one working in the vicinity of Cuba toward the other party.

We also have been classifying the lands south from Bloomfield in the vicinity and we have covered since about the middle of May up to date, about 400 sections or some 250,000 acres of land. We hope to finish that classification of that area by mid-December if the weather holds out. Until such time as we have that work finished and have the canal surveyed, we can't do much more on the project or tell you anything about what may develop.

Now you folks know that we have completed a report on the La Plata units of the Animas-La Plata Project. The La Plata units, as you know, are one in Colorado and one in New Mexico; and that involves, of the first unit, some 3500 acres in New Mexico and about 10,000 acres in Colorado. The Animas-La Plata Project as a whole consists of about seven units totalling some 110,000 acres, of which about half lies in New Mexico and half in Colorado.

We have completed the report on the Hammond Project, which lies up the River here between Farmington and Bloomfield; and that would involve the development of about 3700 acres.

We have been working quite some time on a water supply study of the entire San Juan River Basin. The preliminary report on those studies was completed just prior to October 15th and that was submitted to our Regional Office. Now that report will be the basis of our determining the available water for these several projects that I have mentioned and of course for the surplus waters in this Basin.

The Pine River Project involves some lands in New Mexico on the Pine River along the San Juan River in the vicinity of Arboles. There is not a great acreage in that but it is involved in that project and they are included. The lands in New Mexico are included in our Pine River report.

Also involved in the studies in the Basin is what we call the Dulce-Chama-Navajo Project, and that involves lands in Colorado and New Mexico. There are approximately 15,000 acres in that project of which about 12,000 acres lie in the State of New Mexico. We haven't done any actual field surveys on that project as yet because we had to defer that until such time as we completed this basin water supply study that I just mentioned.

Except for the Shiprock Project, which we have done some preliminary work on, which involved in our studies about 70,000 acres, and I believe now the Indian Service is continuing that investigation, I think that's all the work that we are doing now in this area.

If there are any questions I would be glad to try to answer them.

MR. COURY: Thank you, Mr. Headerman. Would anyone like to ask Mr. Headerman any questions? If you have any questions now is the time to ask them. (No response.)

COM. BISHOP: I would like to ask how much water you propose to consume if these projects for New Mexico are completed; how much will be the ultimate consumption for New Mexico? Can you tell me that?

MR. HEDDERMAN: No, we couldn't tell you that. We are investigating these various projects and their potentialities. Of course that will be up to the State of New Mexico to determine or say which projects they wish to have constructed if they are constructed, and of course those various projects will have to fall within the water allocated to the State.

COM. BISHOP: The Commission ought to know something about the needs-

MR. HEDDERMAN: How is that?

COM. BISHOP: The Commission would like to know about the needs of the State. We really haven't very much on New Mexico and the Commission would like to know about the needs for New Mexico in order to be fair in the allocation of the water to New Mexico.

JUDGE WILSON: That is what some of these other gentlemen will tell you, Mr. Bishop. We need all the water we can get. There are so many places to put it.

MR. HEDDERMAN: Now this development to the south of Bloomfield known as the South San Juan Project, that project would be limited by available water, not by available lands.

MR. J. R. RITER, BUREAU OF RECLAMATION, DENVER, COLORADO: Mr. Chairman, I wonder if Mr. Bishop's question couldn't be answered by referring to the Colorado River Basin Report of the Bureau which shows for New Mexico an estimated consumption in the Basin of 450,000 acre feet.

MR. WILLIAM R. WALLACE, SALT LAKE CITY, UTAH: Does that include the Indians?

MR. RITER: That includes the Indians.

JUDGE WILSON: Does that include the possible transmountain diversion?

MR. RITER: That is the water that would be consumed in the Basin through the development of the potential projects as listed in the Basin Report.

JUDGE WILSON: But you don't purport to say, Mr. Riter, that there are not other potential possibilities for use of water in New Mexico--

MR. RITER: No.

JUDGE WILSON: --in addition to the ones the Bureau has already reported on?

MR. RITER: Mr. Wilson, I think it would be foolish for me to say there are not other possibilities. The history of development in the Colorado River Basin indicates every time we take a look at it we raise our sights. You will recall back in 1922 we had a report then which indicated the Upper Basin could not use consumptively anywhere near 7,500,000 acre feet. Now the version as of 1946 indicates the Upper Basin could use if it had the water, 9,100,000 acre feet.

JUDGE WILSON: But the point I am making is that under your present tests of feasibility, these are all the projects you have studied. But looking toward the future, there may be a change in the feasibility formula and there might be other land that water could be taken to which we think now would be unfeasible. Perhaps the future might disclose that ten, twenty, fifty years from now, other projects might be feasible.

In other words, there is a vast development here in this area of natural gas. This may be one of the greatest gas producing areas in the world. It is conceivable that with a great deal of cheap gas we might put in pumping projects that would make water available which may be absolutely unfeasible now.

Those are things I want to let the Commission know, that we are not limiting ourselves to the amount of water that has been mentioned in the Bureau of Reclamation Report.

COM. BISHOP: According to the parties that have been studying that, Fred, it takes more water than is available now. It looks like we pretty near have to stay within the ones already studied in the allocation or we aren't going to get any place.

JUDGE WILSON: That is true, but we want all the possibilities considered, and then the state itself will determine where the water is to be used. I imagine a good many of the states have projects mentioned, described, and inventoried where they know they are not going to build them all.

COM. BISHOP: We have a million acres in Wyoming we would like to irrigate. We realize we don't have enough water.

MR. COURY: I don't know what chart Mr. Riter referred to--450,000 acre feet. He is either looking at the wrong chart or all the projects are not listed because on the inventoried projects we have 70,000 at Shiprock; 25,500 on the Monument Rock; 12,000 in the McDermott Glade; outside of the South San Juan, the San Juan-Chama diversion; outside of the 50,000 acres in irrigation now and the supplemental water for the present land and what additional land can be placed under irrigation; and you total that acreage up and multiply by four acre feet to the acre and you will exceed a million acre feet of water. So I think the chart Mr. Riter is looking at--

MR. E. O. LARSON, BUREAU OF RECLAMATION, SALT LAKE CITY, UTAH: I think the question was asked how much water could the State of New Mexico use and Mr. Riter came back and mentioned 450,000 acre feet.

MR. COURY: That isn't diversion depletions.

MR. RITER: It may be I misunderstood the question. If I understood the question properly it was: How much will the depletion be for the projects Mr. Hedderman has described? I referred to page 169 of the Report which refers to in-basin depletions only 450,000 acre feet. That doesn't show what the potential transmountain diversion will be. That is a problem to be studied, Mr. Coury.

And there is another thing to bear in mind also: You take the South San Juan and the San Juan-Chama; you can't use water on both projects, they are competitive. In other words, they both derive the source from the same stream. You either turn it in this way and use it on the South San Juan or you have the alternative of taking it across the Divide and using it in the San Juan-Chama. Those two projects are directly competitive because they both derive the water supply from the same source.

JUDGE WILSON: May the record show that while those two projects are competitive at the present time in that the water comes from the same source and it can't be used on both projects, still there is a possibility that if the water should be taken through the transmountain diversion this other land might be watered in the future from some other source if the water were available.

MR. RITER: If water were available, yes.

THE CHAIRMAN: I don't know whether your question has been answered to your satisfaction or not. There must be a distinction made between the consumption of water and water applied. Your calculations were made, I think, on the basis of how much you would have to apply to that and Mr. Riter attempted to say that what he was talking about was the depletion after the water had been applied. In other words, you might be required to apply five acre feet to an acre of land but the depletion would be maybe as low as a foot and a half or even lower, that is, the consumptive use.

And I hope you will all bear in mind the difference between the amount of water that you are applying and the amount of water you are consuming in certain areas.

COM. BISHOP: Mr. Chairman, my question was to get at what was the ultimate consumptive use by the whole set-up. I don't care about the details. That is what I have in mind.

MR. RITER: For the benefit of Tom McClure I would like to put one statement in the record. I know Mr. McClure has taken issue with our unit rates of depletion. I know if he were here he would say we have underestimated it and want that matter reviewed. If you will permit me I would like to put that in the record for Mr. McClure.

MR. COURY: I believe that we have with us a man who has given one of the potential projects in San Juan Basin quite a bit of thought and spent quite a lot of time on it, Mr. Paul B. Palmer. Will you give us a few words on the Hammond Project in San Juan County?

MR. PAUL B. PALMER, FARMINGTON, NEW MEXICO: Mr. Chairman, Commissioners, and gentlemen: It has been a good many years since I have had this project you might say "under my thumb" and the war has intervened and a lot of water has gone down this river since. The Hammond Project Mr. Hedderman touched on and perhaps has been mentioned too before I came in. I don't know what went on before but briefly, the old Hammond Project was settled prior to 1900 by members of the L. D. S. Church. It was called the colonization program, and from various reasons in which you are not interested, perhaps, the project was ultimately abandoned.

However, before it was abandoned it was one of the most progressive little communities in the county. And there were, so to speak, good engineering reasons why it was a failure. Those engineering problems would not be looked upon nowadays as so important and would not hold us back probably as they did fifty years ago.

The acreage estimates that we did have on the Hammond Project are considerably higher than Mr. Hedderman gave you but I take it he classes it as A-1 land. As a matter of fact, there is probably double that amount of land that we simple country people know is good land because while it may go back through seepage or something of that type, our dairymen find in this country you can grow clover and some of the finest production on this so-called no good land. That has been our experience particularly in the past few years, the land that the Government doesn't think is worth a dollar an acre, we find some of our highest production is made from it by turning it into crops that will be produced on lands that are full of salt and alkalies.

However, the Hammond Project is not entirely dead and there are a few people living over there. Some of them are pumping on it and they are trying to revive the thing and have been for some years. At one time, in fact if the war had not intervened, it is very probable that the Hammond Project would have been fully underway today, but when that came along and Reclamation took it over for analysis, the other project was given up.

Our office did secure land applications on the Hammond and at one time we had applications there that if they had all been approved and accepted would have been enough to settle fifteen or twenty thousand acres of land. We still have all of those applications on file. I don't know how many of them will still be interested.

I don't know exactly what the present acre cost of the new surveys show, but briefly speaking, the Hammond Project covers land that is very similar to what you see here in our valley. It has a nice slope. It is on the south side of the San Juan. It is a little bit higher than Farmington in altitude. The west end of it is approximately three and a half or four miles above

here just across the San Juan River and it extends up from there a distance of approximately twenty miles.

As I recall, the canal would be 25 to 30 miles in length depending on the location of it and how far down they came and where they took out their heading. The land has a gentle slope in most instances. A good deal of it is covered with sagebrush and we know that is an indication of great fertility in our western area. This land at one time had some of the best producing orchards that the county has ever seen. Some of the finest apples were raised up there 35 years ago that the county has ever seen. In other words, the land is good, the water is there, and it is potentially a very fine project and should be put through.

The Indian Department at one time was very desirous of buying this land and settling the Navajo Indians upon it. The white settlers felt that if they did so it would in effect divide the county completely and leave to the white settlers only that land north of the Animas and San Juan Rivers and all south of there would become permanently Indian land. Consequently that design was blocked in 1935 and since that time the Indian Department has not become interested again in buying it for the Indians so far as I know, not that they wouldn't like to but they did give it up.

I don't know that anything more is wanted on that Hammond Project. I think it will suffice to say that the land is fertile, the slope is good, the climate is as good as this is or similar and there can be no question about the feasibility of the projects in my opinion. However, while I am here, with the permission of the Chairman I would like to mention another matter that I am very vitally concerned with and I think all of us are or at least we should be.

Next to my opinion of politics, the Navajo Indian situation in the State of New Mexico and Arizona, and to some extent in Utah and Colorado, is probably the biggest of our national disgraces. We have approximately 60,000 Navajo Indians who used to claim the area where we white people now live and have our homes. They used to live and roam through about 40,000,000 of these acres, and when our fathers came out here they saw fit to push them back as we have been doing for centuries; and we gave them or let them--tolerated perhaps would be better--on land on which it is very difficult for them to make a living. As I say, they once roamed on this area clear over into Colorado, clear over to Albuquerque, clear west to Flagstaff, and north to the southern most and eastern most part of Utah. And the land or the major portion of where this water runoff goes through was all Navajo Indian land.

Today those are the most backward in a way of the peoples of the earth. About 90 percent of them are illiterate. The Government has presumed to educate them for 75 years and yet approximately 90 percent of them can't speak the English language or read and write. It is deplorable to see the condition in which most of them live. We get big headlines in our newspapers about troubles in China and Tibet and faraway lands, but if these farmers would come into the Navajo country they would find conditions that are just as amazing and certainly more appalling.

The point I want to make is that these people at least morally have a very high claim upon the waters of the San Juan, Animas, and La Plata Rivers, and therefore the waters of the Colorado. It is true they haven't been officially used, a great deal of it. It is also true that where they have had ditches built, the Navajo has become a good farmer as he has become a good stockman. Some of the finest wheat, melons, potatoes, and all of the commodities that we raise in this area are raised a little bit west of us by the Navajo Indians on the Navajo Reservation. Many of them become

adept farmers and are, strange enough, making a living on ten acres of land where our white men would starve to death. If they had had larger acreages they would farm it comparatively speaking to that much better advantage.

Now these Navajo Indians have approximately 16,000,000 acres south and west of here in the four states. How much of that could be irrigated I don't know, but the Bureau of Reclamation has some figures on that and so does the Indian Department. For years I have been and still am a critic of the administration of Indian affairs. It has been my observation that the Indian Bureau as a whole--not speaking as individuals but as a whole--have had in mind the protection of their jobs rather than the welfare of the Navajos. That is true in a lot of other bureaus but particularly of the Indian Bureau. And consequently, these white men have been diligent in seeing that they got a job tomorrow rather than that the Navajo had something to live on tomorrow.

Therefore, as a private citizen, however representing a large group if not the largest group of Navajo Indians in a private capacity, I feel perfectly at liberty to speak for them because I do represent the largest Navajo organization that was ever organized and it is in existence and operating in a way very successfully. These Navajo Indians have few spokesmen of their own. They have few collegemen of their own. They have few leaders of their own, and I do presume to speak for them in that capacity because they are not very able to take that burden upon themselves, perhaps I am not either. But I would like to put it into the record that there is claim that the United States Government, the people of these states whether they are white or Indian, should give their moral support to these Indian people and that water should be saved for them.

They have as fine land as we have if it has the water. As I said, they were given the worst of the land because our forefathers considered that water could not be gotten to it and it couldn't have been under the old system; but with modern conveniences, modern machinery, it can be gotten to the Indian land, especially with storage dams. And we can rehabilitate the largest tribe of Indians that is in existence in America today, the Navajo tribe.

They are the largest tribe. They are the most rapidly increasing tribe, and yet they, as I said, are the most backward and most illiterate. However, up to 1930 they were the only self-supporting Indian tribe in the United States, and that has been one result of their great independence and also their ability to change their condition from that of a nomad to a very good stockman and from a stockman to a farmer, which they have been able to do and adapt themselves in a few years.

So I think that we should consider their claims that they have thousands of acres of ground out there and that there are fifty or sixty thousand of those people today, and ten years at the same rate of progress there will be at least 75,000 of them, and as I say there are 16,000,000 acres of those lands and a good many of those acres of land can be irrigated and cultivated successfully. A good deal of that lies in the State of Arizona and about half or a little more of that population is in the State of Arizona. I care not whether that allocation is made in New Mexico or Arizona or both. Some of it I think can be made in Colorado and Utah for their benefit also as they reside in both of those states.

I think we should look at their problem more from the standpoint of our group of states rather than to divide and take away from just one or two. For instance, if New Mexico is entitled to so many acre feet of water, I think the claims of the Navajo Indians should possibly be in excess of that, and the same thing is true of Arizona and the other states where these people reside, because they in a way are still under the Federal Government and they should be looked upon as a joint problem of at least the four states where they live.

Now as surely as that is done and these people are given a means of livelihood they will be amalgamated into our civilization and assimilated and they will take their place shoulder to shoulder with our white people. And you will find they are just as good citizens as any of us when they have the opportunity presented to them. We have declared them to be citizens of the United States by the Act of Congress of 1924. On the one hand we give them liberty and all the rights and privileges of citizenship and on the other hand we snatch the rights all away and leave them the obligations of citizenship. Approximately 3500 of their men were in the services of their country and they don't vote.

There are a lot of things. There are a lot of things I could tell you about why the Navajo Indian situation is a national disgrace. It is also a disgrace to the State of New Mexico and to the State of Arizona in particular. But something should be done by this body to recognize the rights of these people and to do something about it. I am not telling you what to do but I think something should be done and we should recognize that these people have some rights because they were here a long time before we were here. Thank you. (Applause.)

JUDGE WILSON: I would like to call on Mr. Orval Ricketts to make a statement. I am not trying to confine you. You may make a general statement about the situation as you see it, Mr. Ricketts.

MR. ORVAL RICKETTS, FARMINGTON, NEW MEXICO: Mr. Chairman, I got here late. I don't know where you have gone up to here. You might confine me to something definite.

JUDGE WILSON: Just talk about San Juan County and New Mexico and your water aspirations and your need for water.

MR. RICKETTS: As a newspaper man, I am not accustomed to speaking extemporaneously on a subject as vast as this; but I could perhaps give you some idea that would probably be coherent or backed up on statistics just on a moment's notice.

I have lived in the county going on forty years now. Most of that time I have been engaged in the newspaper business. As I related at the meeting last evening, my first impression of the value of irrigation and the possibilities of irrigation development came as a boy who was raised in the Mississippi River Valley where irrigation, of course, was unknown. We came out here and I first worked on a ranch here, and of course the talk was of the productive value of our soil in this country where water could be beneficially applied. And as I learned later, the first ditches in this country were taken out by squatters.

At one time this was Indian Reservation, and back I believe on July 4, 1876, by Congressional Act, the land was opened for homesteading. However, at that time there had been no surveys made and so the original settlers merely came in and took up what they called squatters' rights. They knew they would eventually be entitled to 160 acres and they surveyed in their crude way their small farmsteads along the lower valleys and the beginning of your irrigation came from individual ditches.

A man would take up a lower bench along the valley and go a mile or two above and attempt to build his own ditch, and put a few acres under cultivation. Then as time went on neighbors below would extend the ditch as more squatters would come along. I believe it was not until 1880, four years after it was opened, that the first reconnaissance survey was made by the United States official land department. So these ditches have sprung up that way, first irrigating the lower levels and then they would take out

ditches that were longer in length to irrigate the higher level as I think in our Animas Valley here we have three, possibly four, benches; and as time would go on, these ditches have been built to cover the higher levels.

As you heard Mr. Palmer state, the value of our land and productive ability are excellent. But back in that early day, the general dream was that south of the San Juan River there was a great area of land that was subject to reclamation by water from the San Juan River. As I read to you last evening, this was dramatized and brought to early day attention, about the turn of the century, by a young engineer by the name of Mr. Jay Turley, who had been employed by the Territory of New Mexico to do some engineering work for it. It was a matter of several years' work--he was grub-staked as he went--and then when he presented his bill for his full services, the Territory found it did not have money sufficient to pay their engineer so they made him a proposition that they would offer him the use of the waters of the San Juan River in payment for his services. He finally accepted that proposition.

He didn't question the right of the Territory to so allocate the waters of the stream, took it for granted that that was within their right. So he spent then a number of years, in fact the greater part of his life after that, attempting to organize land companies, private land companies--that was in the days before the Reclamation Bureau--to place this land under cultivation, thereby hoping to recover financially his debt from the Territory for the services rendered.

The early day news stories about that as we find in our old files envisions an empire, such as he claimed, a million acres that he thought could be beneficially irrigated, and I think he had not one but several eastern groups interested in financing his project, but for one reason or another they fell down at the last moment.

I was interested last evening in the discussion of the matter by Fred Wilson of our State, attorney for the Interstate Streams Commission, whose law partner, the late Richard Hanna, was one of the men who had assisted Turley in his project. It was recounted at one time that he was offered I think a certain sum per acre for his rights in this water and in the project that would have netted him a very handsom profit, but he thought if it was worth that much to those fellows it was worth twice that much for future use and so he turned that down.

As I understand it, what I have to say here is more in the nature of the dreams and aspirations of our development rather than the engineering details which the Reclamation Bureau's duty is to take care of so ably. This is kind of a sketchy background.

Mr. Turley's estimate of a million acres was evidently not made by a minute survey but wholesale, I imagine, by looking at the map and taking in the area which he proposed to irrigate and including all that land within that area as being irrigable. Under our present Reclamation Bureau survey which was started this summer, a careful study is being made of these lands. It seems that there are several possible levels to be considered and each higher level entails a greater cost, of course. And so they are making this study as will be a matter of record, and then we will have some accurate information.

At this time I believe we are unable to say that we would ask this new commission for water sufficient to irrigate a stated number of acres because we are not familiar with what is possible or what is practical or what is feasible. That is, as we feel, purely an engineering detail. We don't wish to come to you and say we would like to have 500,000 acres irrigated until such time that we know there are that number of acres that could be beneficially irrigated and would be an economic project. So we have gone a long ways from

Turley's dream of a million acres to the present day.

We wish to be reasonable. We know there is only this 7,500,000 acre feet to be divided among the four Upper States. As yet we are not acquainted with the means or methods by which this will be divided. I don't think that we are going to ask for any lion's share of this water. But when our surveys are completed and we can sit around a table and say we have so many acres here that can be reclaimed beneficially, we should like that of course to be considered.

We should touch probably a little on the Indian situation. Mr. Palmer has gone into the Indian situation as a whole; I should like to touch on the Indian situation as it applies merely to San Juan County.

As you know, roughly speaking there are 18,000 inhabitants of our county. Practically half of those are Navajo Indians. Now we look upon the Navajo Indian not necessarily as a problem, not necessarily as a ward of the Government. But to us the Navajo is a friend and a neighbor.

We have been living among Navajos these many years and Mr. Palmer has told you of their economic condition and he is correct in what he has stated. They are an underprivileged people. In the few projects in the county the Government has prepared for them they have proved to be very excellent farmers, those who care to. Of course they are fundamentally a stock-raising people and even with the small farms they like to raise some livestock, even on these small areas. But we look upon the Navajo as a potential farmer and as a neighbor. We also look upon the Navajo as a fellow citizen.

In discussing this South San Juan Project, we realize that any great project over there would probably be at least half within Navajo Reservations, in Navajo lands. That question has come up in higher circles. You men who have attended water meetings have probably heard that there was some disposition of saying the Navajo was not to be considered in reclamation; but to we people who are his neighbor--as I said both friend and neighbor and a fellow citizen--he should be considered equally in reclamation projects with his white brother.

So in a county where half of our population is Navajo we feel that anything that can benefit his economic status will benefit the entire community. So we have that friendly feeling and that should be a matter of record. And in discussing this south side project, in the future when you come to grips with it from your engineers' reports, I should like to present at least one community sentiment, that the Navajo be considered not as a report, not as a paper proposition, but as a part of the whole scheme. He is a resident here along with the rest of us and whatever will help him will help us and we want no line of demarcation drawn between what benefits the Navajo and what benefits the white man. I wouldn't say that is possibly the prevailing sentiment, it is a strong sentiment, and I think the day will come when it will be the prevailing sentiment.

The Indian Department through the Bureau of Reclamation has certain programs, and I take it, Mr. Wilson, we will hear from the Indian Bureau in this hearing?

JUDGE WILSON: I had hoped some of them would be here.

MR. RICKETTS: --and they will tell you of the 70,000 acres that are now outlined as possible irrigation on the Navajo and an additional 25,000 north of the South San Juan that will benefit your Navajo people. I want you men to feel in the final discussion and the final allocation that

We wish this would be handled with the projects beneficial to the human beings who live in this section regardless of their color or race.

I would like to call your attention to another possibility in speaking of reclamation on either side of the San Juan River. A week ago yesterday the Southern Union Production Company on Parker Dome, which is just this side of the Colorado State Line about fifteen miles northwest of Farmington, brought in the fourth deep testing well. It was not the largest brought in; the largest was 120,000,000 cubic feet daily production. This well proved to be 40,000,000 cubic feet daily production. But the interesting part is it proved a third and as yet unknown producing sand. They have 14 producing wells in the shell sands but they have these four deep test wells and the officials made this statement publicly this week that they have changed their position from that of being worried if there would be gas production enough to supply the State of New Mexico, which has worried them the last fifteen years, to a point now where they are looking for a market for gas, and they feel there is a great unexplored gas field in this region.

That means if we are going to have a surplus of gas, gas is economical for pumping purposes and instead of building long canals it may be the reclamation engineers will find that many areas heretofore considered not feasible for reclamation can be economically furnished with water through pumping systems. That is something for the future. But the point I am trying to bring out is that in any allocation of water at this time I doubt whether we of this county would feel like signing away in perpetuity any water rights at the immediate time because there are so many unknown factors and so many future potential factors involved in our consideration of this water problem.

I feel a little bit at loss here to know how to proceed. I don't want to take in the whole territory here because we have worked with the Bureau of Reclamation at Durango and they have a number of projects which have been completed, that is, the preliminary surveys have been completed, and they of course should go into this record.

But I might close by saying that we of this section, while we possibly have more potential lands than there will be water available, wish in the final analysis to abide by the reports of the Reclamation Bureau engineers, in whom we have every confidence, and when they have made their reports complete and we have access to them, we are willing to sit around a table with our neighbors in Colorado and the other Basin States and to abide by any reasonable decision that these men can arrive at. But that must be done on the basis of intelligent knowledge and not merely based on the dreams we have had in these past many years.

COM. WATSON: May I ask one question? What is the depth of both the shallow and deep production?

MR. RICKETTS: The shallow is in the shell sands with a thousand and fourteen to sixteen to two thousand feet--this varies somewhat; and the deep tests that were brought in were this third sand, that they brought in Friday. They went through, of course, three sands in this deep test well, which was down to 9400 feet but they went back and cut it off to 8600 which was where this third producing sand is now being developed.

MR. A. J. NEFF, FARMINGTON, NEW MEXICO: I would like to have Mr. Mecham's statement read stating the reason he didn't go ahead with his proposition here, if I could get somebody to read it.

MR. COURY: It would be quite lengthy to read.

MR. NEFF: We have been listening to a lot of lengthy discussions

here. I would like to have that read here.

MR. COURY: We would like to have it read for you before the day is through but we have a program set and we will try to get to it this afternoon if we can.

MR. NEFF: I would like to make a statement on this Colorado and New Mexico Compact. If I am not out of order I would like to make a statement here about how this compact was brought out, how it was brought before the legislatures and the governors of the states.

In 1906 I bought a place on the La Plata and settled there. At that time we had the first rights, all the water in the La Plata River. All north of the line there in Colorado was Indian land and hadn't been thrown open for settlement. About the time I came here, I think, just a year before, they threw that land open to settlement, that reservation. Well, the settlers took up that land and went to using the water.

Now the first two years I was here they hadn't taken any of the water, Colorado hadn't. I cut 600, over 600 tons of hay for two years on my place and had the first rights to the water. It was allocated according to priority in New Mexico.

Well, they commenced to taking all the water. We objected and demanded that we had a right to that water, first right to it, but they paid no attention. And they kept taking our water, taking up land and taking our water until 1918 we didn't get a drop of water on my place where in 1906 I cut 600, over 600 tons of hay over the place. In 1918 we didn't get a drop of water out of the River. I cut four tons and a half of hay and that's all I got off my place and the reason I got that there came a rain in July and the water settled in the low places and I got to cut that much hay.

We knew we had to do something or get off the River. So we held a meeting and a committee was appointed and we would go to Durango and see a lawyer there and see what we could do about it. Mr. Hatfield and Toy and myself were appointed to that committee. We went up to Durango and we went in to Mr. Perkins' office. He helped adjudicate the water in New Mexico about 1901. We went in there to see him and told him what we wanted. He took the statute books of Colorado and turned to a place there that said all the water that originated in the State of Colorado belongs to the state. He turned over a few pages and it said water cannot be impounded in the State of Colorado to be used outside of the state. Those laws are still on the statute books of Colorado as far as I know--never heard of them being repealed.

Well, we knew we didn't have money enough to fight the State of Colorado. We came down and appointed a man to go over to Santa Fe and see if we couldn't get help from the State of New Mexico to fight that proposition. We appointed Mr. Retiras. He went over to Santa Fe and stated the case to them and the legislature voted $10,000 and the Governor authorized Stephen P. Davis to take our case to the United States Courts. Well, it took him a little time to collect data, you know, to start a suit on, and about the time that he got ready to start suit, the Chambers of Commerce of Aztec and Farmington began to holler, "Compromise! Compromise!"

They took that out of our hands and they compromised it and we couldn't do a thing up there on the La Plata. We didn't want to compromise it. We had the right to that water. But they compromised it, the two Chambers of Commerce of Aztec and Farmington. They didn't have a bit of interest in that La Plata but they engineered that. They had more influence in Santa Fe and they got that compromise and we got this compact and they

have been trying ever since to break that compact and beat us out of what little water we got under the compact.

Now as I understand it they recognized that Colorado had some right here to that water. They couldn't compromise anything unless they recognized that Colorado had some interest in that water. They have been trying now to build a reservoir up there and whenever they do they will break this compact. When they got the compact, the people up there stopped it when they sent our water down here. We sent a man to Santa Fe to find out what they would do about it, they wouldn't turn it down. The Governor appointed a committee, made an appropriation and appointed a committee and went up to Denver to see what Colorado was going to do about that compact. They went up and they told them they didn't--

JUDGE WILSON: Mr. Neff, pardon me just a moment, please. This is very interesting and we want everybody to have an opportunity to say anything they want to say, but this is just a little bit off the point that the Commission desires to hear information on. It is very interesting and we would be very glad to let you talk later in the day. There are a few men that have to talk this morning.

MR. NEFF: I don't want to take up any of your time. I want to state the position of us people up there on the La Plata on this reclamation business.

JUDGE WILSON: We will be glad to have you state it.

MR. COURY: I would like to have a few words stated by the man who has given a good many years of his life to water problems in San Juan County, one of the main factors who began the proceedings for the adjudication of water in San Juan County. He followed this very closely and I would like to hear a few remarks from Mr. Ed Foster, President of the San Juan Reclamation Association.

MR. ED H. FOSTER, FARMINGTON, NEW MEXICO: Chairman Bashore, Members of the Commission and their assistants: I have been, I think, in five different meetings with you folks and I know it is very tiresome, very boresome, and not a hard thing for you to do. You men put in a lot of hard work and I am not going to bore you with a long talk. But I am going to go in as near as I can to the starting, as you got some of that that has gone on through the different men that have talked already, and just state to you the beginning of the irrigation here, bring it up pretty much to the present time. But I would like to state for the information of those folks within our county who are here to listen and get information--that is what we have been primarily interested in and the reason for myself and others of the county going to your annual meetings and getting informed.

I find that that is the only way that these problems both interstate and national can be solved. We mustn't look at these from a selfish standpoint. And I would like to say to these men of the county that I have sat in the meeting of five different annual reclamation meetings where everyone of those faces within this Commission as well as others that are sitting amongst you here attended. And I find clear from your Government employees on down to members of your Reclamation Association those men are vitally interested in solving these water and land problems on a long drawn out, farsighted plan.

You Government men, Mr. Redderman, Mr. Larson, of our district here, have been very faithful. They are conscientious. These men on your Commission are the same. Everyone of them I find are men who know their business. They have made a study of it throughout their lifetime and in my opinion that is the only way to get the positive facts before you folks, in the form of surveys and records. When we have those I don't think you will find anyone any

better to get along with in those divisions than San Juan County.

And I want to give our county the benefit of knowing these men. I would like to meet them personally. You will find them all mighty fine people and I found this that I would like to state also along this line. This doesn't divide any water nor does it divide any land nor does it put any water on it but it does give you an idea in my opinion what we should have, and I know we will all appreciate that we have got men on here that we have got faith in, men who we have a great leaning toward getting our problems properly settled. They don't do as we do in a great many cases because the ordinary layman cannot do engineering work. He cannot do attorney work. If you folks would hear these folks sometimes, the attorneys and the engineers seem to differ a little; but I notice when they get together there is harmony amongst them. They try to solve those problems.

Another thing I have noticed about them, we all like to get out in politics. Right now it is a little bad, but in all my experience I have never heard one word of a political nature expressed by those men. They do not know state lines. Their surveys and conditions as they find them are just as they are and not according to one state or another. I must say that about our friend, Mr. Hedderman, who is the one probably closest, and Mr. Nielsen, outside of our State Engineer's office, that I have talked to them repeatedly and in no case can anyone as far as I have been in their company say that they have ever mentioned anything regarding politics in the state. They take it as they find it.

And we can rest assured that when these reports and your compact is set up by these men, it will be I am satisfied a very impartial one, not a short-time set-up--it will be a long-time set-up, and as far as trying to tell them what they must do, I don't think we should do that. We have got our projects. We are going to have them surveyed. We are going to have reports on them and I am glad to report--I don't know right now just who said it but it was said officially that instead of it being sometime in the fall perhaps of 1947 the earliest time that these reports could be submitted, I was informed last night that they were in hopes of having these reports finished by the middle of December of 1946, which is just good news to us.

We are assured that with these men taking the evidence as they will of the four states, the five states--excuse me, Mr. Arizona--those reports will be in and we will be able to get all of our projects into the report before there is any final decision made on allocations of water, perhaps divisions of water to the five states. As to our projects, I will quit and let these men go.

But I would like to say back in '77, as has been told you, the first settlers came into this district and along from that time on until the '80's I have been told that these men started irrigation. They found the lower lands of course easily watered by ditch. They were men who came in here and had to succeed by the sweat of their brow. They found the same lands on the bottoms that you will find today on your mesas. Of course all cheaper projects at the present time are irrigated. Those men worked diligently from year to year and up until sometime in the 1900's they were still building ditches, putting more land under cultivation. At that time we never thought anything about a shortage of water, division of water, or anything of the kind, but they have gone ahead and those lands are valuable lands.

We have created a neighborhood here that we feel proud of. We have a county as well as our adjoining state--I am not going to bar them--we have a neighborhood here that I believe is as friendly and as cooperative, and one that wants to live and let live. As you heard them speak, the Indian comes into the picture. They can possibly be taken care of but we still have

Mark land, we have more projects. Most of those projects have been brought out and I will not dwell on them because that is an engineer and attorney feat and those reports will be properly brought to us and I see no reason for taking up your time on that.

But I would like to merely dwell in concluding on the fact of our trying to get those reports, then getting together and making our decisions. There isn't any question somebody has got to drop--in fact all--some projects. When those are made, I would like to see them go right on as they have and allow us to go into those meetings, set up the projects which we believe are the most worthy, and give you our ideas of setting up the program that will finally be followed and no doubt to the satisfaction of this county.

On the diversion, I am satisfied it has got to be in the picture. There are certain things which have brought that into the picture very forcibly and I think when the engineering report is brought in it will be brought out. San Juan County and Colorado are interested. It will be brought out through them just what those conditions are.

As far as our wants are concerned, from all the meetings I have attended I am satisfied the Reclamation people feel that first you must take care of your immediate neighborhood, your immediate settlements. There is no inclination on the part of these engineers nor these commissions to try to upset a neighborhood. I found that out, that it isn't their intention to try to close a settlement that has been set up for years past. It is to help out and give that settlement a right to go ahead and state their cases as they see them. I feel that we have nothing to fear as far as we are concerned when we have projects that are feasible and projects that are in advance of others, or even on similar conditions. I feel that your Commission would study and weigh the situation very closely and probably bend over to give you your present projects in the condition they are now and extend them and build them up.

I think that is the intention of all of their reports, to make the burden so there is no injustice done to anyone. At present that will be all I have to say and I certainly thank you folks. (Applause.)

MR. COURY: At this time I would like to have an expression from Judge Mather Eakes.

MR. MATHER M. EAKES: Mr. Chairman, gentlemen, I shall detain you for just a very few minutes. I have not become closely acquainted or deeply informed about the question of water or water rights and water diversion, conservation or the reclamation projects that are before this group. Consequently it is not possible for me to say things that would be particularly informative.

I was called upon professionally not very long ago to organize and incorporate the La Plata Conservancy District. That was the topic really that I understood was assigned to me this morning and a very simple statement covers that. The La Plata Conservancy District has been incorporated and organized but it incorporates a potentiality of some ten to twelve thousand acres; that is, of course, irrigable land. Most of it is land that has been irrigated in the past. At the present time there are some 4000 acres under irrigation or there were at the time of the formation of this compact with Colorado. That compact from my information, the use, restricts us to 3800 acre feet.

Now that about covers the information with reference to that organization. It was incorporated not to do any particular thing at the present time. As I understand it the directors of that organization do not intend to take any positive action at this time. But it was primarily the placing of a group of people in that splendid farming and production area of the La Plata River Valley

in New Mexico in a position to meet contingencies as they might arise, and that organization is now legally in a position to contract with the United States Government regarding the useage of water if the Government should at any time construct the reservoir that has been contemplated and spoken about on the La Plata River and crossing the Line into Colorado.

I might state that it is not the purpose of this organization to abrogate or attempt to abrogate in the future the compact that exists, as I understand it the purpose of this organization to maintain that compact and the rights that now are obtained for them under that compact. If any effort is made or any development is projected that would in any way interfere with the operation of that compact, this organization is in a position to resist and I believe successfully such efforts that may be made.

Now having spoken of that let me say that generally the purpose of the people of San Juan Basin and New Mexico so far as I understand it is to conserve what they have and to conserve a sufficient quantity of water from these streams to enable them to make such development in the future as may be feasible. Hypothecating what I said in the statement that I made in the beginning that my information is not very extensive, I do think that as a citizen and an observer there is enough reclaimable land in the Valley of the San Juan River at the present time to use most of the water of that stream. It is not necessary for me then to enlarge on the statements that have been made by Mr. Palmer in his discussion here this morning and others and the statement that Mr. Foster has just made that there are projects all throughout and within the reach of irrigation from these streams that would take all the water that can be spared from it.

I am not an engineer and I know very little about engineering. I think I do know that engineering is not an exact science, especially when it comes to dealing with water and water rights any more than medical science is an exact science, any more than law is an exact science. We are dealing with things that are necessarily relevant in their nature and character.

Personally I am convinced that the waters of the San Juan Basin can be used in the San Juan Basin and should be so used. I am not in any sense disposed to fail to cooperate in every constructive move that is made for the development in any of this area by every other area that can use its own resources. I am deeply prejudiced--and I use that word "prejudice" advisedly even if it is a confession--I am deeply prejudiced against any move to take the water of one watershed into the realm of another watershed. I do not believe that there is a watershed area anywhere in the country where the water cannot be used within that watershed if it is properly developed. I mean, of course, a country where there are irrigable lands. There are some sections where that does not exist. But we in this area do not wish and I think we will not sign away our rights to the waters of these rivers unless and until we know that those waters cannot be beneficially used by reclamation projects and by every feasible method of development within that area and within that watershed.

We desire to have a backlog of resource for future development. This is a new country. I use that word "new" advisedly. It is true there have been settlers here for a long time but it has been unfortunately true that their ability and their resources for developing these lands has been limited. It is not sufficient to say, "We want to give you all the water you now use." The waters that are now being used are inadequate for the future. It is not sufficient to say, "After we have given you the water that you are now using we want to take the residue of those waters across the mountains into another area that needs it." We want to know and we would insist on knowing just exactly where we are at before we would consent to those things.

Another thing I wish to mention is this: You dry up the riverbed of these rivers and in my opinion you do an irreparable damage even to that that is now in use. "Oh," you say, "your ditches will be filled; we will give you the water you need for your ditches." Okay. But I still say when you dry up the riverbed you are tending to dry up the valley that is watered by those ditches and ultimately you tend to dry up the ditches themselves. You are dealing with a very delicate and difficult problem when you undertake to say how will divert the water of these streams across mountains into another area.

Now I don't wish to be understood as being in a belligerent frame of mind; I am not. You say engineers will tell us that these things will not dry up a riverbed, that there will still be ample water in that channel. Maybe so. I am open-minded. But I am from Missouri on that question. I have to be shown. And there are engineers and engineers. When you produce a half dozen engineers to testify one way it wouldn't be very difficult to get an equal number as these lawyers know to testify the other way, just as you would medical men, just as you would others. That is why I say these things are not an exact science.

Let's work these problems out harmoniously if possible. We all desire that. But I beg of this association to use every precaution to see that the needs and wants of the people of these valleys are met before anything rash is attempted.

By the way, it may be interesting to the members of the legal profession here present if I call attention to a provision that exists in the laws of the State of Oklahoma. I have never known it in any other state, but there is a statute in that state which provides that the common law is abrogated for the most part--I am not using the exact language--or that all laws shall be interpreted not strictly because they may be in derogation of the common law, but shall be interpreted liberally for the wants and needs of the people. That's been on the statute books of the State of Oklahoma for many, many years. It has never been interpreted or passed upon by the Supreme Court of that state. I think it is a marvelous provision. I think the courts of the state should face up to a proper interpretation of that phrase, that laws should be interpreted to meet the wants and needs of the people.

That is what we ask in this instance, not only in the interpretation of the law but in the administration of the law. And I feel perfectly confident that the members of this association and the Reclamation Association generally, the Reclamation Bureau generally, will find people in this area ready to cooperate to the fullest extent.

Mr. Foster's expressions here have been very interesting and gratifying. He is one of the most cooperative men I have ever known. He's at the head of this organization in this county. He is a broadminded man; the people in this county will probably follow his leadership and I do not mean anything I have said to be in contradiction to the position he has taken, simply that we might decide on the course of action we shall pursue before we relinquish that which we have.

MR. COURY: Seeing that the hour is almost noon, probably we will be breaking for lunch. Prior to recessing, with the permission of the Chairman it may be well at this point to give you some statistics. As I understand it, the Commission is very deeply interested in statistics, particularly in the area that they are visiting. This won't take but a few minutes.

In 1942 the Charles Ilfeld Company was sponsoring a series of broadcasts over Station KOB and Mr. Moulton, president of that corporation, requested that we compile statistical information concerning San Juan County.

Approximately a dozen men spent practically three weeks compiling the factual records.

At the outset I want to make this statement that the statistical records I am giving you on San Juan County for the year 1942 are very conservative. We all know and feel sure that the figures that I am going to quote you on San Juan County are very conservative.

We found that there are 54,091 acres of irrigated farm land in San Juan County. This is in 1942. The number of irrigated farms in San Juan County, Indian and non-Indian--that is both--total 2,683 farms.

The estimates on the livestock and others for 1942 were based on dollar estimates on 1941 prices.

We found that there was 8000 head of cattle shipped from San Juan County with a value of $400,000. There were 55,000 lambs shipped at a value of $375,000. There were a thousand horses and mules at $50,000, and 5,000 hogs at $140,000, which made the livestock industry of San Juan County a total of $965,000.

In the poultry division we found there were shipped or exported 25,000 chickens at a value of $15,750; 2,000 turkeys at a value of $8,000, totalling for the poultry division, $23,750.

Now in the livestock and poultry products, there were 49,200,000 lbs. of milk exported from this county to the outside with a value of $450,000. There were 400,000 dozen eggs at a value of $100,000; and 805,000 lbs. of wool at $300,000 making a total for livestock and poultry products of $850,000.

The farm products are strictly non-Indian. We had no way of determining what the value of the Indian products was and these figures as I stated are the figures on the products that were actually shipped outside the county.

There were 500,000 bushels of corn valued at $450,000. There were 35,000 bags of pinto beans valued at $175,000; 38,500 tons of alfalfa, $577,500; 36,000 bushels of wheat at $36,000; 110,000 bags of potatoes at $165,000; 40,000 bushels of oats and barley at a value of $50,000; 30,000 bags of onions at $45,000. And the truck crop that was shipped, we estimated at $75,000. There were 10,000 lbs. of honey valued at $3,000; which makes a total non-Indian farm products shipped from San Juan County in 1942, based on the 1941 prices, $1,576,500.

The fruit we placed in a different category since this is a great fruit country. There were 300,000 bushels of apples shipped at a value of $225,000. There were 40,000 bushels of peaches at $75,000; 6,000 bushels of apricots at $25,000; 250 tons of grapes at $10,000; and 30 tons of cherries at $4,500; making a total of the fruit, $339,500, and making the total of livestock, poultry, livestock and poultry products, farm products non-Indian, and fruit, $3,754,750.

There were 5,179,434 gallons of gasoline shipped from Farmington at a value of $300,000.

I would like to make one other remark. I was told by a person who had done quite a bit of investigating that the Department of Agriculture in 1901 in Washington printed a pamphlet and made the statement that the apples produced in the San Juan Basin in New Mexico were the highest quality and considered one of the finest apples in the United States.

The New Mexico Agricultural College at Las Cruces in 1944 gave this statistical figure: Of the apple orchard acreage in the State of New Mexico, 38 percent lies in San Juan County. That 38 percent produces 52 percent of the apples of the State of New Mexico and we have always felt and we strongly believe with our soil or the climate and other things pertinent that the San Juan Basin in New Mexico probably has no other equal. We don't mean that as a Chamber of Commerce talk, but you gentlemen should know. I believe you want to hear exactly what we feel and we don't say it in a bragging way. But when some trees produce as many as 75 and 80 boxes of apples to one tree, you certainly have good land, good climate, and good water.

JUDGE WILSON: We will turn the meeting back to the Chairman so he may adjourn if he wishes.

THE CHAIRMAN: It is now five minutes after twelve. We went to give everybody a chance to be heard. I think we might recess for lunch but I would like to get back here as promptly as possible after lunch. What time would be convenient? Can we get back at 1:15 or 1:30?

MR. COURY: Can everyone be back at 1:15?

(Assents.)

THE CHAIRMAN: Let's get back here, then, at 1:15.

(12:05 p.m. Recess for lunch.)

(1:15 p.m. Meeting resumed.)

THE CHAIRMAN: Judge, you and Mr. Coury may proceed. I believe the meeting is in the hands of Mr. Coury. Just go right ahead.

MR. COURY: Mr. Chairman, I would like at this time for Mr. Robert L. Maddox of Aztec to address the Commission. Mr. Maddox.

MR. ROBERT L. MADDOX, AZTEC, NEW MEXICO: Chairman Bashore, Members of the Commission, gentlemen: I will just take a few minutes of your time. I am going to be brief in trying to go over the situation in general. But I have been a resident of San Juan County for forty-six years and I came here when I was a very young child. When I was about 18 or 19 years of age during the summer months I worked on an irrigation project on the survey as chainman. I followed that line of work for a number of years; finally got up where I was a leveller, transfer, and I believe I have been on more section corners in San Juan County or as many as any other man in town. Consequently I am familiar with the County as a whole.

I have always been vitally interested in irrigation possibilities because I know from personal contact what this land will produce here when put under irrigation. And I am satisfied from my personal observation and from the technical data and information that I have obtained from various sources that if we put the land under water that is available here, there won't be any water left going down to the San Juan and Animas Rivers.

Another possibility that has developed here in recent years is this gas development. I am at present engaged in producing natural gas with a gas well. I know that one of the gas wells I have--I believe--would pump as far as fuel is concerned all the water that is in the San Juan River at a very nominal cost.

We had some experience over on the San Juan. One man had a pumping plant that was operating irrigating 200 acres at the cost of approximately

$25.00 per month for fuel.

I know the property south of San Juan. I know there is a million acres out there; I know there is not enough water for the million acres. Take the Las Animas La Plata Project with lands in New Mexico and Colorado there are approximately 125,000 acres taking the big project that covers the Navajo land on the south side of the San Juan. Therefore, as I say, that would utilize all the water that is available to us flowing down those rivers.

I think one gentleman here said that we didn't have a Navajo problem here, but I don't agree with him on that. I feel we do have a Navajo problem that we are eventually going to have to solve if we are going to give the Navajo Indians what they are justly entitled to. We have a good many of them out here. They live more or less, a large percentage of them which is a disgrace to this nation, on a verge of starvation. If we can put some of their land under irrigation they will be able to support themselves and become useful citizens. I think it is the duty of the United States Government to see that those Indian rights are protected because when given the opportunity they are very efficient as farmers as well as stockmen. They are able to support themselves on very small acreages, much smaller than is required by the white man.

We do not irrigate all the land that could be irrigated if the water was available because the carrying capacity is small on account of the state of the dams and headgates. The acreage in this county could be substantially increased and the apple, bean, and hog and sheep production would be substantially increased likewise. I think that is about all I have to say on the subject. (Applause.)

MR. COURY: At this time we have with us a farmer who in the past years has irrigated by pumping with gasoline driven engines and pumped with natural gas driven engines, and he tells me he has irrigated 200 acres at a cost of approximately $25.00 per month for five or six months of the year. At this time I would like to have Mr. Joe Mangum of Bloomfield make a few remarks on his experiences with pumping a 200 acre project farm that he has. Mr. Mangum.

MR. JOE MANGUM, BLOOMFIELD, NEW MEXICO: Mr. Chairman, ladies and gentlemen, Mr. Bashore: I have lived in this county for forty-one years, practically entirely on the same project we have been talking about here today. And in order to keep my water up, I have done some pumping and got quite well, managed to make a living. I find that the natural gas since it came along--I pumped some with gasoline engines before I used the natural gas--I find the natural gas very economical and I watered 200 acres there the first year with it. I think that it's going to prove to be one of the best projects that we have in the way of irrigation in this country.

During these forty-one years this fall that I have been there I have seen the River practically dry and during other times very low in which all the water would be out in the irrigating ditches at times, which means that we have no water to spare to anybody. If all the land in this county was under irrigation, we would just have to have some storage of some sort in some years. In other years we would have an abundance of water. But the river would get very low some years so that it has been in my time that all of the water in the river was in the irrigating ditches up and down the river. I think from the natural gas standpoint, the land is available and if taken care of by water, we have the finest climate and the finest production here that you have anywhere. I don't feel we have any water to spare. Thank you.

COM. BISHOP: Would you mind telling me how high you lift it?

MR. MANGUM: It is just 30 feet. If you men cross the Bloomfield bridge you will notice a little pumping plant right by the side of the bridge to the east is my pumping plant. That is the old bridge site.

COM. BISHOP: Would you mind telling us what kind of a pump and what kind of an engine you have?

MR. MANGUM: It is a Caterpillar 60 engine and a Palmer pump.

COM. BISHOP: What size?

MR. MANGUM: It's a 6 inch intake and 8 out, and pumps water--I will say that pump will throw plenty of water for 400 acres.

COM. WATSON: Do you buy the gas or do you produce it?

MR. MANGUM: I buy it.

COM. WATSON: How much do you pay a thousand for it?

MR. MANGUM: Well, I figured it out about 75 cents a thousand. It has raised considerable since then. I don't know just what it is at the present time.

COM. WATSON: Have you made figures or estimates to compare the cost of pumping with gasoline and natural gas so you are satisfied in your own mind the natural gas is cheaper?

MR. MANGUM: Yes, sir; there is no comparison it is just so much cheaper. I pumped with the gasoline on a 6 inch pump this year and it cost me around $300 for gasoline; and on that big Caterpillar 60 it cost me less than $200 with the natural gas. So it is very economical fuel.

MR. COURY: Mr. Watson, I believe you asked a question what the rate on the gas was?

COM. WATSON: Yes.

MR. COURY: I think Mr. Foster could also answer that; he is connected with the gas company.

MR. FOSTER: To clear the records there I would like to say that the rate we use and that Mr. Mangum used are 75 cents a thousand for the first two thousand or two and a quarter; 60 cents a thousand for the next two thousand; 25 cents a thousand for the next thirty-five thousand; and 15 cents a thousand all over that up to two million feet, with a 12-1/2 cent rate above the million.

THE CHAIRMAN: Will the reporter just see if we have it right? (The record was read.) There is just one question I wanted to ask on that: that pump-ing as I understand it is out of the River?

MR. MANGUM: Yes, sir.

THE CHAIRMAN: All right, thank you.

MR. COURY: I would like to call on Mr. Dave Martin, who is Secretary of the Bloomfield Irrigation District, which is one of the larger irrigation districts in the county. Mr. Dave Martin.

MR. DAVE A. MARTIN, BLOOMFIELD, NEW MEXICO: Mr. Chairman, gentlemen,

our irrigation district serves about 4,000 acres of irrigated land which comes from the San Juan River and we irrigate only from gravity flow, of course. And the statements heretofore made regarding production I think will apply probably as well to the Bloomfield Irrigation District as to any other comparable area in the county.

Our costs for maintenance are usually about $2.00 an acre for actual maintenance. We have had some other charges for deficiency and interest but have retired all of our bonded indebtedness and are now down to a point where our debt is very small and in another year or two we expect to have no charges except for maintenance.

Lying just above our ditch line on the north side of the San Juan River--our ditch, by the way, is taken out of the San Juan River about nine or ten miles above Blanco and is about 35 miles long. Naturally an engineer knows that is a lot of length for the area that we irrigate. However, outside the District there is perhaps a thousand acres of land that is served from the same heading from the same ditch line, but they are old established ditches above our original intake. We have moved up and taken in these other ditches and other lands but they are not included in the District so that we serve altogether about 5,000 acres of land.

Lying just north and above that ditch line there is quite a lot of land that would be susceptible to irrigation by pumping from our ditch. We would hope that in time, if the pumping business develops as we hope it will, a lot of that land could be serviced from our ditch line. In the same time there is a possibility that a higher line from storage on the San Juan would take care of those lands by direct gravity flow--perhaps not all of it. The ditch line might not be high enough to cover it all. But there are many thousands of acres of valuable land lying above the ditch line on the San Juan and Animas, lying between these two rivers that come together at Farmington, that would be susceptible to irrigation by pumping and that perhaps would not be served by gravity flow. I think that has been very well taken care of.

The matter of diversion of the water of the San Juan is very interesting to us of course. And in that connection there has been some talk of what has been termed compensatory storage. Some have thought that eventually since the question of diversion came up, the people of this county if storage were provided for one acre foot of water should be willing to give up one acre foot of water for use on the other side of the Divide by diversion or otherwise, and just personally I want to register an objection to that. This water comes from now, of course, that falls in Colorado--there is very little of this water that originates in New Mexico--but the snow falls in Colorado and we feel like the Lord put it there for the people of this side of the Divide. He put the snow there and the land here and there are people here to use it.

Mr. Wallace very eloquently spoke here last night of the opportunities of the children here. Well, that is the dream of the people here, develop this land for the children that are growing up here. The fathers and mothers that are working here don't want the children to have to leave this country and go somewhere else. They love it themselves and they expect their children to grow up here and find development and opportunity for themselves to develop and to achieve their destiny in San Juan County.

There is one other thing that I wish to speak of. It has been pretty well covered and at the risk of duplicating what some others have said I would like to perhaps add a little to what has been said about the Navajo Indian people. Those of us who live in New Mexico love New Mexico, but I don't believe there is a man here, New Mexican or otherwise, that

It well enough to take the place of the Navajo Indians and stay with it as they have, back about '78 or some such time, many, many years ago at any rate, they can moved those people out of this country, mostly, and took them over to Fort Sumner, and they were in concentration camps, let us say, for a couple of years or three. They were so dissatisfied and unhappy that they told the government that if they could be brought back here they would never make any more trouble and they would get along on this reservation. Well, we feel, or at least I do--perhaps I am not speaking for all--that it was implicit in the contract with those people--if not it should have been--that the water the Lord gave to this land should have been given to them with the land.

Now their country is saturated with people. They have come to the point where they can't progress and exist any longer on that little bit of land. As nomads they raise sheep and goats and maybe a few cattle, and some melons and corn and possibly a little bit of beans when the rain is sufficient and favorable, but they have a desperate way of getting along. If they are not provided for they are going to have to scatter over the country in order to exist and live and they are people that do not intermarry. They do not want to go away. They don't want to scatter. And if their land is irrigated and they are provided for in that way, those people in a number of generations will progress and become civilized and will take their places as good American citizens.

We look on them here as friends and neighbors but we do feel that there is a great moral question there to be taken care of, that it's more than a good neighbor policy. They are people that have been in this country hundreds of years before this country was discovered, before the first one of our forebears came to America. And I would just hope that eventually that great problem of a people who should be provided for will be considered by the Commission.

I know if you understood it and if you understand it at the time that it will commend itself to your hearts for a people that have lived and suffered and struggled and stayed with a country as long as they have, if they had an opportunity, which none but the Government can provide and should have perhaps long ago, no one else can provide it for them and they are really, surely, entitled to a break. Thank you.

MR. COURY: Gentlemen, I am going to ask a gentleman who doesn't belong to this area, he comes over from the Rio Grande side--I wonder if the Assistant Director from Region 5, Mr. Thompson would say a few words as to the needs of water on the other side of the Divide.

MR. A. H. THOMPSON, BUREAU OF RECLAMATION, AMARILLO, TEXAS: Mr. Chairman, Members of the Commission, ladies and gentlemen: For the record I am a representative of Region 5 who is charged with the responsibility of investigating the Rio Grande Basin, I want it understood that I cannot assume any of the responsibilities of these states in dividing the waters of the Colorado River Basin. Nor can I assume any of the responsibilities of the States and local interests in stating which projects might be constructed after the allocations are made.

I do want to point out, if I might, the Rio Grande Basin, extending in about this area (indicating on map), which embraces two of the Colorado River Compact States, the State of Colorado and the State of New Mexico. We have been studying this basin for several years and find that the economy, the livelihood of this basin is directly related to the three great resources, land, water, and people. We find since before the 16th century that the lands have been brought into production to the extent that practically all of the waters of the Rio Grande are now in use. We also find that additional supplies of that needed resource will have to come, if at all, from the Colorado River Basin. We know the population is going to grow. We know that growth and

maintaining an economic standard depends on water.

In addition to the Rio Grande I might add one more statement that should water come over to the Rio Grande through the San Juan-Chama diversion, it will permit backing water up over the Sangre de Cristo Divide, taking it to other parched lands in the area of Colfax and Mora counties in the Canadian River Basin above Conchas Reservoir. I want to present this statement to show what our needs are and if you care for any more details I would be glad to have you call on Mr. Forester, our project engineer at Monte Vista or Mr. Mutz, our area planning engineer at Albuquerque. Thank you.

MR. COURY: Is there anyone else here from San Juan County who would like to make a statement to the Commission before we turn the remainder of the afternoon over to our good friend from Durango? I want you to feel free. If there is anything on your mind, now is the time to state it; and in order to expedite things, instead of calling on you individually I would welcome having any of you take the floor now if you have any questions or if you have anything to say.

MR. A. J. NEFF, FARMINGTON, NEW MEXICO: I would like to have the letter of Mr. Turley before the convention and I would like to have it read.

JUDGE WILSON: Mr. Neff, do you have any more copies of that?

MR. NEFF: I can make one. I don't think I have any. I wouldn't say for sure. That is the original.

JUDGE WILSON: I am sure the Commission would be interested in reading the letter but it is so long that I don't believe we should read it to them but let them read it themselves. If you have another copy you can substitute a copy.

MR. NEFF: Well, I can make a copy.

JUDGE WILSON: Make a copy and mail it in to me or Mr. Coury and we will turn it over to the Secretary of the Commission and he will see to it that every member of the Commission reads it. But I don't believe we have time to have it read. It is eight or ten pages; it is very long. We will be very glad to file it with the Secretary of the Commission.

MR. NEFF: All right.

JUDGE WILSON: I will be glad to have you send me a copy.

MR. NEFF: Will you please give me your name? I didn't catch it.

JUDGE WILSON: Fred Wilson, Albuquerque, New Mexico.

COM. BISHOP: I would like to suggest that if he is going to have it typed he have a copy made for each state. That is five copies.

JUDGE WILSON: I don't know whether you want to go into that expense or not.

MR. NEFF: I don't care anything about that.

JUDGE WILSON: That is fine.

MR. NEFF: I consider it important that this letter be placed before this Commission.

article.

JUDGE WILSON: I am sure the Commission will be interested in your

MR. NEFF: I will have those copies made. Let me send them to you and let you distribute them.

JUDGE WILSON: Be very glad to.

MR. NEFF: All right.

MR. COURY: At this time I believe I will conclude that portion pertaining to the State of New Mexico. Since many of the projects in this part of the State are interlocked with the southwestern part of Colorado and we have a group present with us from that portion of that basin, I at this time will turn the meeting over to Mr. Dwight Sexton of Durango, Colorado, who will present their portion to the Commission. Mr. Sexton.

MR. D. W. SEXTON, DURANGO, COLORADO: Thank you, Mr. Coury. If you gentlemen will excuse me I will not try to stand. For the benefit of the record I am Dwight Sexton of Durango, Secretary-Treasurer of the Southwestern Colorado Water Conservation District, comprising the counties of western Montezuma, San Juan, La Plata, Archuleta, Hinsdale, San Miguel, Montezuma, and Dolores.

Gentlemen of the Commission, we are mighty happy to be here, as we always are, and participate in anything of a water nature in which we are so closely associated with New Mexico. We are just across the Line in Colorado, and as has been stated before, we grow the water up there that you people down here use.

We are vitally interested in a number of projects. I think the largest and most important to our entire San Juan Basin is the Animas-La Plata Project. That project, I believe, consists of some 110,000 acres and is approximately divided equally, 50 percent between Colorado and New Mexico. There may be just a little difference there. That project consists of some nine reservoirs starting at Howardsville above Silverton, Colorado, and extending clear through into New Mexico. We feel that is one project that must be underway. It should be a "must" on the reclamation list and it is a "must" as far as New Mexico and Colorado are concerned.

We next feel that the Pine River Extension is second in line. We have the Vallecito Reservoir already completed. We ask that the present canals and laterals be extended to cover some 50,000 additional acres. That also includes land in Colorado and New Mexico in which we are both vitally interested.

Then we have the project that is not so far along, on the Florida River. That river I believe would have no connection with New Mexico outside of where it empties into the Animas, which is entirely within the State of Colorado. That project would consist of some 20,000 acres over all--7,000 acres of additional land and including supplemental water for some 13,000 acres presently irrigated. In that also the City of Durango should have a vital interest in that future water supplies must come from the Florida River.

The Jackson Gulch or Mancos Project we want to just mention briefly in that it was started some few years ago with conscientious objector labor. At the close of the war this item of labor was discontinued and the project was put up for contract construction. Then the President's economy order came through and this project is at present frozen. It takes in some, I believe, a thousand acres of additional water for lands in that basin plus domestic water for Mesa Verde National Park. I think every effort is being made to blast that project out of the present freeze order. Just what luck we will have we don't

know. Those briefly are the items that we are interested in with our neighbor New Mexico.

We feel that we are against any diversion, either to another basin or transmountain, until such time as the Bureau has had ample time to make sufficient studies and prove that there is water available for the immediate basin. If they prove that, then we will talk to them about diversion intrabasin or otherwise.

We have in the eastern end of our District the counties of Hinsdale and Archuleta. We have a director present from Hinsdale County and I would like to call now upon Archie Toner, who will give you the ideas of Archuleta County in the eastern part of our District. Mr. Toner.

MR. ARCHIE B. TONER, FORT COLLINS, COLORADO: Mr. Chairman, Judge Wilson and Mr. Coury: Water becomes more vital to us every day. I wonder how many of you men ever experienced being in a town where you couldn't even buy a drink, you couldn't get a cup of coffee or you couldn't get water enough to shave by. I experienced that day before yesterday, spent a little over fifteen hours in that town and we couldn't get a drink of water.

Now that brings home very vividly to us just what water can mean to our town and to our farms. I think one of the first things that all of us who are interested in the waters of the Colorado River and the Upper Basin particularly should do would be to acquaint ourselves with the projects in the four Upper Basin States and including that part of Arizona which is considered in the Upper Basin. That is one of the main things. Now our Commissioners are fairly well informed on that and the rest of us should become more so. After this water is allocated we will all begin to discuss it, farmers and all of us, and trips through the upper reaches of the Colorado River would be wonderful vacations to any and all of us. There are many things to see up there, good land up in this part--I mean New Mexico and all of them. There are many wonderful things to see, reservoirs in construction, already constructed, and some of them in the process of engineering surveys being made.

Now we of the Southwestern Water Conservation District feel that we are vitally interested in the lower part of the San Juan Basin, that is, New Mexico and that part of Arizona because their problems are our problems. We are more or less isolated. We are isolated from our capitol city and our industrial area just the same as the people of San Juan County are isolated from theirs. I have a particular interest in San Juan County because I was born here in this town, but when I was quite young they tossed me over the fence, and until '37 we owned a farm here in San Juan County.

If we would take a few moments and project ourselves into the future and try to see the picture that this Commission will--they will be the governing body of the picture in the future hundreds of years from now. We can't consider the period of our lifetime; we have got to consider our relatives in the future, our sons and daughters and granddaughters and on down the line for a period of hundreds of years. We must do that now. The Commission realizes that and we people who are bringing information to them must realize that that is the thing they must look at in the future.

We have been told in the past few years, oh say since 1930, that we had a vast surplus of meat animals in the United States, and I dare say 90 percent or maybe 99 percent of us have believed that we had a surplus. But we started out with 72,000,000 head of cattle--using cattle as an example--that is what we started out with in 1930. You know what happened through the depression. Our standard of living dropped to where a large percent of the people couldn't afford meat. They just didn't have the "wherewith" to buy it. Then we built up our population about 12,000,000

head to close to 85,000,000; the war came on, raised our standard of living, and it is the dream of everyone of us to keep that standard of living where it is today and if we do we have no surplus of cattle. We have no surplus of hogs or sheep.

The sheep population is dropping rather drastically and just mentioning how that can affect us: Take Australia and there. One of my classmates in college is over there. He is administrator of the food we ship to Australia. He wrote back a few months ago and told us what the situation was there. They have lost the major part of their sheep in Australia due to drouth. That's going to help raise the price of wool in this country.

That all leads up to this: The increased need, the increase in population since 1930 has been rather large and it will continue to be large, the increase--it means we are going to need more meat animals and the Forest Service report the forest lands are stocked to capacity today, public domain is stocked to capacity, and we are going to be forced to resort to some other means of raising this livestock. That will mean tame grass and irrigated pasture. That has been one of my hobbies for many years, experimental work along that line.

And we can well utilize all of the water on this side within the Colorado River Basin and that some people think we may have as a surplus. In the future we can utilize every bit of that right here in the Upper Basin to develop tame grass, irrigated pasture, and thereby raise enough beef animals, hogs, cattle and sheep, and poultry, to take care of that amount of water. I mention poultry there because that is a growing industry in the United States, and to raise pullets up to the laying age economically you can utilize a very large amount of pasture, as we call it--range, poultry range. They will do fine up to the laying time and then they must be taken off and put on regular feeds.

I think everyone of us--I hope everyone of us--has confidence in the men who have been appointed to make the decisions on the allocation of the water in this Upper Basin. Then let's give them our support and after they have made their decisions, let's not do a lot of crabbing and go ahead and abide by those decisions and make a concerted effort. Now as Honorable Billy Wallace said the other day, he said, "Regardless of how these decisions are made, the water is to be used by Americans." We are all Americans and we must be patriotic in our attitude on the division of this water. I thank you.

MR. SEXTON: Mr. Coury, I find that I didn't put into my short report the Dolores Dove Creek Project. The reason I didn't was because I understood it came in the Grand Junction meeting, but it might be well to mention it at this time. That is the contemplated reservoir on the Dolores River to take in that vast bean empire around the Dove Creek section over there. That has long been under study but as yet nothing concrete has come from those studies. We are asking that the Bureau expedite those studies just as fast as possible so that the people of that region may have their opportunity to either accept or reject.

Have I covered everything, Judge Stone, from this end of it?

MR. TONER: We might mention a little something on the San Juan-Chama transmountain diversion there and how it is directly connected in the two states. The San Juan-Chama diversion, the big diversion that pertains to the San Juan Basin as a whole, both in Colorado and in New Mexico, would service a sizable amount of land in Colorado in the Kiute Park area which lies partly in Colorado and partly in New Mexico. Then right on south of that, with not too long a canal, we could service a lot of land in the Dulce, New Mexico, country; and then the balance of it could be taken around a long canal--expensive--but

it could be taken around and placed on the South Bloomfield Project.

Then in the report there is a definite figure set to take care of small projects in the country. We have a good many on our side of the State Line there and there are a few in New Mexico on this side of the State Line that are small and not expensive, but they do service a good type, Class 1, land, that we would like considered in there and figured in the division of the water.

The time will come in the not too far distant future when we are going to need to utilize all the land we possibly can do due to the depletion of the soils in the East and Middle East. We are going to have to go to new lands. We have not yet gotten across to a large percent of our farmers the proper methods of irrigation. That is up to we people in the states connected with the college to do that. We can save water; we can save land. You people who came across the Dove Creek area no doubt saw very good examples of the right way and the wrong way to farm on dry land, and the same applies on irrigated land. Thank you.

MR. SEXTON: I think that is all we have, Mr. Chairman. We thank you very kindly for your courtesy.

MR. COURY: Thank you, Mr. Sexton. I ask again before turning this back to Mr. Wilson, is there anyone else present locally who has anything to say or wishes to say anything at this time? (No response.) If not, I will turn this back to Judge Wilson.

Before turning it back I would like to briefly state the viewpoints as we have presented them to the Commission for their deliberations in arriving at a conclusion with respect to the ultimate division of the water. As you have noticed this morning with the huge development of gas fields in San Juan County within the past six or eight months, the matter of pumping water with natural gas has definitely come into the picture. Probably the Bureau of Reclamation and others, being that it is a relatively new idea, haven't given it much serious thought. But I certainly believe that the Commission in their deliberations before arriving at their ultimate conclusion in the division of the water should take into consideration such factors as pumping water with natural gas.

Of course, Judge Wilson I believe at Salt Lake made a statement that it may be wise to divide a certain number of acre feet among the four states equitably and possibly leave the balance of it for a few years hence to be divided. After listening to what the various persons stated here today I have mulled it over in my mind and I believe probably that if that can't be done, in the division of water every state should be at least reserved some certain number of acre feet for possible projects that probably none of us can see at this time. Nevertheless we all feel sure that the Commission in their deliberations and making their final report will probably take all this into consideration; however I felt that I should restate that at this time.

I will turn this meeting back to Judge Wilson.

JUDGE WILSON: Thank you, Mr. Coury. Now on behalf of Mr. McClure, who is the Commissioner for New Mexico, I would like to thank the people from New Mexico as well as the gentlemen who came down from Colorado, for coming here and expressing your views. I think all of you who know Tom McClure know that he will in future negotiations be zealous in guarding and protecting the rights as he sees them of the people of New Mexico. But I think you will also find that he realizes the importance and the necessity of recognizing the interests and rights of the other states in the waters of this basin.

I am very glad to observe the splendid spirit of cooperation that seems to exist between the people in Colorado and the people in New Mexico in this area. It is that sort of a spirit that will settle problems, if they are settled, amicably and reasonably.

In closing I want to say this, that I believe this Commission realizes that it is not its duty, and all of you realize it is not its duty or within its province to say where the water is going to be used in any state. They will attempt to make a fair and just and equitable allocation of water considering the states as a whole, the needs of the states as a whole, the people in them; and then it will be up to the people of each state to determine where the water will be used. I am sure that the people of each state can do that because I feel that the compact method of settling interstate matters is on trial and if these five states can't get together and make a fair and just and equitable allocation of this water, then you need not be surprised if we are confronted with additional bureaucracy with greater powers. The Government will assert greater powers, because progress is going to continue one way or the other and we all want it to continue under the democractic process and the compact process.

I thank you Mr. Commissioner and I will now turn the meeting back to you.

THE CHAIRMAN: The Chairman on behalf of the Commission wishes to express the appreciation of the Commission to you, Judge Wilson, and to you, Mr. Coury, and to Mr. Sexton and Mr. Toner from Colorado, for the efficient and orderly conduct of this meeting; also to you, Mr. Coury, for making our arrangements in advance here in the way of hotel accommodations so efficiently. And thanks to the people of this community for their hospitality. I don't believe there is any doubt in the minds of the Commissioners today in regard to the possibilities of raising apples in the San Juan Basin. I judge that from the evidence before us. It has been a very successful meeting and all of you have made contributions. You have expressed your ideas and you have had the opportunity to say what you have wanted to say. The Commissioners I feel sure all appreciate that.

I wish to make one or two observations and I want to be very brief. References have been made to feasible projects, references have been made to the Colorado River Report, and perhaps some of you conclude that the projects listed in the Colorado River Basin Report are feasible projects. Perhaps they are, but it depends upon the formula or the standard you apply as to their feasibility. This Colorado River Report wherever figures on cost are used, refers to the situation existing on January 1, 1940. Now those costs are out of date as you all know. Take the price of pinto beans in this community; it is considerably different than it was January 1, 1940.

Apparently the Bureau of Reclamation did not attempt to say that these projects were feasible, and with your indulgence, I would like to read from page 1 of the Regional Directors' letter of March 22, 1946:

> "This report, with its substantiating material, provides a basin-wide perspective for planning development on a sound basis. It is intended to serve as a medium through which the Congress may be apprised of the potentialities for the development of the basin's water resources and as a guide in the selection of projects that ultimately will comprise the comprehensive plan for the utilization of the waters of the Colorado River system for irrigation, electrical power, and other purposes."

On page 19 of the report I quote as follows:

"The total estimated construction cost of all the potential within-

basin projects outlined in this report is $2,185,442,000, based on January 1946 prices. Cost allocations to some benefits of a public character cannot appropriately be considered repayable by the water users under Reclamation laws. Of the total cost, it is estimated that an allocation of $25,000,000 may reasonably be made to flood control. It is further estimated that gross revenues collectable from irrigators, power users, and municipalities will amount to $57,500,000 annually in excess of costs for operation and maintenance. The latter sum could be applied toward repayment of those reimbursable costs resulting from the allocations made to the various benefits."

Now whether the projects listed in the Colorado River Basin Report are feasible or not will have to be resolved by the Congress. Certainly I doubt very much, as an individual, whether any of them are feasible under the Reclamation Law as it exists at the present time. However, the Bureau of Reclamation was directed to make a report and that is the report. Now as to what becomes what is an undetermined question at this time. Perhaps if the compact is worked out, the next step will be an attempt to secure a basin-wide authorization for development on some formula not now existing but perhaps similar to that of the Missouri Basin development.

So I make those remarks simply to show you that we have a long ways to go. It is necessary for everybody to work pretty closely together to work this out. The Commission has a big job and you folks have a big job, too. I was impressed with what Mr. Toner said: After the Commission does the best it knows how and comes to some impartial decision, fair to everybody, then in place of doing a lot of crabbing, you get behind it and try to support it because it has a long way to go after this Commission negotiates its compact. It goes to the legislatures of the five states and then to the five governors for approval; then it goes to the Congress of the United States, passed by the Congress of the United States and then signed by the President, if you please, and the President might veto it. There are a lot of hurdles to go over.

I was very much interested in the remarks about the possibilities of pumping with gas. That is something that I think we can all look forward to with hope. But at the same time we must not forget that the difficulties of the old irrigation systems today are largely on account of the low summer flows, and you can have an excellent pumping plant without storage and you are still in difficulty. So storage is going to be necessary on the Colorado River in spite of everything, in spite of all the economies we can introduce into the matter of the operation of irrigation systems.

At the beginning of the session we neglected to introduce the Commissioners from the various states, and at this time the Chairman will call on the Commissioner for Arizona for any comments he wishes to make.

COM. CARSON: Mr. Chairman, gentlemen, I certainly appreciate this meeting and the things that you have told us and want to assure you that we will take them into careful consideration in the progress that we may make.

I don't know that it has yet been explained to you that there is an Engineer Committee appointed by this Commission now functioning, gathering facts, and we are trying to ascertain the facts before we undertake to negotiate this compact. And when those facts are ascertained, we will try to negotiate a compact the best we are able with a full feeling and sense of the responsibility we are undertaking, and with the hope and purpose of doing injury to nobody and benefit for all of the Colorado River Basin States.

This is all one area, one economy. What helps you helps Arizona. What helps Arizona helps you. What helps you helps Colorado and what helps Colorado helps you. It is a matter of adjusting it as fairly and equitably as we can so that ultimately this Upper Basin area will completely utilize and consumptively use 7,500,000 acre feet of water. Thank you.

THE CHAIRMAN: Thank you, Mr. Carson. Going in alphabetical order, the Chair will now call on Com. Stone of Colorado.

COM. STONE: Mr. Chairman, Members of the Commission, gentlemen: Here today as elsewhere we have discussed and there has been much comment concerning the allocation of the water reserved to the Upper Basin under the Colorado River Compact. It seems always to happen in these meetings that we lose sight of a very important element which must be considered by this Commission in negotiating a compact. I refer to the obligations of the four states of the Upper Division to make deliveries of water at Lee Ferry--those four states, Colorado, New Mexico, Utah, and Wyoming.

Someone has referred to the water which arises in the mountains of Colorado and flows into the San Juan Basin. That situation is typical throughout the Upper Basin. These states in signing the Colorado River Compact have already pledged themselves--and it is the purpose of these states I know to observe the Colorado River Compact--to deliver 75,000,000 acre feet of water over continuing ten-year periods at Lee Ferry. That must indicate to you very clearly that whereas in a meeting such as this we are wont to consider the benefits and to talk about the allocation of the water that will benefit us, we must consider a present and a continuing obligation. I want to mention that to you because you must know that this Commission in making allocations of water must likewise consider the respective obligations of these four states to make deliveries of water at Lee Ferry.

Figuratively we are given a pail of water. We have got to empty out half of that pail of water for the Lower Basin, and then we allocate among ourselves, among the five states, what is left.

So that is important when we think of projects and potentialities of development in any area; and when we think of the water that is in that area, there is a present obligation against that water under the Colorado River Compact. We cannot, and keep our obligations under the Colorado River Compact, disregard that very important matter. It is important to call that to your attention I am sure.

Fred Wilson made a very appropriate remark and I should like to briefly emphasize it. He stated that this Commission is obligated and is charged, if you please, with making the allocations among the five states. We haven't got very many things to feel fortunate about in this job we have undertaken, but I think we can feel fortunate that we are not obligated to determine the distribution and use of this water within each state. That is a problem and a matter for each state to decide and work out for itself. The Commission, as would be true if a Supreme Court decision were rendered, is obligated to determine the equitable apportionment among the compacting states. That means a mass allocation of water to each state. What each state does with that water and where each state uses that water, I take it--in fact I know--is not the concern of this Commission. That is the concern of the states and the citizens of each of the states, to work out in cooperation with the Bureau of Reclamation where the Bureau of Reclamation is engaged in working out project plans.

Then another question which came to my mind while some of this evidence was being introduced here today was with reference to what each state is going to give up. It seems quite clear to me on the basis of the Bureau Report that no state is going to be able to get all of the water it would like to have.

The report indicates, I believe, something like 2,000,000 acre feet in excess of what we have if all of the projects that are envisioned in that report were built. And so we get down to the question of an equitable apportionment of a very scarce and limited resource.

Now this question of equitable apportionment is sometimes determined by the courts. In this case we are attempting to determine it amicably through compact negotiations. That is reached by an agreement and we, the Commission, only negotiate a compact. In the end the legislatures must ratify and the Congress must approve of it. I was also much impressed with Judge Wilson's statement that we are on trial, very definitely on trial. We are attempting to demonstrate the states under our constitution and in a democratic way can work out our own water problems. And as he said, this limited resource and its use is going to go forward and if we don't set the pattern some higher power is very apt to set it for us. So we have not only got to be patient but we must be very fair in dealing among ourselves.

That brings to mind another matter which I think we should keep in mind. The immediate occasion for the agreement of the states to initiate compact negotiations is the statement in the Colorado River Report that in a major way--not to the last detail but in a major way--development within the Colorado River Basin by the Bureau of Reclamation had proceeded about as far as it could go until the states had performed in the Upper Basin one important function, namely, the determining of how much water each state could use for its future development. You have mentioned projects here, all of them important. But I think here as elsewhere in the Basin, except for small projects that are clearly within what might be a state's share of the water, we cannot proceed much further until this allocation has been made.

Someone has mentioned this matter of engineering studies. We have used the engineers a lot at the meeting last night and yet we find that they are like a right arm in this work. It seems so utterly foolish in this day with so much information available--not as much as we would like to have--not to carefully sift and understand that information and to properly apply it in determining equitable apportionment. Many of these troublesome questions are resolved through an understanding and agreement upon the facts. Lawyers, some of us lawyers, may quarrel endlessly and find that our arguments are of little avail in the face of the actual facts which must be understood and applied in making an equitable apportionment. For that purpose this Engineer Committee was set up.

Some have assumed that the report of the Bureau of Reclamation furnishes all of the facts. Well, in the first place, the states owe it to their citizens to ascertain whether those facts as found by the Bureau are in accordance with the views of the state. Secondly, there are many important factors of factual information which are needed in making an equitable apportionment which are not covered by the Bureau's Colorado River Basin Report. Some of the matters which are covered do not go far enough for the purposes of making a compact. And so this Commission put the engineers to work and this committee is acting in an advisory capacity to give us the facts before we begin to talk about the apportionment. And as the Chairman told you this morning, we now have a Legal Advisory Committee.

This is a case where we have got to realize that the Upper Basin is an empire in which all of these states have a common interest and we must work together with an understanding of each other's problems while at the same time zealously considering the rights of each individual state. I hope that we can keep that in mind and that as we go along and if and when a compact is negotiated we shall be able to support it not only with the facts but with sound reason and judgment.

Before I close my statement I wish to express our regret that our friend and co-worker, Thomas M. McClure, Member of the Commission for New Mexico, is unable to be here today because of illness. Tom has had wide experience in compact making. He not only has a rich background of experience but--and I have served with him on two other compacts--it has been my experience that Tom McClure will be fair and at the same time will zealously represent the interests of New Mexico. You, indeed, have an able and capable man on the Commission. He has the assistance of a very capable legal adviser in Fred Wilson.

We all want to express our appreciation for your presentation here today. That is our primary function here--to hear from you and to get your statements and I assure you they will be given full consideration.

THE CHAIRMAN: Mr. Watson, Commissioner for Utah.

COM. WATSON: Mr. Chairman, ladies and gentlemen, I wish to express to you my appreciation for the fine spirit of cooperation that you have evidenced here and for the many facts that have been brought out. Such a hearing is the democratic way of arriving at a conclusion. If in all of our difficulties in our lives we could have a common understanding, if we could sit down and talk things over with our opponents and our adversaries, in nearly all cases we would come to a fair conclusion. This is particularly true in a case of this kind.

The hearings that we have had in other states have been of the same order as this hearing. They have brought forth certain facts that we must consider.

You know in this Rocky Mountain cordillera, we have a great desert and the communities where men make their living are more oases in that desert. In that desert there is a great river that now goes in large part to waste--into the ocean. In spite of all that we may do at the present time, much of the water goes to waste. If the energy of that river could be calculated, we would find the loss would be stupendous. So the sooner we can agree upon a formula to apportion equitably these waters the better.

It is true that a long time will have to pass before the final answer and before the final drop of water is utilized. Great reservoirs will have to be built to level out the river so that the water that is now going to waste can be properly utilized. However, at the present time I think we should make an effort to divide the water equitably and on a just basis. Very soon we would have projects developing in each state. It is such a hearing as this that stimulates us and collects the facts so that proper conclusions can be made.

Now when this Engineering Committee reports it will recommend certain facts upon which an equitable apportionment of the water can be made. This Commission is not bound by the recommendation, but it may be such that it can be accepted. It will tell this Commission where the water comes from and how the stream acts. The origin of the water may not be the most important question, it hasn't been in the past. States have gotten water that don't produce any at all, so that may be a minor issue. Then it will tell us how the water can be regulated in the stream, how the river can be made to act subject to our will. That will be a very important question. There are places in the basin where types of beneficial use are of the very highest, municipal use if for pleasure, and also the raising of very productive crops. This is important. The saving of a civilization may come into the picture. These are all things that this Commission must fully consider.

I again wish to thank you for your good work and I am sure everybody

here will do his best to fulfill his obligation.

THE CHAIRMAN: The Commissioner for Wyoming, Mr. Bishop.

COM. BISHOP: Mr. Chairman, ladies and gentlemen, I am indeed pleased to be here today and listen to the problems of the people of New Mexico. From what I have heard in all the other states, your problems are the same as our problems. We all have much more land that we have water.

It is our job on this Commission to divide the 7,500,000 acre feet of water allocated to the states of the Upper Basin by the Colorado River Compact. The Bureau of Reclamation Report shows that we need more than 9,000,000 acre feet of water to take care of the projects that they have proposed. So it's the duty of this Commission to sit around the table and work out a plan for equitable division of that water.

I am not going to try to make a speech about this like all these other fellows because they have taken away all my thunder. All I want to say, ladies and gentlemen, is I thank you for your hospitality and Wyoming is willing to sit around the table with the other fellows and be reasonable in making this division. Thank you.

THE CHAIRMAN: After we adjourn I would like to have Mr. Riter meet with the Commissioners for just a few minutes. Judge Wilson, I didn't call on New Mexico because you I think did your share of the work today, and unless you have further remarks to make and unless the Commissioners have further business to come before this meeting, a motion is now in order for the adjournment.

JUDGE WILSON: I have nothing further.

THE CHAIRMAN: I forgot one thing here that is very important. We have a gentleman here with us today who it doesn't make much difference where you go, if it is a meeting about water, he is present. He doesn't like to have anything to say but he is sure a strong listener; and if he is called on he generally has some very good advice to give us. I don't want to introduce him as a citizen of Utah but rather as a citizen of the West. Mr. Wallace. (Applause.)

MR. WILLIAM R. WALLACE, SALT LAKE CITY, UTAH: Mr. Chairman, I have perfect faith in the willingness and ability of this group to secure all the necessary data and to arrive at the right conclusion. However, I would like to say that I listened with great care to a statement made by the Chairman when these meetings began in which he outlined the information, the quantity and its quality, that was required upon which to base a decision. I have listened carefully and I waited until this time to ask a question.

I have listened very carefully to the reports made by Mr. Riter as Chairman of that Committee. He has confined himself as nearly as I could judge to two problems, the source of the water and the amount of the obligation of each state to deliver water to Lee Ferry. There has not been a settlement made yet in any of these major problems that has not been based as the major item upon the use of water. We have heard no discussion of the use possibilities.

Our settlement with the Republic of Mexico was on the basis of use possibilities. Our settlement with the Lower Basin was on the basis of use possibilities. California produces practically no water and the settlement was on the basis of use possibilities. That is true with the main stem of the Colorado in Arizona and it is certainly true as to the State of Nevada. I don't know why that is the case but I look upon it as far as the State of

Utah is concerned that the paramount item is based upon the possibility of the power possibilities. I like to refer to that matter because I think so far as my state is concerned, it is the major item.

Now I would like to ask a question: Why in the study of the engineer group has that problem not been brought to the fore?

I am not a lawyer or an engineer; I am just an ordinary businessman. But by George it is the one thing that we can look forward to in the West based on our tremendous mineral resources and based on our climate and ability to raise these wonderful fruits. And not only agriculture. The first call upon water supply is water to drink. The next is for municipal supply, all the various uses to which a municipality can put water. The third is agriculture and there can be none of these others unless agriculture is prosperous. And last is the application of the water to the making of power.

I know the Chairman well enough and I know it was in his heart and I know how he emphasized it at the first meeting, said that we should have approximately all the facts before this decision is made; and certainly one of the major factors is that of use of water supply.

Thank you very much, Mr. Chairman. (Applause.)

THE CHAIRMAN: Thank you, Mr. Wallace. Does the Chair hear a motion for adjournment?

COM. STONE: I move we adjourn.

COM. CARSON: Second.

THE CHAIRMAN: It has been moved and seconded that we adjourn.

(Thereupon a vote was taken and the motion of Com. Stone carried unanimously.)

(3:00 o'clock p.m., Saturday, November 2, 1946, Meeting No. 3 of the Upper Colorado River Basin Compact Commission adjourned.)

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	**18**	**Z, AA**
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

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Upper Colorado River Compact Commission Inflow-Outflow Manual

1949 August

UPPER COLORADO RIVER COMPACT COMMISSION

INFLOW-OUTFLOW MANUAL

PREPARED BY
ENGINEERING ADVISORY COMMITTEE

AUGUST 1949

H. W. BASHORE

Salt Lake City, Utah

August 5, 1949

Upper Colorado River Basin Compact Commission

Gentlemen:

Pursuant to instructions given at your Vernal, Utah, meeting July 21, 1948, the Engineering Advisory Committee has investigated methods which might be adopted by the Commission for the measurement of stream depletions. On October 6, 1948, at Bishops Lodge the Engineering Advisory Committee appointed a sub-committee composed of R. D. Goodrich, Chairman, R. M. Gildersleeve, and John R. Erickson to prepare a manual on the inflow-outflow method of determining stream depletions in the Upper Colorado River Basin. The manual has been completed, and was reviewed and adopted by the Engineering Advisory Committee on July 1, 1949, in Denver, Colorado.

The manual submitted herewith provides examples of the administrative procedures which will be required to carry out the provisions of Article VI of the Upper Colorado River Compact.

Respectfully submitted,

J. R. Riter, Chairman, Federal
J. R. Riter

R. Gail Baker, Arizona
R. Gail Baker

R. A. Meeker, ~~Arizona~~ Colorado
R. A. Meeker

R. J. Tipton, ~~Colorado~~ Arizona
R. J. Tipton

R. M. Gildersleeve, Colorado
R. M. Gildersleeve

F. C. Merriell, Colorado
F. C. Merriell

J. H. Bliss, New Mexico
J. H. Bliss

J. R. Erickson, New Mexico
J. R. Erickson

C. O. Roskelley, Utah
C. O. Roskelley

R. D. Goodrich, Wyoming
R. D. Goodrich

H. T. Person, Wyoming
H. T. Person

H. P. Dugan, Federal
H. P. Dugan

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BRANCH OF PROJECT PLANNING
Hydrology Division
Denver Federal Center
Denver, Colorado

Reply Attention: 700

AUG 19 1949

Mr. H. W. Bashore, Chairman,
Upper Colorado River Basin Compact Commission,
Post Office Box 367,
Mitchell, Nebraska.

Dear Mr. Bashore:

I am enclosing the first copy of the "Inflow-Outflow Manual" accepted by the Upper Colorado River Basin Compact Commission at their final meeting August 5, 1949.

Members of the Engineering Advisory Committee have indicated their approval of the manual by their signatures on the letter of transmittal. As Chairman of the Compact Commission, I believe it desirable that you retain custody of this copy.

Very truly yours,

John R. Riter, Chairman,
Engineering Advisory Committee,
to U.C.R.B.C.C.

Enclosure

UPPER COLORADO RIVER COMPACT COMMISSION

INFLOW - OUTFLOW MANUAL

INTRODUCTION

This manual has been prepared in accordance with the directions of the Upper Colorado River Compact Commission to provide examples of the administrative procedures which will be required to carry out the provisions of Article VI of the Upper Colorado River Compact which reads as follows:

> "The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the Upper Basin and for each State of the Upper Basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the Commission, by unanimous action, shall adopt a different method of determination."

During the negotiations leading to the adoption of the Upper Colorado River Basin Compact, there was exhaustive discussion and very careful consideration of the problems arising from the necessity of measuring the amount of man-made depletion of the virgin flow of the Colorado River and its tributaries, especially at Lee Ferry and at State lines. After thorough discussion of available methods of measurement of consumptive use of water and stream depletion due to the activities of man, especially that caused by irrigation of agricultural crops, the Compact Commission, at the Vernal, Utah meeting, adopted the "Inflow-Outflow Method" as the most practical one for the required purpose.

At the Vernal meeting Mr. R. J. Tipton discussed the work of the depletions sub-committee and recommended that the Commission instruct the Engineering Advisory Committee to prepare a report outlining methods which could be adopted by the Commission for making these measurements.

Following that suggestion the Commission adopted the motion, made by Commissioner Stone as follows:

> "Mr. Chairman, to implement and to carry out the suggestions made by Mr. Tipton, I move that there be referred to the Engineering Advisory Committee for its study and report at the next meeting of the Commission, the matters which were suggested by Mr. Tipton and any other engineering matters which in the judgment of that committee should be included in its report at the next meeting of the Commission." (See page 332 of minutes of Meeting No. 7, held at Vernal, Utah, July 7-21, 1948).

As a result of discussions at previous meetings and in accordance with the action by the Commission indicated above, a sub-committee of the Engineering Advisory Committee was appointed at its meeting held on October 6, 1948, at Bishop's Lodge, with instructions to "write the manual on the inflow-outflow method of measuring consumptive use for the guidance of the future administrative body to be created by the proposed compact."

In the Final Report of the Engineering Advisory Committee, dated November 29, 1948, under the subject of Assignments by Compact Commission, it is stated that at the Vernal meeting the Engineering Advisory Committee was instructed, among other things, "to prepare additional studies of the inflow-outflow method of measuring uses in the Upper Colorado River Basin." (p. 10). On the same page of the Report it is also stated, that "Studies of the inflow-outflow method of measuring uses in the Upper Colorado River Basin are being continued. A manual will be presented to the Compact Commission for use by the administrative body when the studies are completed."

From these brief references to the inflow-outflow method in the proceedings of the Commission and its Engineering Advisory Committee, it is evident that its importance in the future administration of the Upper Colorado River is fully appreciated and that the method and its application should be made a matter of record and easy reference for the guidance of the Administrative Commission.

Article VIII, paragraph (d), of the Compact empowered the Commission to establish and maintain gaging stations, collect and analyze data on stream flow, storage and use of water, and to determine the quantity of water used each year in the Upper Colorado River System and the quantity delivered each year at Lee Ferry. All of these powers and duties are necessary and sufficient for the utilization of the inflow-outflow method in the administrative procedures of the Commission.

APPLICATION OF INFLOW-OUTFLOW METHOD

UPPER COLORADO RIVER BASIN

General Discussion

On all rivers utilized for irrigation purposes consumptive use or man-made depletion at the point of use differs in varying degrees from depletion at state lines or at the lower end of a valley or of a basin. This is a fact that depends upon the conditions which modify the quantities of water flowing down stream channels. Of the total amount of precipitation which falls upon any given drainage basin only a small portion ever reaches a stream in the form of actual discharge. After having been gathered from surface run-off and from springs and by seepage from the ground along creek and river banks, losses in stream flow continually occur along these natural banks and from the stream itself. These losses are mostly due to evaporation from the water surface and from the ground adjacent to the stream, especially where the banks are low and the ground water table is relatively high, and to transpiration from the native vegatation, trees, shrubs, or bushes and grasses which now and always have lined most rivers as well as the smaller tributaries. The operations of man do not change the nature of these losses but the quantity is affected in the degree to which the river system is controlled and utilized. Losses due to natural causes vary with the stage of flow in rivers and streams, being greater for high stages than for low stages.

Development of Pertinent Factual Data

After two years of exhaustive research, investigation and study, the Engineering Advisory Committee obtained and agreed upon rates and quantities of man-made depletions at sites of use and the effect of such depletions at key points on the Colorado River and its principal tributaries. The work was carried on by the sub-committee on Depletion, of which Mr. Tipton was chairman. The general studies to determine stream depletions were covered by the following investigations (page 40 of Engineering Advisory Committee Final Report).

1. "Determination of areas using water as a result of man-made irrigation."

2. "Determination of unit rates of consumptive use of irrigation water."

3. "Computation of stream depletions at sites of use by application of unit rates of consumptive use of irrigation to water using areas and summation of transmountain diversions, and other uses of water by man."

4. "Estimation of channel losses between sites of use of water and Lee Ferry, Arizona, for historic and virgin flows during the period 1914-45."

5. "Computation of stream depletions above certain key gages, at state boundaries, and at Lee Ferry."

Unit rates of consumptive use of irrigation water, (item 2 above) were determined by Mr. Harry F. Blaney and Mr. Wayne D. Criddle of the Soil Conservation Service, U. S. Department of Agriculture. These data can be

found in Appendix B of the Engineering Advisory Committee Final Report.

All of this mass of detailed information was utilized in the determination of virgin flows and present stream depletions. As further man-made depletions occur through the development of additional irrigated areas and other uses, the effects of the several factors indicated above upon these depletions will be automatically integrated by the application of the inflow-outflow method.

This method was fully explained by the chairman of the sub-committee on Depletions at the joint meeting of the Legal and Engineering Advisory Committees held in Denver on June 29, and 30, 1948, and thoroughly discussed by them. As a result of the action at this meeting, a similar and more detailed presentation of the subject was made to the entire Commission on July 8, 1948, at Vernal, Utah, illustrated by maps and graphs showing results of earlier studies, and uses that have been made of the method.

The inflow-outflow method of measuring depletion by man's activity is particularly applicable to the Upper Colorado River Basin. A change in the flow of the river at Lee Ferry, because of man's activity in the basin, can be measured by the change in relationship between the sum of the virgin flows of certain key tributaries near the rim of the basin and the outflow at Lee Ferry. The upper rim stations are designated as inflow-index stations because it is not possible or practicable, nor is it necessary, to measure all of the inflow. It is, however, necessary to correct the inflow-index for man-made depletions above the points of measurement.

The depletion by man's activities in the various sub-basins of the Colorado River at or near the state lines can be measured by the change in relationship between the sum of inflow-index amounts and the outflows at points located at or near the state lines.

Practically all of the irrigation development in the Upper Basin will be limited to the irrigation of lands along tributaries and along the upper reaches of the main streams. The lowest major point of diversion of Green River water for irrigation purposes may be a short distance below the Wyoming-Utah state line. Below that point the Green River enters a series of deep canyons. After the Colorado River leaves Colorado and enters Utah it flows in a deep canyon and there is little opportunity to utilize the water in the Upper Basin for irrigation purposes from that point down. The same is true with respect to the San Juan after it leaves the State of New Mexico.

It is in the canyon sections of these rivers where the major reservoir capacity will be provided to generate hydro-electric energy and to enable the States of the Upper Division to comply with their obligation provided for under Article III (d) of the Colorado River Compact, not to deplete the flow of the Colorado River at Lee Ferry below 75,000,000 acre-feet in progressive ten-year series. The Upper Colorado River Basin Compact provides that the evaporation loss from such reservoirs used for the common good of the four States of the Upper Division shall be charged in proportion to the amount of beneficial consumptive use being made by each state at the time the loss occurs. The evaporation loss is to be measured in terms of depletion at Lee Ferry. The best method of determining this loss is by measuring the change in relationship between inflow to the section (which consists of the sum of the flows of the major tributaries and the main streams below the principal irrigated areas and above the main stem reservoirs) and the outflow from the basin at Lee Ferry.

The following discussion and the accompanying maps and curves are presented as a basis for determining future depletions in the Upper Colorado River Basin and within sub-divisions of the Basin. The inflow-outflow correlation curves have been determined from annual values of discharge. Adjustments have been made for transmountain diversions and depletions for irrigation above the inflow-index stations. Examples of such adjustments are given in the Appendix. As further data are accumulated, while development is proceeding, averages of the data in relation to the average for virgin conditions will measure the total depletion. These averages should be computed for periods which are long enough to define accurately the depletions for given stages of development. Prior to and during the construction of the main stem reservoirs the averages should be continuing until the aggregate capacity of such reservoirs have been filled, drawn-down and re-filled, at which time the period prior to the first filling should be dropped from the computation of continuing averages. The period for computing continuing averages shall then extend until the reservoirs have been drawn-down and filled a third time, when the years between the first and second filling shall be dropped, and so forth.

Plate No. 1 is an outline map of the Upper Colorado River Basin on which is shown the major stream system and the location of inflow-index gaging stations which are applicable to develop an inflow-outflow relationship for that basin. Shown also on the plate is the location of Lee Ferry, which is the outflow point for the basin.

Plate No. 2 is a correlation curve showing the relation between the historic flow at the inflow-index stations corrected for man-made depletion above those stations and the outflow at Lee Ferry. The points from which the curve was developed, are the annual values for the years 1932 through 1948.

The Engineering Advisory Committee to the Upper Colorado River Basin Compact Commission, by exhaustive studies, estimated the mean annual virgin flow at Lee Ferry at 15,638,500 acre-feet for the period 1914 to 1945.

It was estimated that the virgin flow at Lee Ferry for a virgin inflow-index of 5,657,000 acre-feet, which was the average for the period 1932 through 1948, amounts to 13,662,000 acre-feet. This is shown on the Plate, and there has been projected through that point a curve indicating estimated relationship between virgin inflow-index and virgin outflow. Actually, the slope of the curve may not be exactly as shown. As time goes on and more development takes place in the Upper Basin, new relationships will result between inflow-index and outflow and the change in slope of those curves will provide a guide for determining the proper slope of the virgin curve. Under ultimate conditions of development, the slope of the virgin curve will have little significance because the flow at Lee Ferry will be largely equated and the depletion at Lee Ferry by man's activity will be the difference between that equated flow and the long-time average virgin flow.

Table No. 1 indicates inflow-index stations that were used to develop the curve on Plate 2, and the annual run-off at each of those stations for the period used. The corrections made for man-made depletions above the stations are also shown.

Plate No. 3 is an outline map of the San Juan Basin above Bluff, Utah. Shown on the map is the main stem of the San Juan and its principal tributaries. There are indicated on the map the locations of inflow-index gaging stations, stations near the Colorado-New Mexico stateline, which measure the outflow from the upper San Juan Basin and inflow to the lower San Juan Basin, and the gaging station near Bluff, Utah, where the outflow from the basin is measured.

Plate No. 4 is a correlation curve, showing the relation between the sum of virgin flows at the inflow-index stations and the outflow at the station near Bluff, Utah, for the period 1932 through 1948.

Plate No. 5 is a correlation curve showing the relation between the virgin inflow at the inflow-index stations of the upper San Juan Basin and the outflow stations near the Colorado-New Mexico stateline.

Plate No. 6 shows the relation between the inflow to the lower San Juan Basin as measured by the flow past the stations near the Colorado-New Mexico stateline and the outflow from the basin near Bluff, Utah.

There are shown on Plates 4, 5, and 6 the virgin relationships, the shapes of which may be changed as more information is gathered in the future. The change in relation between the inflow as shown on Plate No. 5, and the outflow shown on that curve will measure the additional depletion made by man in Colorado above points near the Colorado-New Mexico stateline.

The curve shown on Plate 6 is intended to be the means of measuring additional depletion caused by man's activities in New Mexico and portions of Colorado, Utah and Arizona on the flow of the river near Bluff, Utah. The change in relationship as there is additional development in the states will be a measure of the depletion by man's activities in these states of the flow of the river at Bluff, Utah. The man-made depletion by Colorado and by the other states of the flow of the river at Bluff must be determined by adjustments in the changes in relationships of the inflow-outflow curves shown on Plates 4, 5, and 6 as development in the state proceeds.

The data from which Plates No. 4, 5, and 6 were derived are included in Tables No. 2, 3, and 4.

Plate No. 7 is an outline map of the Colorado River Basin above Cisco, Utah. It shows all the main stem of the Colorado River and its tributaries in Colorado. Included above Cisco is a small low water producing tributary drainage area in Utah. On the map are shown the locations of inflow-index gaging stations and the outflow station at Cisco.

Plate No. 8 is a curve showing the relationship between historic flow past the inflow-index stations corrected for man-made depletions above those stations and the outflow as measured at the gaging station near Cisco, Utah for the period 1932 through 1948. On the plate is shown the estimated virgin inflow-outflow relationship. As time goes on and additional developments are made of the waters of the Colorado River in Colorado, the relationship between the inflow-index and the outflow will change. This change will indicate the increased depletion of the flow of the river at Cisco by man's activities which will have taken place since the period covered by the basic curve, and will also show the depletion of the virgin flow of the river near Cisco.

The values determining the relationships shown in Plate No. 8 are given in Table No. 5.

Plate No. 9 is an outline map of the Green River Basin above Green River, Utah. It shows the Green River and its principal tributaries. Several sub-basins are shown on the map, including the White River above Watson, Utah, the Yampa River above Maybell, Colorado, the Little Snake River above Lily, Colorado, the Green River above Linwood, Utah, and Henry's Fork above Linwood, Utah.

Plate No. 10 shows an inflow-outflow curve for the White River above Watson, Utah. The inflow-index is measured at the gaging station near Meeker. The estimated virgin flow curve is shown on the plate.

On Plate No. 11 is an inflow-outflow curve of the Yampa River above Maybell, Colorado. The inflow stations are the Yampa River at Steamboat Springs and the Elk River at Clark; the outflow station is at Maybell. The period covered by the curve is 1932 through 1948. The estimated virgin relationship is shown on the plate.

The inflow-outflow relationship for the Little Snake River is shown on Plate 12. The inflow-index stations are the Little Snake River near Slater, Slater's Fork near Slater, and Savery Creek near Savery. The outflow station is at Lily, Colorado. The estimated virgin relationship is shown on the plate.

Plate No. 13 shows the inflow-outflow relationship for the Green River in Wyoming. The index-inflow is measured at Green River at Warren Bridge, North Piney Creek near Mason, Pine Creek at Pinedale, Fontenelle Creek near Fontenelle and Black's Fork near Millburne. The outflow is measured at Linwood, Utah. The estimated virgin relationship is shown on the Plate. The change in relationship of the inflow and outflow as shown on this curve will measure the increase in man-made depletion by Wyoming in the Green River basin, except for the Little Snake River and the Henry's Fork.

The curve on Plate 14 shows the inflow-outflow relationship for Henry's Fork above the outflow station on that tributary near Linwood, Utah. The estimated virgin relationship is also shown on this Plate.

The values used to develop the curves shown on Plates 10 to 14 inclusive are given in Tables 6 to 10 inclusive.

Plate 15 shows the relationship between the inflow to the Green River below all major developments in Colorado and Wyoming and above all major developments in Utah and the outflow of the Green River at Green River, Utah. The inflow stations determining this curve are the White River near Watson, Utah, the Yampa River near Maybell, Colorado, the Little Snake River near Lily, Colorado, the Green River near Linwood, Utah, Henry's Fork near Linwood, Utah, Ashley Creek near Vernal, Utah, the Duchesne River near Tabiona, Utah, the Strawberry River at Duchesne, Utah, and the Price River near Heiner, Utah. The outflow station is at Green River, Utah. The records for the inflow-index of Ashley Creek, the Duchesne, Strawberry, and Price Rivers were corrected for the man-made depletions above the stations. This curve will serve as a temporary means of measuring man-made depletions in Utah of the flow of the Green River at Green River, Utah. There should be established or continued outflow stations on the major Utah tributaries, more specifically enumerated as follows: Sheep Creek, Carter Creek, Brush Creek, Ashley Creek, Duchesne River, and Price River. After records have been accumulated for a sufficient period, the Utah inflow-index stations related to the new outflow stations should be used to determine the man-made depletion of the Utah tributaries. The values used for Plate No. 15 are shown in Table No. 11.

Plate No. 16 shows the relationship between all of the inflow-index stations shown on Plate 15, plus the Colorado River at Cisco and the San Juan River at Bluff, and the outflow of the Colorado River at Lee Ferry. A change in the relationship shown on this curve can be used at the beginning of the administration to check the effect of Utah's future development on the virgin flow at Lee Ferry and the effect of main stem reservoirs which may be built. After records of flow have been accumulated near the mouths of the Utah tributaries

named above and near the mouths of the San Rafael. Dirty Devil and Escalante Rivers, the records at those points should be substituted for the upper Utah stations used in computing the relationship shown on Plate 15. From that time on the correlation developed by such a relation can be utilized to determine the effect on the river at Lee Ferry of the operation of main stem reservoirs. The new records of flow near the mouths of the Utah tributaries will permit the substitution of at least two new relationships for the relationship shown on Plate 15. The new relationships will measure directly the Utah depletions and other changes caused by the activities of man.

As development proceeds, gaging stations may of necessity have to be abandoned and others may have to be added because of the pattern of development. For example, the creation of the Flaming Gorge Reservoir will necessitate the moving of the Green River station near Linwood, Utah, and the Henry's Fork station at Linwood, Utah to points upstream. In addition to moving the Henry's Fork station it will then be necessary to retain the existing station on Blacks Fork near Green River, Wyoming, and reestablish the Green River station at Green River, Wyoming. The development of the Yellow Jacket Project along the Yampa River in Colorado and/or the Deadman Bench Project along the White River in Colorado and Utah will necessitate some change in the locations of key stations. There will be other instances throughout the basin where changes in locations of gaging stations will be necessary, some of which will be mentioned later.

Table No. 12 includes the data relative to Plate No. 16.

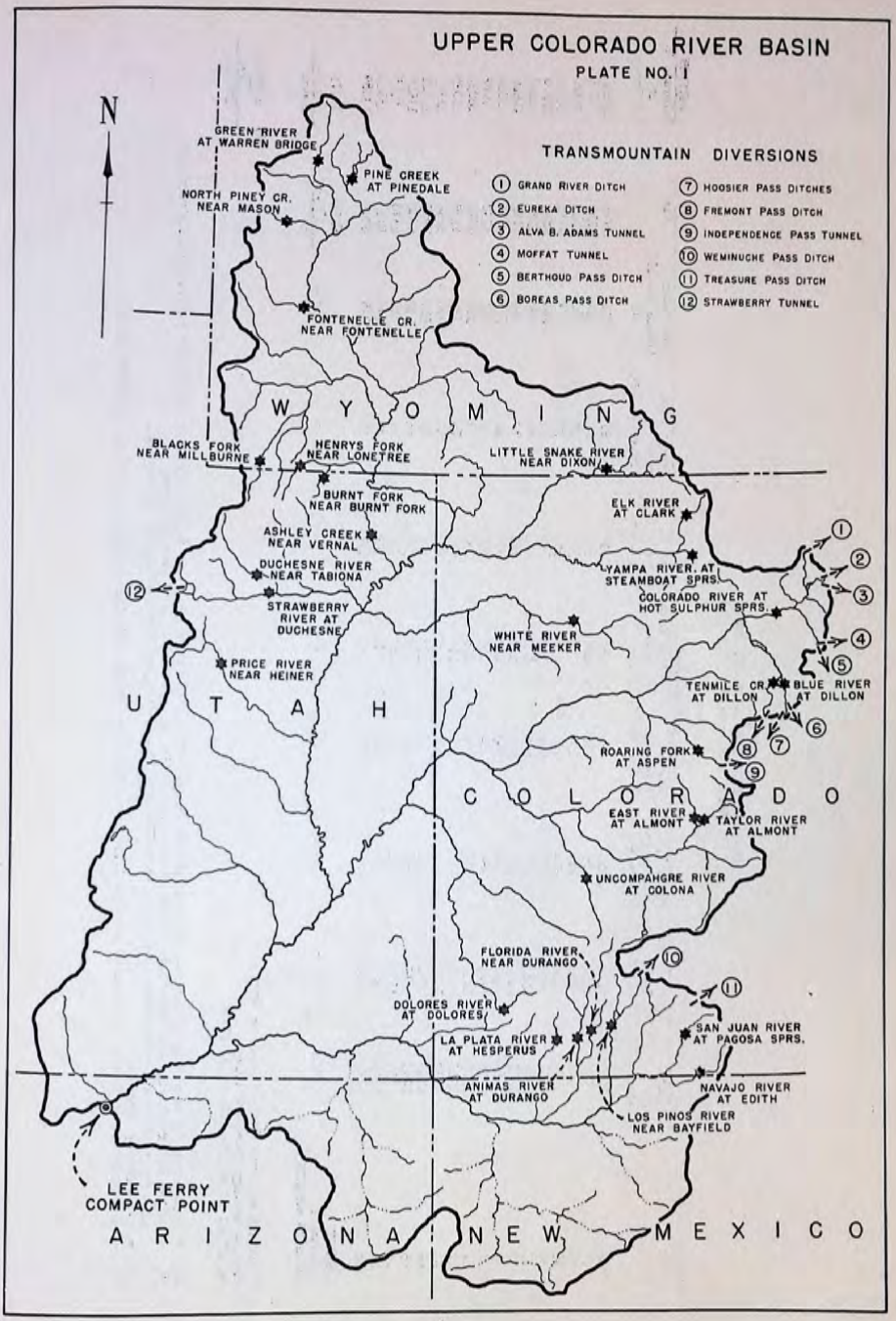
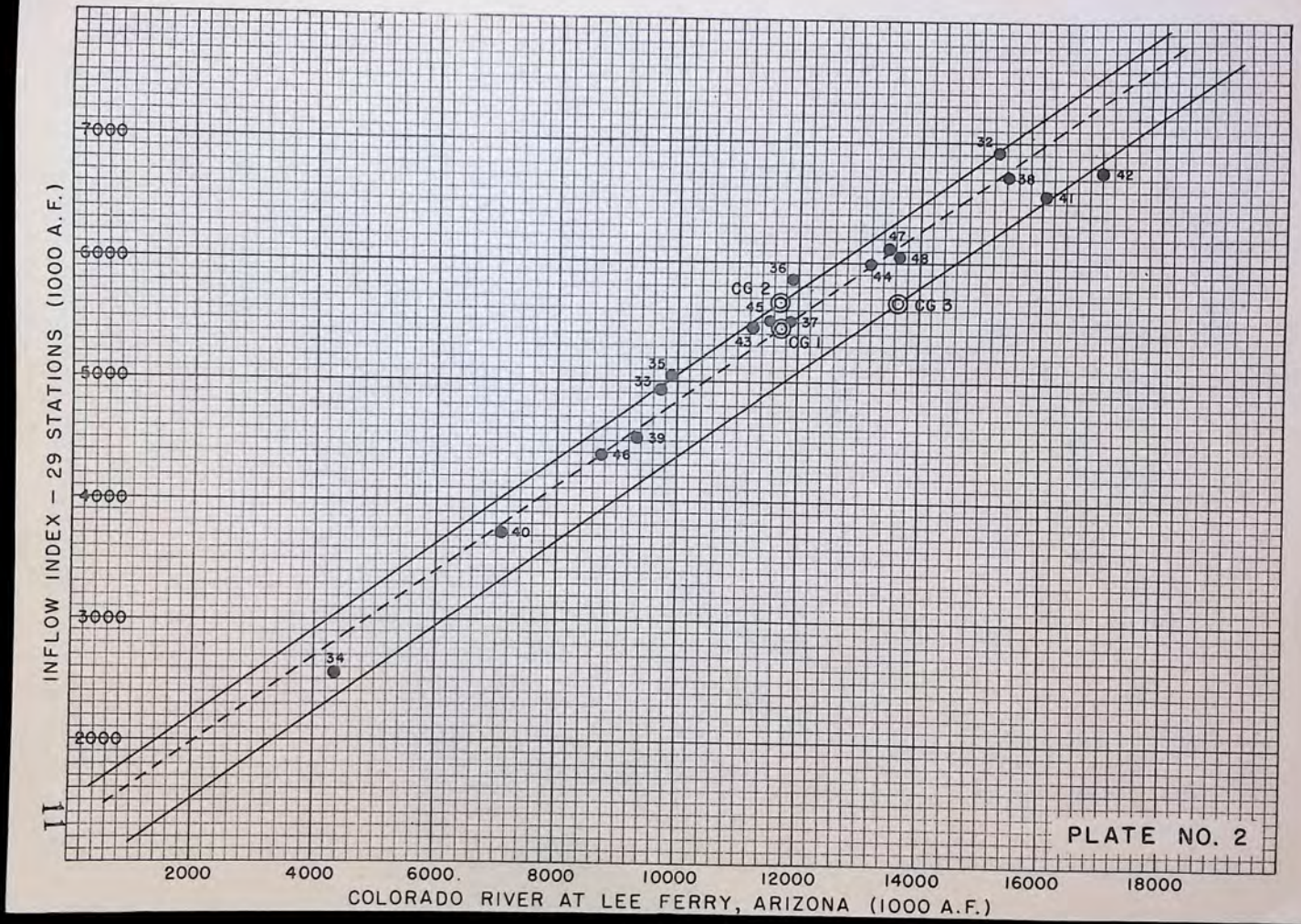

UPPER COLORADO RIVER BASIN
PLATE NO. 1
N
TRANSMOUNTAIN DIVERSIONS
1 GRAND RIVER DITCH
2 EUREKA DITCH
3 ALVA B. ADAMS TUNNEL
4 MOFFAT TUNNEL
5 BERTHOUD PASS DITCH
6 BOREAS PASS DITCH
7 HOOSIER PASS DITCHES
8 FREMONT PASS DITCH
9 INDEPENDENCE PASS TUNNEL
10 WEMINUCHE PASS DITCH
11 TREASURE PASS DITCH
12 STRAWBERRY TUNNEL
GREEN RIVER AT WARREN BRIDGE
PINE CREEK AT PINEDALE
NORTH PINEY CR. NEAR MASON
FONTENELLE CR. NEAR FONTENELLE
WYOMING
BLACKS FORK NEAR MILLBURNE
HENRYS FORK NEAR LONETREE
LITTLE SNAKE RIVER NEAR DIXON
BURNT FORK NEAR BURNT FORK
ELK RIVER AT CLARK
ASHLEY CREEK NEAR VERNAL
DUCHESNE RIVER NEAR TABIONA
YAMPA RIVER AT STEAMBOAT SPRS.
COLORADO RIVER AT HOT SULPHUR SPRS.
STRAWBERRY RIVER AT DUCHESNE
WHITE RIVER NEAR MEEKER
PRICE RIVER NEAR HEINER
TENMILE CR. AT DILLON
BLUE RIVER AT DILLON
UTAH
ROARING FORK AT ASPEN
COLORADO
EAST RIVER AT ALMONT
TAYLOR RIVER AT ALMONT
UNCOMPAHGRE RIVER AT COLONA
FLORIDA RIVER NEAR DURANGO
DOLORES RIVER AT DOLORES
LA PLATA RIVER AT HESPERUS
SAN JUAN RIVER AT PAGOSA SPRS.
ANIMAS RIVER AT DURANGO
NAVAJO RIVER AT EDITH
LOS PINOS RIVER NEAR BAYFIELD
LEE FERRY COMPACT POINT
ARIZONA
NEW MEXICO

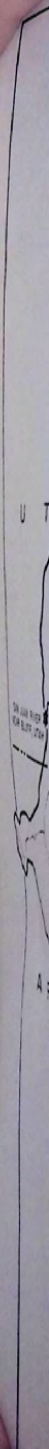
TABLE NO. 1
COLORADO RIVER BASIN ABOVE LEE FERRY
Units 1000 Acre Feet

WATER YEAR	INFLOW-INDEX									OUTFLOW
	San Juan Index (Table No. 2)	Upper Colo. R. Index (Table No. 5)	White R. near Meeker (Table No. 6)	Yampa R. Index (Table No. 7)	Little Snake R. near Dixon	Green R. Index (Table No. 9)	Henrys Fork Index (Table No. 10)	Utah Index (Table No. 11) (a)	Sum	Colorado R. at Lee Ferry
1932	1887	1891	542	730	c 689	691	55	431	6916	15286
33	967	1496	485	582	c 487	532	46	341	4936	9745
34	579	923	245	256	c 67	315	12	148	2545	4396
35	1554	1581	366	476	c 215	553	30	299	5074	9912
36	1229	1944	419	682	c 320	745	47	478	5864	11970
37	1455	1515	330	492	c 440	644	68	580	5524	11897
38	1687	2154	496	662	411	724	79	518	6731	15440
39	969	1407	372	503	254	596	49	355	4505	9394
1940	798	1165	360	462	252	388	26	287	3738	7082
41	2317	1816	450	499	316	597	73	509	6577	16052
42	1926	2118	477	541	418	651	85	533	6749	17029
43	1170	1677	377	526	332	841	43	490	5456	11263
44	1746	1791	398	466	333	634	87	542	5997	13221
45	1248	1613	461	611	485	590	68	432	5508	11545
46	819	1359	364	491	288	622	47	388	4378	8745
47	1215	1928	554	643	384	808	88	496	6116	13515
48	1777	1934	459	558	298	598	52	375	6051	13689
AVERAGE									5451	11775
Adjustment	12.4	61.8	34.0	15.1	(b) 27.5	36.2	0	19.4	206.4	1887.1
ADJUSTED AVERAGE									5657	13662

Depletion at sites of use above Lee Ferry (d) 1960.4
Present salvage above Lee Ferry 73.3
DEPLETION OF VIRGIN FLOW AT LEE FERRY 1887.1

(a) = Sum-Ashley Cr. near Vernal, Duchesne R. near Tabiona, Strawberry R. at Duchesne and Price R. near Heiner corrected for transmountain diversions.
(b) = Adjustment for irrigation depletions of 9510 acres above station at rate of 1.42 acre feet per acre; also for estimated by-passed water amounting to 14,000 acre feet to irrigate 3820 acres below the station.
c = Estimated by correlation.
(d) = Transmountain diversions in Colorado averaged 37,200 acre feet more for the 1932-1948 period than for the 1914-1945 period.


INFLOW INDEX – 29 STATIONS (1000 A.F.)
7000
6000
5000
4000
3000
2000
2000
4000
6000.
8000
10000
12000
14000
16000
18000
COLORADO RIVER AT LEE FERRY, ARIZONA (1000 A.F.)
32
38
42
41
47
48
44
36
CG 2
CG 3
45
37
43
CG 1
35
33
39
46
40
34
PLATE NO. 2



SAN JUAN RIVER BASIN
ABOVE BLUFF, UTAH

PLATE NO. 3

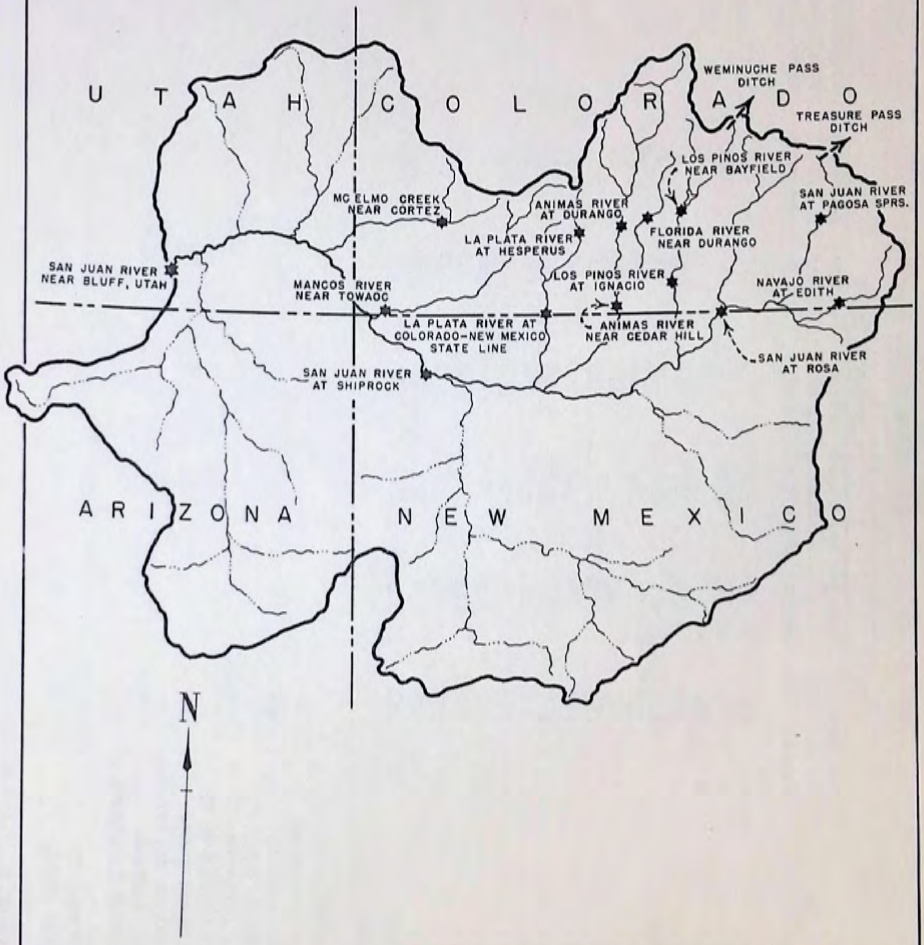


TABLE NO. 2
SAN JUAN RIVER BASIN ABOVE BLUFF
Units - 1000 Acre Feet

WATER YEAR	INFLOW - INDEX								OUTFLOW
	San Juan R. at Pagosa Spgs.	Navajo R. at Edith	Los Pinos R. near Bayfield	Animas R. at Durango	Florida R. near Durango	La Plata R. at Hesperus	Transmountain Diversions above Stations	Sum	San Juan R. near Bluff
1932	c 435	c 183	373	743	111	42	0	1887	2948
33	c 190	c 78	194	431	52	22	0	967	1242
34	c 105	c 57	125	250	28	14	0	579	662
35	c 375	c 155	317	567	100	40	0	1554	2183
36	233	115	255	522	72	32	0	1229	1631
37	342	170	284	540	80	38	1	1455	2336
38	345	142	351	710	98	40	1	1687	2466
39	184	86	208	426	46	17	2	969	1239
1940	157	70	149	361	40	20	1	798	996
41	528	218	412	949	142	66	2	2317	4242
42	401	191	350	832	105	46	1	1926	3078
43	225	89	221	538	62	32	3	1170	1445
44	351	116	382	768	87	41	1	1746	2289
45	290	119	192	548	68	29	2	1248	1620
46	120	54	166	422	39	16	2	819	865
47	205	78	211	626	67	26	2	1215	1488
48	353	103	411	769	102	37	2	1777	2319
AVERAGE								1373	1944
								12.4	162.1
								1385	2106
ADJUSTED AVGE.									
Acres irrigated above station	3150	2930	0	4060	160	350			
Depletion rate a.f. per acre	0.81	1.25		1.16	1.00	0.90			
Acres irrigated by by-passed water	0	75	100	0	0	0			
Irrigation depletions above station	2.6	3.7	0	4.7	0.2	0.3			
Estimated by-passed water	0	0.4	0.5	0	0	0			
ADJUSTMENT TO INFLOW INDEX	2.6	4.1	0.5	4.7	0.2	0.3		12.4	

(a) = Transmountain diversions averaged 800 acre feet more for 1932-1948 period than for 1914-1945 period.

Depletion at sites of use above Bluff
Present salvage above Bluff
DEPLETION OF VIRGIN FLOW AT BLUFF

(a) 166.6
4.5
162.1

c = Estimated by correlation.

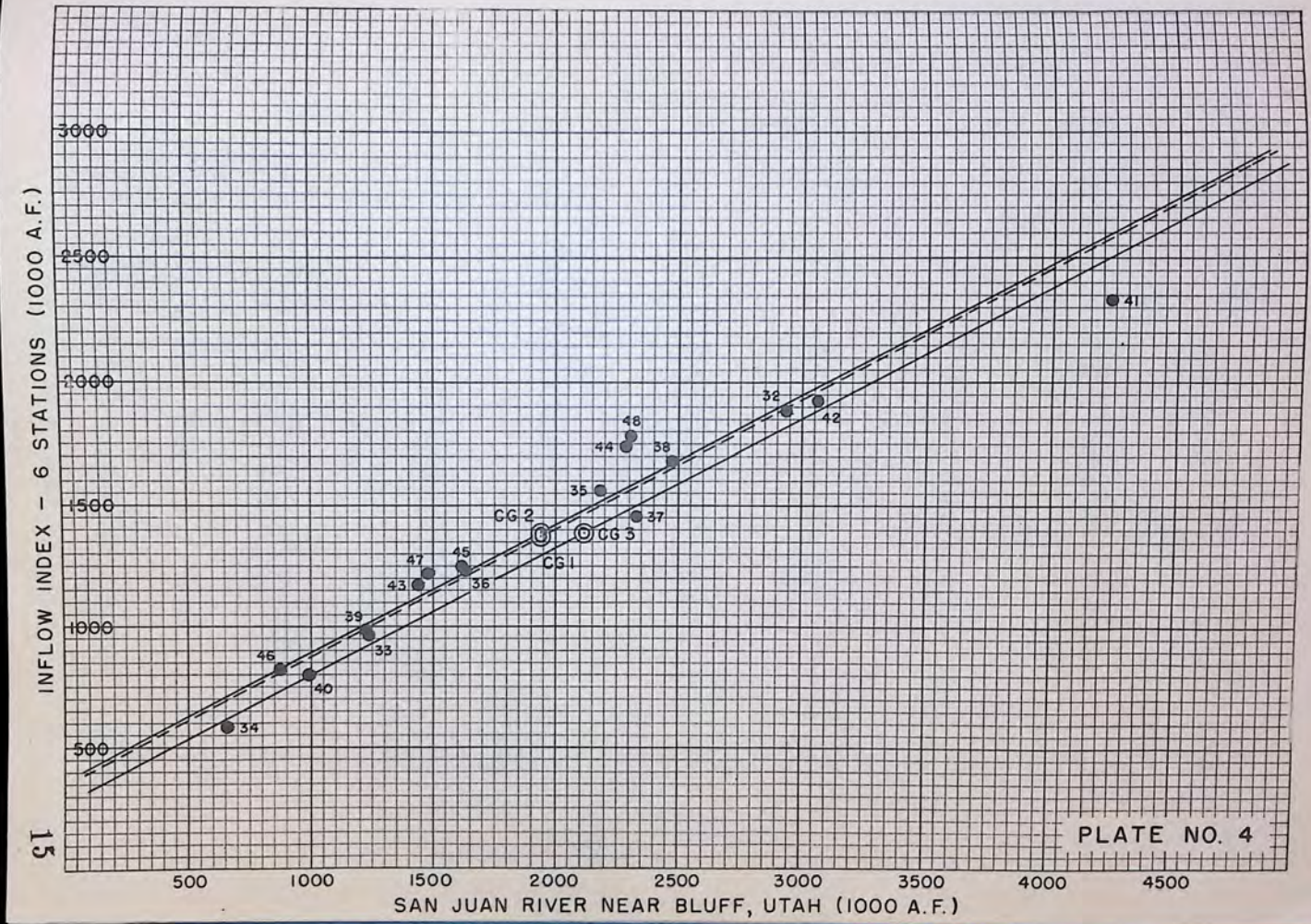

INFLOW INDEX - 6 STATIONS (1000 A.F.)
3000
2500
2000
1500
1000
500
SAN JUAN RIVER NEAR BLUFF, UTAH (1000 A.F.)
500
1000
1500
2000
2500
3000
3500
4000
4500
CG 2
CG 3
CG 1
48
44
38
35
37
32
42
41
47
45
43
36
39
33
46
40
34
PLATE NO. 4

TABLE NO. 3
SAN JUAN BASIN IN COLORADO
Units 1000 AF

WATER YEAR	INFLOW-INDEX San Juan Index (Table No. 2)	OUTFLOW San Juan R. at Rosa	Los Pinos R. at Ignacio	Animas R. near Cedar Hill	La Plata R. at Colo.-N.M. Stateline	Mancos R. near Towaoc	McElmo Cr. near Cortez	Sum
1932	1887	1401	362	c 925	30	58	c 45	2821
33	967	528	118	c 515	14	21	c 32	1228
34	579	321	59	c 300	8	9	c 30	727
35	1554	1143	272	758	22	35	c 41	2271
36	1229	741	173	636	25	37	c 38	1650
37	1455	1149	235	689	45	57	c 42	2217
38	1687	1096	281	879	28	53	c 46	2383
39	969	578	136	488	11	15	c 33	1261
1940	798	425	84	417	10	18	c 38	992
41	2317	1777	431	1240	70	87	59	3664
42	1926	1334	295	992	66	92	51	2830
43	1170	622	127	623	24	43	45	1484
44	1746	923	273	861	29	c 61	36	2183
45	1248	758	91	590	25	c 42	35	1541
46	819	342	42	439	10	c 15	(a) 28	876
47	1215	546	96	668	12	c 28	c 46	1396
48	1777	926	298	866	22	c 40	c 43	2195
AVERAGE	1373							1866
Adjustment	12.4							49.0
ADJUSTED AVERAGE	1385							1915

Depletion at sites of use above stateline stations (d) 49.0
Present salvage above stateline stations (b)
DEPLETION OF VIRGIN FLOW AT STATELINE STATIONS 49.0

(a) = Furnished by Durango office, U.S.B.R.
(b) = Not estimated by Engineering Advisory Committee
c = Estimated by correlation
(d) = Transmountain diversions averaged 800 acre feet more for 1932-1948 period than for 1914-1945 period.

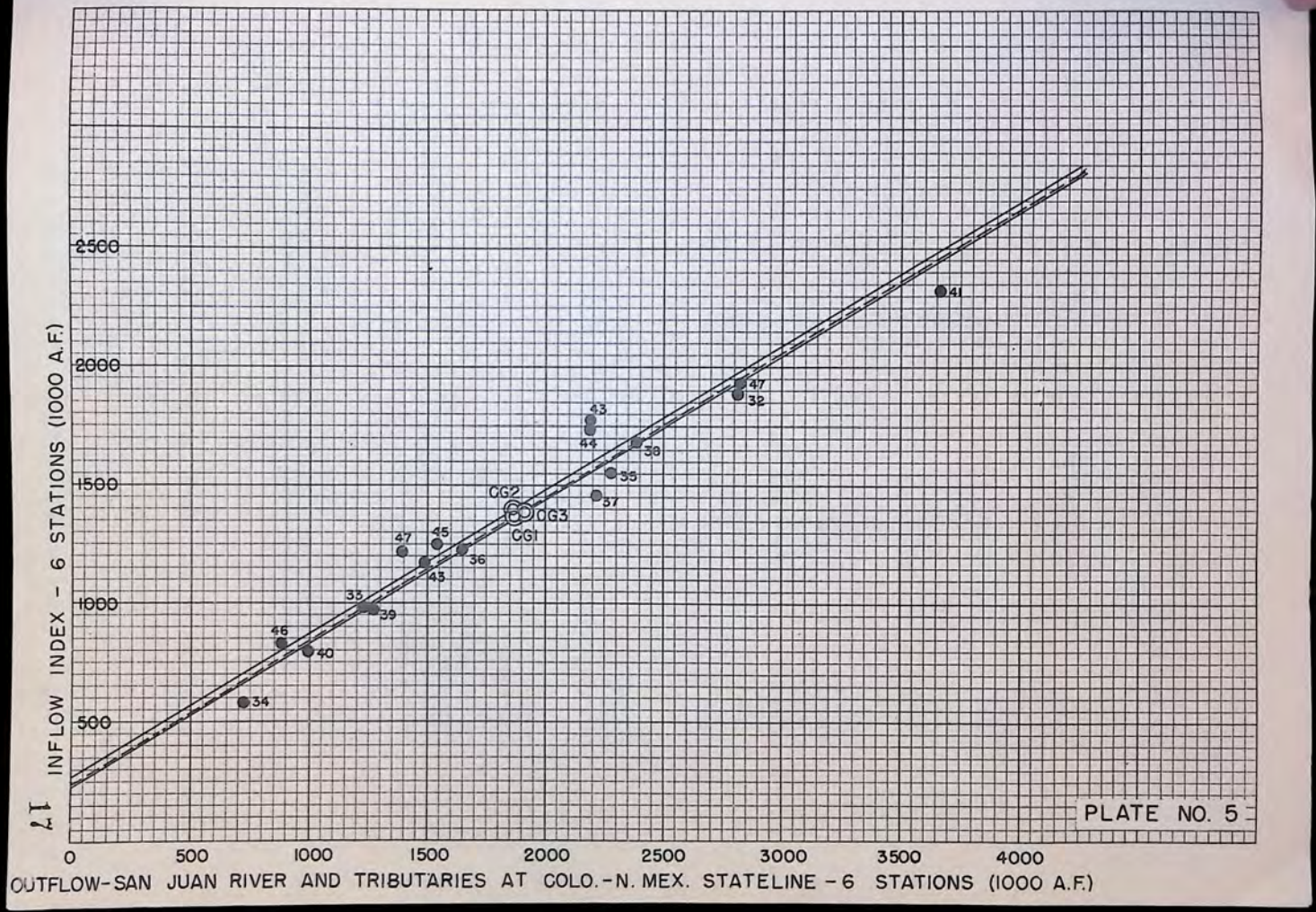
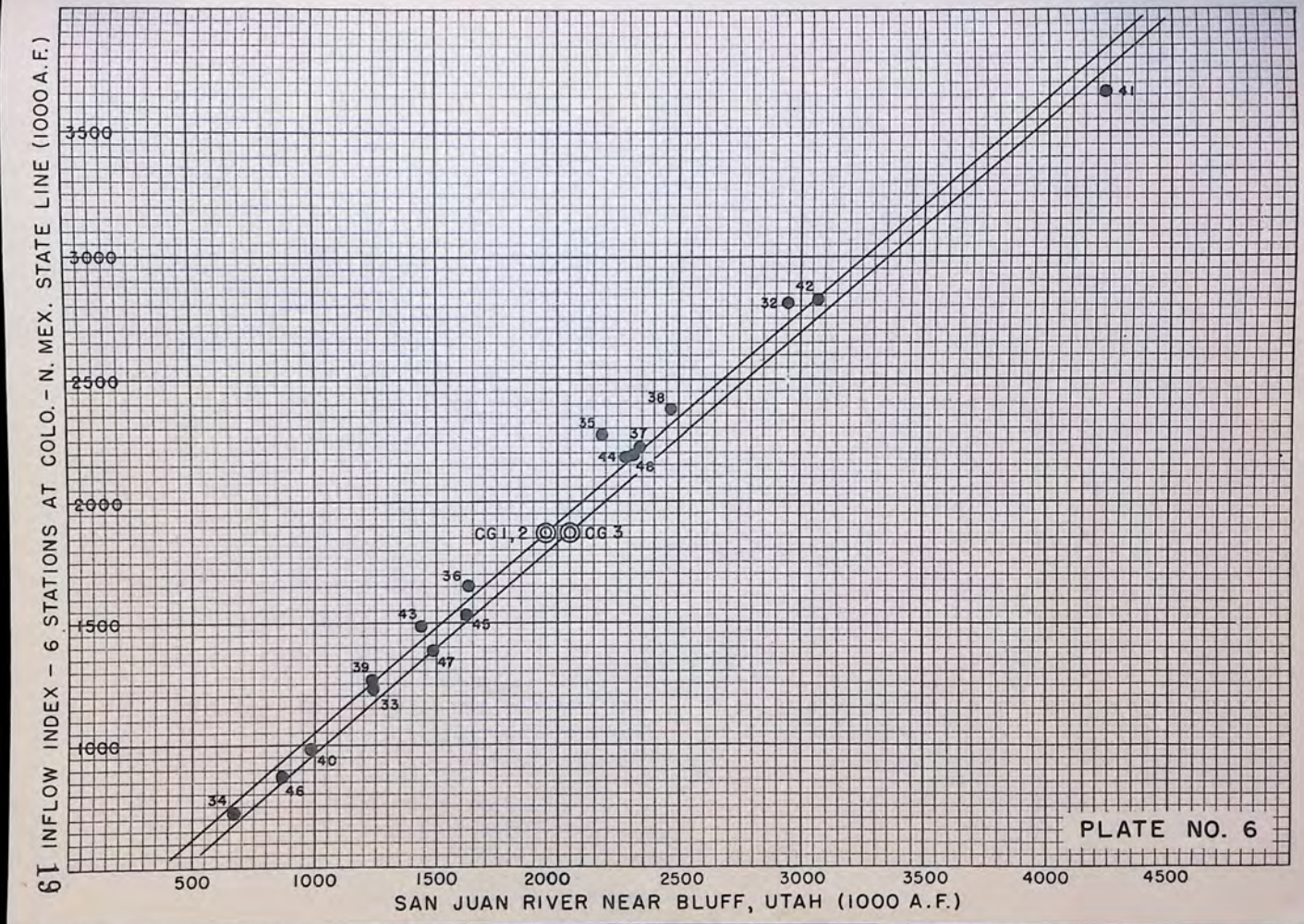

INFLOW INDEX - 6 STATIONS (1000 A.F.)
2500
2000
1500
1000
500
0
500
1000
1500
2000
2500
3000
3500
4000
OUTFLOW-SAN JUAN RIVER AND TRIBUTARIES AT COLO.-N. MEX. STATELINE - 6 STATIONS (1000 A.F.)
41
47
32
43
44
38
35
37
CG2
CG3
CG1
47
45
43
36
35
39
46
40
34
PLATE NO. 5

TABLE NO. 4
SAN JUAN BASIN - COLO.-N.M. STATELINE TO BLUFF
Units 1000 AF

WATER YEAR	INFLOW-INDEX Table No. 3 (a)	OUTFLOW San Juan R. near Bluff
1932	2821	2948
33	1228	1242
34	727	662
35	2271	2183
36	1650	1631
37	2217	2336
38	2383	2466
39	1261	1239
1940	992	996
41	3664	4242
42	2830	3078
43	1484	1445
44	2183	2289
45	1541	1620
46	876	865
47	1396	1488
48	2195	2319
AVERAGE	1866	1944
Adjustment		113.1
ADJUSTED AVERAGE		2057

Depletions at sites of use - Stateline stations to Bluff	117.6
Present salvage - Stateline stations to Bluff	4.5
DEPLETION OF VIRGIN FLOW AT BLUFF - Stateline Stations to Bluff	113.1

(a) = Sum San Juan R. at Rosa, Los Pinos R. at Ignacio, Animas R. near Cedar Hill, La Plata R. at Stateline, Mancos R. near Towaoc, McElmo Cr. near Cortez.


INFLOW INDEX - 6 STATIONS AT COLO. - N. MEX. STATE LINE (1000 A.F.)
3500
3000
2500
2000
1500
1000
500
1000
1500
2000
2500
3000
3500
4000
4500
SAN JUAN RIVER NEAR BLUFF, UTAH (1000 A.F.)
41
32
42
38
35
37
44
46
CG 1, 2
CG 3
36
43
45
47
39
33
40
46
34
PLATE NO. 6

COLORADO
UTAH

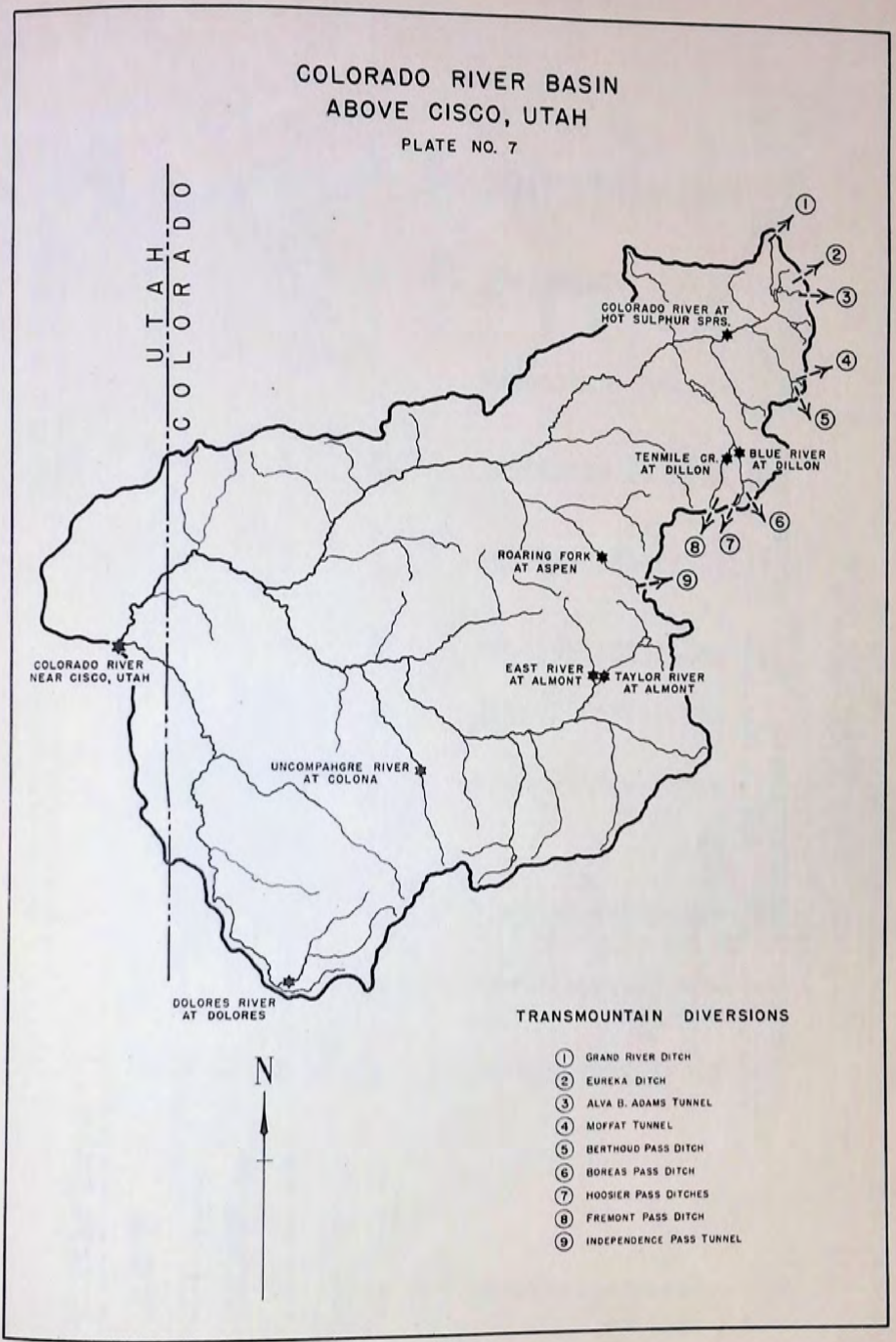

COLORADO RIVER BASIN
ABOVE CISCO, UTAH
PLATE NO. 7
UTAH
COLORADO
COLORADO RIVER AT HOT SULPHUR SPRS.
TENMILE CR. AT DILLON
BLUE RIVER AT DILLON
ROARING FORK AT ASPEN
COLORADO RIVER NEAR CISCO, UTAH
EAST RIVER AT ALMONT
TAYLOR RIVER AT ALMONT
UNCOMPAHGRE RIVER AT COLONA
DOLORES RIVER AT DOLORES
N
TRANSMOUNTAIN DIVERSIONS
1 GRAND RIVER DITCH
2 EUREKA DITCH
3 ALVA B. ADAMS TUNNEL
4 MOFFAT TUNNEL
5 BERTHOUD PASS DITCH
6 BOREAS PASS DITCH
7 HOOSIER PASS DITCHES
8 FREMONT PASS DITCH
9 INDEPENDENCE PASS TUNNEL

TABLE NO. 5
COLORADO RIVER BASIN ABOVE CISCO
Units - 1000 Acre Feet

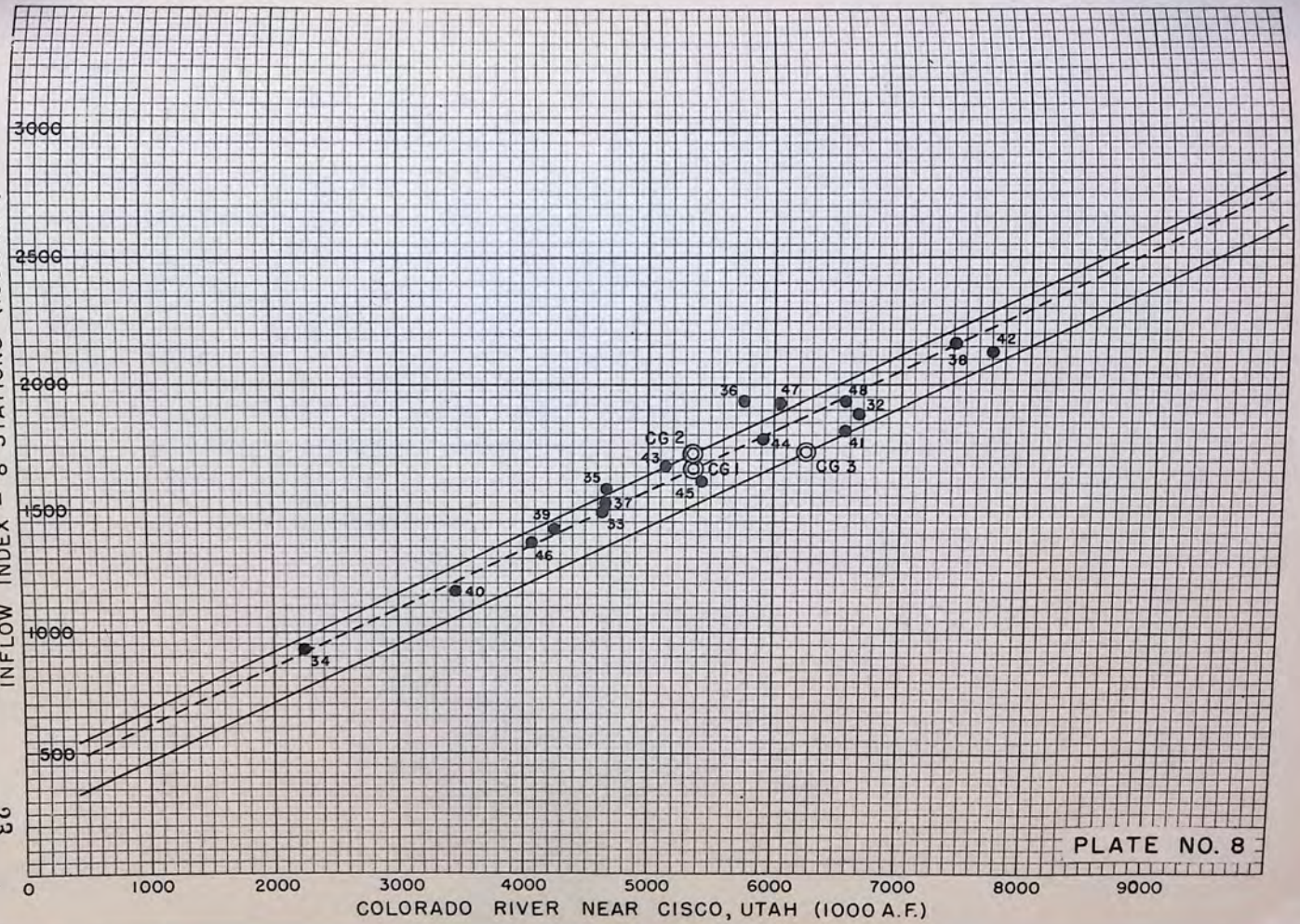
WATER YEAR	INFLOW-INDEX										OUTFLOW
	Colorado R. at Hot Sulphur Springs	Blue R. at Dillon	Tenmile Cr. at Dillon	Roaring Fork at Aspen	East R. at Almont	Taylor R. at Almont	Uncompahgre R. near Colona	Dolores R. at Dolores	Transmountain Diversions above stations	Sum	Colorado R. near Cisco
1932	462	76	81	c 114	c 238	232	216	453	19	1891	6687
33	466	70	88	* 104	c 197	192	150	213	16	1496	4631
34	254	54	55	* 63	c 144	138	102	102	11	923	2220
35	397	65	71	80	247	223	* 160	306	32	1581	4681
36	550	108	113	95	298	288	142	291	59	1944	5766
37	321	56	60	51	208	197	157	396	69	1515	4664
38	563	88	97	81	276	226	280	426	117	2154	7422
39	353	77	82	60	183	213	158	192	89	1407	4252
1940	293	49	53	35	135	149	160	216	75	1165	3463
41	358	70	67	53	243	138	272	522	93	1816	6576
42	434	78	77	96	232	261	323	572	45	2118	7706
43	376	77	88	67	247	228	170	325	99	1677	5137
44	334	63	70	57	232	256	260	448	71	1791	5903
45	388	75	82	57	217	156	204	328	106	1613	5406
46	306	74	78	56	194	191	153	216	91	1359	4062
47	498	108	112	103	271	217	212	316	91	1928	6051
48	373	93	94	85	280	317	226	389	77	1934	6587
AVERAGE										1665	5366
ADJUSTED AVERAGE										61.8 / 1727	889.6 / 6256
Acres irrigated above station	12710	143	201	120	7360	360	15510	2525			
Depletion rate - acre feet per acre	0.83	1.00	1.00	1.03	0.82	0.82	1.44	1.43			
Acres irrigated by by-passed water	140	0	0	2100	0	0	1500	0			
Irrigation depletions above station	10.5	0.1	0.2	0.1	6.0	0.3	22.3	3.6			
Estimated by-passed water	0.7	0	0	10.5	0	0	7.5	0			
ADJUSTMENT TO INFLOW-INDEX	11.2	0.1	0.2	10.6	6.0	0.3	29.8	3.6		61.8	
Depletion at sites of use above Cisco											(a) 919.5
Present salvage above Cisco											29.9
DEPLETION OF VIRGIN FLOW AT CISCO											889.6

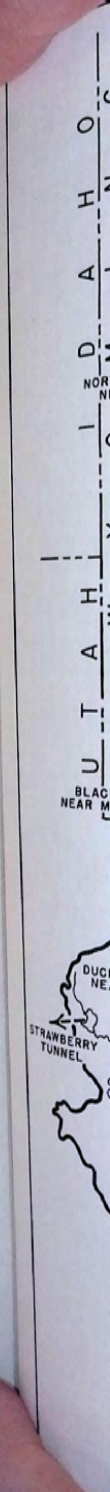
c = Estimated by correlation
* = Runoff estimated for winter months

(a) = Transmountain diversions averaged 36,400 acre feet more for 1932-1948 period than for 1914-1945 period.

c - Estimated by correlation
* - Runoff estimated for winter months

(a) - Transmountain diversions averaged 36,400 acre feet more for 1932-1940 period than for 1914-1945 period.




STRAWBERRY
TUNNEL

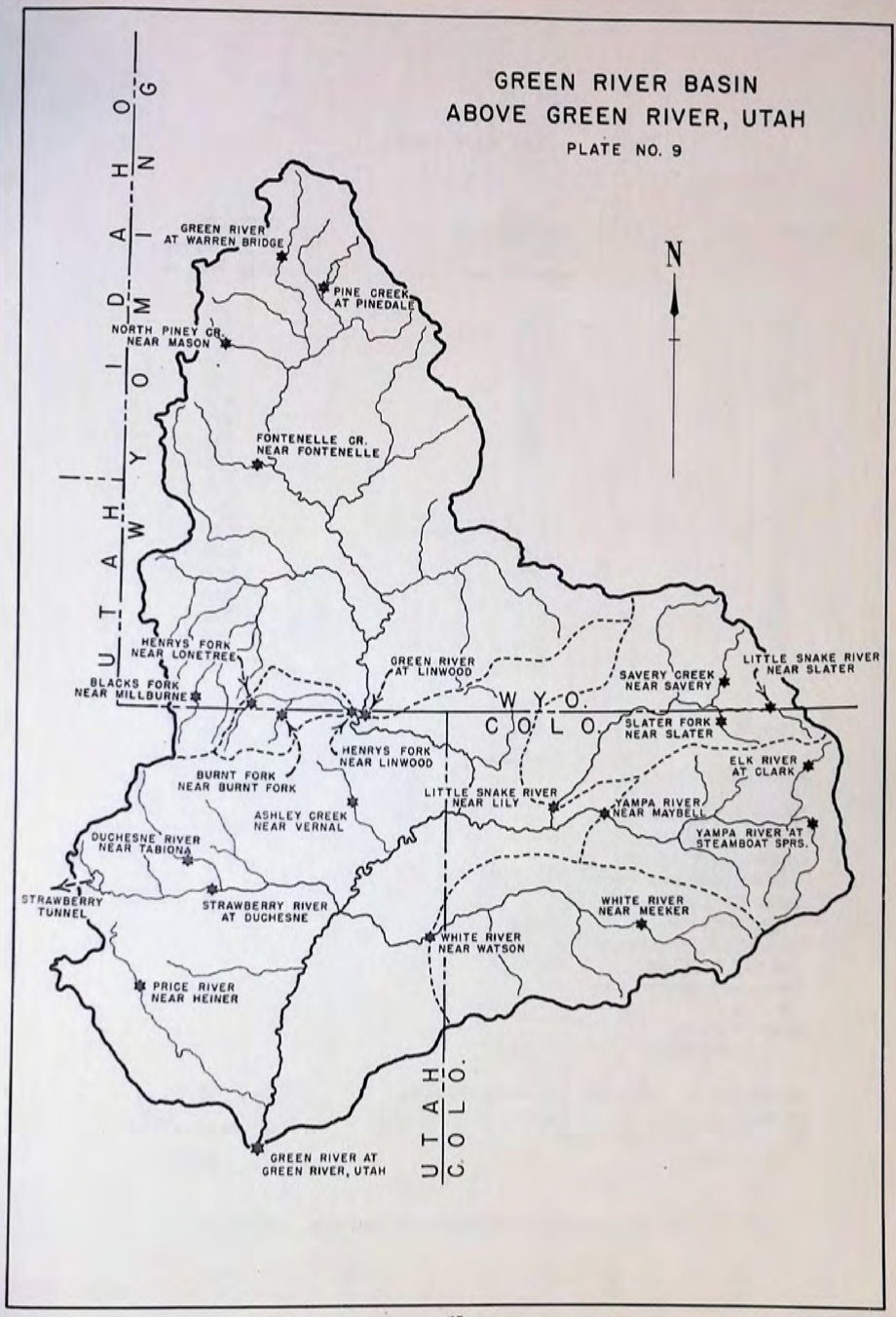

GREEN RIVER BASIN
ABOVE GREEN RIVER, UTAH
PLATE NO. 9
N
IDAHO
WYO.
UTAH
COLO.
GREEN RIVER AT WARREN BRIDGE
PINE CREEK AT PINEDALE
NORTH PINEY CR. NEAR MASON
FONTENELLE CR. NEAR FONTENELLE
HENRYS FORK NEAR LONETREE
BLACKS FORK NEAR MILLBURNE
GREEN RIVER AT LINWOOD
SAVERY CREEK NEAR SAVERY
LITTLE SNAKE RIVER NEAR SLATER
SLATER FORK NEAR SLATER
ELK RIVER AT CLARK
HENRYS FORK NEAR LINWOOD
BURNT FORK NEAR BURNT FORK
LITTLE SNAKE RIVER NEAR LILY
YAMPA RIVER NEAR MAYBELL
YAMPA RIVER AT STEAMBOAT SPRS.
ASHLEY CREEK NEAR VERNAL
DUCHESNE RIVER NEAR TABIONA
STRAWBERRY TUNNEL
STRAWBERRY RIVER AT DUCHESNE
WHITE RIVER NEAR MEEKER
WHITE RIVER NEAR WATSON
PRICE RIVER NEAR HEINER
GREEN RIVER AT GREEN RIVER, UTAH

TABLE NO. 6
WHITE RIVER BASIN
Units - 1000 Acre Feet

WATER YEAR	INFLOW-INDEX White River near Meeker	OUTFLOW White River near Watson
1932	542	595
33	485	537
34	245	281
35	366	402
36	419	472
37	330	392
38	496	599
39	372	448
1940	360	388
41	450	552
42	477	688
43	377	436
44	398	446
45	461	499
46	364	394
47	554	569
48	459	528
AVERAGE	421	484
	33.7	33.7
ADJUSTED AVGE.	455	518

Acres irrigated above station	12270
Depletion rate - acre feet per acre	1.28
Acres irrigated by by-passed water	3600
Irrigation depletions above station	15.7
Estimated by-passed water	18.0
ADJUSTMENT TO INFLOW-INDEX	33.7

Depletion at sites of use above Watson	33.7
Present salvage above Watson	(a)
DEPLETION OF VIRGIN FLOW AT WATSON	33.7

(a) = Not estimated by Engineering Advisory Committee

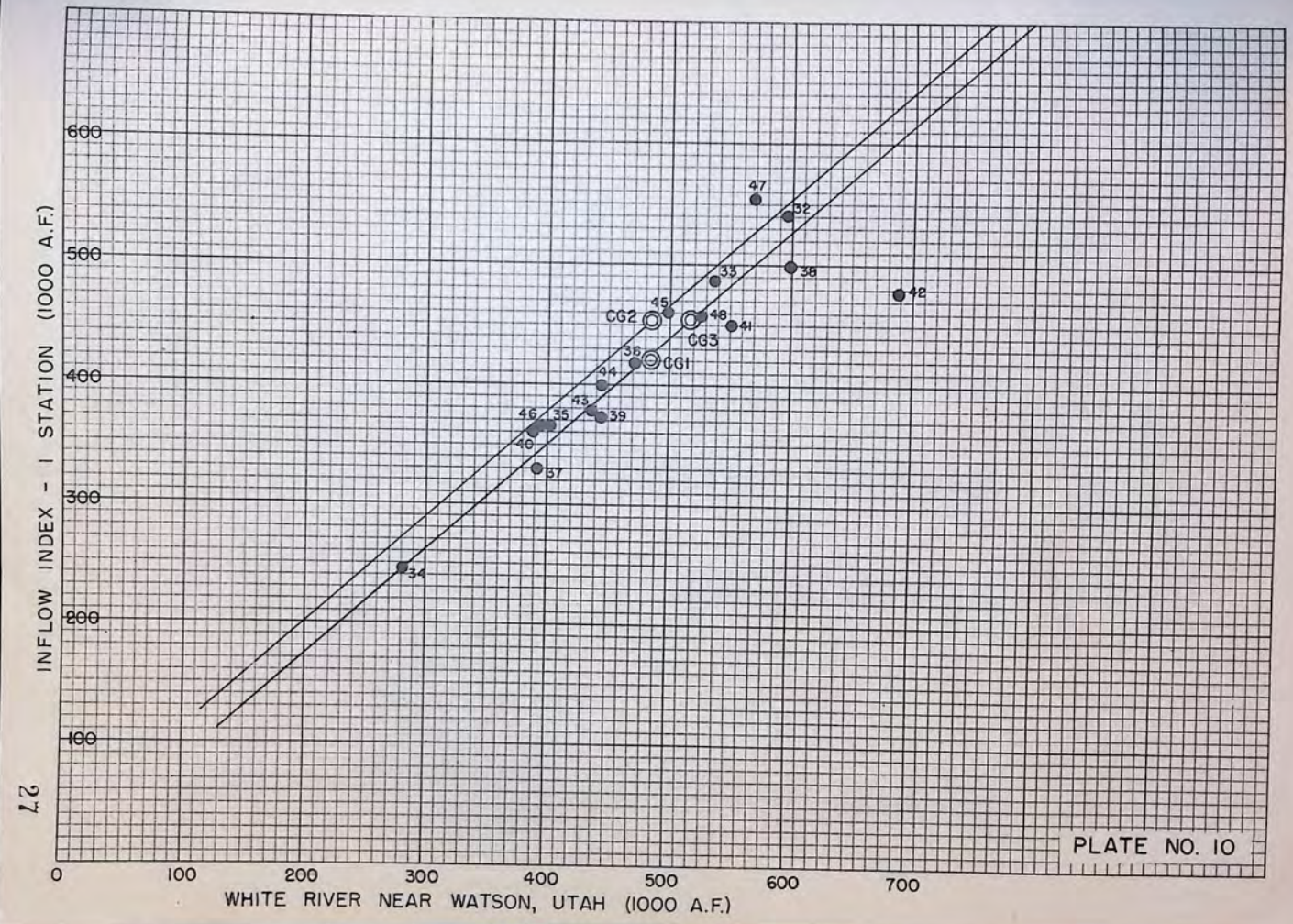

INFLOW INDEX - 1 STATION (1000 A.F.)
WHITE RIVER NEAR WATSON, UTAH (1000 A.F.)
0
100
200
300
400
500
600
700
100
200
300
400
500
600
47
32
33
38
42
45
CG2
48
41
CG3
36
CG1
44
43
46
35
39
40
37
34

PLATE NO. 10

TABLE NO. 7
YAMPA RIVER BASIN
Units - 1000 Acre Feet

WATER YEAR	INFLOW-INDEX Yampa R. at Steamboat Springs	Elk R. at Clark	Sum	OUTFLOW Yampa R. near Maybell
1932	378	352	730	1388
33	342	240	582	1061
34	127	129	256	374
35	252	224	476	878
36	384	298	682	1144
37	231	261	492	940
38	374	288	662	1228
39	300	203	503	930
1940	260	202	462	847
41	303	196	499	990
42	317	224	541	1189
43	294	232	526	905
44	248	218	466	851
45	322	289	611	1243
46	275	216	491	856
47	382	261	643	1310
48	344	214	558	1183
AVERAGE	302	238	540	1019
			15.1	52.8
ADJUSTED AVERAGE			555	1072
Acres irrigated above station	19730	230		
Depletion rate - acre feet per acre	0.64	0.73		
Acres irrigated by by-passed water	0	460		
Irrigation depletions above station	12.6	0.2		
Estimated by-passed water	0	2.3		
ADJUSTMENT TO INFLOW-INDEX	12.6	2.5	15.1	
Depletion at sites of use above Maybell				53.0
Present salvage above Maybell				0.2
DEPLETION OF VIRGIN FLOW AT MAYBELL				52.8

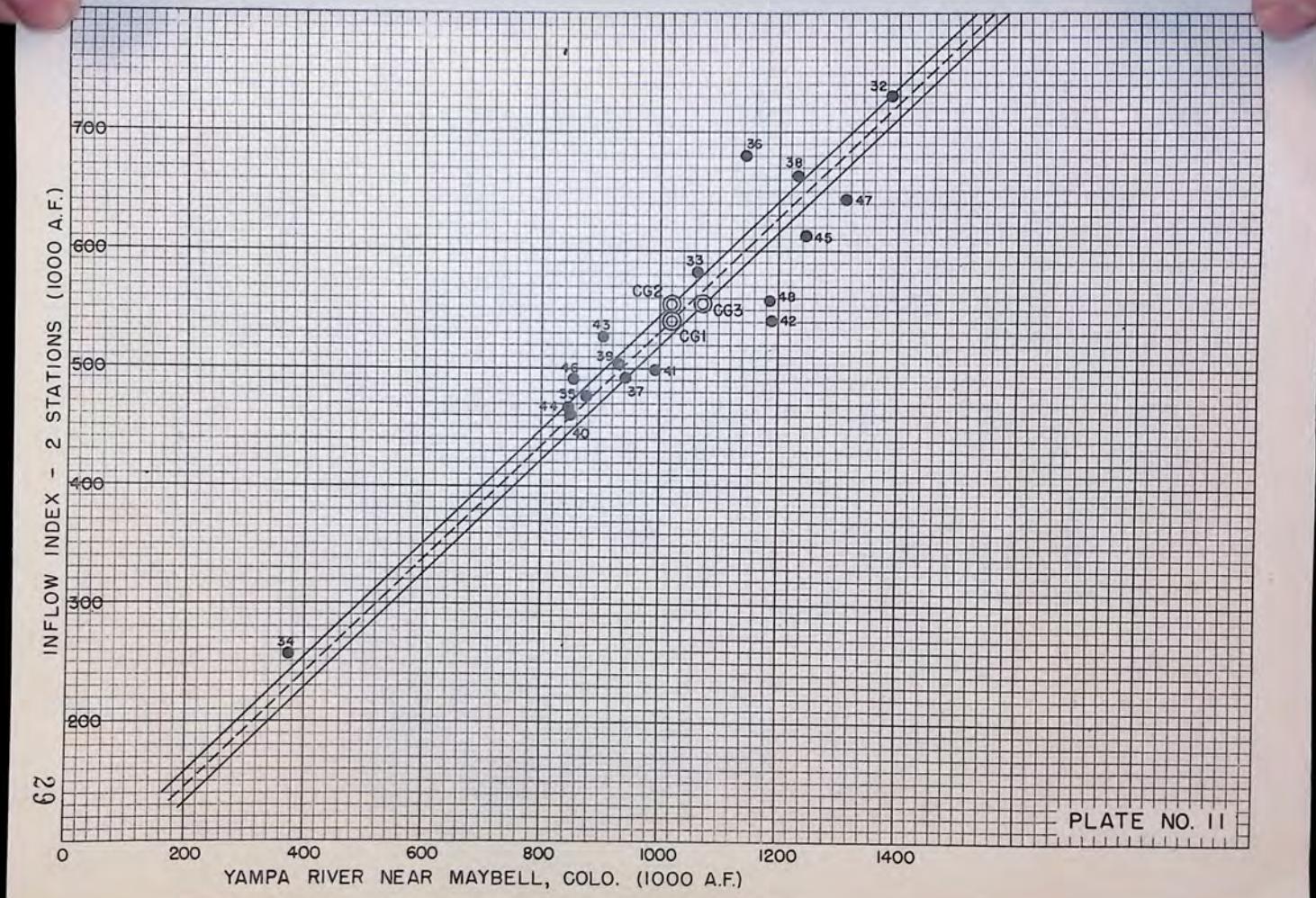

INFLOW INDEX - 2 STATIONS (1000 A.F.)
YAMPA RIVER NEAR MAYBELL, COLO. (1000 A.F.)
0
200
400
600
800
1000
1200
1400
200
300
400
500
600
700
32
36
38
47
45
33
CG2
CG3
CG1
49
42
43
39
46
41
35
37
44
40
34
PLATE NO. 11

TABLE NO. 8
LITTLE SNAKE RIVER BASIN
Units 1000 Acre Feet

WATER YEAR	INFLOW - INDEX				OUTFLOW
	Little Snake R. near Slater	Savery Cr. near Savery	Slater Fk. near Slater	Sum	Little Snake R. near Lily
1942	180	95	61	336	461
43	155	61	45	261	340
44	146	80	50	276	391
45	200	108	79	387	479
46	152	58	45	255	324
AVERAGE	167	80	56	303	399
				7.2	30.2
ADJUSTED AVERAGE				310	429
Acres irrigated above station	2000	1400	1300		
Depletion rate - acre feet per acre	1.42	1.42	1.42		
Acres irrigated by by-passed water	10	130	0		
Irrigation depletions above station	2.8	2.0	1.8		
Estimated by-passed water	0	0.6	0		
ADJUSTMENT TO INFLOW-INDEX	2.8	2.6	1.8	7.2	

Depletion at sites of use above Lily	30.5
Present salvage above Lily	0.3
DEPLETION OF VIRGIN FLOW AT LILY	30.2

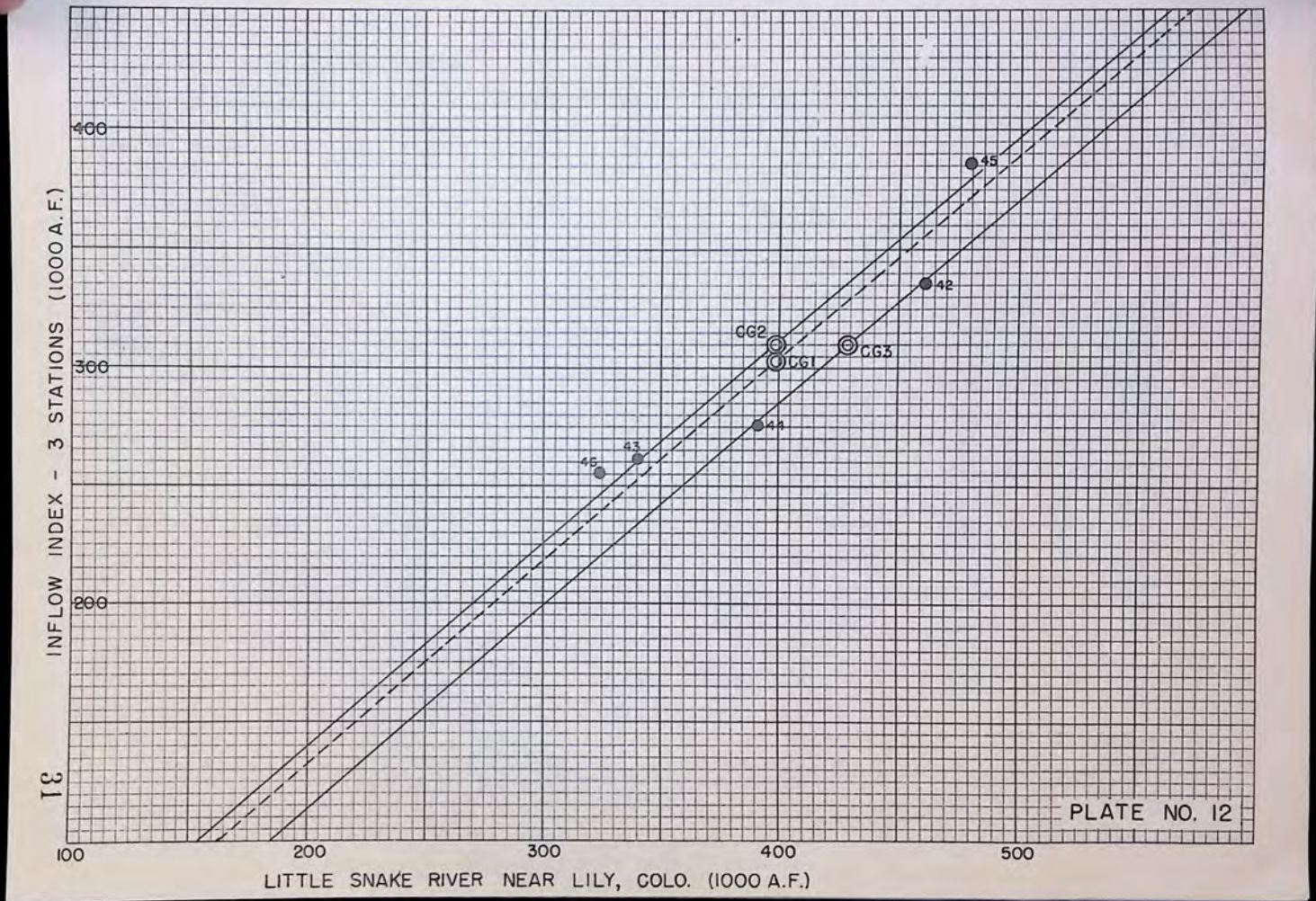

INFLOW INDEX - 3 STATIONS (1000 A.F.)
400
300
200
100
200
300
400
500
LITTLE SNAKE RIVER NEAR LILY, COLO. (1000 A.F.)
45
42
CG2
CG1
CG3
44
43
46
PLATE NO. 12

TABLE NO. 9
GREEN RIVER BASIN ABOVE LINWOOD
Units 1000 Acre Feet

WATER YEAR	INFLOW-INDEX						OUTFLOW
	Green R. at Warren Br. near Daniel	N. Piney Cr. near Mason	Pine Cr. at Pinedale	Fontenelle Cr. near Fontenelle	Blacks Fork near Millburne	Sum	Green R. near Linwood
1932	375	* 45	* 100	* 55	c 116	691	1371
33	* 315	* 29	* 69	* 33	c 86	532	1054
34	209	* 18	* 28	* 7	c 53	315	396
35	319	* 34	78	28	c 94	553	917
36	433	* 52	103	66	c 91	745	1700
37	* 380	* 32	70	44	c 118	644	1368
38	394	* 43	115	51	c 121	724	1533
39	338	* 41	78	39	c 100	596	1132
1940	238	20	43	11	76	388	535
41	342	11	87	21	136	597	1255
42	392	27	94	19	* 119	651	1434
43	486	59	127	67	* 102	841	1938
44	375	36	77	36	* 110	634	1515
45	328	36	81	26	* 119	590	1304
46	345	40	90	44	103	622	1425
47	427	55	133	62	131	808	2235
48	341	40	67	46	104	598	1447
AVERAGE	355	36	85	38	105	619	1327
ADJUSTED AVERAGE						36.2	193.6
						655	1521
Acres irrigated above station	3600	620	200	3640	0		
Depletion rate - acre feet per acre	0.95	0.95	0.95	0.95			
Acres irrigated by by-passed water	500	200	5000	0	0		
Irrigation depletions above station	3.4	0.6	0.2	3.5			
Estimated by-passed water	2.5	1.0	25.0	0	0		
ADJUSTMENT TO INFLOW-INDEX	5.9	1.6	25.2	3.5	0	36.2	
Depletion at sites of use above Linwood							194.9
Present salvage above Linwood							1.3
DEPLETION OF VIRGIN FLOW AT LINWOOD							193.6

c = Estimated by correlation
* = Runoff estimated for winter months

* - Runoff estimated for winter months

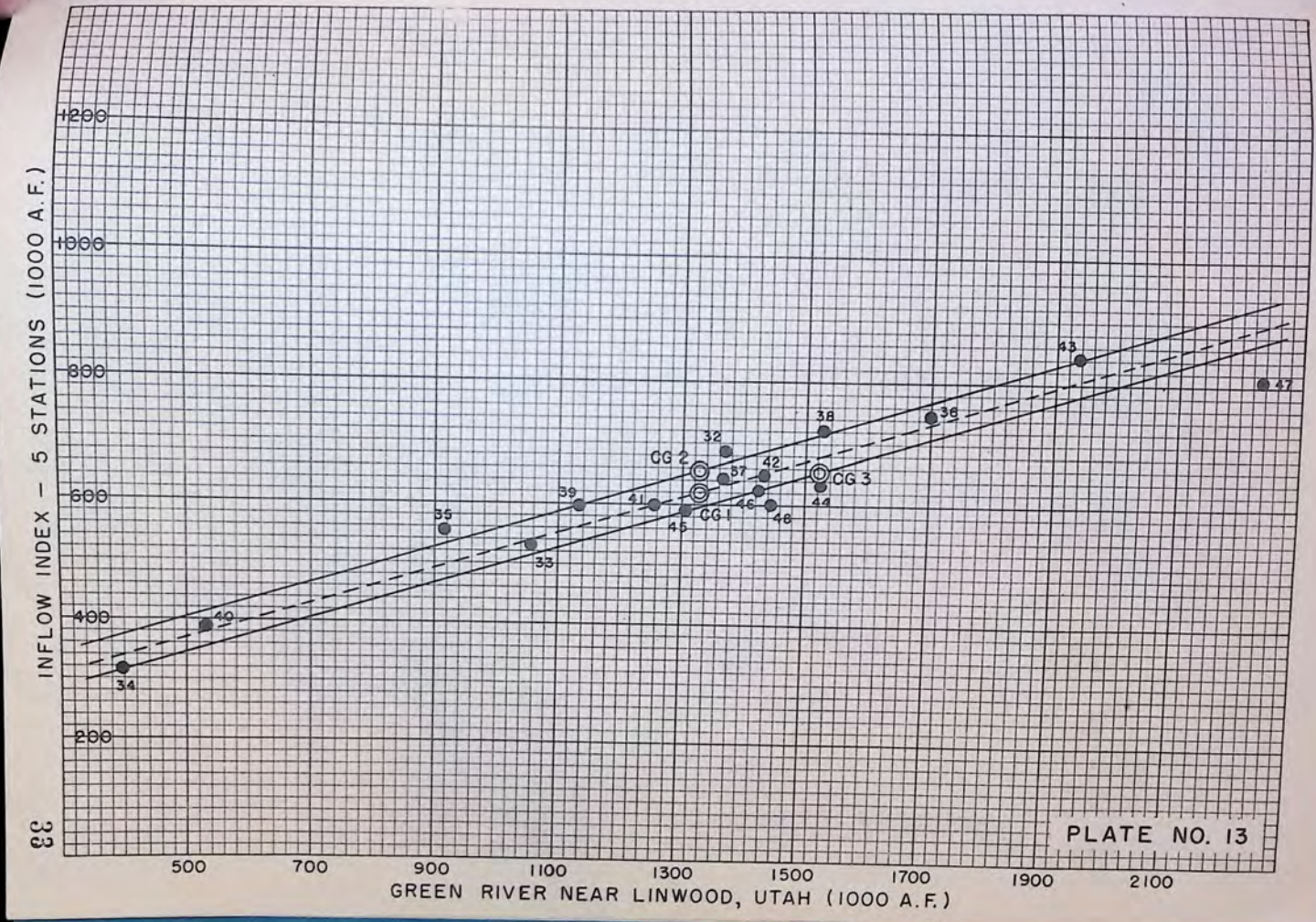


TABLE NO. 10
HENRYS FORK BASIN
Units 1000 Acre Feet

WATER YEAR	INFLOW-INDEX			OUTFLOW
	Henrys Fork near Lonetree	Burnt Fork near Burntfork	Sum	Henrys Fork at Linwood
1929	c 46	c 37	83	105
1930	c 35	c 28	63	73
31	c 13	c 12	25	28
32	c 35	c 25	60	55
33	c 20	c 16	36	46
34	c 9	c 8	17	12
35	c 23	c 18	41	30
36	c 21	c 18	39	47
37	c 33	c 26	59	68
38	c 36	c 27	63	79
39	c 23	c 20	43	49
1940	c 16	c 14	30	26
41	c 41	c 32	73	73
42	c 35	c 28	63	85
43	* 22	* 17	39	43
44	* 41	* 34	75	87
45	* 35	* 22	57	68
46	20	14	34	47
47	34	28	62	88
48	25	22	47	52
AVERAGE	28	22	50	58
				24.9
ADJUSTED AVERAGE				83

Depletion at sites of use above Linwood	24.9
Present salvage above Linwood	(a)
DEPLETION OF VIRGIN FLOW AT LINWOOD	24.9

(a) = Not estimated by Engineering Advisory Committee
c = Estimated by correlation
* = Runoff estimated for winter months

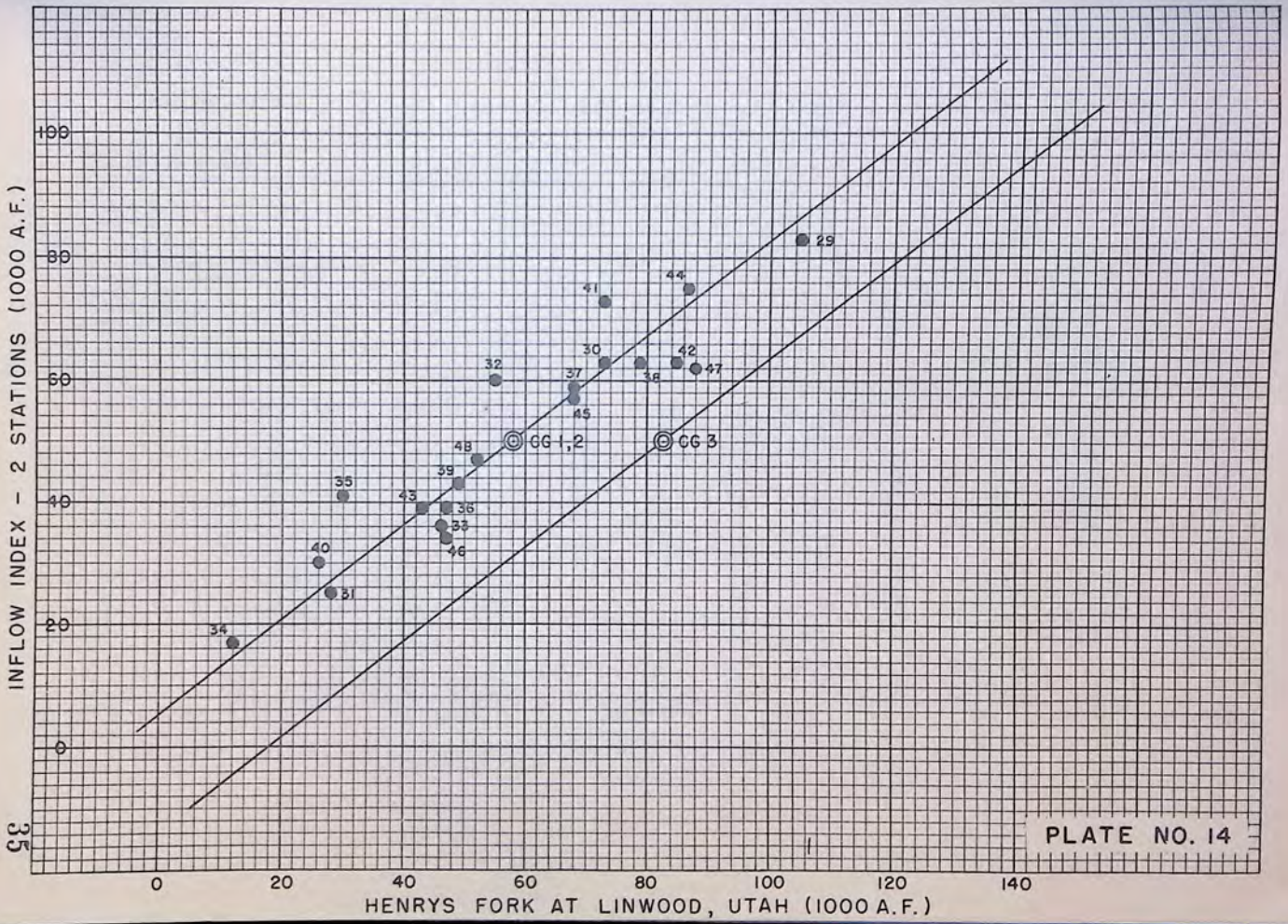

INFLOW INDEX - 2 STATIONS (1000 A.F.)
HENRYS FORK AT LINWOOD, UTAH (1000 A.F.)
0
20
40
60
80
100
120
140
100
80
60
40
20
0
29
44
41
30
42
47
38
32
37
45
CG 1,2
CG 3
48
39
35
43
36
33
46
40
31
34

PLATE NO. 14

TABLE NO. 11
GREEN RIVER BASIN ABOVE GREEN RIVER UTAH
Below Major Developments in Colorado and Wyoming
Units 1000 Acre feet

WATER YEAR	INFLOW-INDEX											OUTFLOW
	White R. near Watson	Yampa R. near Maybell	Little Snake R. near Lily	Green R. near Linwood	Henrys Fork at Linwood	Ashley Cr. near Vernal	Duchesne R. near Tabiona	Strawberry R. at Duchesne	Price R. near Heiner	Transmountain Diversion Operation (a)	Sum	Green R. at Green R., Utah
1932	595	1388	758	1371	55	74	145	92	58	62	4598	4822
33	537	1061	538	1054	46	48	107	73	65	48	3577	3525
34	281	374	80	396	12	31	57	23	26	11	1291	1307
35	402	878	242	917	30	64	94	49	48	44	2768	2850
36	472	1144	356	1700	47	42	167	106	86	77	4197	4147
37	392	940	487	1368	68	79	158	148	113	82	3835	4134
38	599	1228	480	1533	79	77	162	117	93	69	4437	4747
39	448	930	303	1132	49	66	117	70	61	41	3217	3420
1940	388	847	260	535	26	54	96	49	53	35	2343	2376
41	552	990	395	1255	73	92	150	106	107	54	3774	4242
42	688	1189	461	1434	85	101	144	107	122	59	4390	4990
43	436	905	340	1938	43	63	181	103	70	73	4152	4270
44	446	851	391	1515	87	94	164	115	98	71	3832	4476
45	499	1243	479	1304	68	63	144	88	67	70	4025	4159
46	394	856	324	1425	47	47	144	78	54	65	3434	3469
47	569	1310	467	2235	88	92	178	97	65	64	5165	5484
48	528	1183	285	1447	52	68	125	65	63	54	3870	4146
AVERAGE											3700	3917
											19.4	401.6
ADJUSTED AVERAGE											3719	4319
Acres irrigated above station						0	6915	3700	1000			
Depletion rate - acre feet per acre							1.60	1.60	1.70			
Irrigation depletions above stations						0	11.8	5.9	1.7		19.4	
ADJUSTMENT TO INFLOW-INDEX											19.4	
Depletion at sites of use below Colorado and Wyoming developments and above Green River, Utah												415.8
Present salvage in area												14.2
DEPLETION OF VIRGIN FLOW IN AREA												401.6

(a) = Information from Region IV, U.S.B.R.

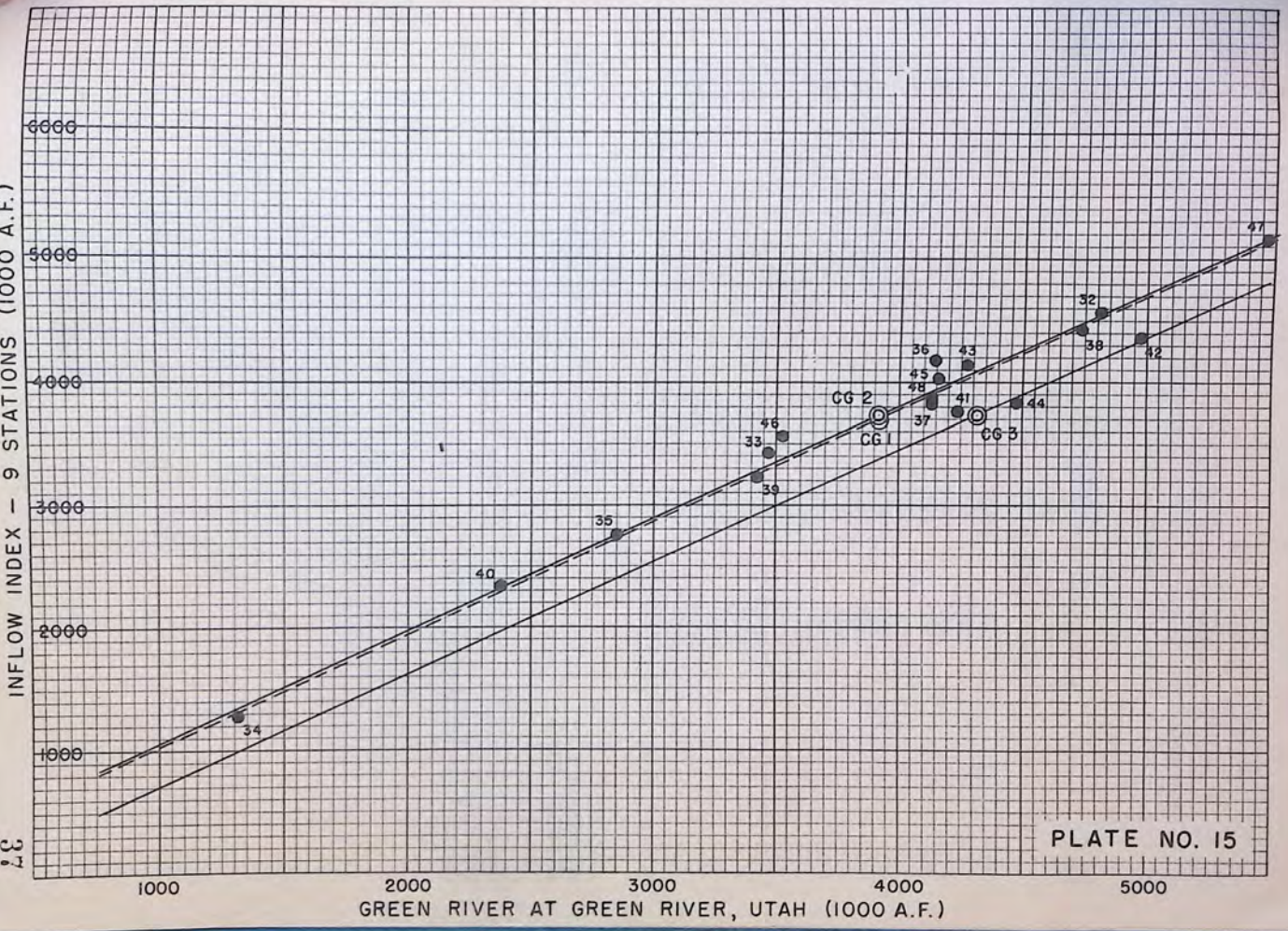
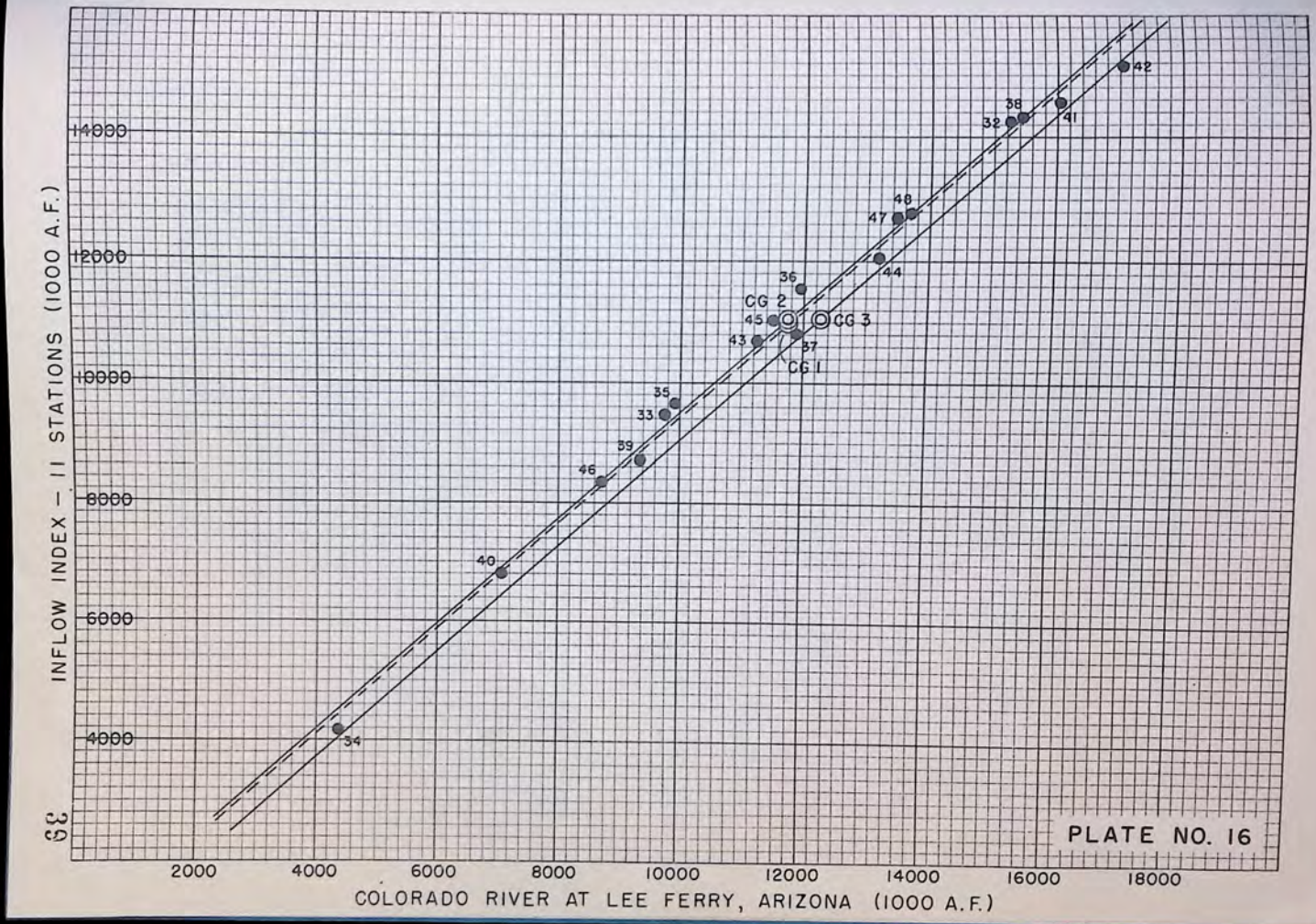

INFLOW INDEX – 9 STATIONS (1000 A.F.)
6000
5000
4000
3000
2000
1000
1000
2000
3000
4000
5000
GREEN RIVER AT GREEN RIVER, UTAH (1000 A.F.)
34
40
35
46
33
39
CG 2
CG 1
36
43
45
48
37
41
CG-3
44
32
38
42
47
PLATE NO. 15

TABLE NO. 12
COLORADO RIVER BASIN ABOVE LEE FERRY
Below Major Developments in Colorado, Wyoming, New Mexico and Arizona
Units - 1000 Acre Feet

WATER YEAR	INFLOW-INDEX				OUTFLOW
	Sum-Inflow-Indices (Table No. 11)	Colo. R. near Cisco	San Juan R. near Bluff	Sum	Colorado R. at Lee Ferry
1932	4598	6687	2948	14233	15286
33	3577	4631	1242	9450	9745
34	1291	2220	662	4173	4396
35	2768	4681	2183	9632	9912
36	4197	5766	1631	11594	11970
37	3835	4664	2336	10835	11897
38	4437	7422	2466	14325	15440
39	3217	4252	1239	8708	9394
1940	2343	3463	996	6802	7082
41	3774	6576	4242	14592	16052
42	4390	7706	3078	15174	17029
43	4152	5137	1445	10734	11263
44	3832	5903	2289	12024	13221
45	4025	5406	1620	11051	11545
46	3434	4062	865	8361	8745
47	5165	6051	1488	12704	13515
48	3870	6587	2319	12776	13689
AVERAGE				11010	11775
Adjustment				(a)19.4	500.2
ADJUSTED AVERAGE				11029	12275

Depletion at sites of use in area and above Lee Ferry	537.3
Present salvage in area	37.1
DEPLETION OF VIRGIN FLOW IN AREA	500.2

(a) From Table No. 11


INFLOW INDEX — 11 STATIONS (1000 A.F.)
14000
12000
10000
8000
6000
4000
2000
4000
6000
8000
10000
12000
14000
16000
18000
COLORADO RIVER AT LEE FERRY, ARIZONA (1000 A.F.)
CG 1
CG 2
CG 3
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
PLATE NO. 16

RECOMMENDATIONS

The Engineering Advisory Committee recommends that:

A. In General:

1. The Commission follow the basic procedure herein outlined as a means of measuring depletions by the inflow-outflow method until refinements or changes are made and agreed to by the Commission.

2. As records of run-off are accumulated the basic procedure be checked and relationships extended for the river sections covered by this report.

3. Studies be made by the Commission in regard to:

   a. Other areas and river sections which may require inflow-outflow relationships.

   b. Segregation of depletions between states in sections where more than one state is involved and where the water leaving the states passes through common carrier channels.

   c. A determination of virgin conditions, throughout the variation of meteorological conditions that can reasonably be expected.

4. Where new gaging stations are constructed to replace old ones, all be maintained concurrently for as long a period as necessary to establish a reliable correlation between the records of these stations.

B. Specifically:

1. The following existing stations were utilized in the determination of the inflow-outflow relationships described herein and should be retained for compact administrative purposes:

   a. LaPlata River at Hesperus, Colorado
   b. LaPlata River at Colorado-New Mexico State Line
   c. Animas River at Durango, Colorado
   d. Florida River near Durango, Colorado
   e. Animas River near Cedar Hill, New Mexico
   f. Los Pinos River near Bayfield, Colorado
   g. Los Pinos River at Ignacio, Colorado
   h. San Juan River at Pagosa Springs, Colorado
   i. Navajo River at Edith, Colorado
   j. San Juan River at Rosa, New Mexico
   k. Dolores River at Dolores, Colorado
   l. Uncompahgre River near Colona, Colorado
   m. Taylor River at Almont, Colorado
   n. East River at Almont, Colorado
   o. Roaring Fork at Aspen, Colorado
   p. Ten Mile Creek at Dillon, Colorado

q. Blue River at Dillon, Colorado
r. Colorado River at Hot Sulphur Springs, Colorado
s. White River near Meeker, Colorado
t. White River near Watson, Utah
u. Yampa River at Steamboat Springs, Colorado
v. Elk River at Clark, Colorado
w. Yampa River near Maybell, Colorado
x. Little Snake River near Slater, Colorado
y. Slater Fork near Slater, Colorado
z. Savery Creek near Savery, Wyoming
aa. Little Snake River near Dixon, Wyoming
bb. Little Snake River near Lily, Colorado
cc. Pine Creek at Pinedale, Wyoming
dd. Green River at Warren Bridge near Daniel, Wyoming
ee. North Piney Creek near Mason, Wyoming
ff. Fontenelle Creek near Fontenelle, Wyoming
gg. Black's Fork near Millburne, Wyoming
hh. Green River near Linwood, Utah
ii. Henry's Fork near Lonetree, Wyoming
jj. Burnt Fork near Burntfork, Wyoming
kk. Henry's Fork at Linwood, Utah
ll. Ashley Creek near Vernal, Utah
mm. Duchesne River near Tabiona, Utah
nn. Strawberry River at Duchesne, Utah
oo. Price River near Heiner, Utah
pp. Green River at Green River, Utah
qq. Colorado River near Cisco, Utah
rr. San Juan River near Bluff, Utah
ss. Colorado River at Lees Ferry, Arizona
tt. Paria River at Lees Ferry, Arizona

2. The following gaging stations which have been discontinued, be re-established:

a. South Fork White River near Buford, Colorado
b. North Fork White River near Buford, Colorado
c. McElmo Creek near Cortez, Colorado
d. Mancos River near Towaoc, Colorado
e. Green River at Green River, Wyoming

3. New gaging stations as follows be established:

a. Colorado River near Colorado-Utah State Line
b. Los Pinos River near Colorado-New Mexico State Line
c. McElmo Creek near Colorado-Utah State Line
d. Pine Creek near Fremont Lake, Wyoming
e. Fontenelle Creek above irrigation
f. Ham's Fork above irrigation
g. Dirty Devil near mouth
h. San Rafael near mouth

APPENDIX

APPENDIX

Statistical Method for Virgin Condition Correlations

Many of the early records of stream discharge in the basin were obtained under less favorable conditions than is the case in more recent years. In many instances, also, it was necessary to complete partial or missing records by estimating. A frequent necessity was that of extending records back for years on numerous tributary streams as well as at some points on the main river when discharge records were only for short periods. This was accomplished by correlations with flow at stations with longer records and usually with satisfactory results. For the present purpose, however, shorter series of years are used since a larger number of index stations can then be selected, including but few estimated values of discharge.

Example of Method as Applied to a Sub-Basin

Perhaps the best procedure for illustrating the methods used in deriving the correlation curves between inflows and outflows shown in the report is by the use of a typical example.

The data relative to which are shown in Table No. 5, Plate No. 8, and which has been previously presented as showing the inflow-outflow relationship for the Colorado River Basin above Cisco, Utah, is an example where both irrigation depletions and transmountain diversions are made above the inflow-index stations. Depletions above these stations due to irrigation have been comparatively constant from year to year during the period of correlation. However, during the same period the annual transmountain diversions made above the inflow-index stations varied between 11,000 acre-feet and 117,000 acre-feet.

The starting point for determining the inflow-outflow relationship was the correlation of historic data for selected inflow and outflow stations. In this case the annual amounts of transmountain diversions above the inflow stations were added to the recorded flows at those stations before the original correlation was made. The average of such adjusted inflow-indices was then plotted against the average of the outflows for the period of correlation as indicated by the point labeled C.G.1. The slope of the curve through the point C.G.1 was calculated from the annual data, and the coefficient of determination for this historic relationship computed to be 0.915. This shows in general 91.5 percent of the variation in outflow is due to corresponding variation in the inflow-index.

The correction for the smaller, more constant depletion due to irrigation was then applied to the average point described above, resulting in a point C.G.2, which is the point from which the average virgin relationship for the period may be determined.

The average of the transmountain diversions made in the entire basin above Cisco for the period of correlation, together with the average of all other man-made depletions in that basin were used in determining the point representing average virgin flow at Cisco for that period.

In the final report of the Engineering Advisory Committee the estimated average depletion at sites of use, due to irrigation, municipal uses, and reservoir evaporation losses, is given as 840,000 acre-feet. The salvage in the basin was also estimated to be 29,900 acre-feet. The average of the transmountain diversions made above Cisco is 79,500 acre-feet for the period of correlation. The sum of the average transmountain diversions and the average depletion at sites of use, minus the estimated salvage, is the average depletion of the virgin flow at Cisco for the period, which in this case amounts to 889,600 acre-feet.

A distance representing this amount was therefore laid off by scale to the right of C.G.2 and marked C.G.3. Lines were then drawn through the points C.G.1, C.G.2, and C.G.3 on the slope previously determined for the historic correlation, to indicate the probable relationship between virgin inflow-index and virgin outflow quantities. As stated in the description of the inflow-outflow curves previously presented, this virgin flow curve may not be exactly parallel to the historic trend lines, but until further data are obtained these curves may be used with reasonable results.

Inflow Stations Required for Index

Throughout the Colorado River Basin there are a few rim gaging stations with long records concurrent with outflow records. Correlations may be established for long periods by using the stations available, including some estimated values to complete missing portions of the record. A considerable number of additional stations have been installed on various tributaries in recent years. A study was made to determine the effect on a basic inflow-outflow relationship of the addition of more rim gaging stations to the original inflow-index, or the substitution of gaging stations for some which were used in the basic correlation.

The Colorado River Basin above Cisco was selected as an example, and the comparative results of the study are shown in the following tabulation:

Number of Inflow-Index Stations	Period of Correlation	Coefficient of Determination	Ratio of Inflow-Index to Outflow
9	1914-1947	0.952	31%
9	1939-1947	0.957	31%
15	1939-1947	0.966	46%
11	1939-1947	0.946	29%

A basic relationship between inflow-index at selected rim stations and outflow of the Colorado River at the gaging station near Cisco, Utah, was determined for the period 1914-1947. No corrections other than for annual transmountain diversions above them were made to the recorded flows at the index stations in determining this relation. The coefficient of determination (r^2), computed by least squares for the relation for individual years, is 0.952. Total corrected run-off at the inflow stations was about 31 percent of the run-off at Cisco for the period.

The inflow stations were selected primarily because of the long period of recorded run-off, rather than that they were ideally located to represent index inflow. The following tabulation lists the inflow stations used in the basic correlation, together with the approximate areas irrigated both above the gage and by water bypassing the gage. These areas were determined by a study of the U.S.B.R. land classification plane table sheets.

Gaging Stations	Acres Irrigated	
	Above Gage	By water Bypassing Gage
Colorado River near Hot Sulphur Springs	12,710	140
Blue River at Dillon	143	0
Roaring Fork at Aspen	120	2,100
Plateau Creek near Collbran plus Buzzard Creek near Collbran	2,180	410
East River at Almont	7,360	0
Taylor River at Almont	360	0
Uncompahgre River at Colona	15,510	1,502
Dolores River at Dolores	2,525	0

By 1939 a number of gaging stations had been established on other tributaries of the Colorado River above Cisco. In order to determine the effect on the inflow-outflow relationship of the addition of inflow stations a correlation was first made between the combined run-off of the stations listed above and the run-off at the outflow station near Cisco for the period 1939-1947. It was assumed that no significant changes had occurred in acreages irrigated above the gages or in the amounts of bypassed water for the long or short periods. Run-off at the inflow stations was corrected for annual transmountain diversions above the stations. For this correlation, $r^2 = 0.957$. The combined corrected run-off of the inflow stations represents about 31 percent of the outflow run-off for the period.

A second annual correlation for the period 1939-1947 was made between inflow-index run-off and outflow run-off at Cisco. The combined run-off of the following gaging stations was added to that of the stations listed above.

Gaging Station	Acres Irrigated	
	Above Gage	By water Bypassing Gage
Williams River near Leal	50	40
Snake River at Dillon	225	18,000 acre-feet (for power)
Ten Mile Creek at Dillon	201	0

Gaging Station	Acres Irrigated Above Gage	Acres Irrigated By water Bypassing Gage
Crystal River near Redstone	115	2,040
North Fork Gunnison River near Somerset	3,207	0
Tomichi Creek near Sargents	1,940	0

This group of inflow stations, together with those listed above, includes gaging stations on the important tributaries of the Colorado River system above Cisco, with the exception of the Eagle River and the Lake Fork of the Gunnison River. Corrections to the recorded run-off at the inflow stations were made for transmountain diversions as for the other correlations. No corrections were made for diversions above or bypassing the stations. The value for r^2, as computed for this correlation was 0.966. Total run-off of the inflow stations was approximately 46 percent of the run-off at the outflow station near Cisco.

Of the inflow stations represented in the latter correlation, there are some with considerable areas irrigated above the gages or comparatively large amounts of water bypassing the gages. In some instances it might be difficult to determine whether changes had occurred in depletions above the gages, or it might be expensive to make measurements of water bypassing the gages. As an example, the Granby and Shadow Mountain Lake Reservoirs, which are regulatory reservoirs for the Colorado-Big Thompson Transmountain Diversion Project, are being constructed above the gage on the Colorado River at Hot Sulphur Springs, Colorado. In the future, the record at Hot Sulphur Springs must necessarily be corrected for the operation of these reservoirs, including the net evaporation losses resulting from their operation.

A third correlation, for the 1939-1947 period was therefore made to ascertain the effect of eliminating some of the stations, or substituting other stations higher on the streams, so that the major portion of the consumptive uses would occur below the inflow stations and thus be automatically integrated into the inflow-outflow relationship. For this analysis, the stations on Colorado River near Grand Lake and Fraser River at Winter Park were substituted for Colorado River at Hot Sulphur Springs and the stations on Snake River at Dillon, Crystal River near Redstone, Uncompahgre River at Colona, and Buzzard and Plateau Creeks near Collbran were eliminated. Such elimination would preclude the necessity for measuring winter flows around Snake River at Dillon or for measuring bypassed water at Colona and Redstone in several ditches. The inflow stations used for the third correlation are listed in the following table:

Gaging Station	Acres Irrigated Above Gage	Acres Irrigated By water Bypassing Gage
Colorado River near Grand Lake	200	2,430
Fraser River at Winter Park	0	0
Blue River at Dillon	143	0
Ten Mile Creek at Dillon	201	0
Williams River near Leal	50	40
Roaring Fork at Aspen	120	2,100
East River at Almont	7,360	0
Taylor River at Almont	360	0
North Fork Gunnison River near Somerset	3,207	0
Tomichi Creek near Sargents	1,940	0
Dolores River at Dolores	2,525	0

The value for r^2 in this correlation was 0.946, with the total run-off at the inflow stations representing 29 percent of the total outflow, as compared with the ratio of 31 percent for the first correlation and 46 percent for the second.

The coefficient of determination for the third correlation is not significantly different from the coefficients for the other correlations for the 1939-1947 period, indicating that the final list of 11 stations would form the basis of a satisfactory inflow-outflow relationship. At the same time the list included only two stations with any considerable amounts of water bypassing them, and in each instance the major portion of this water may be measured in one canal. The irrigated areas above each of the stations is of the native hay meadow type, and these areas have become practically stabilized over a long period of years. Consumptive uses for presently contemplated projects, exclusive of transmountain diversions, will occur in most instances below the inflow stations.

The addition of a station which has been re-established on North Inlet to Grand Lake and stations above principal diversions on Crystal River and Eagle River might strengthen the relationship by increasing the ratio of total measured inflow to recorded outflow.

In any instance of the addition or elimination of inflow stations from those used as an original basis, the stations which are eliminated should be continued in operation for a sufficient length of time to permit correlations to be made so that the relations shown by any selected new group of inflow stations may be used in lieu of the original relation to insure continuity over a long period of time.

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and consent of the Senate: *Provided*, That a person who has within ten years been on active duty as a commissioned officer in a Regular component of the armed services shall not be eligible for appointment as Under Secretary of Defense. The Under Secretary shall perform such duties, and shall exercise such powers, as the Secretary of Defense may prescribe. The Under Secretary shall act for, and exercise the powers of, the Secretary of Defense during his absence or disability."

Restriction.

SEC. 2. Subsection (a) of section 301 of such Act (5 U. S. C., sec. 171b), is amended by adding at the end thereof the following:

61 Stat. 507.
5 U. S. C., Supp. II, § 171b.
Post, p. 585.

"The Under Secretary of Defense shall receive the compensation prescribed by law for Under Secretaries of executive departments."

Approved April 2, 1949.

[CHAPTER 48]

AN ACT

April 6, 1949
[S. 790]
[Public Law 37]

To grant the consent of the United States to the Upper Colorado River Basin Compact.

Upper Colorado River Basin Compact.
Consent of Congress.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of the Congress is hereby given to the compact, signed (after negotiations in which a representative of the United States, duly appointed by the President, participated and upon which he has reported to the Congress) by the Commissioners for the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, on October 11, 1948, at Santa Fe, New Mexico, and thereafter ratified by the legislatures of each of the States aforesaid, which said compact reads as follows:

"UPPER COLORADO RIVER BASIN COMPACT

"The State of Arizona, the State of Colorado, the State of New Mexico, the State of Utah and the State of Wyoming, acting through their Commissioners,

"Charles A. Carson for the State of Arizona,

"Clifford H. Stone for the State of Colorado,

"Fred E. Wilson for the State of New Mexico,

"Edward H. Watson for the State of Utah and

"L. C. Bishop for the State of Wyoming,

after negotiations participated in by Harry W. Bashore, appointed by the President as the representative of the United States of America, have agreed, subject to the provisions of the Colorado River Compact, to determine the rights and obligations of each signatory State respecting the uses and deliveries of the water of the Upper Basin of the Colorado River, as follows:

"ARTICLE I

"(a) The major purposes of this Compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River System, the use of which was apportioned in perpetuity to the Upper Basin by the Colorado River Compact; to establish the obligations of each State of the Upper Division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River Compact; to promote interstate comity; to remove causes of present and future controversies; to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of water and to protect life and property from floods.

"(b) It is recognized that the Colorado River Compact is in full force and effect and all of the provisions hereof are subject thereto.

"ARTICLE II

"As used in this Compact:

"(a) The term 'Colorado River System' means that portion of the Colorado River and its tributaries within the United States of America.

"(b) The term 'Colorado River Basin' means all of the drainage area of the Colorado River System and all other territory within the United States of America to which the waters of the Colorado River System shall be beneficially applied.

"(c) The term 'States of the Upper Division' means the States of Colorado, New Mexico, Utah and Wyoming.

"(d) The term 'States of the Lower Division' means the States of Arizona, California and Nevada.

"(e) The term 'Lee Ferry' means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

"(f) The term 'Upper Basin' means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the Colorado River System above Lee Ferry.

"(g) The term 'Lower Basin' means those parts of the States of Arizona, California, Nevada, New Mexico and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the Colorado River System below Lee Ferry.

"(h) The term 'Colorado River Compact' means the agreement concerning the apportionment of the use of the waters of the Colorado River System dated November 24, 1922, executed by Commissioners for the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, approved by Herbert Hoover, representative of the United States of America, and proclaimed effective by the President of the United States of America, June 25, 1929.

46 Stat. 3000.

"(i) The term 'Upper Colorado River System' means that portion of the Colorado River System above Lee Ferry.

"(j) The term 'Commission' means the administrative agency created by Article VIII of this Compact.

"(k) The term 'water year' means that period of twelve months ending September 30 of each year.

"(l) The term 'acre-foot' means the quantity of water required to cover an acre to the depth of one foot and is equivalent to 43,560 cubic feet.

"(m) The term 'domestic use' shall include the use of water for household, stock, municipal, mining, milling, industrial and other like purposes, but shall exclude the generation of electrical power.

"(n) The term 'virgin flow' means the flow of any stream undepleted by the activities of man.

"ARTICLE III

"(a) Subject to the provisions and limitations contained in the Colorado River Compact and in this Compact, there is hereby apportioned from the Upper Colorado River System in perpetuity to the States of Arizona, Colorado, New Mexico, Utah and Wyoming, respectively, the consumptive use of water as follows:

"(1) To the State of Arizona the consumptive use of 50,000 acre-feet of water per annum.

"(2) To the States of Colorado, New Mexico, Utah and Wyoming, respectively, the consumptive use per annum of the quantities resulting from the application of the following percentages to the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by Upper Basin under the Colorado River Compact and remaining after the deduction of the use, not to exceed 50,000 acre-feet per annum, made in the State of Arizona.

"State of Colorado, 51.75 per cent; State of New Mexico, 11.25 per cent; State of Utah, 23.00 per cent; State of Wyoming, 14.00 per cent.

"(b) The apportionment made to the respective States by paragraph (a) of this Article is based upon, and shall be applied in conformity with, the following principles and each of them:

"(1) The apportionment is of any and all man-made depletions;

"(2) Beneficial use is the basis, the measure and the limit of the right to use;

"(3) No State shall exceed its apportioned use in any water year when the effect of such excess use, as determined by the Commission, is to deprive another signatory State of its apportioned use during that water year; provided, that this subparagraph (b) (3) shall not be construed as:

"(i) Altering the apportionment of use, or obligations to make deliveries as provided in Article XI, XII, XIII or XIV of this Compact;

"(ii) Purporting to apportion among the signatory States such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact; or

"(iii) Countenancing average uses by any signatory State in excess of its apportionment.

"(4) The apportionment to each State includes all water necessary for the supply of any rights which now exist.

"(c) No apportionment is hereby made, or intended to be made, of such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact.

"(d) The apportionment made by this Article shall not be taken as any basis for the allocation among the signatory States of any benefits resulting from the generation of power.

"ARTICLE IV

"In the event curtailment of use of water by the States of the Upper Division at any time shall become necessary in order that the flow at Lee Ferry shall not be depleted below that required by Article III of the Colorado River Compact, the extent of curtailment by each State of the consumptive use of water apportioned to it by Article III of this Compact shall be in such quantities and at such times as shall be determined by the Commission upon the application of the following principles:

"(a) The extent and times of curtailment shall be such as to assure full compliance with Article III of the Colorado River Compact;

"(b) If any State or States of the Upper Division, in the ten years immediately preceding the water year in which curtailment is necessary, shall have consumptively used more water than it was or they were, as the case may be, entitled to use under the apportionment made by Article III of this Compact, such State or States shall be required to supply at Lee Ferry a quantity of water equal to its, or the aggregate of their, overdraft or the proportionate part of such overdraft, as may be necessary to assure compliance with Article III of the Colorado River Compact, before demand is made on any other State of the Upper Division;

"(c) Except as provided in subparagraph (b) of this Article, the extent of curtailment by each State of the Upper Division of the consumptive use of water apportioned to it by Article III of this Compact shall be such as to result in the delivery at Lee Ferry of a quantity of water which bears the same relation to the total required curtailment of use by the States of the Upper Division as the consumptive use of Upper Colorado River System water which was made by each such State during the water year immediately preceding the year in which the curtailment becomes necessary bears to the total consumptive use of such water in the States of the Upper Division during the same water year; provided, that in determining such relation the uses of water under rights perfected prior to November 24, 1922, shall be excluded.

"ARTICLE V

"(a) All losses of water occurring from or as the result of the storage of water in reservoirs constructed prior to the signing of this Compact shall be charged to the State in which such reservoir or reservoirs are located. Water stored in reservoirs covered by this paragraph (a) shall be for the exclusive use of and shall be charged to the State in which the reservoir or reservoirs are located.

"(b) All losses of water occurring from or as the result of the storage of water in reservoirs constructed after the signing of this Compact shall be charged as follows:

"(1) If the Commission finds that the reservoir is used, in whole or in part, to assist the States of the Upper Division in meeting their obligations to deliver water at Lee Ferry imposed by Article III of the Colorado River Compact, the Commission shall make findings, which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to the reservoir capacity allocated for that purpose. The whole or that proportion, as the case may be, of reservoir losses as found by the Commission to be reasonably and properly chargeable to the reservoir or reservoir capacity utilized to assure deliveries at Lee Ferry shall be charged to the States of the Upper Division in the proportion which the consumptive use of water in each State of the Upper Division during the water year in which the charge is made bears to the total consumptive use of water in all States of the Upper Division during the same water year. Water stored in reservoirs or in reservoir capacity covered by this subparagraph (b) (1) shall be for the common benefit of all of the States of the Upper Division.

"(2) If the Commission finds that the reservoir is used, in whole or in part, to supply water for use in a State of the Upper Division, the Commission shall make findings, which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to the reservoir or reservoir capacity utilized to supply water for use and the State in which such water will be used. The whole or that proportion, as the case may be, of reservoir losses as found by the Commission to be reasonably and properly chargeable to the State in which such water will be used shall be borne by that State. As determined by the Commission, water stored in reservoirs covered by this subparagraph (b) (2) shall be earmarked for and charged to the State in which the water will be used.

"(c) In the event the Commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the Upper Division, the storage of water for consumptive use shall be given preference. Any reservoir or reservoir capacity hereafter used to assure deliveries at Lee Ferry shall by order of the Commission be used to store water for consumptive

use in a State, provided the Commission finds that such storage is reasonably necessary to permit such State to make the use of the water apportioned to it by this Compact.

"ARTICLE VI

"The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the Upper Basin and for each State of the Upper Basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the Commission, by unanimous action, shall adopt a different method of determination.

"ARTICLE VII

"The consumptive use of water by the United States of America or any of its agencies, instrumentalities or wards shall be charged as a use by the State in which the use is made; provided, that such consumptive use incident to the diversion, impounding, or conveyance of water in one State for use in another shall be charged to such latter State.

"ARTICLE VIII

Upper Colorado River Commission.

"(a) There is hereby created an interstate administrative agency to be known as the 'Upper Colorado River Commission'. The Commission shall be composed of one Commissioner, representing each of the States of the Upper Division, namely, the States of Colorado, New Mexico, Utah and Wyoming, designated or appointed in accordance with the laws of each such State and, if designated by the President, one Commissioner representing the United States of America. The President is hereby requested to designate a Commissioner. If so designated the Commissioner representing the United States of America shall be the presiding officer of the Commission and shall be entitled to the same powers and rights as the Commissioner of any State. Any four members of the Commission shall constitute a quorum.

U.S. Commissioner.

"(b) The salaries and personal expenses of each Commissioner shall be paid by the Government which he represents. All other expenses which are incurred by the Commission incident to the administration of this Compact, and which are not paid by the United States of America, shall be borne by the four States according to the percentage of consumptive use apportioned to each. On or before December 1 of each year, the Commission shall adopt and transmit to the Governors of the four States and to the President a budget covering an estimate of its expenses for the following year, and of the amount payable by each State. Each State shall pay the amount due by it to the Commission on or before April 1 of the year following. The payment of the expenses of the Commission and of its employees shall not be subject to the audit and accounting procedures of any of the four States; however, all receipts and disbursement of funds handled by the Commission shall be audited yearly by a qualified independent public accountant and the report of the audit shall be included in and become a part of the annual report of the Commission.

Budget.

"(c) The Commission shall appoint a Secretary, who shall not be a member of the Commission, or an employee of any signatory State or of the United States of America while so acting. He shall serve for such term and receive such salary and perform such duties as the Commission may direct. The Commission may employ such engineering, legal, clerical and other personnel as, in its judgment, may be necessary for the performance of its functions under this Compact.

In the hiring of employees, the Commission shall not be bound by the civil service laws of any State.

"(d) The Commission, so far as consistent with this Compact, shall have the power to:

"(1) Adopt rules and regulations;

"(2) Locate, establish, construct, abandon, operate and maintain water gaging stations;

"(3) Make estimates to forecast water run-off on the Colorado River and any of its tributaries;

"(4) Engage in cooperative studies of water supplies of the Colorado River and its tributaries;

"(5) Collect, analyze, correlate, preserve and report on data as to the stream flows, storage, diversions and use of the waters of the Colorado River, and any of its tributaries;

"(6) Make findings as to the quantity of water of the Upper Colorado River System used each year in the Upper Colorado River Basin and in each State thereof;

"(7) Make findings as to the quantity of water deliveries at Lee Ferry during each water year;

"(8) Make findings as to the necessity for and the extent of the curtailment of use, required, if any, pursuant to Article IV hereof;

"(9) Make findings as to the quantity of reservoir losses and as to the share thereof chargeable under Article V hereof to each of the States;

"(10) Make findings of fact in the event of the occurrence of extraordinary drought or serious accident to the irrigation system in the Upper Basin, whereby deliveries by the Upper Basin of water which it may be required to deliver in order to aid in fulfilling obligations of the United States of America to the United Mexican States arising under the Treaty between the United States of America and the United Mexican States, dated February 3, 1944 (Treaty Series 994) become difficult, and report such findings to the Governors of the Upper Basin States, the President of the United States of America, the United States Section of the International Boundary and Water Commission, and such other Federal officials and agencies as it may deem appropriate to the end that the water allotted to Mexico under Division III of such treaty may be reduced in accordance with the terms of such Treaty;

59 Stat. 1219.
Report.

59 Stat. 1237.

"(11) Acquire and hold such personal and real property as may be necessary for the performance of its duties hereunder and to dispose of the same when no longer required;

"(12) Perform all functions required of it by this Compact and do all things necessary, proper or convenient in the performance of its duties hereunder, either independently or in cooperation with any state or federal agency;

Annual report.

"(13) Make and transmit annually to the Governors of the signatory States and the President of the United States of America, with the estimated budget, a report covering the activities of the Commission for the preceding water year.

"(e) Except as otherwise provided in this Compact the concurrence of four members of the Commission shall be required in any action taken by it.

Availability of information.

"(f) The Commission and its Secretary shall make available to the Governor of each of the signatory States any information within its possession at any time, and shall always provide free access to its records by the Governors of each of the States, or their representatives, or authorized representatives of the United States of America.

"(g) Findings of fact made by the Commission shall not be conclusive in any court, or before any agency or tribunal, but shall constitute prima facie evidence of the facts found.

"(h) The organization meeting of the Commission shall be held within four months from the effective date of this Compact.

"ARTICLE IX

Acquisition of water rights.

"(a) No State shall deny the right of the United States of America and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity of any signatory State to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals and conduits in one State for the purpose of diverting, conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the States of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing or regulating water in an upper signatory State for consumptive use in a lower signatory State, when such use is within the apportionment to such lower State made by this Compact. Such rights shall be subject to the rights of water users, in a State in which such reservoir or works are located, to receive and use water, the use of which is within the apportionment to such State by this Compact.

"(b) Any signatory State, any person or any entity of any signatory State shall have the right to acquire such property rights as are necessary to the use of water in conformity with this Compact in any other signatory State by donation, purchase or through the exercise of the power of eminent domain. Any signatory State, upon the written request of the Governor of any other signatory State, for the benefit of whose water users property is to be acquired in the State to which such written request is made, shall proceed expeditiously to acquire the desired property either by purchase at a price satisfactory to the requesting State, or, if such purchase cannot be made, then through the exercise of its power of eminent domain and shall convey such property to the requesting State or such entity as may be designated by the requesting State; provided, that all costs of acquisition and expenses of every kind and nature whatsoever incurred in obtaining the requested property shall be paid by the requesting State at the time and in the manner prescribed by the State requested to acquire the property.

"(c) Should any facility be constructed in a signatory State by and for the benefit of another signatory State or States or the water users thereof, as above provided, the construction, repair, replacement, maintenance and operation of such facility shall be subject to the laws of the State in which the facility is located, except that, in the case of a reservoir constructed in one State for the benefit of another State or States, the water administration officials of the State in which the facility is located shall permit the storage and release of any water which, as determined by findings of the Commission, falls within the apportionment of the State or States for whose benefit the facility is constructed. In the case of a regulating reservoir for the joint benefit of all States in making Lee Ferry deliveries, the water administration officials of the State in which the facility is located, in permitting the storage and release of water, shall comply with the findings and orders of the Commission.

Reimbursement for loss of taxes.

"(d) In the event property is acquired by a signatory State in another signatory State for the use and benefit of the former, the users of water made available by such facilities, as a condition precedent to the use thereof, shall pay to the political subdivisions of the State in which such works are located, each and every year during which such rights are enjoyed for such purposes, a sum of money equivalent to the average annual amount of taxes levied and assessed against the

land and improvements thereon during the ten years preceding the acquisition of such land. Said payments shall be in full reimbursement for the loss of taxes in such political subdivisions of the State, and in lieu of any and all taxes on said property, improvements and rights. The signatory States recommend to the President and the Congress that, in the event the United States of America shall acquire property in one of the signatory States for the benefit of another signatory State, or its water users, provision be made for like payment in reimbursement of loss of taxes.

"ARTICLE X

La Plata River Compact.

"(a) The signatory States recognize La Plata River Compact entered into between the States of Colorado and New Mexico, dated November 27, 1922, approved by the Congress on January 29, 1925 (43 Stat. 796), and this Compact shall not affect the apportionment therein made.

"(b) All consumptive use of water of La Plata River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XI

"Subject to the provisions of this Compact, the consumptive use of the water of the Little Snake River and its tributaries is hereby apportioned between the States of Colorado and Wyoming in such quantities as shall result from the application of the following principles and procedures:

"(a) Water used under rights existing prior to the signing of this Compact.

"(1) Water diverted from any tributary of the Little Snake River or from the main stem of the Little Snake River above a point one hundred feet below the confluence of Savery Creek and the Little Snake River shall be administered without regard to rights covering the diversion of water from any down-stream points.

"(2) Water diverted from the main stem of the Little Snake River below a point one hundred feet below the confluence of Savery Creek and the Little Snake River shall be administered on the basis of an interstate priority schedule prepared by the Commission in conformity with priority dates established by the laws of the respective States.

"(b) Water used under rights initiated subsequent to the signing of this Compact.

"(1) Direct flow diversions shall be so administered that, in time of shortage, the curtailment of use on each acre of land irrigated thereunder shall be as nearly equal as may be possible in both of the States.

"(2) The storage of water by projects located in either State, whether of supplemental supply or of water used to irrigate land not irrigated at the date of the signing of this Compact, shall be so administered that in times of water shortage the curtailment of storage of water available for each acre of land irrigated thereunder shall be as nearly equal as may be possible in both States.

"(c) Water uses under the apportionment made by this Article shall be in accordance with the principle that beneficial use shall be the basis, measure and limit of the right to use.

"(d) The States of Colorado and Wyoming each assent to diversions and storage of water in one State for use in the other State, subject to compliance with Article IX of this Compact.

"(e) In the event of the importation of water to the Little Snake River Basin from any other river basin, the State making the importation shall have the exclusive use of such imported water unless by written agreement, made by the representatives of the States of Colorado and Wyoming on the Commission, it is otherwise provided.

"(f) Water use projects initiated after the signing of this Compact, to the greatest extent possible, shall permit the full use within the Basin in the most feasible manner of the waters of the Little Snake River and its tributaries, without regard to the state line; and, so far as is practicable, shall result in an equal division between the States of the use of water not used under rights existing prior to the signing of this Compact.

"(g) All consumptive use of the waters of the Little Snake River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XII

"Subject to the provisions of this Compact, the consumptive use of the waters of Henry's Fork, a tributary of Green River originating in the State of Utah and flowing into the State of Wyoming and thence into the Green River in the State of Utah; Beaver Creek, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; Burnt Fork, a tributary of Henry's Fork, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; Birch Creek, a tributary of Henry's Fork, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; and Sheep Creek, a tributary of Green River in the State of Utah, and their tributaries, are hereby apportioned between the States of Utah and Wyoming in such quantities as will result from the application of the following principles and procedures:

"(a) Waters used under rights existing prior to the signing of this Compact.

"Waters diverted from Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek and their tributaries, shall be administered without regard to the state line on the basis of an interstate priority schedule to be prepared by the States affected and approved by the Commission in conformity with the actual priority of right of use, the water requirements of the land irrigated and the acreage irrigated in connection therewith.

"(b) Waters used under rights from Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek and their tributaries, initiated after the signing of this Compact shall be divided fifty percent to the State of Wyoming and fifty percent to the State of Utah and each State may use said waters as and where it deems advisable.

"(c) The State of Wyoming assents to the exclusive use by the State of Utah of the water of Sheep Creek, except that the lands, if any, presently irrigated in the State of Wyoming from the water of Sheep Creek shall be supplied with water from Sheep Creek in order of priority and in such quantities as are in conformity with the laws of the State of Utah.

"(d) In the event of the importation of water to Henry's Fork, or any of its tributaries, from any other river basin, the State making the importation shall have the exclusive use of such imported water unless by written agreement made by the representatives of the States of Utah and Wyoming on the Commission, it is otherwise provided.

"(e) All consumptive use of waters of Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek, Sheep Creek, and their tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"(f) The States of Utah and Wyoming each assent to the diversion and storage of water in one State for use in the other State, subject to compliance with Article IX of this Compact. It shall be the duty of the water administrative officials of the State where the water is stored to release said stored water to the other State upon demand. If either the State of Utah or the State of Wyoming shall construct a reservoir in the other State for use in its own State, the water users of the State in which said facilities are constructed may purchase at cost a portion of the capacity of said reservoir sufficient for the irrigation of their lands thereunder.

"(g) In order to measure the flow of water diverted, each State shall cause suitable measuring devices to be constructed, maintained and operated at or near the point of diversion into each ditch.

"(h) The State Engineers of the two States jointly shall appoint a Special Water Commissioner who shall have authority to administer the water in both States in accordance with the terms of this Article. The salary and expenses of such Special Water Commissioner shall be paid, thirty percent by the State of Utah and seventy percent by the State of Wyoming.

"ARTICLE XIII

"Subject to the provisions of this Compact, the rights to the consumptive use of the water of the Yampa River, a tributary entering the Green River in the State of Colorado, are hereby apportioned between the States of Colorado and Utah in accordance with the following principles:

"(a) The State of Colorado will not cause the flow of the Yampa River at the Maybell Gaging Station to be depleted below an aggregate of 5,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification and approval of this Compact. In the event any diversion is made from the Yampa River or from tributaries entering the Yampa River above the Maybell Gaging Station for the benefit of any water use project in the State of Utah, then the gross amount of all such diversions for use in the State of Utah, less any returns from such diversions to the River above Maybell, shall be added to the actual flow at the Maybell Gaging Station to determine the total flow at the Maybell Gaging Station.

"(b) All consumptive use of the waters of the Yampa River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XIV

"Subject to the provisions of this Compact, the consumptive use of the waters of the San Juan River and its tributaries is hereby apportioned between the States of Colorado and New Mexico as follows:

"The State of Colorado agrees to deliver to the State of New Mexico from the San Juan River and its tributaries which rise in the State of Colorado a quantity of water which shall be sufficient, together with water originating in the San Juan Basin in the State of New Mexico,

to enable the State of New Mexico to make full use of the water apportioned to the State of New Mexico by Article III of this Compact, subject, however, to the following:

"(a) A first and prior right shall be recognized as to:

"(1) All uses of water made in either State at the time of the signing of this Compact; and

"(2) All uses of water contemplated by projects authorized, at the time of the signing of this Compact, under the laws of the United States of America whether or not such projects are eventually constructed by the United States of America or by some other entity.

"(b) The State of Colorado assents to diversions and storage of water in the State of Colorado for use in the State of New Mexico, subject to compliance with Article IX of this Compact.

"(c) The uses of the waters of the San Juan River and any of its tributaries within either State which are dependent upon a common source of water and which are not covered by (a) hereof, shall in times of water shortages be reduced in such quantity that the resulting consumptive use in each State will bear the same proportionate relation to the consumptive use made in each State during times of average water supply as determined by the Commission; provided, that any preferential uses of water to which Indians are entitled under Article XIX shall be excluded in determining the amount of curtailment to be made under this paragraph.

"(d) The curtailment of water use by either State in order to make deliveries at Lee Ferry as required by Article IV of this Compact shall be independent of any and all conditions imposed by this Article and shall be made by each State, as and when required, without regard to any provision of this Article.

"(e) All consumptive use of the waters of the San Juan River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XV

"(a) Subject to the provisions of the Colorado River Compact and of this Compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

"(b) The provisions of this Compact shall not apply to or interfere with the right or power of any signatory State to regulate within its boundaries the appropriation, use and control of water, the consumptive use of which is apportioned and available to such State by this Compact.

"ARTICLE XVI

"The failure of any State to use the water, or any part thereof, the use of which is apportioned to it under the terms of this Compact, shall not constitute a relinquishment of the right to such use to the Lower Basin or to any other State, nor shall it constitute a forfeiture or abandonment of the right to such use.

"ARTICLE XVII

"The use of any water now or hereafter imported into the natural drainage basin of the Upper Colorado River System shall not be

charged to any State under the apportionment of consumptive use made by this Compact.

"ARTICLE XVIII

"(a) The State of Arizona reserves its rights and interests under the Colorado River Compact as a State of the Lower Division and as a State of the Lower Basin.

"(b) The State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River Compact as States of the Lower Basin.

"ARTICLE XIX

"Nothing in this Compact shall be construed as:

"(a) Affecting the obligations of the United States of America to Indian tribes;

"(b) Affecting the obligations of the United States of America under the Treaty with the United Mexican States (Treaty Series 994);

59 Stat. 1219.

"(c) Affecting any rights or powers of the United States of America, its agencies or instrumentalities, in or to the waters of the Upper Colorado River System, or its capacity to acquire rights in and to the use of said waters;

"(d) Subjecting any property of the United States of America, its agencies or instrumentalities, to taxation by any State or subdivision thereof, or creating any obligation on the part of the United States of America, its agencies or instrumentalities, by reason of the acquisition, construction or operation of any property or works of whatever kind, to make any payment to any State or political subdivision thereof, State agency, municipality or entity whatsoever, in reimbursement for the loss of taxes;

"(e) Subjecting any property of the United States of America, its agencies or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to this Compact.

"ARTICLE XX

Termination.

"This Compact may be terminated at any time by the unanimous agreement of the signatory States. In the event of such termination, all rights established under it shall continue unimpaired.

"ARTICLE XXI

Ratification and approval.

"This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States and approved by the Congress of the United States of America. Notice of ratification by the legislatures of the signatory States shall be given by the Governor of each signatory State to the Governor of each of the other signatory States and to the President of the United States of America, and the President is hereby requested to give notice to the Governor of each of the signatory States of approval by the Congress of the United States of America.

Deposit of original.

"IN WITNESS WHEREOF, the Commissioners have executed six counterparts hereof each of which shall be and constitute an original, one of which shall be deposited in the archives of the Department of State of the United States of America, and one of which shall be forwarded to the Governor of each of the signatory States.

"Done at the City of Santa Fe, State of New Mexico, this 11th day of October, 1948.

[sgd] Charles A. Carson
CHARLES A. CARSON
Commissioner for the State of Arizona
[sgd] Clifford H. Stone
CLIFFORD H. STONE
Commissioner for the State of Colorado
[sgd] Fred E. Wilson
FRED E. WILSON
Commissioner for the State of New Mexico
[sgd] Edward H. Watson
EDWARD H. WATSON
Commissioner for the State of Utah
[sgd] L. C. Bishop
L. C. BISHOP
Commissioner for the State of Wyoming
[sgd] Grover A. Giles
GROVER A. GILES
Secretary

"Approved:
"[sgd] Harry W. Bashore
HARRY W. BASHORE
Representative of the United States of America."

Approved April 6, 1949.

[CHAPTER 49]

AN ACT

April 6, 1949
[H. R. 2101]
[Public Law 38]

To abolish the Regional Agricultural Credit Corporation of Washington, District of Columbia, and transfer its functions to the Secretary of Agriculture, to authorize the Secretary of Agriculture to make disaster loans, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) there are hereby transferred to the Secretary of Agriculture (hereinafter referred to as the Secretary) all the functions of the Regional Agricultural Credit Corporation of Washington, District of Columbia, including but not limited to functions with respect to—

Regional Agricultural Credit Corporation, Washington, D. C.
Transfer of functions.

(1) loans to bona fide fur farmers as provided for in the last proviso in the paragraph headed "Regional Agricultural Credit Corporation of Washington, District of Columbia", in title II of the Government Corporations Appropriation Act, 1949 (Public Law 860, Eightieth Congress);

62 Stat. 1192.

(2) loans under authorization by the Secretary for the Regional Agricultural Credit Corporation of Washington, District of Columbia, to reenter an area or region where a production disaster has occurred, as provided for in the proviso in section 2 of the Department of Agriculture Appropriation Act, 1949 (Public Law 712, Eightieth Congress); and

62 Stat. 529.

(3) the liquidation of all other loans heretofore made by the Regional Agricultural Credit Corporation of Washington, District of Columbia, and of all assets, contracts, property, claims, rights, and liabilities relating thereto.

(b) There are hereby transferred to the Secretary the functions of the Farm Credit Administration and the Governor thereof with respect to the Regional Agricultural Credit Corporation of Washington, District of Columbia.

Farm Credit Administration.

(c) The Regional Agricultural Credit Corporation of Washington, District of Columbia, is hereby dissolved. The Secretary of the Treasury shall cancel the outstanding certificates of stock of the Corporation.

Dissolution.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
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2	D, E	18	Z, AA
3	F, G	**19**	**AB**
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
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14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

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G9-1
V.1

RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Arizona - Colorado - New Mexico - Utah - Wyoming

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NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

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SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

WATER RESOURCES
CENTER ARCHIVES

MAR 1966

UNIVERSITY OF CALIFORNIA
BERKELEY

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Authorized and Approved
For Reproduction
by the
Commission

29248544

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME I

Record of Preliminary Governors' Meeting, and
for Commission Meetings No. 1-5, inclusive

FOREWORD

The Upper Colorado River Basin Compact Commission authorized this three volume compilation of its official Record of Proceedings. There is attached the certificate of the Chairman and Secretary of the Commission that the record is complete and correct.

The Upper Colorado River Basin Compact Commission was composed of commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and one commissioner appointed by the President of the United States to represent the Federal Government. After a preliminary meeting of the Governors of the States, the Commission commenced its negotiations at Salt Lake City, Utah, on July 31, 1946. As a result of its deliberations, the Compact, known as the Upper Colorado River Basin Compact, was signed at the Palace of Governors, Santa Fe, New Mexico, on October 11, 1948. Subsequently the Compact was ratified by the respective legislatures of the signatory States. The consent of the Congress of the United States, required by Article I, Section 10 of the Federal Constitution, was granted by Public Law 37, 81st Congress, First Session (63 Stat. 31), which was approved by the President of the United States on April 6, 1949. The Compact became effective and binding on the signatory States upon the latter date.

The Compact Commission did not adjourn sine die until August 5, 1949. It maintained its organization until that time to further the ratification of the Compact by the States and the approval of the Compact by the Congress and to perform certain other related duties and functions.

All of the States which negotiated and ratified the Upper Colorado River Basin Compact are signatories to the Colorado River Compact which was signed at Santa Fe, New Mexico, on November 24, 1922, and subsequently ratified by the seven States of the Colorado River Basin (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming). The Congress of the United States gave its consent to the original Compact by the Boulder Canyon Project Act (45 Stat. 1057) in 1928. The provisions of the 1948 Upper Colorado River Basin Compact are subject to the provisions of the 1922 Compact.

The Colorado River Compact of 1922 did not apportion Colorado River water, or its use, among the signatory States. Instead, it divided the beneficial consumptive use of Colorado River water between the Upper and Lower Basins. The division point between the two basins was fixed as Lee Ferry, Arizona, which is located a short distance south of the Arizona-Utah boundary line. The Compact placed an obligation on the Upper Division States (Colorado, New Mexico, Utah, and Wyoming) to deliver specified quantities of water at Lee Ferry for the use of the Lower Basin. Provision was made for the satisfaction of any subsequently created treaty obligations to Mexico. The use of surplus water, over and above that apportioned to the two basins, was reserved for future apportionment.

The Upper Colorado River Basin Compact apportioned among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming the beneficial consumptive use of the water apportioned to the Upper Basin by Article III (a) of the 1922 Compact (7,500,000 acre-feet annually). Provision was made as to the responsibility of the States of Colorado, New Mexico, Utah, and Wyoming in regard to their joint obligation to deliver water at Lee Ferry for use in the Lower Basin.

The 1948 Compact created an administrative agency known as the "Upper Colorado River Commission." This body, in addition to administering the Compact, is charged with the duty of expediting the development of the Upper Colorado River Basin. It is composed of five commissioners, one representing the United States of America, and one representing each of the States of Colorado, New Mexico, Utah, and Wyoming. Arizona is not represented on the Commission because of its relatively small area in the Upper Colorado River Basin. The Federal representative is chairman of the Commission. As an official body, it occupies the unique position of being able to expedite Upper Colorado River Basin development, to aid in shaping such development, and to integrate Federal and State activities and interests.

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Harry W. Bashore, for the United States of America, Chairman
Charles A. Carson, for Arizona
Clifford H. Stone, for Colorado
Fred E. Wilson, for New Mexico (1)
Edward H. Watson, for Utah (2)
L. C. Bishop, for Wyoming
Grover A. Giles, Secretary

(1) Replaced Thomas M. McClure who died during the time the compact was under negotiation.

(2) Was replaced by Harold A. Linke after the compact was signed but before the Commission adjourned sine die.

ENGINEERING ADVISORY COMMITTEE

J. R. Riter, for the United States of America, Chairman
H. P. Dugan, for the United States of America
R. Gail Baker, for Arizona
R. I. Meeker, for Arizona
Royce J. Tipton, for Colorado
R. M. Gildersleeve, for Colorado
Frank C. Merriell, for Colorado
John H. Bliss, for New Mexico
John R. Erickson, for New Mexico
C. O. Roskelley, for Utah
R. D. Goodrich, for Wyoming
H. T. Person, for Wyoming

Charles L. Patterson for Colorado, F. W. Cottrell for Utah and C. S. Jarvis for Utah served as members of the Committee during the early months of the negotiations.

LEGAL COMMITTEE

Charles A. Carson, for Arizona, Chairman
Jean S. Breitenstein, for Colorado
Fred E. Wilson, for New Mexico
W. J. Wehrli, for Wyoming
J. A. Howell, for Utah
J. G. Will, for the United States of America

EXPLANATORY NOTE

This compilation of the Record of the proceedings of the Upper Colorado River Basin Compact Commission is contained in three volumes, as follows:

Volume 1 - Containing the Record of the preliminary Governors' Meeting, and the Record of Meetings Nos. 1 to 5, inclusive, of the Commission.

Volume 2 - Containing the Record of Meetings Nos. 6 to 11, inclusive, of the Commission.

Volume 3 - Containing the Final Report of the Engineering Advisory Committee, and the Inflow-Outflow Manual.

These various meetings, in Volumes Nos. 1 and 2, are separated by blue insert-sheets, to indicate the division between meetings.

A Subject Index for meetings of the Commission appears at the beginning of Volumes Nos. 1 and 2. (See explanation for use, which prefaces the Subject Index). A separate Index for the Engineering Advisory Committee Report appears in Volume No. 3, as a part of that Report.

There appears in this compilation, at the beginning of each separate meeting of the Commission, a chronological Table of Contents, covering developments in each such meeting.

There were 11 official meetings of the Upper Colorado River Basin Compact Commission before it adjourned sine die at Salt Lake City, Utah, on August 5, 1949.

The schedule of all meetings pertaining to the Compact was as follows:

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Meeting No. 1	Salt Lake City, Utah	July 31, 1946	Volume 1
Meeting No. 2	Santa Fe, New Mexico	Sept. 17-18, 1946	Volume 1
Meeting No. 3	Public Hearings	Oct. 28-30-31 and Nov. 2, 1946	Volume 1
Meeting No. 4	Cheyenne, Wyoming	Sept. 8, 1947	Volume 1
Meeting No. 5	Denver, Colorado	Dec. 1-2-3-4, 1947	Volume 1
Meeting No. 6	Denver, Colorado	Feb. 17-18-19-20-21, 1948	Volume 2
Meeting No. 7	Vernal, Utah	July 7-21, 1948	Volume 2
Meeting No. 8	Santa Fe, New Mexico	Oct. 4-11, 1948	Volume 2
	POST-COMPACT MEETINGS		
Meeting No. 9	Denver, Colorado	Dec. 29-30, 1948	Volume 2
Meeting No. 10	Salt Lake City, Utah	Feb. 17-18, 1949	Volume 2
Meeting No. 11	Salt Lake City, Utah	August 5, 1949	Volume 2

C E R T I F I C A T E

Harry W. Bashore, Chairman, and Grover A. Giles, Secretary, of the Upper Colorado River Basin Compact Commission, do hereby certify that the record and proceedings of such Commission, from the 31st day of July, 1946 to the 5th day of August 1949, when the Commission adjourned sine die, contained in the three volume compilation to which this certificate is attached, are a complete and correct reproduction of such record and proceedings, including the Final Report of the Engineering Advisory Committee and the "Inflow-Outflow Manual" approved and adopted by the Commission.

Harry W. Bashore
Chairman

Grover A. Giles
Secretary

SUBJECT INDEX

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* * * * This Subject Index is prepared according to a code number system in this manner: 1:5:21; 2:6:34-40; 2:7:141-142. Interpreted, this code means: Volume 1, Meeting 5, Page 21; Volume 2, Meeting 6, Pages 34 to 40; and Volume 2, Meeting 7, Pages 141 and 142.

In brief, the code is:

First figure	=	Volume Number
Second figure	=	Meeting Number
Other figures in series	=	Page Numbers

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Official Record of Governors' Meeting

Held At
Cheyenne, Wyoming

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July 22, 1946

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(Preliminary Meeting)
Cheyenne, Wyoming
July 22, 1946

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GOVERNORS' CONFERENCE
IN RE
COLORADO RIVER COMPACT
held in
The House of Representatives
Capitol Building
Cheyenne, Wyoming
on Monday,
July 22, 1946.

PRESENT:

From the State of Arizona:
Mr. Charles A. Carson, Official Representative of the Honorable Sidney P. Osborn, Governor.

From the State of Colorado:
The Honorable John C. Vivian, Governor.
Mr. Clifford H. Stone, Director, Colorado Water Conservation Board.
Mr. Jean S. Breitenstein.
Mr. M. C. Hinderlider, State Engineer.

From the State of New Mexico:
The Honorable John J. Dempsey, Governor.

From the State of Utah:
The Honorable Herbert B. Maw, Governor.
Mr. Grover A. Giles, Attorney General.
Mr. William R. Wallace, President of the Utah Water Users Ass'n. and Member of the Committees of 14 and 16.
Mr. Ed H. Watson, State Engineer.

From the State of Wyoming:
The Honorable Lester C. Hunt, Governor.
Mr. L. C. Bishop, State Engineer and Inter-State Streams Commissioner.
Mr. E. B. Hitchcock, Member Planning and Water Conservation Board.
Mr. H. Melvin Rollins, Member of Committees 14 and 16.
Mr. Leland U. Grieve, Asst. Inter-State Streams Comm.
Mr. Richard J. Lumen, Asst. Inter-State Streams Comm.
Mr. Norman W. Barlow, Asst. Inter-State Streams Comm.
Mr. Platt Wilson, Asst. Inter-State Streams Comm.
Mr. Emil C. Gradert, Asst. Inter-State Streams Comm.
Mr. David P. Miller, Asst. Inter-State Streams Comm.
Mr. Joe Micheli, Asst. Inter-State Streams Comm.
Mr. Joe Budd, Asst. Inter-State Streams Comm.
Mr. D. H. Christensen, Asst. Inter-State Streams Comm.
Mr. John Reed, Asst. Inter-State Streams Commissioner.
Mr. Louis J. O'Marr, Attorney General.

For the United States Government:
Mr. Harry W. Bashore, Former Commissioner, U. S. Bureau of Reclamation.
Mr. William E. Warne, Assistant Commissioner, U. S. Bureau of Reclamation.

And other persons appearing in behalf of various organizations, and individuals personally interested herein.

- - - - - - - -

AND THEREUPON, the following proceedings were had, to-wit:

GOVERNOR HUNT: Gentlemen: I think you all know, of course, why we are assembled here this morning. It is a matter of tremendous importance to the Upper Basin Colorado River States, a matter that now has become almost a necessity that it be done and be done with some rapidity, if we expect the development of the Colorado River Basin in the Upper Basin States to get under way.

Before starting a temporary organization, I have the pleasure of introducing my fellow Governors here and the gentleman representing Governor Osborn. I would first like to introduce Governor Dempsey of New Mexico. (Applause) And Governor Maw of Utah. (Applause) And Governor Vivian of Colorado. (Applause) And Mr. Carson, representing Governor Osborn of Arizona. (Applause)

And our friend of long standing, Harry Bashore, who has been designated by the Federal Government to appear here.

Now, gentlemen, the hour is almost approaching twelve, and to the end that we might possibly complete a permanent organization before adjourning for lunch, without any further ado I am going to ask for nominations for a temporary chairman of this organization. Do I hear a nomination?

GOVERNOR VIVIAN: Mr. Chairman, I would like to move the appointment of Mr. Harry W. Bashore as temporary chairman.

GOVERNOR DEMPSEY: Second the motion.

GOVERNOR HUNT: The name of Mr. Bashore has been presented as temporary chairman of this organization. It has been duly seconded. Are there other nominations? If not, do I hear a motion that the nominations be closed?

GOVERNOR VIVIAN: I move the nominations be closed and the chairman directed to cast a unanimous ballot for Mr. Harry Bashore as temporary chairman.

GOVERNOR HUNT: You have heard the motion by Governor Vivian that nominations be closed and the Chair be directed to cast a unanimous ballot for Mr. Harry Bashore as temporary chairman. Are you ready for the question? Those in favor say "Aye."

(The motion, being put to a vote, was duly carried.)

GOVERNOR HUNT: It is a very great pleasure to ask you, Harry, to continue to preside over this organization, if you will, please.

CHAIRMAN BASHORE: Thank you, Governor Hunt. Ladies and gentlemen, I didn't anticipate being pitched into this so abruptly, but I will try to function.

Now, I haven't had much time to think about this. I don't know that we have any program before us, so the meeting is yours. I will make a few suggestions. In the first place, I might state that a Federal representative on this Commission is, according to my understanding, at the request of the Governors of the states. The water belongs to the states, as I understand it, and it is the problem of the states to divide the water equitably. I will have no vote and will not be particularly beneficial, perhaps, except in making observations from time to time and giving whatever assistance I can give.

You folks probably all know that I retired from the position of Commissioner of Reclamation some time ago with the idea of getting out of work, but when this proposition was put up to me, serving as Federal representative of this Colorado River Commission, I couldn't turn it down, because I had been

very much interested in it. I consider it a very important question and it is going to require all of the intelligence and ability that we all have, individually and collectively, to solve it so that things may be accomplished on the Colorado. There is no use in pulling and hauling between yourselves on this Basin. We have got to come out of this with an answer. We cannot expect Congress to answer it, and I am hopeful we will come out with an answer so that we may have an authorization for the development of the Colorado something like we have on the Missouri, where everybody got behind the proposition, and complete authorization was given, with the naming of initial projects in the program. That would be my hope.

Now, I believe that we should proceed, then, to the organization of the Commission, and preliminary to doing that I will submit my own credentials as Federal representative, for the records of the Commission--a letter from President Truman appointing me Federal representative, and my reply. Those letters are presented for the record.

(The letters referred to are as follows:)

"THE WHITE HOUSE
WASHINGTON

July 17, 1946

My dear Mr. Bashore:

Pursuant to the Boulder Canyon Project Act (Act of December 21, 1928, Chapter 42, 45 Stat. 1057), granting the consent of the Congress to the States of the Colorado River Basin to negotiate and enter into compacts or agreements supplemental to and in conformity with the Colorado River Compact and consistent with the Boulder Canyon Project Act, you are hereby appointed as the representative of the United States to participate in the coming negotiations of the States of the Upper Colorado River Basin and to make a report to the Congress of the proceedings and of any compact or agreement entered into.

Very sincerely yours,
(Signed) Harry S. Truman

Mr. Harry W. Bashore,
Mitchell,
Nebraska."

"UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Mitchell, Nebraska
July 19, 1946

My dear Mr. President:

I have received your letter of July 17 in which you state that I have been appointed as the representative of the United States to participate in the coming negotiations of the States of the Upper Colorado River Basin and to make a report to the Congress of the proceedings and of any compact or agreement entered into.

I accept your appointment with pleasure because it offers an opportunity to render constructive service to the United States and to the States of the Upper Colorado River Basin in solving the complex problem of water apportionment which is necessary for the conservation and development of a most valuable national asset.

Very sincerely yours,
(Signed) Harry W. Bashore.

President Harry S. Truman,
The White House.

cc: Commissioner,
Bureau of Reclamation
Washington, D. C. (In Dupl.)

cc: Colorado River Basin Board."

CHAIRMAN BASHORE: Is the Commissioner from the State of Colorado present?

MR. STONE: Mr. Chairman, I am the Commissioner appointed by the Governor, and the appointment has been approved by the State Water Board, in accordance with the law. May I make a motion, Mr. Chairman, for the record, so as to keep the record straight? It seems to me it would be advisable that I make a motion that the states of the Upper Colorado River Basin agree to enter into compact negotiations for the purpose of allocating the waters of the Upper Basin, allocated in accordance with the Colorado River compact, and for the purpose of determining the obligations under the compact for deliveries of water.

I make that as a motion to indicate at the beginning that these interested states have agreed to initiate compact negotiations.

MR. BISHOP: Mr. Chairman, I second the motion.

CHAIRMAN BASHORE: You have heard the motion and it has been seconded. All in favor of the motion signify by saying "Aye."

(The motion, being put to a vote, was carried.)

CHAIRMAN BASHORE: Now, Judge, is it satisfactory to present your credentials as a representative of the State of Colorado, as Commissioner? Do you have those credentials?

JUDGE STONE: I believe I have my letter of appointment here.

CHAIRMAN BASHORE: I may appear a little technical on that, but in the organization of this Commission I think it is quite important.

JUDGE STONE: I will present those credentials. I believe I have them with me. In all events, they will be presented when the Commission meets. The fact of the matter is the approval of my appointment was made just yesterday, so the State Water Board in that resolution is not available here, but the Governor's letter is here.

CHAIRMAN BASHORE: I believe those should be made a part of the record, and also your acceptance of the position as Commissioner.

JUDGE STONE: I will submit that for the record.

"Appointment of Clifford H. Stone as Compact Commissioner to represent the State of Colorado in compact negotiations respecting the waters of the Colorado River and its tributaries above Lee Ferry, Arizona.

Section 9 of Chapter 265 of the Session Laws of Colorado for the year 1937 provides as follows:

'Section 9. The Governor from time to time, with the approval of the Board, shall appoint a commissioner, or commissioners, who shall represent the State of Colorado upon joint commissions to be composed of commissioners representing the states of Colorado and another state or other states for the purpose of negotiating and entering into compacts or agreements

between said states, with the consent of the Congress when necessary, ascertaining and declaring the authority, interest or right of the several signatory states, or any of them, over, in and to interstate waters, all to the end that such waters may be used and disposed of by the several states and their respective citizens in accordance with an equitable apportionment or division thereof made between the signatory states by the terms of the compact or agreement; provided, however, that any compact or agreement so entered into on behalf of said states shall not be binding or obligatory upon any of said states or the citizens thereof unless and until, the same shall have been ratified and approved by the legislatures of all of said signatory states, and by the Congress of the United States when necessary. The Board shall furnish such commissioner or commissioners with such legal, engineering, clerical, and other assistants as the Board may deem advisable and necessary, all legal assistants to be employed with the consent of the Attorney General. Such commissioner or commissioners shall serve at the pleasure of the Governor at a compensation to be fixed by him. The compensation of the legal, engineering and other assistants of said commissioner or commissioners shall be fixed by the Board and all such compensation and necessary traveling expenses of such commissioner or commissioners and his or their said assistants shall be paid out of the funds appropriated for carrying out the purposes of this Act.'

"At a meeting of the Colorado Water Conservation Board, held on the 21st day of July, A. D. 1946, the following proceedings took place, to-wit:

'There is presented to the Board a letter from Governor John C. Vivian, dated July 2, 1946, submitting the appointment of a Commissioner to negotiate a compact respecting the waters of the Colorado River and its tributaries above Lee Ferry, Arizona, which letter reads as follows:

"THE STATE OF COLORADO
Executive Chamber
Denver

The Governor

July 2, 1946

Colorado Water Conservation Board
212 State Office Building
Denver 2, Colorado

Gentlemen:

This is to advise you that I have today appointed Clifford H. Stone, Director of the Colorado Water Conservation Board, to represent the State of Colorado upon a joint commission composed of commissioners representing the States of the Upper Basin of the Colorado River for the purpose of making and entering into a compact respecting the waters of the Colorado River and its tributaries above Lee Ferry, Arizona.

It is understood that any compact negotiated by these Commissioners shall not be binding nor obligatory upon the State of Colorado until it shall have been ratified by the respective legislatures of such Upper Basin States and assented to by the Congress of the United States.

This appointment is made pursuant to Section 9 of Chapter 265 of the Session Laws of Colorado of 1937. In accordance therewith you are hereby requested to approve the appointment of Clifford H. Stone herein made and advise me of such approval.

I am making this appointment now because recent developments indicate the desirability of prompt action by the States of the Upper Basin of the Colorado River in allocating among themselves the waters of that river above Lee

Ferry, Arizona, and of determining their several obligations with respect to the maintenance of the flow of that river at Lee Ferry as required by the Colorado River Compact which became effective on the proclamation of the President, June 25, 1929. A careful study of the present situation has convinced me that expeditious action is necessary to protect Colorado's interest in the Colorado River.

Faithfully yours,
(s) John C. Vivian."

'It was moved by Silmon Smith and seconded by George Pughe that, acting under the provisions of Chapter 265, Session Laws of Colorado, 1937, the Board approve the appointment of Clifford H. Stone as Commissioner to represent the State of Colorado in compact negotiations respecting the waters of the Colorado River and its tributaries above Lee Ferry, Arizona.

After discussion the motion was unanimously passed and declared adopted.

J. M. Dille, Acting Chairman.'

Attest:
Clifford H. Stone,
Director and Secretary.'

'I, Clifford H. Stone, do hereby accept the appointment as Compact Commissioner to negotiate, on behalf of the State of Colorado, a compact respecting the waters of the Colorado River and its tributaries above Lee Ferry, Arizona.

Dated at Denver, Colorado this 21st day of July, A. D. 1946.

(Signed) Clifford H. Stone.'"

CHAIRMAN BASHORE: Is the Commissioner from the State of Wyoming present?

MR. BISHOP: Yes, sir, L. C. Bishop.

CHAIRMAN BASHORE: Are you prepared to submit your credentials?

MR. BISHOP: Inter-State Streams Commissioner.

CHAIRMAN BASHORE: Can you present your credentials for the record, Clark?

MR. BISHOP: Yes, sir.

"Secretary of State,
Cheyenne, Wyoming

This card will identify L. C. Bishop, who holds the official position of State Engineer for the State of Wyoming.

(Signed) Lester C. Hunt,
Secretary of State.

Signature of card holder: L. C. Bishop."

CHAIRMAN BASHORE: The Commissioner from the State of New Mexico.

GOVERNOR DEMPSEY: He is not present, Harry. I think he is in Utah today, but his credentials will be here before your next meeting and you can put them in the record, if you desire, on that basis.

CHAIRMAN BASHORE: All right, Governor Dempsey of New Mexico has assured us that the credentials of the Commissioner from New Mexico will be available before the next meeting.

The Commissioner from the State of Utah. Is he present?

MR. WATSON: Ed H. Watson is my name. I represent the State by statute, and I understand that the Governor will act under that statute and make the proper appointment and give you the proper credentials.

GOVERNOR MAW: Yes, I shall supply those credentials.

CHAIRMAN BASHORE: Very well. The Commissioner from the State of Arizona. I believe his credentials should be presented also, and I presume that they will be available for the next meeting?

MR. CARSON: Yes. Mr. Chairman, I am here as the representative of Governor Osborn. I think he sent Governor Hunt a wire, but I have not been formally designated by him as a commissioner in this matter, but that will be available before the next meeting.

CHAIRMAN BASHORE: I believe that that completes the call for credentials from the Commissioners, and I believe it is now in order for a motion for the appointment of a permanent chairman of the Commission of the Upper Colorado River Basin.

MR. BISHOP: Mr. Chairman, I make a motion that Mr. Harry Bashore, Federal representative, be elected permanent chairman of this organization.

JUDGE STONE: Second the motion.

CHAIRMAN BASHORE: I am not very well versed in parliamentary procedure, but I believe it is proper in a case like this for somebody else to take the Chair while a vote is being called for. Governor Hunt, will you take the Chair?

GOVERNOR HUNT: I will just use this one and you can retain that one.

A motion has been made by Mr. Bishop of Wyoming that the Federal representative, Mr. Harry Bashore, be made the permanent chairman of this organization. Do I hear a second to the motion?

MR. WATSON: I second the motion. May I inquire, does Mr. Bishop mean by that the Chairman of the Compact Commission? Is that the intent of the motion? He said "this organization."

GOVERNOR HUNT: I think that is the intent of your motion, wasn't it, Mr. Bishop?

MR. BISHOP: Yes.

GOVERNOR HUNT: Are there any further nominations? There being none, do I hear a motion that the nominations be closed?

MR. WATSON: I move the nominations be closed and the Chairman be instructed to cast a unanimous vote for Mr. Bashore.

MR. BISHOP: Seconded.

GOVERNOR HUNT: You have heard the motion and you have heard the second. There is no need for me to repeat it. All those in favor of the motion say "Aye."

(The motion, being put to a vote, was carried.)

CHAIRMAN BASHORE: Well, it seems to me like I am being elected a whole lot here this morning.

That, then, provides for a permanent chairman of the Commission. Now what are your wishes as to further action? I don't have anything particular in mind myself. I don't want to put myself in a position of directing your thoughts or actions in this matter.

JUDGE STONE: Mr. Chairman, may I raise a question? I take it that this amounts to an organization of the Commission. The Commission itself is assigned the task of negotiating the compact, and in the case of two states the Commissioners representing those states are not present. As a matter of fact, we are not in a position to proceed with compact negotiations until all the accredited Commissioners are present to sit as a Commission.

CHAIRMAN BASHORE: Yes, I think that is correct, Judge Stone, but I thought there might be other matters that the meeting would desire to take up.

JUDGE STONE: Mr. Chairman, I don't want to do all the talking--

CHAIRMAN BASHORE: Neither do I, Judge. You may have the floor.

JUDGE STONE: --but there was a question raised, and I thought maybe Governor Hunt would present it. It was raised in his office, and it seems to me it might be well to discuss it here in this larger group, Governor, namely, the question of the nature of the participation of the State of Arizona. Mr. Carson was present in the Governor's office when that question came up, and it was discussed briefly. It seems--if I misinterpret the matter, I might be corrected--but it seems it was the opinion that it was advisable that Arizona participate in these negotiations, but that it might be well to define the nature and the extent of Arizona's participation.

That grows out of the fact that Arizona is interested in the apportionment of the water of the Upper Basin, because a considerable territory of that state is within the Upper Basin, and Arizona provides a small amount of the water furnished by the Upper Basin. It is something like seven-tenths of one per cent, or on that order.

However, the Colorado River Compact, which allocates water to the Upper Basin, places the obligation to make deliveries to Lee Ferry on the States of the upper division, and those are the States of Wyoming, New Mexico, Utah, and Colorado.

It seems that Arizona's participation would not extend to the matter of agreeing upon the obligations at Lee Ferry, but Arizona definitely is interested in the apportionment of some of the waters to the extent of her interest.

There is another question, the position of Arizona should be clearly defined with respect to her relation to the Lower Basin, and I raise this as a matter which might well be discussed here, Mr. Chairman.

CHAIRMAN BASHORE: Are there any further remarks on that question?

MR. CARSON: Mr. Chairman, I think Judge Stone has pretty well stated Arizona's interest here. There is an area of 6,000 to 8,000 square miles of Arizona that is in the Upper Basin, as defined by the Colorado River Compact, upon which some water is now being utilized, and there are some plans for additional utilization. So we are very much concerned in the division of the water supply of the Upper Basin, in order to see that that portion of Arizona is taken into account.

We are, of course, somewhat in the anomalous position of being a Lower Basin state also, in which our greatest interest lies, but in this participation it seems to me that Arizona should participate in order to see that her uses of water in that small area are taken into account in the division of waters, and I think it is true, as Judge Stone says, that the obligation to the Lower Basin to deliver water at Lee Ferry is placed upon the four states of the upper division and not upon that section of Arizona that is within the Upper Basin.

So in any compact that might be worked out, we would, of course, desire to very clearly define Arizona's interest in this and not participate in any discussions that relate to the obligations of the upper states to deliver water at Lee Ferry, or the division of that obligation as among themselves.

CHAIRMAN BASHORE: Thank you. The Chair suggests that you prepare, Mr. Carson, a statement defining Arizona's limitation in the deliberations of the Commission for presentation at the next meeting of the Commission of the Upper Colorado. Would that be satisfactory?

MR. CARSON: Yes.

CHAIRMAN BASHORE: Now I am like Judge Stone, I don't want to do all the talking, but I don't know just what we have before us. It seems to me, however, that it is in order now to decide when and where the next meeting of the Commission is to be held.

MR. BISHOP: Mr. Chairman, there is a lot more to do and the lunch hour is past more than a half an hour. I make the motion that we adjourn until two o'clock and come back here and continue our conversation.

I would like to make another further suggestion. I believe when we meet at two o'clock to proceed with the organization, that perhaps we should elect a secretary.

CHAIRMAN BASHORE: Yes. Do I hear a second?

GOVERNOR HUNT: I second Mr. Bishop's motion.

(The motion, being put to a vote, was carried.)

(Whereupon this conference was adjourned until two o'clock, p.m., of the same day.)

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CHAIRMAN BASHORE: Gentlemen, will the meeting come to order? I know there are folks here from considerable distances that haven't had much to say this morning. This meeting is open for discussion, so any comments you wish to make, with the guidance of the Commissioners, would be welcome. The Chair would like to have suggestions from the floor, suggestions which might be taken up very briefly, because we haven't too much time left today. The meeting is in your hands.

Gentlemen, there is a man here from Washington who used to help me out a little bit when I was back there, and I would like to have him come up here and be introduced and maybe say something, if he wants to, providing he doesn't talk too long. He is pretty long-winded, but I will limit him to five minutes. Assistant Commissioner Warne. Bill, come up here and say your piece.

MR. WARNE: Mr. Chairman, I didn't come here really to participate in your meeting. I came here to see your Chairman and to renew acquaintances with you. I happened to be in the vicinity today and wanted to wish you well

and Godspeed in the work of the Commission to allocate the waters of the Upper Basin of the Colorado River. I know this group needs no assurance from the Bureau of Reclamation that we are heart and soul with you in your work, and we are anxious to see the way cleared for a great program to go forward on the Colorado River in the next ten years, and it is only by the success of meetings such as this that will influence the division of the waters and make possible through agreement the selection and prosecution of important development projects in these states, and that is the only way we can have any progress on the river in the years to come.

Now, the Colorado River Compact of 1922 and the Boulder Canyon Project Act cleared the way for the first stage of development of the river as we know it today. I anticipate that the Basin report which you have in your hands, the assignment which you are giving yourselves here as a commission, and the success of your work will be the great monument, the turning point in the dedication and prosecution of the second stage of development of the Colorado River, which will, in my belief, bring construction by the Federal Government and other related projects that will exceed in value those that went into the first stage of the river's development.

I hastily calculated that over a billion dollars had been spent on the Colorado River on water projects directly related to the Colorado River development as a result of the 1922 compact and the Boulder Canyon Project Act. I have an idea that figure will be equalled and perhaps exceed even many times that figure in the second stage of development if we can find a mutuality of agreement for the prosecution of these works in accord among ourselves and with complete cooperation.

That is the thought I would like to leave with you here, that agreement on a sound and satisfactory basis will provide the basis upon which we can and will build the second stage of development of the Colorado River, largely in these four Upper Basin States, because the Lower Basin was the principal scene of the first stage of development perforce. The Upper Basin will be, in the main, the theatre for the second stage.

Now, I wish you well and Godspeed, and I hope for success of your meetings and that they may be all in perfect harmony and that we may go forward and get this great job done. I thank you very much. (Applause)

CHAIRMAN BASHORE: Thank you, Bill. Your remarks are very pertinent and timely. What is the next order of business, gentlemen?

MR. WATSON: Mr. Chairman, the appointment of the Secretary is considered to be the first order of business this afternoon. Is that in order to be done?

CHAIRMAN BASHORE: I think the appointment of a temporary secretary, the request for an appointment of a temporary secretary, would be in order. I doubt if appointment of a permanent secretary can properly be made. At least, it would be just as well to appoint a temporary secretary pending the next meeting of the Commissioners, and then the Commissioners will all be present at that time and a permanent secretary can be appointed. But I think it would be in order to consider the appointment of a temporary secretary at this time.

MR. WATSON: Mr. Chairman, are nominations in order?

CHAIRMAN BASHORE: Yes, sir.

MR. WATSON: I nominate Attorney General Giles as acting temporary secretary. Mr. Giles has acted in that capacity before and he is rather

accessible, and the records of this group, or most of the records, are in Salt Lake City and easily accessible.

I therefore nominate Mr. Giles.

MR. BISHOP: I will second the motion.

CHAIRMAN BASHORE: Do we vote on that nomination, or shall we consider other nominations?

GOVERNOR VIVIAN: Mr. Chairman, I believe this deliberation from now on should be through the Commission members. As I understand it, they are sitting now as a legally constituted Commission. I don't know who made that second, but I think it should be made by some member of the Commission.

CHAIRMAN BASHORE: The second was made by Mr. Bishop, who is a member of the Commission.

JUDGE STONE: I understand that this secretary merely serves as the temporary secretary for this overall meeting, and has nothing to do with the permanent organization of the Commission.

CHAIRMAN BASHORE: I think this temporary secretary would serve at the next meeting until another permanent secretary is appointed by the Commissioners at their next meeting. All the Commissioners are not here today. I will stand corrected on that if the Commissioners are here and the Governor thinks a permanent secretary can be appointed today. I certainly would offer no objection, but in the absence of the Commissioners, one or two of them--

JUDGE STONE: It seems to me you are entirely right.

CHAIRMAN BASHORE: Shall we vote on the nomination? All in favor of the nomination of Mr. Giles respond by saying "Aye."

(The motion, being put to a vote, was carried.)

CHAIRMAN BASHORE: Are all the Commissioners present in favor of him? Mr. Bishop, Judge Stone, you voted "Aye" on that question?

JUDGE STONE: Yes, sir, I voted "Aye."

MR. BISHOP: Yes, sir.

JUDGE STONE: Mr. Chairman, it has been suggested, it seems to me, wisely so, that it might be well at this time for us to adopt an official name for this Commission, and I believe it would be well to consider that. It ought not be a difficult matter to determine, and a suggestion of that kind has been made to me.

CHAIRMAN BASHORE: I think that is a very good idea, Judge. Do you have something to suggest?

JUDGE STONE: You can put the matter before the group. I move that the Commission which has been constituted, set up, at this meeting, be known as the Upper Colorado River Compact Commission.

MR. BISHOP: Mr. Chairman, I agree with that and I will second it, if you will put "Basin" in there, "the Upper Colorado River Basin Compact Commission."

JUDGE STONE: Very well. That is agreeable.

CHAIRMAN BASHORE: What are other suggestions, if any?

MR. BISHOP: I will second the motion of that.

CHAIRMAN BASHORE: The motion has been seconded. Any discussion? The motion is that the name of the Commission shall be the Upper Colorado River Basin Compact Commission. Is that correct, Judge?

JUDGE STONE: Yes, sir.

CHAIRMAN BASHORE: Those in favor respond by saying "Aye."

(The motion, being put to a vote, was carried.)

CHAIRMAN BASHORE: Apparently that is the name of the Commission.

GOVERNOR VIVIAN: Mr. Chairman.

CHAIRMAN BASHORE: Governor Vivian.

GOVERNOR VIVIAN: Unless there is someone else here who has something to say, I now move you that the Commission go in session and determine what it has to determine, and the rest of us withdraw.

GOVERNOR MAW: Second the motion.

CHAIRMAN BASHORE: You have heard the motion and the second. The motion is that the Commission now go into session, and those present not being members of the Commission, withdraw.

GOVERNOR HUNT: Mr. Chairman, I should like to discuss John's motion momentarily. We have with us today here men from over in the Colorado River Basin of Wyoming that have come long distances, that have taken of their time, and I should like to amend your motion, John, that all withdraw excepting the members of the Commission and whoever may be designated by members of the Commission to remain, and that will give our Inter-State Streams Commissioner, who is a member of the Commission, the opportunity to invite his assistants to sit in.

GOVERNOR VIVIAN: I will accept that amendment.

CHAIRMAN BASHORE: You have heard the motion and the amendment.

MR. BISHOP: Mr. Chairman, at this point I would like to say that I expect my assistant Commissioners to sit in on the meetings at any time that we can get them to be present. We figure on that and they are invited.

CHAIRMAN BASHORE: Any further discussion? Those in favor of the motion say "Aye."

(The motion, being put to a vote, was carried.)

GOVERNOR HUNT: I would like to see the Governors in my office for a couple minutes before they leave, if I may.

(Whereupon, the open conference was adjourned.)

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COMMISSIONERS' MEETING

CHAIRMAN BASHORE: Gentlemen, this now is the first meeting of the Upper Colorado River Basin Compact Commission. There are three Commissioners here, I believe--Utah, Wyoming, and Colorado represented. It seems to me that about all we can do is to decide on the time and place of the next meeting, because we lack two representatives here. I would like you to correct me if I am wrong on that.

JUDGE STONE: Mr. Chairman, I agree with you fully. It seems to me that this Commission is not in a position to proceed with any business, except to agree upon the date of the next meeting, in the absence of accredited compact Commissioners from some of the participating states.

MR. BISHOP: Mr. Chairman, do you think it would be wrong for this meeting to, you might say, issue a directive to the Commissioners of all the states to be prepared at the next meeting to submit a statement of the reasonable needs of their states, within the bounds of their ability to pay, down at Lee Ferry? If they will all do that, I think we have something to start off with. It won't be much trouble to get together, because some of us don't want to go too high in what we ask for, because we don't want to sign up for more than we can pay for. I wonder if that wouldn't be an advisable thing to do, and then if we are going to have the list of these projects, why not have each state prepare that list, and if we cannot get together, maybe we would want to do something about that.

My thought at the present time is that I don't think we should consider anything accomplished in dividing water, but our Wyoming delegates are going to be open-minded on it and do the right thing about it. That's just something for you to think about.

MR. WATSON: Mr. Chairman, since you mentioned the subject as to the place of meeting, and it was supported by Judge Stone, I would like to talk on that point, and then after that has been decided upon, continue with the subject Mr. Bishop brought up. We would cheerfully invite you to meet at Salt Lake City the next time, in a very short time, and this committee to arrange upon that time. I would invite you to Salt Lake City for the next place of meeting. If necessary, I will make a motion to that effect, if that is in order.

CHAIRMAN BASHORE: Do I hear a second to that motion?

JUDGE STONE: Someone made a very wise comment at our meeting in one discussion this week, that it might be well to start off these negotiations in some town that is actually within the Colorado River Basin. We necessarily will meet from place to place, but we are dealing with the Colorado River, and why wouldn't it be a good start-off, at least, to meet within the Basin, at some such place as Grand Junction or Glenwood Springs?

MR. BISHOP: Rock Springs, Wyoming, would be all right. We can take care of them all right over there. How does that suit you? What I had in mind, we might be able to get together at this meeting in Salt Lake. We are going to be down there for three or four days, and if the Chairman is going to be there--were you figuring on being there, Harry?

CHAIRMAN BASHORE: Well, I can be there, yes.

MR. BISHOP: We will all be there. We will have Commissioners from all the states there. We are all interested, and I just wonder if it wouldn't be feasible for us to get together and have a meeting there and maybe go a little farther with it. Every little bit helps, you know.

CHAIRMAN BASHORE: Well, Clark, in that connection the same thought occurred to me, but, on the other hand, if the Commission decides to ask the representatives at the next meeting to have this list of projects or apportionment of water available, it is rather short notice to them. They are not here at the meeting and they would be hard pressed to meet that request, it would seem to me.

MR. BISHOP: Mr. Chairman, I don't think we could make any final decision on anything until we had the full committee there and we have given them due notice, and all that sort of thing, but I am sure Wyoming will have several there, and I am sure the other states will, and we might at least consider some of these points we have to consider to bring about the compact.

MR. WATSON: Mr. Chairman, it is only a week or ten days until that time, consequently we don't need a program for that. Now, we can establish our program at that time, if we determine upon the time and place of the meeting now.

JUDGE STONE: Mr. Chairman, it seems to me, although we want to proceed as fast as possible, we have got to remember that there are two of the Commissioners that have not yet been officially accredited. We have only got the rest of this week for that to be accomplished. It has been my observation when you mix up a meeting of the Compact Commission, or take up a matter of that importance in connection with another meeting, you don't get very far. Our next meeting ought to be held separately and a sufficiently long time from now to be sure that these other Commissioners are duly certified as being authorized to represent those other states, and that at that time we should discuss the program and the procedure of the Commission and officially organize the Commission. After all, the Commission is not yet officially organized and cannot be officially organized until all the Commissioners are present. We have no right to do it in the absence of two of the states, through their accredited representatives. For that reason, I think that we ought to put the time of meeting far enough in advance to be sure we are ready the next time to proceed.

CHAIRMAN BASHORE: Well, what shall we do about it? In the first place, what is the location? The place and the time are two things that must be decided on.

MR. BARLOW: In the absence of Mr. Bishop--he has just gone to his office for a minute, and if you could wait a minute or two I think he would like to invite you to Rock Springs. He is just going to try to pick a convenient date on his agenda which will possibly meet the approval here, if you would just wait a minute.

CHAIRMAN BASHORE: Mr. Bishop, do you have a suggestion as to the time and place of the next meeting?

MR. BISHOP: Mr. Chairman, I just looked up my markings on my calendar, and I could get away on the 8th, 9th and 10th, or the 19th, 20th, and 21st, for three days--of August.

MR. ROLLINS: I might suggest that unless you come to Wyoming, it would be pretty hot to hold it in any of these other states.

CHAIRMAN BASHORE: Yes, we realize that.

JUDGE STONE: Glenwood Springs would be all right too.

MR. WATSON: Mr. Chairman, it appears to me that we have an elegant

opportunity to save travel and save time, to have an initial meeting, say, August 1st in Salt Lake, right after the meeting of the Committee of 16, to perfect our agenda. The qualifications of the members can be established in the meantime, and it looks as though we are just taking time by the forelock in doing something there, because the opportunity exists to do it, and at that time we can determine on this other meeting, wherever it may be held, with an agenda prepared for it.

CHAIRMAN BASHORE: Of course, the Chair is absolutely neutral on that. I am a man of leisure and I can meet any date you decide on.

JUDGE STONE: As I understand it, Mr. Watson, your thought there was that we wouldn't meet to necessarily conduct any business, but merely to organize and fix a date for the second meeting?

MR. WATSON: And establish an agenda, if necessary, if we could. In other words, we would accomplish something by all being together, at least, at that time, at practically no extra effort or expense.

MR. BISHOP: You have that meeting on what day, Ed?

MR. WATSON: It could be immediately after our meeting or immediately before the meeting of the Committee of 16.

MR. BISHOP: Don't you think, with the three-day meeting we will have there, Judge, we will probably get through early on the third day, and that we could probably meet in the afternoon of the third day and do that work?

JUDGE STONE: Such a meeting wouldn't be a long meeting, if it is the purpose merely to perfect an organization. It would only require a short time. I think that would be possible.

MR. BISHOP: Mr. Chairman, I make a motion that we leave it to the Chairman to decide on the time, if he will be there, and we will try to have the meeting on the afternoon of the 31st, and if it is impossible, have it on the next day. Our people will be there, and I don't think it will inconvenience them very much if we have to stay over a day.

MR. WATSON: I second the motion.

CHAIRMAN BASHORE: Just a moment. Leaving it to the Chairman--the Chairman will meet any day you select.

JUDGE STONE: I will make a definite motion to the effect that the Commission hold its organization meeting on the first day of August at Salt Lake City, Utah.

MR. WATSON: Second the motion.

JUDGE STONE: I would like, however, to state that part of my motion, "organization meeting," means something, that we merely organize and, if possible, set up an agenda, but get organized and get started.

MR. BISHOP: I will second that.

CHAIRMAN BASHORE: The motion has been made and seconded that the organization, the Upper Colorado River Basin Compact Commission, hold a meeting at Salt Lake City on August 1st at--what time, ten a.m.?

JUDGE STONE: That is all right.

CHAIRMAN BASHORE: --ten o'clock a.m., or earlier, if you like.

JUDGE STONE: We will have to leave the place of meeting up to Mr. Giles, I presume, or someone from Utah, or Mr. Watson.

CHAIRMAN BASHORE: The time, though. We have got the day all right, but what is the hour?

JUDGE STONE: Ten o'clock a.m.

MR. WATSON: At Mr. Giles' office.

MR. ROLLINS: Hotel Utah, Ed.

MR. WATSON: Mr. Giles' office.

JUDGE STONE: Before you put that motion, could we have an understanding that in the event the meeting of the Committee of 16 does not take up three days, and since this meeting will be a short one and we will all be there, we might agree to meet a little earlier just to save time. That is assuming we get through on the 30th or the 31st with the Committee of 16, then we might just as well get together and get this job done and not hold everybody over. I think we ought to adopt it with that understanding.

Now I will restate my motion: That the Upper Colorado River Basin Compact Commission meet at Salt Lake City following the adjournment of the Committee of 16, but not later than August 1st, and that that meeting be held for the purpose of organizing the Commission.

MR. BISHOP: I will second the motion.

CHAIRMAN BASHORE: The motion has been made and seconded. Those in favor say "Aye."

(The motion, being put to a vote, was carried.)

CHAIRMAN BASHORE: Now, is the temporary Secretary here?

MR. GILES: I was elected.

CHAIRMAN BASHORE: Yes. Then you are going to have the job of notifying everyone.

MR. GILES: That is correct.

CHAIRMAN BASHORE: Gentlemen, do we have any further business?

JUDGE STONE: I take it, Mr. Chairman, that in accordance with the usual practice and procedure in compact meetings, each Commissioner will be entitled to have at that meeting such consultants or advisers as he may see fit, is that correct?

CHAIRMAN BASHORE: Yes, I think that is pretty well understood. That is the usual procedure, to have all the advisers that you wish, but, of course, they are not entitled to a vote when it comes to a voting proposition.

MR. BISHOP: Mr. Chairman, at this time wouldn't it be proper to talk about the copies of the proceedings, and how many each state should have? Shouldn't we make a list of states and the number of copies they want, and find out what the cost is going to be and find out how we are going to raise the money?

JUDGE STONE: Do you mean the proceedings of this meeting here today?

MR. BISHOP: Yes.

JUDGE STONE: I think we ought to understand what he has reference to, the question of the proceedings of the Commission. It is a matter which will be determined by the Commission itself, but, as I understand it, Mr. Bishop is now referring to the proceedings of this meeting today, is that correct?

MR. BISHOP: That is right.

CHAIRMAN BASHORE: Well, that is a matter for the Commissioners to decide, I believe.

JUDGE STONE: Mr. Chairman, for Colorado, we will only require one copy of the proceedings of the meeting today.

CHAIRMAN BASHORE: How many copies will Utah require?

MR. BISHOP: Wyoming three.

MR. WATSON: Utah three.

MR. CARSON: Arizona one.

CHAIRMAN BASHORE: New Mexico is not represented. Probably you had better make one for New Mexico. Anything further? There is one matter that should be decided on at the next meeting--I will mention it now--and that is the matter of disseminating information to the press. Do you want a newspaper man to sit in on all the deliberations, or shall the Commissioners prepare a statement to give to the press? That is something that you should be thinking about, I think, to be taken up at the next meeting. There are several ways of doing it. The surest way and the most troublesome way, you might say, because it involves a lot of work, is to have the Compact Commission prepare its own statement for the press. The press will always want to know what you are doing. That is proper; the people want to know.

There is danger, if a newspaper man sits in, that he will get the wrong impression, but, of course, that relieves the Commission of the work of preparing the release. That is something that should be carefully thought about, I believe. Do you have any ideas on that, Judge?

JUDGE STONE: It seems to me that that question should be very carefully considered at the organization meeting. I know it was a matter extensively discussed in the Arkansas Compact, and a plan was worked out, and it seems to me we ought to be giving it some thought. There, there was more than one Commissioner, for each state, and then the Federal representative in that case and one man from each state handled the newspaper releases, and the newspaper men were not permitted to sit in at the conferences. The Federal representative was the Chairman. Such releases as were given out were prepared by these three men, and it seems to me that some comparable arrangement ought to be made when we hold our organization meeting.

CHAIRMAN BASHORE: That is something that needs pretty careful consideration, and I would suggest it be disposed of at the organization meeting to be held in Salt Lake on August 1st.

Anything further?

MR. BISHOP: Mr. Chairman, on the proposition of the expense of the

transcript and the number of copies, I will offer this suggestion in order to put it before the meeting: If it is agreeable with the rest of you, if the gentlemen here will send the copies to us, we will send them out to the states and a bill for their share, based on the number they get, divided into the total, and we will send each state a bill for that.

JUDGE STONE: That is agreeable to Colorado. Send ours to the Colorado Water Conservation Board.

CHAIRMAN BASHORE: I think there should be a copy prepared for the Commission, and mail them the bill for it.

JUDGE STONE: There is no reason why the state shouldn't take care of that. We can include that in the states' and divide the cost of the Commissioners' copy among the states.

CHAIRMAN BASHORE: I would like to have the Commission furnished one copy. I don't know just how it will be paid for, but they can pay for it if there is no other way to pay for it.

MR. BISHOP: We will pay for it, Mr. Bashore. We can charge that up and just prorate it on the bill and each state pay their share of it.

JUDGE STONE: Mr. Chairman, I move that the Commission adjourn.

CHAIRMAN BASHORE: Is there a second?

MR. BISHOP: I second the motion.

CHAIRMAN BASHORE: It has been moved and seconded we adjourn. Those in favor say "Aye."

(The motion, being put to a vote, was carried.)

(Whereupon, this conference was adjourned.)

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JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
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3	F, G	19	AB
4	H	**20**	**AC**
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6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
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9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
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14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

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G9-1
V.1

RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Arizona - Colorado - New Mexico - Utah - Wyoming

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NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

•

SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

WATER RESOURCES
CENTER ARCHIVES

MAR 1966

UNIVERSITY OF CALIFORNIA
BERKELEY

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by the
Commission

29248544

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME I

Record of Preliminary Governors' Meeting, and
for Commission Meetings No. 1-5, inclusive

FOREWORD

The Upper Colorado River Basin Compact Commission authorized this three volume compilation of its official Record of Proceedings. There is attached the certificate of the Chairman and Secretary of the Commission that the record is complete and correct.

The Upper Colorado River Basin Compact Commission was composed of commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and one commissioner appointed by the President of the United States to represent the Federal Government. After a preliminary meeting of the Governors of the States, the Commission commenced its negotiations at Salt Lake City, Utah, on July 31, 1946. As a result of its deliberations, the Compact, known as the Upper Colorado River Basin Compact, was signed at the Palace of Governors, Santa Fe, New Mexico, on October 11, 1948. Subsequently the Compact was ratified by the respective legislatures of the signatory States. The consent of the Congress of the United States, required by Article I, Section 10 of the Federal Constitution, was granted by Public Law 37, 81st Congress, First Session (63 Stat. 31), which was approved by the President of the United States on April 6, 1949. The Compact became effective and binding on the signatory States upon the latter date.

The Compact Commission did not adjourn sine die until August 5, 1949. It maintained its organization until that time to further the ratification of the Compact by the States and the approval of the Compact by the Congress and to perform certain other related duties and functions.

All of the States which negotiated and ratified the Upper Colorado River Basin Compact are signatories to the Colorado River Compact which was signed at Santa Fe, New Mexico, on November 24, 1922, and subsequently ratified by the seven States of the Colorado River Basin (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming). The Congress of the United States gave its consent to the original Compact by the Boulder Canyon Project Act (45 Stat. 1057) in 1928. The provisions of the 1948 Upper Colorado River Basin Compact are subject to the provisions of the 1922 Compact.

The Colorado River Compact of 1922 did not apportion Colorado River water, or its use, among the signatory States. Instead, it divided the beneficial consumptive use of Colorado River water between the Upper and Lower Basins. The division point between the two basins was fixed as Lee Ferry, Arizona, which is located a short distance south of the Arizona-Utah boundary line. The Compact placed an obligation on the Upper Division States (Colorado, New Mexico, Utah, and Wyoming) to deliver specified quantities of water at Lee Ferry for the use of the Lower Basin. Provision was made for the satisfaction of any subsequently created treaty obligations to Mexico. The use of surplus water, over and above that apportioned to the two basins, was reserved for future apportionment.

The Upper Colorado River Basin Compact apportioned among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming the beneficial consumptive use of the water apportioned to the Upper Basin by Article III (a) of the 1922 Compact (7,500,000 acre-feet annually). Provision was made as to the responsibility of the States of Colorado, New Mexico, Utah, and Wyoming in regard to their joint obligation to deliver water at Lee Ferry for use in the Lower Basin.

The 1948 Compact created an administrative agency known as the "Upper Colorado River Commission." This body, in addition to administering the Compact, is charged with the duty of expediting the development of the Upper Colorado River Basin. It is composed of five commissioners, one representing the United States of America, and one representing each of the States of Colorado, New Mexico, Utah, and Wyoming. Arizona is not represented on the Commission because of its relatively small area in the Upper Colorado River Basin. The Federal representative is chairman of the Commission. As an official body, it occupies the unique position of being able to expedite Upper Colorado River Basin development, to aid in shaping such development, and to integrate Federal and State activities and interests.

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Harry W. Bashore, for the United States of America, Chairman
Charles A. Carson, for Arizona
Clifford H. Stone, for Colorado
Fred E. Wilson, for New Mexico (1)
Edward H. Watson, for Utah (2)
L. C. Bishop, for Wyoming
Grover A. Giles, Secretary

(1) Replaced Thomas M. McClure who died during the time the compact was under negotiation.

(2) Was replaced by Harold A. Linke after the compact was signed but before the Commission adjourned sine die.

ENGINEERING ADVISORY COMMITTEE

J. R. Riter, for the United States of America, Chairman
H. P. Dugan, for the United States of America
R. Gail Baker, for Arizona
R. I. Meeker, for Arizona
Royce J. Tipton, for Colorado
R. M. Gildersleeve, for Colorado
Frank C. Merriell, for Colorado
John H. Bliss, for New Mexico
John R. Erickson, for New Mexico
C. O. Roskelley, for Utah
R. D. Goodrich, for Wyoming
H. T. Person, for Wyoming

Charles L. Patterson for Colorado, F. W. Cottrell for Utah and C. S. Jarvis for Utah served as members of the Committee during the early months of the negotiations.

LEGAL COMMITTEE

Charles A. Carson, for Arizona, Chairman
Jean S. Breitenstein, for Colorado
Fred E. Wilson, for New Mexico
W. J. Wehrli, for Wyoming
J. A. Howell, for Utah
J. G. Will, for the United States of America

EXPLANATORY NOTE

This compilation of the Record of the proceedings of the Upper Colorado River Basin Compact Commission is contained in three volumes, as follows:

Volume 1 - Containing the Record of the preliminary Governors' Meeting, and the Record of Meetings Nos. 1 to 5, inclusive, of the Commission.

Volume 2 - Containing the Record of Meetings Nos. 6 to 11, inclusive, of the Commission.

Volume 3 - Containing the Final Report of the Engineering Advisory Committee, and the Inflow-Outflow Manual.

These various meetings, in Volumes Nos. 1 and 2, are separated by blue insert-sheets, to indicate the division between meetings.

A Subject Index for meetings of the Commission appears at the beginning of Volumes Nos. 1 and 2. (See explanation for use, which prefaces the Subject Index). A separate Index for the Engineering Advisory Committee Report appears in Volume No. 3, as a part of that Report.

There appears in this compilation, at the beginning of each separate meeting of the Commission, a chronological Table of Contents, covering developments in each such meeting.

There were 11 official meetings of the Upper Colorado River Basin Compact Commission before it adjourned sine die at Salt Lake City, Utah, on August 5, 1949.

The schedule of all meetings pertaining to the Compact was as follows:

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Meeting No. 3	Public Hearings	Oct. 28-30-31 and Nov. 2, 1946	Volume 1
Meeting No. 4	Cheyenne, Wyoming	Sept. 8, 1947	Volume 1
Meeting No. 5	Denver, Colorado	Dec. 1-2-3-4, 1947	Volume 1
Meeting No. 6	Denver, Colorado	Feb. 17-18-19-20-21, 1948	Volume 2
Meeting No. 7	Vernal, Utah	July 7-21, 1948	Volume 2
Meeting No. 8	Santa Fe, New Mexico	Oct. 4-11, 1948	Volume 2
	POST-COMPACT MEETINGS		
Meeting No. 9	Denver, Colorado	Dec. 29-30, 1948	Volume 2
Meeting No. 10	Salt Lake City, Utah	Feb. 17-18, 1949	Volume 2
Meeting No. 11	Salt Lake City, Utah	August 5, 1949	Volume 2

C E R T I F I C A T E

Harry W. Bashore, Chairman, and Grover A. Giles, Secretary, of the Upper Colorado River Basin Compact Commission, do hereby certify that the record and proceedings of such Commission, from the 31st day of July, 1946 to the 5th day of August 1949, when the Commission adjourned sine die, contained in the three volume compilation to which this certificate is attached, are a complete and correct reproduction of such record and proceedings, including the Final Report of the Engineering Advisory Committee and the "Inflow-Outflow Manual" approved and adopted by the Commission.

Harry W. Bashore
Chairman

Grover A. Giles
Secretary

SUBJECT INDEX

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* * * * This Subject Index is prepared according to a code number system in this manner: 1:5:21; 2:6:34-40; 2:7:141-142. Interpreted, this code means: Volume 1, Meeting 5, Page 21; Volume 2, Meeting 6, Pages 34 to 40; and Volume 2, Meeting 7, Pages 141 and 142.

In brief, the code is:

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Second figure	=	Meeting Number
Other figures in series	=	Page Numbers

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UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD OF MEETING NO. 1

July 31, 1946

Governor's Board Room

State Capitol

Salt Lake City, Utah

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Salt Lake City, Utah
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APPEARANCES
UPPER COLORADO RIVER BASIN COMPACT COMMISSION

HARRY W. BASHORE, CHAIRMAN
Federal Representative
Former Com. Bureau of Reclamation
Mitchell, Nebraska.

GROVER A. GILES, SECRETARY
Attorney General of Utah
Salt Lake City, Utah

COMMISSIONER FOR THE STATE OF ARIZONA:

Charles A. Carson — Special Attorney for the State of Arizona on Colorado River Matters, 419 Title & Trust Bldg., Phoenix, Arizona.

COMMISSIONER FOR THE STATE OF COLORADO:

Clifford H. Stone — Director, Colorado Water Conservation Board, State Office Building, Denver, Colorado.

COMMISSIONER FOR THE STATE OF NEW MEXICO:

Thomas M. McClure — State Engineer, Capitol Building, Santa Fe, New Mexico.

COMMISSIONER FOR THE STATE OF UTAH:

Edward H. Watson — State Engineer, State Capitol, Salt Lake City, Utah.

COMMISSIONER FOR THE STATE OF WYOMING:

L. C. Bishop — State Engineer, Cheyenne, Wyoming.

ADVISERS

ARIZONA:

R. Gail Baker — Reclamation Engineer, Phoenix, Arizona.

Donald C. Scott — Consulting Engineer, Phoenix, Arizona.

COLORADO:

H. Lawrence Hinkley — Attorney General of Colorado, Denver, Colorado.

C. L. Patterson — Chief Engineer, Colorado Water Conservation Board, Denver, Colorado.

R. J. Tipton — Consulting Engineer, Colorado Water Conservation Board, Denver, Colorado.

John R. Erickson — Senior Engineer, Colorado Water Conservation Board, Denver, Colorado.

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F. C. Merriell — Colorado River Water Conservation District, Grand Junction, Colorado.

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Ralph L. Carr — Attorney, Gunnison Water Shed Association, Antonito, Colorado.

NEW MEXICO:

I. J. Coury — New Mexico Interstate Stream Commission, Farmington, New Mexico.

John H. Bliss — Engineer, New Mexico Interstate Stream Commission, Santa Fe, New Mexico.

Fred E. Wilson — Special Assistant Attorney General, Albuquerque, New Mexico.

UTAH:

William R. Wallace	President, Utah Water Users' Association, Salt Lake City, Utah.
Thomas W. Jensen	Utah Water Users' Association, Mt. Pleasant, Utah.
Gerald Irvine	Attorney, Utah Power & Light Company, Salt Lake City, Utah.

WYOMING:

Louis J. O'Marr	Attorney General of Wyoming, Cheyenne, Wyoming.
Ernest B. Hitchcock	Planning and Water Conservation Board, Rock Springs, Wyoming.
Emil C. Gradert	Assist. Interstate Streams Commissioner, Fort Bridger, Wyoming.
H. Melvin Rollins	Assist. Interstate Streams Commissioner, Cheyenne, Wyoming.

BUREAU OF RECLAMATION:

John C. Page	Former Commissioner, Denver, Colorado.
E. B. Debler	Regional Director, Region 7, Denver, Colorado.
E. O. Larson	Regional Director, Region 4, Salt Lake City, Utah.
J. W. Dixon	Director, Branch of Project Planning, Washington, D.C.
N. B. Bennett, Jr.,	Branch of Project Planning, Washington, D. C.
A. F. Johnson	Branch of Project Planning, Washington, D. C.
A. N. Thompson	Assist. Regional Director, Amarillo, Texas.
John R. Riter	Denver, Colorado.
C. B. Jacobson	Denver, Colorado.
H. P. Dugan	Denver, Colorado.
Reid Jerman	Salt Lake City, Utah.
J. Stuart McMaster	Salt Lake City, Utah.
C. H. Jex	Grand Junction, Colorado.

PROCEEDINGS

The meeting was called to order by Chairman Bashore at ten o'clock a.m. on Wednesday, July 31, 1946.

THE CHAIRMAN: Gentlemen, the meeting is called to order.

As you all know, we had a preliminary meeting at Cheyenne, Wyoming, which was called by Governor Hunt of Wyoming. And at that meeting certain actions were taken and a record made of what happened. But it was quite informal for the reason that the Compact Commissioners for the governors did not have credentials. But of course you always have to make a start in organizing a body of people to do something and I think that was a very good start.

However, I believe it will be quite appropriate, after the credentials are presented, for the actions which were taken at the Cheyenne meeting to be reconsidered and revoked or modified as the Commissioners may see fit. That refers also to the transcript of the record. Now that record was made and it stands as the record of the Cheyenne meeting, but I believe it will be quite appropriate to consider how much of that record is pertinent to the deliberations of the Compact Commission.

Now, at this time the Chair will call for the credentials of the representative of the State of Colorado, Compact Commissioner from the State of Colorado.

COM. STONE: I present my credentials. And may I say, I also presented them for the record in Cheyenne.

THE CHAIRMAN: Thank you, Judge Stone. I believe it is not a function of the Commission to pass on the credentials of the members. Each state should understand its own business.

COM. STONE: Mr. Chairman, as a matter of information I might just state what my credentials consist of.

THE CHAIRMAN: I think that would be very well, Judge Stone, to give just a general brief statement as to how you happen to be Commissioner from the State of Colorado.

COM. STONE: These credentials set forth Section 9 of Chapter 265 of the Session Laws of Colorado for the year 1937. That section provides that the Governor of the State of Colorado, with the consent of the Colorado Water Conservation Board, may appoint a Compact Commissioner or Commissioners. That pertinent section is set forth in the credentials.

Then the credentials state that at a meeting of the Colorado Water Conservation Board held on the 21st of July, 1946, the following proceedings took place--this is taken from the record of the proceedings of the State Water Board. The proceedings set forth the letter from Governor John C. Vivian of Colorado dated July 2, 1946, addressed to the Colorado Water Conservation Board, appointing me as Colorado's Commissioner to meet with the other states for the purpose of negotiating a compact for the Upper Basin of the Colorado River, and asked the Board to approve the appointment.

Then the credentials further show that it was moved by--setting forth the name of the member of the Board--and seconded that the appointment of the Governor be approved by the Colorado Water Conservation Board. The proceedings show that that motion was unanimously passed and adopted.

Then the last part of the credentials show that I accept the appointment.

THE CHAIRMAN: Thank you, Judge Stone. I would like to have the record show at this point that at the Cheyenne meeting the Federal Representative presented his credentials, which consisted of a letter from the President of the United States and an acceptance by myself as Federal Representative. Those credentials were filed at the Cheyenne meeting and are a part of the transcript of the proceedings of that meeting.

I want to say just this, that my acceptance of the appointment was made for the sole reason of being able to render a constructive public service. I expect to work on that basis.

Now we will call for the credentials of the Commissioner from the State of Wyoming.

COM. BISHOP: Mr. Chairman, the only credentials that I have is a certificate from the Secretary of State of the State of Wyoming identifying me as the State Engineer of the State of Wyoming. And under our state law the State Engineer is Interstate Stream Commissioner for the purpose of assisting in representing the State of Wyoming in negotiation of compacts for division of the waters of interstate streams.

THE CHAIRMAN: You will file that certificate from the--

COM. BISHOP: Well, it was copied in the other record; and here it is, if the lady would like to copy it.

THE CHAIRMAN: If it is part of the other record it is not necessary to resubmit it.

COM. BISHOP: All right.

THE CHAIRMAN: It will be considered a part of this record. We will now call on the Commissioner from the State of Utah.

COM. WATSON: I have, Mr. Chairman, the Certificate of Appointment signed by Secretary of State E. E. Monson, who sets out that on March 1, 1945, Edward H. Watson was appointed by Governor Herbert B. Maw and duly confirmed by the Senate to the office of State Engineer of the State of Utah for the term ending March 1, 1949. The Secretary further certifies that the:

". .State Engineer is hereby authorized to represent the State of Utah in all interstate conferences held for the purpose of negotiating and entering into compacts between the State of Utah and one or more sister states for the division of the waters of interstate rivers, lakes, or other sources of supply."

This is a quotation from the Statute, and I will give you the citation in a letter of transmittal.

THE CHAIRMAN: Which will be made a part of the record of this meeting?

COM. WATSON: Yes.

THE CHAIRMAN: Thank you, Mr. Watson. We will now hear from the Commissioner from the State of Arizona.

COM. CARSON: Mr. Chairman, I have a letter from Governor Osborn dated July 24, 1946, addressed to you as Chairman of this Commission, appointing me as the representative of Arizona on this Commission. I will file it with the record.

THE CHAIRMAN: Thank you, Mr. Carson.

(The letter referred to is as follows:)

"Mr. Harry W. Bashore
Chairman, Upper Colorado
River Basin Compact Commission

"My dear Mr. Bashore:

"This is to inform you that I have named Charles A. Carson, of Phoenix, Arizona, as the Arizona representative on the Upper Colorado River Basin Compact Commission.

"As you know, Mr. Carson is Arizona Counsel on Colorado River matters. He is a man of honor and integrity and thoroughly familiar with all phases of the Colorado River question. I know that he will serve with ability, fairness and energy and will be helpful in the many perplexing questions which will confront your committee.

"With all good wishes, I am

"Sincerely,
(Signed) Sidney P. Osborn
"Governor."

THE CHAIRMAN: We will now call on the Commissioner from the State of New Mexico.

COM. McCLURE: Mr. Chairman, I have a wire addressed to General Louis O'Marr dated July 30th, which states:

"TCM MCCLURE STATE ENGINEER WILL REPRESENT COLORADO RIVER COMPACT MEETING AT SALT LAKE CITY AS NEW MEXICO COMMISSIONER."

Signed, "JOHN J. DEMPSEY"--Governor of the State of New Mexico.

Now, these credentials will probably be followed by a resolution or by a definite certification by Governor Dempsey if he desires that I continue as Commissioner following the Salt Lake City meeting.

THE CHAIRMAN: Yes, Mr. McClure. Will you submit that for the record?

COM. McCLURE: Yes.

THE CHAIRMAN: And the Chair also wishes to call attention to Governor Dempsey's statement at the Cheyenne meeting in connection with New Mexico's representation at this meeting. Mr. Bishop, can you find that reference?

I think this telegram indicates plainly that the Governor is carrying out his statement that he made at Cheyenne. Will you read that statement, Mr. Bishop?

COM. BISHOP: Mr. Chairman, on page 13* of the proceedings I find this statement:

"CHAIRMAN BASHORE: The Commissioner from the State of New Mexico.

"GOVERNOR DEMPSEY: He is not present, Harry. I think he is in Utah today, but his credentials will be here before your next meeting and you can put them in the record, if you desire, on that basis."

THE CHAIRMAN: I think that is sufficient, Mr. Bishop, is it not?

COM. BISHOP: I was going to give this next one. You can decide if you want it in the record. You said:

"All right, Governor Dempsey of New Mexico has assured us that the credentials of the Commissioner from New Mexico will be available before the next meeting."

THE CHAIRMAN: Now, that completes the submission of credentials, I believe, from the Commissioner of each State.

I believe now it is in order to consider what modifications or verifications should be made in regard to certain actions taken at the Cheyenne meeting, for instance, the appointment of the Federal Representative as Chairman of the Commission. Now it is very properly in order at this time to either modify or verify the action taken by the folks at Cheyenne.

COM. STONE: Mr. Chairman, it seems that each Compact Commission should organize itself. The meeting at Cheyenne was the meeting of a larger group. The Commission itself should, it seems to me, perfect its own organization.

For that reason I move that Harry W. Bashore, the Federal Representative designated by the President of the United States, be made the Chairman of the Upper Colorado River Basin Compact Commission.

* Page 6, Cheyenne minutes in this compilation.

COM. WATSON: Second.

THE CHAIRMAN: The Chair is embarrassed in placing that motion.

COM. STONE: I will put the motion. Gentlemen, you have heard the motion. Are there any comments, any discussion? (No response.) (Thereupon a vote was taken and the motion of Com. Stone carried unanimously.)

THE CHAIRMAN: Thank you, Judge Stone. I shall be very happy to try to serve as Chairman.

COM. McCLURE: I would appreciate it if the record will show that my usual signature is Thomas M. McClure and not Tom McClure, as the wire says.

THE CHAIRMAN: Very well, Mr. McClure.

Now you have for consideration the appointment of a secretary. At the Cheyenne meeting Mr. Giles was, we might say, thrown into the job. And it's up to the Commissioners now to reconsider or verify the action taken at the informal Cheyenne meeting. What is the pleasure of the Commission?

COM. STONE: Mr. Chairman, may I inquire, are the proceedings of the Cheyenne meeting available now?

THE CHAIRMAN: They are, Judge Stone.

COM. BISHOP: I have the copies, all of them, ready to turn over to the states, the number that they ordered. I was wondering, however, if you wanted to go over them and edit them in any way, or just take them as they are?

I might say, for the purpose of the record, that I haven't found very many errors in the minutes. The name of Mr. O'Marr, our Attorney General, one of the appearances from Wyoming, did not show, and I have included that in all the copies. Also Mr. William E. Warne was shown as "Warren." I have corrected that on the first page of all of the copies.

THE CHAIRMAN: Judge Stone, I think we will come a little later to consider that record there, as I mentioned in the beginning. It is a record of the Cheynne meeting, but it is quite possible that the Commissioners will wish to modify it so far as it pertains to the deliberations of the Upper Colorado River Basin Compact Commission.

COM. STONE: The point I had in mind, Mr. Chairman, was this: that before we select a secretary, shouldn't we discuss the manner in which we are going to keep a record of the Compact Commission? Experience has demonstrated, and particularly on the Colorado River, when the Colorado River Compact was made, that we cannot be too careful in keeping the record of the proceedings of this Commission. And it seems to me that before we designate a secretary we should determine the duties of the secretary and the manner in which we are to keep this record.

I have this in mind, that on other compact proceedings, certain other ones, a complete record was kept in one way. In other proceedings they have been kept in another way. On the Colorado River it is now disclosed, or has been shown, that the proceedings of the Commission are not all available. Some very vital questions were resolved by the Commission, and the record showing the intent and purpose of the Commission is not available on certain material provisions of the Colorado River Compact.

We are now engaged in working out the Compact for the Upper Basin, and for the future and for those who may have occasion in the future to construe any compact which may be made and apply it, we ought to be very careful about our record.

I should like to make this suggestion, just for the Commission to consider, that we keep a complete transcript of the proceedings of the Commission. That then the secretary, or whoever may be designated as such, make a resume of the material portions of that transcript for the purpose of providing a record of the compact proceedings.

That does involve a considerable amount of work on the part of a secretary or whoever may be assigned to do that work, and it seems to me that any record thus prepared ought to be one which is considered and formally approved by the Commission.

That is a procedure which has been adopted in certain other compact proceedings. It may not be the best one, but at least it is a basis for having in the future a record which is so important on any compact. We can't rely solely on loose notes that are kept in the form of minutes. Because, after all, those minutes may evidence the opinion or the impression that the person has who makes those minutes; and the record itself should be the agreement of the Commission as constituting an agreed record.

If that is supported by complete transcript, we should be able to conclude this work with a proper record for the future.

Now, if that procedure should be adopted and recognized as the best procedure, then it may indicate the extent of the duties of the secretary. That is the reason I bring it up at the present time.

THE CHAIRMAN: In that connection, Judge Stone, it is my thought that the Compact Commissioners should, in their attendance at these meetings, from time to time submit carefully prepared statements for the record.

Now, we all talk too much--I do too--but I think we want to keep our record concise and as much to the point as possible. I have some ideas on this that I am going to try out on you later, as to the next meetings, and I have an idea that it will be necessary if you follow my suggestion to do some work. I simply want to emphasize that we should keep a record we will not be ashamed of --make it concise, leave out as much jawbone as possible, and then not be apprehensive about having to refer to it in clearing something up at some future time when the matter comes before the legislatures of the states or the Congress of the United States.

COM. STONE: That is exactly right. And that is the reason I think we need a record aside from the transcript. Because the transcript will include a lot of what we might describe as chatter, and bantering back and forth matters which need not become a part of the record. But this prepared record would include the careful statements of the Commission members and would be reviewed by the entire Commission as constituting a record in the end which will be concise and to the point and as evidencing the intents and purposes which were back of any action taken by the Commission. That would reduce the size of the record and be one which we can submit to Congress or the legislature or that future generations can look into. And yet that transcript may be very helpful in the future when some question may come up. In other words, I distinguish between the transcript and the agreed record of the Commission.

THE CHAIRMAN: Oh, yes. Mr. Bishop?

COM. BISHOP: I was thinking, in connection with this, that it might be well to have an editing committee appointed to go over this and exclude a lot of statements that are rather immaterial and have no connection with the Compact proceedings.

THE CHAIRMAN: Gentlemen, let's keep on the beam on this. Judge Stone, do you want to put your ideas in the form of a motion?

COM. STONE: Well, if that is the desire of the Chair--that will open it up for discussion.

I move, Mr. Chairman, that this Commission, for the purpose of keeping an adequate and concise record of its proceedings, make provision for the preparation of a transcript of its proceedings, that from such transcript there be prepared by the secretary or some person designated to perform that function, a concise and precise record of all the material matters which take place in Commission meetings, that record to be reviewed and approved by the Commission.

THE CHAIRMAN: Do I hear a second?

COM. McCLURE: I will second that motion, Mr. Chairman.

THE CHAIRMAN: Any remarks?

COM. CARSON: Mr. Chairman, as I understand that, the reporter's transcript, made from time to time, will not be published or a part of the record of this Commission?

COM. STONE: That is correct.

COM. CARSON: But the only publication will be the record as later approved by the Commission?

COM. STONE: As later prepared from the transcript and approved by the Commission.

COM. BISHOP: The transcript would be preserved, of course?

COM. STONE: Yes.

COM. BISHOP: So it would be available. If they had done that in the Colorado River Compact we would be able now to find some of the statements that some of us would very much like to have.

COM. STONE: That is true. The transcript should be retained, and should be corrected, probably; but just as a matter of procedure in connection with such an arrangement it would seem that when this record is prepared each time, there should be enough copies for each member of the Commission, so that at the succeeding meeting we can go over that record and correct it for approval.

THE CHAIRMAN: Any further discussion of the motion? (No response.) (Thereupon a vote was taken and the motion of Com. Stone carried unanimously.)

COM. CARSON: Mr. Chairman, I would like to nominate Grover Giles as secretary of this Commission.

THE CHAIRMAN: Mr. Giles has been nominated for secretary. Do I

hear a second to the nomination?

COM. McCLURE: I will second the nomination.

THE CHAIRMAN: It has been moved and seconded Mr. Giles be appointed as secretary. Any discussion? (No response.) (Thereupon a vote was taken and the motion of Com. Carson carried unanimously.)

COM. STONE: Mr. Giles has got a real job preparing the record.

THE CHAIRMAN: Judge Stone, I feel rather sympathetic towards Mr. Giles from now on.

COM. STONE: Mr. Chairman, in connection with that do we not have some other matters? There is going to be some expense involved in hiring the reporter to take the proceedings and prepare the transcript. And then there is the question, I presume, of transcript being made available, a copy to each member of the Commission. We ought to determine in what way we are going to obtain the services of a reporter. I assume that we will be meeting from place to place in the Basin.

That has been done in various ways. It can be done so that we get a reporter in different places. We may be some places where we can't obtain a reporter. And then there is the question of the division of the expense of paying the reporter for his or her time, and for preparing the transcript.

THE CHAIRMAN: Yes, those questions are very pertinent, Judge Stone. I believe there is some underbrush, though, that should be cleared away as we proceed.

For instance, at the Cheyenne meeting, a name was selected for this body. I don't believe that we have taken action on that at this meeting to verify or change or to accept it or to reject it. As I recall it, the name informally adopted for this body was the Upper Colorado River Basin Compact Commission. I would be glad to be corrected if that is not correct.

MR. GILES: That is correct.

THE CHAIRMAN: Very well. Is that name acceptable to the Commissioners?

COM. McCLURE: Mr. Chairman, I move we accept that name.

COM. BISHOP: I second the motion.

THE CHAIRMAN: It is moved and seconded that the action taken at the Cheyenne meeting be accepted as to the name of this body. Any discussion? (Question is called for. Thereupon a vote was taken and the motion of Com. McClure carried unanimously.)

THE CHAIRMAN: Now, the next matter that I have on my notes here was the relation with the press. And what I mean by that is, how deliberations of the Commission may reach the public in the proper way. I think the Commission should have some control over what goes out to the press. People have a right to know everything that is going on, but the difficulty is to get it to them accurately. The question naturally arises, shall we invite a representative from the papers in the towns or the cities where these meetings may be held? The danger of that is that there are good reporters and there are bad reporters; and sometimes they get things balled up. I don't see how they do as well as they do, however, when they listen to the talk that goes on in these meetings-- I wonder how they can do as well as they can. But that is something we must dispose of.

It might be best to exclude the press and make these meetings executive sessions, and then delegate to somebody the responsibility of giving to the press a prepared statement. That makes more work for the Commissioners, but you have all accepted these appointments, and I assume that you are ready to do a lot of work, so that shouldn't be considered.

COM. McCLURE: Mr. Chairman, these scare headlines can certainly not help the Commission any from the experience I have had in other negotiations, because you can create a tremendous pressure by some headline that looks good on the paper but may not be representative of the item that follows.

THE CHAIRMAN: What is the wish of the Commission in regard to relations with the press?

COM. BISHOP: I know from experience that we have had heretofore sometimes the papers come out with a statement that isn't in accordance with the facts, even; and it seems to me if we are going to allow reporters to be present, and what not, that they should submit to the Commission an outline of what they are going to put in and let the entire Commission approve it.

THE CHAIRMAN: In that connection, Mr. Bishop, that is a good suggestion, but it just won't work for the reason that a lot of these papers have a certain time to come out, and if you put that requirement on, you give some paper an advantage and some a disadvantage, and they are all competitive, as they should be. If you put the papers to that trouble, so the reporter after he has prepared his statement must get the attention of the Commission, I think it takes too much time.

Now, that is just my opinion of it. I took the liberty to ask a young gentleman from one of the local papers to sit in this morning. I told him we might throw him out before we got through, or exclude him later. But am I right on that, or not?

MR. GORDON KIRBY (Reporter, DESERET NEWS): That is right, yes, sir.

THE CHAIRMAN: So, Mr. Bishop, while your suggestion is a good one, I am afraid it won't work.

COM. BISHOP: I agree the facts should be presented to the public, and the press should put it out. But I do know from experience--and I think Judge Stone will agree with that--that some of the meetings of the Committees of Fourteen and Sixteen have been misconstrued and written up so they weren't intelligible. Some of these fellows don't know what an acre foot of water is, and they call it a second foot, and so on; and by the time they get through writing it up it doesn't make sense.

COM. STONE: Mr. Chairman, aren't the Compact meetings in their very nature--don't Compact Commissions meet in executive session except when the Commission votes to have an open meeting to hear from persons who may desire to appear before the Commission? If that is a very essential nature of a Compact meeting, then aren't we obligated to arrange some definite procedure which is fair to the press and fair to the public--and that means that the Commission must assume the task of preparing press releases to be handed to the press except at such times as it may be an open meeting and everyone is permitted to be present?

Now, I take it when I refer to executive session, that means the executive session of the Commission and its advisers. That shouldn't exclude those who are called in by each state to sit as consultants or advisers to

the Commissioners, but it seems it is just a plain proposition of arranging for somebody to be responsible for preparing the press releases, and I can't conceive of anyone who could better do that than the Chairman of the Commission. And he may see fit to review his release with the members of the Commission. That is a matter for him to determine.

But we are five states here; it seems to me no one state should be put in the position where he may inadvertently color the release in accordance with some of his own particular views, and our Federal Representative sits here as representing the Federal Government, and serving as the balance wheel for all the rest of us.

You said that we have got to work--maybe we will put some work on you, too, Mr. Chairman. But I believe the appropriate person to be responsible for the relations with the press and the preparation of releases should be placed in the hands of our Chairman, with the understanding that we should stand ready to assist or review any releases that he may suggest.

THE CHAIRMAN: Some arrangement must be made. Because I think you are technically correct, Judge Stone, that these meetings are all executive sessions. Nevertheless, every state will come in with its advisers, lawyers, engineers and what not, and I, as the Federal Representative, expect to have some advisers. I think they have all got to be muzzled, and somebody has got to be responsible for putting out the right kind of information to the public.

Naturally these newspaper reporters will circulate among those that have been in attendance and try to get something out of them. I think they should keep still about it and have it the responsibility of someone to put it out. And then if he puts out something he shouldn't, it is his problem and the Commission can castigate him and chastise him and whatever they like. At least, they can put their finger on somebody.

COM. McCLURE: Mr. Chairman, I move that all sessions of this Commission, exclusive of open sessions so decided by the Commission, be executive sessions; that the Chairman of this Commission will prepare and present what press notices that are issued from the Commission. This he may do with the States' representatives' assistance, or by himself.

COM. WATSON: I second the motion.

THE CHAIRMAN: Motion has been made and seconded. Are there any comments? Any discussion? (Question is called for. Thereupon a vote is taken and the motion of Com. McClure carries unanimously.)

THE CHAIRMAN: Well, apparently the Chairman has some work to do. And I will accept that responsibility.

COM. BISHOP: Mr. Chairman, at this point I wonder if it wouldn't be a good idea for each state to announce its advisers, and the Commissioner to announce his advisers, for the purpose of the record?

THE CHAIRMAN: Mr. Bishop, I am not sure that everyone is prepared to do that. I doubt if I will be able to announce the advisers that I feel I am going to need because I think the Federal Representative is going to need a lot of advisers from the Bureau of Reclamation and the Department of the Interior. And whether you are prepared at this time to name them all--

COM. BISHOP: I was thinking the people that are here should be recorded here. And if, for the benefit of the record, we will announce the ones we are responsible for, the ones we have invited to come, or what not.

THE CHAIRMAN: All right, Mr. Bishop, you may announce your advisers from the State of Wyoming.

COM. BISHOP: Attorney General O'Marr; H. Melvin Rollins; Ernest B. Hitchcock and Emil C. Gradert.

THE CHAIRMAN: Are they legal advisers or engineer advisers?

COM. BISHOP: They are just advisers. They are what we call assistant commissioners, except the Attorney General, who is a legal adviser.

THE CHAIRMAN: Well, the Chair, of course, is familiar with Attorney General O'Marr's professional attainments, but I wanted the record to show.

COM. BISHOP: The other gentlemen are assistant stream commissioners, appointed by the Governor, under the Wyoming law.

THE CHAIRMAN: Oh, yes. Thank you, Mr. Bishop.

COM. McCLURE: Mr. Chairman, I make a motion that this session of the Commission be considered as open session until further action by the Commission.

COM. BISHOP: I will second the motion.

THE CHAIRMAN: You have heard the motion as made by Mr. McClure and seconded by Mr. Bishop. Is there any discussion? (No response.) (Thereupon a vote was taken and the motion of Com. McClure carried unanimously.)

COM. McCLURE: I make that motion on the basis that I feel that several of the states present are not prepared to name their advisers, and consequently we prefer all present from that state to attend this opening hearing.

THE CHAIRMAN: Yes.

COM. BISHOP: Mr. Chairman, I still think we ought to have a record of all these gentlemen here. That is a thing we have always done in all meetings, is have a record of who is in attendance in the meetings.

THE CHAIRMAN: The Chair has no objection to that, Mr. Bishop, and I suggest, in order to do that, you pass a paper around and each person write his name and official capacity--or if he hasn't any official capacity, what state he is from.

(Paper is started around audience.)

Now, the Chair does not wish to monopolize all the discussion here, nor to try to dictate the proceedings. But I do have in mind an agenda, or some work for the next meeting, assuming that we have one. And if the Commissioners have any matter that they wish to take up at this time before we get to the consideration of the agenda, I believe it is now in order.

COM. STONE: I didn't understand, Mr. Chairman. Pardon me. I didn't hear.

THE CHAIRMAN: Off the record.

(Discussion off the record.)

COM. STONE: Mr. Chairman, I do think, in line with the procedural matters we have been discussing, that we should arrange for the manner in which we are going to secure our reporters--reporter or reporters--and the manner in which they are going to be paid. That is quite material.

THE CHAIRMAN: Yes, I think that is quite pertinent at this time, Judge.

COM. STONE: And the number of copies of the transcript which should be available; that is right in line with what we are discussing.

THE CHAIRMAN: Yes.

COM. BISHOP: Wouldn't the transcript, one copy for each state, be enough to go over for preparing it for the final record that you speak of, Judge?

COM. STONE: I should think so, Mr. Bishop. That is all we need.

COM. BISHOP: We don't want a lot of copies of the transcript to get out around, and then when we get the final record we will get as many copies as we need.

COM. STONE: My idea is we should agree on the number of copies. And it seems to me you are entirely correct that we should not have more than one copy of the transcript for each member of the Commission, and that the original should be made available to the Secretary and retained by the Secretary.

Then we should agree among ourselves as to the number of copies of the record when it is prepared and agreed to by the Commission.

COM. BISHOP: Mr. Chairman, in order to get the record straight on this, I make a motion that one copy of the transcript be prepared for each state, and that each state pay its proportionate share of the cost of the same, and that when the final record of the meeting is made, that each state pay for such copies as they need.

COM. STONE: I second that motion.

THE CHAIRMAN: The motion has been made and seconded. Is there some discussion?

COM. STONE: Do I understand, Mr. Bishop, when you say "proportionate share"--what do you mean by the "proportionate share"?

COM. BISHOP: I mean each state would pay one-fifth, if you want to put it that way. That is what I mean.

COM. STONE: Does that include the cost for the services of the reporter?

COM. BISHOP: Yes.

THE CHAIRMAN: Off the record.

(Discussion off the record.)

(Com. Bishop thereupon restates his motion as follows:)

COM. BISHOP: I make a motion that the original of the transcript be prepared for the Secretary, two copies for the United States and one copy for

each state, and that each state pay one-fifth of the total cost of the same, including the service of the reporter; and that when the final record of the meeting is made that each state pay for such copies as they need.

THE CHAIRMAN: You have heard the motion. Do I hear a second?

COM. WATSON: I second the motion.

THE CHAIRMAN: It is moved and seconded that the motion as made by Mr. Bishop be adopted. Any remarks? (No response.) (Thereupon a vote was taken and the motion of Com. Bishop carried unanimously.)

COM. STONE: Mr. Chairman, while we are on the record, a question: There has been some discussion about the record of the Cheyenne meeting, as to how we should determine what portion of that should be preserved. It has been suggested by Mr. Bishop, who has read it, very obviously certain portions should be included. Would it be appropriate for the Secretary, or a committee, as the Commission may determine, to review that record and suggest as parts of our record what portion should be retained, that review to be acted upon at the next meeting of the Commission?

THE CHAIRMAN: I think it is quite pertinent to the deliberations of this body to consider what part of that record shall be made as a record of this Commission. That record stands as the record of the Cheyenne meeting, but that was not necessarily a meeting of the Compact Commissioners.

COM. STONE: That is right.

THE CHAIRMAN: So the Compact Commissioners can decide how much of that record they care to accept.

COM. STONE: To get the matter before the Commission, and in line with the duties which we have assigned to our Secretary, I move that the Secretary be requested to make a review of the record of the Cheyenne meeting held on the 22nd day of July, 1946, and submit his review for the approval of the Commission at its next meeting.

COM. BISHOP: I will second the motion.

THE CHAIRMAN: Any remarks on the motion as made and seconded? (No response.) (Thereupon a vote was taken and the motion of Com. Stone carried unanimously.)

COM. BISHOP: Now, Mr. Chairman, is it the idea that these copies that we have here will be destroyed and the only record we have will be the edited record?

THE CHAIRMAN: Mr. Bishop, it would be my idea that they should not be destroyed. The record stands for what it is worth. That is the record of the Cheyenne meeting, and I think probably the governors will want a copy of the record. But we should make it plain that it isn't a record of the Compact Commissioners of the Upper Colorado River Basin States, and we can accept--I say "we"--I mean this body can accept any part of it as its record.

I don't mean it should be destroyed, because I think this Commission has no business saying it should be destroyed. But it has a right to say what part of it it wants considered as its own record.

COM. BISHOP: I have these copies here, Mr. Chairman, I will be very glad to dispose of, and I don't have any list of the number of copies

ordered by each state, but I have a total of nine copies.

COM. STONE: We ordered one, I recall that.

COM. BISHOP: You ordered one. Well, I will give you one and check you off for one. And you will get a bill for that later. Grover, you got one?

MR. GILES: I have one.

THE CHAIRMAN: Off the record. (Discussion off the record and copies of the transcript of the Cheyenne meeting distributed.)

COM. STONE: May I mention a matter that seems appropriate to come up at this time?

I think the record ought to be clear on what basis we are proceeding to negotiate an Upper Colorado River Basin Compact. That matter has been of considerable concern to my state, and no doubt the other states have given it some consideration. The question was also discussed at the Cheyenne meeting. But in this organization meeting it seems to me the record ought to be clear on that subject.

Section 19 of the Boulder Canyon Project Act provides:

"That the consent of Congress is hereby given to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming"--
and you will note here seven states are named--
--"to negotiate and enter into compacts or agreements, supplemental to and in conformity with the Colorado River compact and consistent with this act for a comprehensive plan for the development of the Colorado River and providing for the storage, diversion, and use of the waters of said river. Any such compact or agreement may provide for the construction of dams, headworks, and other diversion works or structures for flood control, reclamation, improvement of navigation, diversion of water, or other purposes and/or the construction of power houses or other structures for the purpose of the development of water power and the financing of the same; and for such purposes may authorize the creation of interstate commissions and/or the creation of corporations, authorities, or other instrumentalities.

"(a) Such consent is given upon condition that a representative of the United States, to be appointed by the President, shall participate in the negotiations and shall make report to Congress of the proceedings and of any compact or agreement entered into.

"(b) No such compact or agreement shall be binding or obligatory upon any of such States unless and until it has been approved by the legislature of each of such States and by the Congress of the United States."

Now, the term "such States" does not refer to the five states appearing here and initiating compact negotiations. It refers, in addition to these states, to the States of California and Nevada. Now, it seems that we must make the record very clear that we are not proceeding under Section 19 of the Boulder Canyon Project Act; for if we do, then it can be argued after we make a compact that it is not good until it is ratified and approved by California and Nevada, which ratification and approval may not be forthcoming, and it is a matter which deals solely with the Upper Basin of the Colorado River.

There is a provision in the Colorado River Compact itself--that is Article VI of the Colorado River Compact--which may be some basis for

initiating these compact negotiations. But it seems to me that we have the authority, irrespective of Section 19 of the Boulder Canyon Project Act, or irrespective of Article VI of the Compact, to negotiate a compact, which compact, when approved by the Congress, implies previous consent, and since a Federal Representative has been designated and we are ready to proceed, and in view of the fact that one state or states of the Colorado River Basin may say that we have not proceeded correctly, since the other states under Section 19 should ratify the Compact, we should make it very clear at this time, and on the record, that we are not proceeding under Section 19 of the Boulder Canyon Project Act, but are proceeding independently of that section, and, if you please, independently of the Colorado River Compact, except that we must comply with the provisions of the Colorado River Compact in making any compacts for the apportionment of the waters of the Upper Basin of the Colorado River.

COM. BISHOP: Mr. Chairman, since our Governor, in sending out the notices for the first meeting, cited Article VI as the article under which the meeting was called, it would seem to me there would be no question but what that was the Article we had in mind. And it seems to me that Article covers the situation entirely.

COM. STONE: We shouldn't be put in a rigid position, when we have clear authority, irrespective of that Article or irrespective of Section 19. If we proceed, we are in keeping with the spirit of Article VI of the Compact, and yet we are not saying that we are proceeding entirely under that, because we have authority under the law of compact making to proceed irrespective of it. If that Article were not in the Compact at all, we would have the authority.

COM. BISHOP: Mr. Chairman, Wyoming is willing to concede that we are proceeding irrespective of our Article VI, although we believe Article VI covers the entire situation.

COM. STONE: May I call the Commission's attention to the last sentence of Article VI, which provides:

"Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or by direct future legislative action of the interested States."

Article VI itself says we may be free to proceed as we see fit.

COM. BISHOP: Mr. Chairman, I would like to have our Attorney General say a few words on that, if that is in order.

THE CHAIRMAN: General O'Marr.

ATTORNEY GENERAL O'MARR: Mr. Chairman and gentlemen: I am sorry that I can't agree with the Colorado position with respect to our authority to proceed under this Compact. I don't want to take a great deal of time to discuss it, but I also have given the same considerable thought and study.

I think to understand our position here--at least Wyoming's position--we have to go back into history somewhat. The Enabling Act of 1921 contains about the same provision with respect to the states involved being authorized to make the Compact as the Project Act of 1928. In other words, in the Enabling Act Congress gave its consent to the seven states to enter into a compact or agreement providing for the equitable division and apportionment among said states of the water supply of the Colorado River.

Now, taking that literally it meant, as I construe it, that the states would make a division apportioning among each of the states the water of that river. But what was done? The states entered into the Colorado River Compact. Now, they didn't make a division of the water as between the seven states. They made a division as between two groups of the seven states, and that was the only division of water that was made by the Colorado River Compact. In other words, the states placed their construction upon the Enabling Act, giving them the right to make a group division of the water.

Congress acquiesced in that construction because Congress in 1938, in the Project Act, ratified the action of the states.

Now, I think that the Compact itself contemplated a division between the states of the two groups; that is, the groups of the Upper and Lower Basin. Because in the very first article of the Compact, after reciting the major purposes of the Compact, the last sentence reads:

"To these ends the Colorado River Basin is divided into two Basins, and an apportionment of the use of part of the water of the Colorado River System is made to each of them"---

then follows this significant language:

---"with the provision that further equitable apportionments may be made.

Now, what did the Commission have in mind about further equitable apportionments? There have been perpetual apportionments as between the two Basins, 7,500,000 acre feet of water to each. Certainly it didn't have that in mind. And if you consider the fact further, that this Compact contemplates in various parts the rights of the states as to water, it would naturally follow, it seems to me, that the "further equitable apportionment" was intended to divide the water as between the states in the two Basins.

Now, Section 19 of the Project Act, as Judge Stone has mentioned here, provides that the consent of Congress is given to the seven states:

---"to negotiate and enter into compacts or agreements, supplemental to and in conformity with the Colorado River Compact. . ."

It is true, in the first sentence of that Section, the supplemental agreements referred to are somewhat limited by the provisions, which are that such agreements must be in conformity with the Compact and:

---"providing for the storage, diversion, and use of the waters of said river."

But the very next sentence, in my opinion, broadens the scope of the purpose and character of the agreement because it says, "Any such compact or agreement"--that is, the supplemental compact or agreement--"may provide"--among other things, for a division of the water.

Now, what division could there have been intended except a division between the states? There had been a division between the groups of states, and of course, as contemplated by the Compact it couldn't be completed until there had been a division of the water as between the two groups, and also perhaps a definition of the obligation of each state under the Colorado River Compact. Not only that, but the last sentence that I have referred to provides for something more which has nothing to do with the development of the river in providing for storage, diversion and use, because it goes on and authorizes "the creation of interstate commissions and/or the creation of corporations, authorities, or other instrumentalities."

So it seems to me the Project Act really intended the negotiations that we are now entering into for a division of the water as between the individual states.

Now, it is true, as Judge Stone has pointed out here, that the subdivision "b" of Section 19 does read, taking it literally, that there must be the approval of the legislatures of the seven states, but I think that could be read to mean the legislatures of the states entering into the compact for the division of water with respect to themselves and fixing their respective obligations under this Colorado River Compact.

COM. STONE: General O'Marr, may I remark there, my point was-- you have presented an argument as to how you think we might construe it. On the other hand, it might be construed otherwise, that all seven states might have to approve it. And my point is, why should we involve that question when, as a matter of fact, we have authority to proceed otherwise than under Section 19; and if we make it clear we aren't proceeding under it we don't involve that question.

MR. O'MARR: I think that would be as risky as to take the position we are contending for now, which I expect to show here in a moment. As a matter of fact, I don't see why the question is raised because we have all agreed we are going to have a meeting, we have agreed we are going to divide this water.

Now, what difference does it make whether we are operating without express authority, or whether we are operating under express authority? That is the point I am trying to make here.

COM. WATSON: I wish to ask this question: Did not this further apportionment refer to an apportionment of the surplus in 1963, and was it not considered at that time and by Mr. Hoover especially that there was five million acre feet more water in the River than we now find, consequently was not there additional water to be apportioned between the two basins at that time?

MR. O'MARR: There would be no need for a general statement here in a case where an express provision is made for it in the Compact in Section "f" of Article III of the Compact. There express provision is made for a further allocation of the water after 1963 under certain conditions, of course. So I say that there would have been no need for this general statement or general provision for further equitable apportionment if it had referred to or was intended to refer to the apportionments that were expressly provided for in the Compacts.

Now lawyers of course know that the practical or the administrative and executive construction of these Acts are largely followed by the courts. That is especially true of the Federal courts, where the meaning or the intent of the legislative action is uncertain.

Now, I state here that the Commission which negotiated the Colorado River Compact made a construction as to its meaning that was acquiesced in by the Congress and so that the states involved really placed a construction upon the statute under which they were acting. The Compact itself says that they were acting under the Enabling Act of 1921. And Congress approved the Compact containing that provision.

But that's not all. If you will read the appointment of the Federal Representative at this meeting you will find that the President himself based his appointment upon Section 19 of the Project Act of 1928, and he

also stated there--may I read that? This is what the President says:

"Pursuant to the Boulder Canyon Project Act (Act of December 21, 1928, Chapter 42, 45 Stat. 1057), granting the consent of the Congress to the States of the Colorado River Basin to negotiate and enter into compacts or agreements supplemental to and in conformity with the Colorado River Compact and consistent with the Boulder Canyon Project Act, you are hereby appointed as the representative of the United States to participate in the coming negotiations of the States of the Upper Colorado River Basin and to make a report to the Congress of the proceedings and of any compact or agreement entered into."

So there we have an Executive construction or interpretation of the Project Act. Moreover, that is the only Act of Congress that I know of which permits or authorizes the appointment of a Federal Representative to represent the United States in negotiations of this character.

So I see no objection to our proceeding under the provisions of that Act. It has been customary, of course--at least it was in the case of the Colorado River Compact--to refer to the authority under which they are proceeding. I don't think that is absolutely necessary, because the law speaks for itself.

If it would be less objectionable to Judge Stone here not to make any reference to this provision of the Project Act in the Compact which we may negotiate, I would see no objection to following that idea.

COM. STONE: General O'Marr, I want to make my position clear. I object to any implication whatsoever that we are proceeding under Section 19. And for that reason it is my position the record should be made clear that we are not proceeding under it and we have, after you have concluded your statement, I think, further studies on that which we would like to offer.

MR. O'MARR: That is the conclusion I have reached in studying this question.

COM. STONE: I don't object to Article VI, but I do object to Section 19, proceeding under it.

MR. O'MARR: It seems to me that if we are going to follow out the position of the Government in this thing we have got to operate or consider ourselves operating under Section 19 of the Project Act.

COM. STONE: As a matter of fact, we feel that the Government appointment itself, if it is construed in the way you construe it, is dangerous. I don't wish to lay ourselves liable to attack on our proceedings by any state after we have been able to adjust the use of waters by the States of the Upper Basin.

MR. O'MARR: Thank you very much, gentlemen. I think that any court that this might be presented to would follow the construction I have mentioned here, in view of the history of this legislation and the Acts not only of the Colorado Commission, but the action of the President in making the appointment and basing it, as he has clearly done, under the Project Act.

COM. STONE: Mr. Chairman, Mr. O'Marr has clearly stated his position. May I ask your permission to ask Mr. Breitenstein, the attorney for the Colorado Water Conservation Board, who has prepared a brief on this subject setting forth the views of the Colorado people, to submit his conclusions on this subject?

THE CHAIRMAN: Judge Stone, before you do that I would like to state my views on the subject. I am not a lawyer, but I can read the English language. And I have associated with lawyers about forty years.

It is my conception that the President is relying on the Boulder Canyon Project Act in its entirety, which includes the Santa Fe Compact.

Now, there is one difference in the consideration of this Compact by the Upper Basin States, as I see it, and that is that a Federal Representative must participate in a negotiation. I believe that compacts have been worked out and ratified in other basins, sub-basins, without a Federal Representative being present. But you have that definite limitation in the Boulder Canyon Project Act, and perhaps that is the only limitation--I don't know--but certainly that is a limitation, and that limitation has been provided for by the appointment of a Federal Representative.

I really don't see any merit in trying to tie it to any one particular section.

Now, that expresses my views, gentlemen, and we will now hear from Mr. Breitenstein.

COM. STONE: May I for the record make it clear that Colorado believes that in any event and under whatever section or provision of law we proceed, whether the general law or by some specific provision, that there must be a Federal Representative in these negotiations? I think that is advisable in all compacts.

But I should also like to say that under the law, states may proceed without any previous authority being given by Congress. That has been decided many times. And that subsequent approval by the Congress implies previous consent.

But aside from that, certainly on the Colorado and in most compact negotiations, there should be a Federal Representative. And my state would not want to proceed without one. However, we do not believe that any law is necessary for the appointment, any statute or specific provision of law is necessary to appoint a Federal Representative for a particular compact negotiation.

THE CHAIRMAN: Just a moment, Judge Stone. Do you agree or not that in this particular case it is absolutely necessary for the appointment of a Federal Representative?

COM. STONE: I agree that it is necessary from the point of view of policy and appropriate proceedings. But I don't agree that you have to have, either in the Boulder Canyon Project Act or by any other specific provision of law, the authority for the appointment of such a Federal Representative. If a Federal Representative is appointed and all the states proceed and the Federal Representative himself proceeds to function and makes a report to Congress, his appointment is proper, and that appointment in itself is recognized by Congress, and the States, by the ratification of the compact and the approval of Congress so that it seems to me that is a legalistic question that is avoided by the actual procedure whereby a Federal Representative is appointed and participates.

That is my position on it. Mr. Breitenstein can probably enlighten you further on that.

THE CHAIRMAN: Mr. Breitenstein.

MR. BREITENSTEIN: Probably there is very little I can add to what Judge Stone has said. I am sure that the Commission and all of the states wish to have a Compact here which is free from legalistic objections which might be raised by any state to upset the work which is done here.

For that reason, the determination of the authority under which the States are now meeting seems to me to be an important feature which should be defined at the outset of your negotiation.

And I might say that I disagree one hundred per cent with the position which has been taken by the State of Wyoming in regard to this. Perhaps it would be well to consider just a little elementary law on the set-up of our government.

The states, as you all know, have such powers as they did not surrender to the Federal Government. Before the United States Constitution was adopted the states had the power to enter into compacts and agreements, and that has been recognized by many decisions.

The only restriction placed upon the power of states to enter into agreements or compacts by our Constitution is that the consent of Congress must be obtained. Except for that the states have plenary power to enter into compacts or agreements, unless by some other voluntary action they have given up that power.

Now, so far as these states are concerned, there is no provision of the Boulder Canyon Project Act which in any way interferes with that plenary power of the states. And since there is none, I say that it is a grave error of judgment to tie these proceedings in to any provision of the Colorado River Compact or of the Boulder Canyon Project Act, and it is particularly dangerous to tie them into the Boulder Canyon Project Act, because clearly, in my opinion, Section 19 of the Boulder Canyon Project Act requires the consent of each of the seven states for there to be a valid compact. In that I thoroughly disagree with Attorney General O'Marr. Seven of the states would have to agree, in my opinion, before you would have a compliance with Section 19 of the Boulder Canyon Project Act. And I apprehend that none of us wish to have a situation where some state can come in and overthrow all the work that might be done.

So why, in the name of Heaven, do you tie yourself to a provision which can be used as a knife at your throat to kill your efforts to have the compact done?

Now, bear this in mind also. The Boulder Canyon Project Act is an Act of the Congress of the United States. It is not an Act of the Legislature of Utah or Wyoming or Colorado or Arizona. The states did not in any way become bound by the provisions of the Boulder Canyon Project Act except by such action as they voluntarily took after the Act was passed. And none of them that I know of took any act which restricted their power to compact by requiring compliance with the provisions of Section 19. That, I say, is out of the window.

Now you come down to Article VI of the Compact and you recall that Article VI starts out by reference to a claim or controversy and goes on and says what can be done.

Are we conceding right here and now that there is a claim or controversy? And if we are conceding it, what is the claim or controversy?

So, if you are going to proceed under Article VI, it seems to me that

something further has to be done to define what you are trying to do here. But Article VI in its concluding paragraph specifically recognizes the rights of the states to proceed as they had the right and power to proceed in the past.

Now you come down then to the question of the procedure to be followed. Do you have to have a Congressional Act giving you the power to enter into a compact? The answer to that is clearly no. Take water compacts. In Colorado we have the La Plata Compact, with no prior Congressional Act and no Federal Representative. We have the South Platte Compact, without prior Congressional Act and no Federal Representative. We have the Costilla Creek Compact, which was approved by Congress last month, with no prior Federal Act and no Federal Representative.

I am sure if you will read the compacts between states which have been made and approved by Congress in the history of our country you will find that better than two-thirds of those compacts had no prior Congressional assenting legislation and the participation of no Federal Representative. So you do not need that to have a legal compact.

Now, I thoroughly agree that the states here should not meet and compact without a Federal Representative. That is, in my opinion, more than desirable; it is necessary.

The question of the procedure to be followed in the workings of the Federal Government to obtain the appointment of a Federal Representative is something which is solely the concern of the Federal Government. Under the letter appointing Commissioner Bashore here, it seems to me that the President has referred to what he thought were appropriate justifications for the appointment, and the appointment is proper. But that does not in any way tie the hands of the states as to their position in negotiating this compact.

And I say to you that if you take the position that you are proceeding under the Boulder Canyon Project Act, you are merely furnishing material for some other state to come in in the future and upset possibly what you are doing.

There are two things in this letter which I think are important. First, the letter does not refer to Section 19 of the Boulder Canyon Project Act. There is no reference in the letter to Section 19. So why should we bring it in?

COM. BISHOP: That is right.

MR. BREITENSTEIN: Next, the letter refers to the Boulder Canyon Project Act and says--perhaps I had better read it to get the point:

> "Pursuant to the Boulder Canyon Project Act. . . granting the consent of the Congress to the States of the Colorado River Basin to negotiate and enter into compacts or agreements supplemental to and in conformity with the Colorado River Compact and consistent with the Boulder Canyon Project Act, you are hereby appointed as the representative of the United States. . ."

The phrase expressly states it is in conformity with the Colorado River Compact and says shall be consistent with the Boulder Canyon Project Act.

I take it that the President did not mean by this letter to tie

the states down to Section 19 of the Boulder Canyon Project Act. The President says two things: that there must be a proceeding in conformity with the Colorado River Compact--that is, we must recognize the terms, provisions and conditions of the Colorado River Compact, and I am sure that everybody at the table here has that thought in mind; and next, that it shall be consistent with the Boulder Canyon Project Act. And I heard no suggestion that these proceedings would in any way be inconsistent with the Boulder Canyon Project Act.

So that I say you can proceed under this letter of appointment of Mr. Bashore as the Federal Representative to enter into the compact which you desire to make here, and if your record shows clearly that you are not proceeding under Section 19 of the Project Act there can not be the legalistic objection which otherwise might be raised to the results of your labors.

MR. GILES: Mr. Chairman, may I speak as Attorney General of the State of Utah in asking Mr. Breitenstein this question?

In your statement you stated that is is not only highly desirable that a Federal Representative sit in these negotiations, but you said it is necessary. What I would like to know is, do you mean necessary by reason of specific authority?

MR. BREITENSTEIN: No, you have got to get your compact and Congressional approval of your compact, and Colorado had one very unfortunate experience in compacting.

Colorado had a compact with Kansas and Nebraska on the Republican River. No Federal Representative participated in the making of that compact, and when we got back to Congress that point was raised. And while we did ultimately get Congressional approval, the President vetoed it. And while he doesn't say so in his veto, I understand one of the points which was raised was the lack of participation by a Federal Representative.

COM. STONE: It was not a legal objection, but a policy.

MR. BREITENSTEIN: A practical objection.

MR. GILES: That was what I wanted to get at. I wanted to follow up your question to Judge Stone.

THE CHAIRMAN: Thank you, Mr. Breitenstein. Now, we have had a lot of conversation. What are we going to do about it?

COM. CARSON: Mr. Chairman, it seems to me that it is very clear that this compact, if made, and when made, will not be effective unless and until it is ratified by the respective legislatures of the respective states and by the Congress. I do not think that the states are bound by any provision that limits their right of compacting, which is inherent in their sovereignty, subject to those conditions. So I think that we are safe in proceeding to negotiate a compact, and if we can work one out and it is ratified by the legislatures and by Congress it will be fully effective, and it is not necessary to tie down the specific authority here to compact to any particular provision of that statute or of any law. And as I understand it, that is what Judge Stone desires to see, that we are proceeding under the sovereign capacity of states to compact, subject only to ratification by Congress and the legislatures.

COM. STONE: That is my position. I think the record should be clear that we are proceeding accordingly, and that no implication can be made in the future that we are proceeding under Section 19 of the Boulder Canyon Project Act.

COM. CARSON: That is right.

COM. BISHOP: Mr. Chairman, for the purpose of the record I would like to say that Wyoming considers that there is a controversy, as provided by Article VI, subsection (c) which reads:

". .as to the allocation of the burdens incident to the performance of any article of this compact or the delivery of waters as herein provided;"

and subsection (e), which reads:

". . .as to the diversion of water in one State for the benefit of another State. . ."

COM. STONE: Mr. Chairman, to bring this matter to a conclusion, I make a motion that the record show that the five states of Arizona, Utah, Wyoming, New Mexico and Colorado are proceeding to negotiate a compact for the apportionment of the waters of the Upper Basin of the Colorado River and for the purpose of determining obligations at Lee Ferry of the respective states under the Colorado River Compact, under their authority to compact as sovereign states, and that we are not proceeding under the provisions of Section 19 of the Boulder Canyon Project Act.

COM. WATSON: Second the motion.

THE CHAIRMAN: You have heard the motion. Is there any discussion?

MR. GILES: As Attorney General again I speak--as Secretary I have no authority to speak but I think as Attorney General I perhaps do.

THE CHAIRMAN: You can act in a dual capacity, Grover.

MR. GILES: I am wondering, Judge Stone, if it is necessary to go beyond the statement that you are proceeding as sovereign states? I don't believe you have to negative the idea that you are not proceeding under Section 19.

COM. STONE: I am willing to eliminate the part of my motion referring to Section 19 on the theory that the motion with that eliminated carries the same implication.

THE CHAIRMAN: Now off the record.

(Discussion off the record.)

THE CHAIRMAN: Will you read the motion as amended?

(Com. Stone's motion was thereupon read as follows by the Reporter:

"I make the motion that the record show that the five states of Arizona, Utah, Wyoming, New Mexico and Colorado are proceeding to negotiate a compact for the apportionment of the waters of the Upper Basin of the Colorado River and for the purpose of determining obligations at Lee Ferry of the respective states under the Colorado River Compact, under their authority to compact as sovereign states."

COM. BISHOP: I second that motion with the understanding that you add to it that everything pertaining to Section 19 of the Boulder Canyon Project Act and sections and subsections of the Colorado River Compact be stricken from the minutes of this meeting.

COM. STONE: I don't know why we should strike it because it discloses on its face the purpose of the motion. And if we begin to strike discussion that leads up to conclusions we lose the effect of the record. I wouldn't like to strike that.

COM. BISHOP: I will second the motion without any stipulation.

THE CHAIRMAN: You have heard the motion as stated by Judge Stone and seconded by Mr. Bishop. Is there discussion of the motion? (Question is called for.) (Thereupon a vote was taken and the motion of Com. Stone, as amended, unanimously carried.)

COM. BISHOP: Mr. Chairman, in order to shorten up the minutes, I would like to move--

THE CHAIRMAN: Is this on the record now?

COM. BISHOP: Yes. --that the statement that I made pertaining to Article VI of the Colorado River Compact be stricken from the minutes.

THE CHAIRMAN: Do I hear a second?

COM. STONE: I think we would all consent to that if that is Mr. Bishop's wish.

COM. McCLURE: I will second the motion.

THE CHAIRMAN: The Chair will order it stricken from the record if there is no objection.

We are consuming a lot of time here and it is now twelve o'clock. But at the Cheyenne meeting the Chair requested Mr. Carson from Arizona to make a statement at this meeting defining the limitation of the participation of the State of Arizona in the deliberations of this proposed compact. Mr. Carson, are you ready to submit such a statement for the record at this time?

COM. CARSON: Yes.

THE CHAIRMAN: You may proceed.

COM. CARSON: Part of Arizona is in the Upper Basin as defined by the Colorado River Compact, and Arizona is therefore entitled to share in the apportionment of the use of the 7,500,000 acre feet of water apportioned to the Upper Basin by the Compact for use in that part of Arizona which is in the Upper Basin. Under the terms of the compact, the four states of Colorado, New Mexico, Utah and Wyoming make deliveries of water at Lee Ferry for use in the Lower Basin, which comprises California, Nevada, most of Arizona, and parts of New Mexico and Utah.

That part of Arizona which is in the Upper Basin, and those parts of New Mexico and Utah which are in the Lower Basin have no part in the obligation of the four states to deliver water at Lee Ferry. Arizona therefore can very properly join in a compact apportioning the use of water apportioned to the Upper Basin by the Colorado River Compact, but in doing so must be careful to preserve her rights as a Lower Basin state.

That part of Arizona which is in the Upper Basin has not been sufficiently investigated as to water supply and beneficial uses of water, present and potential. We will, however, proceed to secure information as rapidly as possible upon the question of the water supply and beneficial use of water in

that portion of Arizona which is in the Upper Basin for presentation to this Commission at a subsequent meeting.

THE CHAIRMAN: Gentlemen, you have heard Mr. Carson's statement of Arizona's limitation and participation in this proposed compact. Are there any comments?

The statement will be accepted for the record without a motion. I think that is proper.

Now, what is the pleasure of the Commission? It is now twelve o'clock. Shall we proceed to twelve-thirty and meet at two? I would like to accomplish something at these meetings, and we take up a lot of time.

COM. STONE: Would it do the same thing if we recessed now and reconvened at one-thirty?

THE CHAIRMAN: That is all right with me. Without waiting for a motion to adjourn, the Chair will adjourn the meeting to be convened at one-thirty.

(12:05 p.m. Noon recess.)

(1:30 p.m. Meeting resumed.)

THE CHAIRMAN: Gentlemen, the meeting will now come to order. It is now three minutes to two. There are several things that must be disposed of this afternoon, and I submit for the consideration of the Commission the question of collecting certain information, or as much of it as possible, to be available for the consideration of the full Commission at its next meeting. I make no attempt to dictate in this matter, and I offer this as a suggestion for the consideration of the Commission, that each state submit for individual drainage areas and streams and in summary form the following:

1. The average virgin flow reaching the state boundaries.
2. The water now delivered at the state line.

I will go through this rapidly, and then I will go through it again.

3. The areas irrigated.
4. The value of annual crop production under present conditions.
5. The cost of the works.
6. The annual cost of operating the works.
7. The cost-benefit ratio of existing developments.
8. The area desired to be added.
9. The estimated capital cost of each addition.
10. The estimated annual cost of operation.
11. The estimated annual benefit.
12. The cost ratio for areas added.
13. The estimated cost ratio for the full development.

Now, off the record.

(Discussion off the record.)

THE CHAIRMAN: I have submitted this for your consideration and I would like to have an expression from the Commission as to the necessity or modification or addition of the program that I have suggested.

COM. BISHOP: Mr. Chairman, I wonder why we should go into the proposition of the present crop values unless we are going to consider that lands in the lower areas are of more value and for that reason probably should have a larger share of the water? It seems to me we should confine our activities to the matter of the lands to be irrigated, the water to be divided and the obligation of each state in delivering their share of the water at Lee Ferry.

COM. STONE: Mr. Chairman--

THE CHAIRMAN: Pardon me just a moment, Judge Stone. Of course I will not argue that question at all. That is in the hands of the Commission as to the need or lack of necessity for this information. It is offered as a suggestion to get this Commission to work. Now, if you know of any easier way to get at it or get away from some of this and eventually work out a formula, that's fine and dandy. I am not arguing the position.

COM. BISHOP: I agree with your position with the exception of that, Mr. Chairman. But it seems to me right there you are hitting on a soft spot. And I am sure that Wyoming is not going to concede that the water that originates on our watershed should be taken down the stream for use on lands in some lower area just because land down there is more valuable.

THE CHAIRMAN: Well, Mr. Bishop, let me ask you a question: How are you going to determine the distribution of the water within your own state? On what basis are you going to make an allocation in your own state, which you will do, subconsciously or otherwise, in the allocation between the states? Would that information be of any benefit to you in that respect?

I agree with you thoroughly in what you say as to the relationship between the states. But within the state I am thinking of.

COM. BISHOP: I wouldn't think we would want to bring it to this Compact Commission if we used it in our own state. I think that would be a matter that we would decide among ourselves.

THE CHAIRMAN: Any further remarks on the suggestion made by the Chair?

COM. McCLURE: Mr. Chairman, some of these things in my state are going to be pretty hard to determine now--

THE CHAIRMAN: I realize that.

COM. McCLURE: --without any investigation at all of the project plan.

THE CHAIRMAN: I realize that, but I think those investigations should be made and completed and can be made and completed. We can't operate on hot air.

COM. McCLURE: I grant you that. But I thought that you were talking about something to be presented at the next meeting.

THE CHAIRMAN: As much of it as possible.

COM. BISHOP: That is practical.

THE CHAIRMAN: Now, some of the states are in better position to present it than others. But we have got to get this thing started some way, or somehow, and there is no use having a meeting with no program or no objective.

COM. McCLURE: But if we had that information I would be in a whole lot better shape to tell this Commission how much water we want, I will tell you that.

THE CHAIRMAN: I realize that. But I think the information should be obtained.

Now, how much of it can be assembled by the time of the next meeting is another question I don't know. It is going to be a lot of work on the part of the Reclamation Bureau in segregating this data and getting additional data, very likely. Now the information, as I understand it--and I haven't read the report--is not segregated by states or drainage basins within the states. But you are going to have to have that sooner or later in my opinion.

But don't put me in the position of arguing what you are going to do. I am trying to suggest something on which we can base our procedure.

COM. McCLURE: Mr. Chairman, I think that information would be valuable information for the Commission.

COM. BISHOP: Mr. Chairman, in the matter of the economic studies, it would seem to me that we should all accept the study that has been made by the Bureau of Reclamation, because we have pretty near got to go by studies that have been prepared by some agency that is at least supposed to be neutral.

I hadn't planned, as far as Wyoming is concerned, on going into the matter of economic studies. I will say that we don't agree one hundred per cent with the Bureau, but we figure that we have got to take the judgment of someone. We would rather agree on the Bureau of Reclamation experts than anyone else that we have in mind.

THE CHAIRMAN: Well, Mr. Bishop, I had no notion that you would reject the information made available by the Bureau of Reclamation. But I do believe that you will need it in a little different form--

COM. BISHOP: Yes.

THE CHAIRMAN: --segregated in a little different arrangement.

Now, perhaps the Chair overstepped the bounds of propriety in suggesting this program. But any other suggestion, or a better suggestion, or a modification of it, certainly we want to consider.

COM. STONE: Mr. Chairman, I agree with the Chairman that before we attempt to discuss the allocation of water among the states and the obligation at Lee Ferry of the various states, we need to consider the pertinent data, engineering information, which have to do with the question of water supplies and the factors which determine the apportionment of those water supplies and determine the questions of respective state obligations at Lee Ferry.

But I suppose you want a frank discussion of some of these items.

I can't conceive why, at least at this time, and I can't see at any time in the future why a study of annual costs and cost ratios to benefits, cost of each addition to a project, and those matters, have anything to do with the apportionment of water of the River Basin among the interested states. As a matter of fact, we are apportioning waters for all time to

come, probably, and that matter of cost ratios and benefits may change. No state should have its rights in water determined by the cost of projects or the ratio of cost to benefits.

It seems to me that the important question here before us from a factual point of view is the matter of water supplies, the matter of the available water supplies in each state, the question of irrigable land, and matters which will be helpful in determining what is each state's equitable share of the water, irrespective of what we may do with that water some time in the future. We can't say today what we may do some time in the future, and we don't want to determine our rights to water on the economics with respect to specific projects as they exist today.

Now, Mr. Bishop referred to the Bureau's report. I have great respect for the Bureau, and I have recognized fully the work which the Bureau has done in getting up this report. But we have been in the habit, in our state, of making some independent investigation ourselves on some of these matters.

In the first place, there may be some conclusions in this report, so far as they apply to this project, on which we do not fully agree. And if so, we ought to know.

In the second place, there is certain information needed in order to make the Compact, which is not contained in this report. That should be determined.

And for us to say we are relying on experts--we recognize them as experts, but experts disagree sometimes. And we are obligated to our own people to make some independent studies on these matters.

There is a third question which I think might be helpful to suggest at this time, and what I am suggesting grows out of experience in other compact-making. It often happens that if we do sit down with qualified people, engineers who have studied this river, and representing the states, very often we can agree upon basic facts. And to the extent that we agree upon basic facts we make easier the task of allocating water. Possibly we can agree upon all of the basic facts. And it would seem we ought to adopt a procedure whereby we would make a joint study through the engineer advisers to see where we agree and where we disagree. Possibly we will agree on a lot of it. And there ought to be established some procedure.

Mr. Chairman, I anticipated that this would be a question the Commission would want to determine, and I asked Mr. Patterson to go into that matter of engineering data which seemed necessary.

And I would appreciate it if we might hear from him on that question at this time. He is the Chief Engineer of the Colorado Conservation Board, and is one of my advisers. And I would like it, since he has given some study to this, if he could speak briefly on this subject.

THE CHAIRMAN: We want a full and frank discussion, having in mind always that the Commission is expected to get results. Now, we must set up some sort of a procedure at this time, or a program that we expect to work out--

COM. STONE: I think that is entirely right.

THE CHAIRMAN: --in the establishment of basic facts. Now, if the facts are all available on which the Commission thinks it can operate, why, let's have them.

Now, Mr. Patterson, we would like to hear from you.

MR. PATTERSON: I will try to keep my remarks confined to the statement you just made--if the facts are all available, let's have them--and further, limit it to water.

It seems to me that we could properly do that in this opening phase of this study by this Commission, because as I understand it, what you propose to do is to divide up among the states the quantity of water heretofore allocated to the Upper Basin by the existing Compact and to define your relative obligations to meet the delivery obligation at Lee Ferry.

On that question I will make the statement that there is nothing in this report of the Bureau of Reclamation concerning the sources of the waters of the Colorado River above Lee Ferry by states. And it seems to me that it would be futile to ask one state to assume an obligation to deliver water at Lee Ferry when Nature, and not that state, produces the water.

So I say the first thing that you will need to do is to assemble information and agree upon it as to the amounts of water which the states above Lee Ferry contribute to the flow of the Colorado River.

The next step, as I see it, is that in each of the individual states determinations will have to be made of the amounts of water leaving state boundaries.

Then the question of conveyance loss to Lee Ferry enters into the picture, and in my opinion there is a substantial loss of water, for example, from the Wyoming boundary to Lee Ferry, as this river flows through Utah and part of Arizona.

There is nothing in this report to guide you as to the amount of the water that will arrive at Lee Ferry after you add up the amounts passing the state boundaries. Then you are asked to divide up a quantity of water of about seven and a half million acre feet, which is a good deal more than is now being used in the Upper Basin, that actual use being something over two million acre feet. The rest of that water now to be divided up will be accomplished by various types of development--irrigation, power, exportation, silt control, streamflow regulation, and so forth.

It seems to me that you are going to need information about some of those details to work out an allocation among the states or an apportionment of the Upper Basin share among them, keeping in mind the physical ability of each state to produce water and to deliver water, and keeping in mind, too, that the ability of each state to use and consume water is largely dependent upon what Nature produces within its boundaries. There are some exceptions to that general rule, but I believe it does prevail here.

Now, it seems to me there that you must start with water and work up information that you understand and can accept and can agree to, I hope with the aid of the Bureau of Reclamation in working these things out, because all Federal interests must also be satisfied, and understand what you are dealing with. I predict if you don't do that your meetings from here on will be very much delayed by arguments about facts that can be worked out in advance and to the satisfaction of everyone interested.

I want to point out some other little matters that you perhaps could possibly go into. There is a figure developed in this report--the most of the details of that analysis appear in the report--showing under virgin conditions a flow annually at Lee Ferry of 16,270,000 acre feet.

Please understand that I am not attempting to criticize or suggest that you adopt any other figure. But I do forecast this, that when you go into these various river and reservoir operation studies--and by the way, there is nothing in the report regarding the effect from the standpoint of streamflow regulation of reservoirs proposed for construction along the main river and its principal tributaries above Lee Ferry--that is another matter you will have to undertake as a study. When you go into that question you are going to have to use this information not by annual or long-time averages, but more by monthly amounts, and if you encounter what I have in trying to work up the information requested of my Department by the officials and representatives of Colorado, you will be startled by one thing, I am sure--that here is a report of the Secretary of the Interior, sponsored by the Bureau of Reclamation, which shows the annual value at Lee Ferry; and another agency of the Department of the Interior, the Geological Survey, have recently published a report giving their estimates of the quantities of water annually at Lee Ferry. From 1897 to 1922 those two annual values are in material disagreement. And until one or the other of those official records is adjusted to something that suits you, I predict that you will have a good deal of dispute.

Now, as to breaking down the water supply as to its sources above Lee Ferry, I imagine you are going to have to rely largely upon information published by the United States Geological Survey. And if you do, then it may be that the figures published by that agency of the recorded flows at Lee Ferry from 1897 to 1922 may fit in with those Upper Basin figures published by the same agency, and you may elect, after that is given consideration, to perhaps adopt those figures. I am not trying to inject anything in this picture to interfere with the study program that you have outlined, Mr. Chairman--but to go back to the one basic statement that is made here, this Commission does have an immense amount of work to do. What you do in this field of factual information is the basis, the groundwork, and the starting-point of all of your future and further negotiations.

I do want to add this: that while it would be of great value in planning in the states individually and in assigning portions of their water supply to individual projects, to have all of the agricultural and economic information that your outline indicated, my own opinion is that it is not essential to the initiation of these compact negotiations. I am quite confident that if it should appear that our lands now or in the future were going to be less productive than the lands in Utah, Wyoming or New Mexico--I am quite confident that fact would not disturb our claiming our right to some water.

In other words, we are dealing here with an existing compact in which the division of water between the Basins was not made on any stated comparative data of that character. And it seems to me that you are borrowing trouble if you go into those matters as the sole basis of this work. I realize that each state, after its share and its obligations are specified, may want for its own purposes of assigning water to individual projects to have that information. But I doubt if it is a matter that is pertinent to this division of a predetermined quantity of water and a pre-specified obligation among the several states involved.

I think that is all I would care to offer on that right now.

THE CHAIRMAN: Thank you, Mr. Patterson. Well, it seems that the suggestion of the Chair has drawn a little fire. We'll see if we can get some more. Mr. Wilson?

MR. WILSON: Mr. McClure has asked if I want to say anything. And I don't know whether I can contribute anything.

THE CHAIRMAN: Don't feel embarrassed about that.

COM. McCLURE: I would like Mr. Fred E. Wilson to say a few words. He is Special Assistant Attorney General and represents our Interstate Streams Commission as legal adviser.

THE CHAIRMAN: Very well.

MR. WILSON: I just want to say this, referring to the suggestion of the Chairman as to what data and information he suggested ought to be before the Commission--I will say I am inclined to agree with the Chairman that data and information and perhaps other information will be necessary if this Commission proposes to allocate all the water, the 7,500,000 acre feet, among the states.

In other words, I don't see how you can possibly allocate the 7,500,000 acre feet among the states until you have this basic information. No state would be in a position to be able to ascertain or uphold any suggestion as to quantity unless this information was available--unless you want to divide the water on the basis of equality. If that is the idea, of course this Commission can make a division of all the water on the basis of four sovereign states, with a consideration of Arizona's interest to a portion. Now, you can do that without any data or any information, I should think. But unless you are prepared to do that, and I apprehend very few states would agree that is the basis on which the allocation should be made--although I think New Mexico would agree to that readily, here today.

If you are not going to do that, I think the information that Mr. Bashore, your Chairman, has suggested, is essential, and you have to have it some time during your proceedings before you can arrive at an allocation of all the waters in perpetuity and forever and ever.

Now, I just have this thought. I may be all wrong, but what thinking I have done on this matter led me to believe that the most that can be accomplished by this Commission within the next three months or the next six months or the next year is to divide a quantity of the water among the states. We will say we will divide X acre feet of the 7,500,000 acre feet among the states upon some basis. Now, I am not prepared to suggest what that basis would be, but I do believe that this Commission can determine what would be a fair quantity of water to take out of the whole, and then find some basis on which to allocate a portion of that to each state, so that certain projects can have water available and you can begin your development work.

It seems to me that that is about the only thing that this Commission can do, unless you wait until you get the information that has been suggested by Mr. Bashore, and additional information that the Bureau is now engaged in getting together. Of course, I appreciate the fact that you must take into consideration perhaps present uses and potential uses and all of those things. But I do believe that you must begin working on the theory that you are going to divide a certain quantity of water and give each state a portion of the waters of the Upper Basin of the Colorado, so that certain projects can be picked out and we will know that those projects will have some water, and then divide the balance in years to come.

THE CHAIRMAN: Thank you, Judge Wilson.

MR. GILES: Mr. Wilson, will you submit to a question?

MR. WILSON: Yes.

MR. GILES: I am thinking of the mechanics of partial allocation.

What is your notion about the legalistic mechanics of a thing of that sort? Can you take a compact of this sort by steps?

MR. WILSON: I think this Compact Commission could enter into an agreement that you are dividing a certain quantity of water out of the total 7,500,000 acre feet: Utah so much, New Mexico so much, Wyoming so much, Arizona and Colorado so much. That's a temporary thing, but that would be firm--each state would have that quantity of water as it is apportioned by it in perpetuity, but the balance remains there to be allocated later by agreement among the states on some basis that future investigation, future facts, will justify.

COM. STONE: Do you think we should determine questions of that kind until we have got some of this basic information? That is a question of final decision, whether we make an apportionment of all of the 7,500,000, or a partial one. And it seems to me that we can't disregard the double phase of this work. Perhaps the basic, or at least one of the basic things for this Commission to do is to determine our obligations at Lee Ferry. We are not concerned here solely with the question of dividing the water. These states have assumed an obligation in the Colorado River Compact to deliver a specified amount at Lee Ferry, and that is going to be a very important phase of these negotiations.

When we get into that subject, as well as the subject of apportioning the water, the engineering information on water and an agreement on the available water supplies is so important, and that is a big task in itself. It seems to me that we could well start out on that one phase of the study of the basic information needed, in order that we may proceed here. And I surmise that we may agree almost entirely on some of those things. I think we should attempt that, first.

As to whether any of these other items which you suggest should come in, that can be determined later. We have got a big task immediately ahead of us on that one thing, first. And I should like to see us set up a procedure to get into the question of collecting, as you put it, certain information. Only I would say at this point that that information and that study should be confined to the thing we are dealing with, namely water.

THE CHAIRMAN: Are there any further remarks?

COM. CARSON: Mr. Chairman, on that list as you read there--which I haven't got completely set down here--it seems to me that it does not cover anything except water.

COM. STONE: What I am referring to is this question of economics, ratio of cost to benefits, and the cost of each addition to a project, and estimated annual costs, annual benefits--those are economic things which it seems to me that we need not necessarily determine. But if we do decide to go into those things, we shouldn't do it until we deal with the water question.

I should think it would be dangerous for a state to determine its rights to water on economics today. Economics will come into the project later on.

COM. CARSON: I didn't understand that it was suggested that any division would be based on those economic studies.

COM. STONE: Those were just some of the items suggested by Mr. Bashore.

COM. CARSON: I think perhaps you are overemphasizing the effect of

the economics study or any information concerning it upon the ultimate apportionment of water among the states.

COM. STONE: My point is, I don't see the need of going into that now, at least.

COM. CARSON: When you assemble the information on the tributary flows and the uses and the part reaching the state line and additional areas in that particular sub-basin that might utilize water, you would have all of the economic phases that the Chairman has suggested available as you make this first study, so that to separate the two would require a double going over of the same reports and projects and information.

COM. STONE: My point is, Charlie, how will the study of projects costs and the estimate of the ratio between costs and benefits--how is that going to aid us in any way whatsoever in determining the amount of water that is available to meet deliveries at Lee Ferry or to apportion it among the states?

COM. CARSON: I don't think it will be any controlling factor. It would be compiled as a part of the same analyses of information available.

I think we in Arizona can pretty largely comply with the Chairman's suggestion in a relatively short period of time. We are willing to go ahead and do it as far as we can. I think it would be a valuable thing if as full information as possible could be obtained here within the reports that are now available, or such studies as might be made before we meet again, although it might not be completed at that time.

COM. STONE: I would hate to undertake immediately all that question of economics. I know in our state that is a big, long study in itself. And I think we ought to put first things first. I think we ought to study water. We won't have any economics until we know how much water there is for these projects. And that is what we are dealing with.

There is a lot of disagreement on the economics. I imagine there will be disagreements among the states on the Bureau's report on that question. I don't like to see us get into that broad phase unless it is necessary.

COM. BISHOP: Mr. Chairman, they considered all those in negotiating the Colorado River Compact, and there was argument after argument made by the representatives of the Lower Basin that their land was worth from two to five times as much as ours, and they were entitled to more water. But the Upper Basin States would not agree with that, and if that had been considered as of major importance we probably wouldn't have gotten seven and a half million acre feet, or anywhere near it.

COM. STONE: I agree with you, Mr. Bishop, that I could never subscribe to the point that water is more valuable downstream and therefore downstream should have more water. I don't think it is an essential question to be determined in dividing water. There are other factors of equitable apportionment which are controlling, and not that.

COM. BISHOP: But they had all of those before them when they negotiated the Colorado River Compact. They had all the studies there.

COM. STONE: That is right. There is no reason why--

COM. BISHOP: They threw them out the window. And I say that would

be wasting our time, to go into those studies, because we won't use them after we get them.

COM. STONE: They weren't used in the Colorado River Compact.

COM. BISHOP: They were used as an argument.

COM. STONE: I know, but they weren't used in determining the apportionment.

COM. BISHOP: No, they weren't.

COM. STONE: Who knows what the economics is going to be fifty years from now, when some state wants to use its water?

THE CHAIRMAN: Judge Stone, it was not my suggestion that you present the economics for fifty years--the present economics.

COM. STONE: That is what I am worried about, Mr. Chairman.

THE CHAIRMAN: Well, it can be taken care of, I should think by some statement, qualifying statement as to the economics at the present.

COM. McCLURE: Off the record.

(Discussion off the record.)

THE CHAIRMAN: Judge, I believe the record will show that the suggestion of the Chairman was that as much of this information as is readily available be gathered for the next meeting.

COM. WATSON: Mr. Chairman, that presupposes that the meeting will be a long time from the present.

THE CHAIRMAN: No, sir, I don't presume that at all. I would think that within thirty days, if the Commission is ever going to accomplish anything, we should have another meeting, and see what you can get together in the meantime.

COM. WATSON: May I add, in the case of Utah there are certain long-time records on the Colorado River with which we are all familiar, but there is other data, such as the amount of water contributed by Utah, of which we are not cognizant--that is, we can't accurately state what Utah contributes. We are not familiar with the evaporation of the main stem of the river in Utah through which Wyoming and Colorado's water, as well as Utah's water, flows. It will take some time for us to evaluate these amounts.

Now, it looks to me as though in this compact we are trying to get at something feasible so that we can start some projects. If we have a project in Utah that is desirable, and we can qualify within the limits of Utah's theoretic share and be well within those limits, we want to start that project. But if we wait until we get all this data, we never will start this project, or any other project.

THE CHAIRMAN: Well, I might make this observation, that the ratification of this proposed compact by the state legislatures and by the Federal Congress, does not necessarily mean starting the project in any state. That's a step. It is a very important step, but after that you will have to secure authorization for the Colorado River scheme or a part of it. And that isn't all. After that you will have to secure appropriations, and in securing those

appropriations certainly the Bureau of the Budget and the Congressional committees will require economic justifications.

I may be thinking in too technical a manner. But if you will pardon me if I refer to my experience when I was Commissioner of Reclamation, I know what you are up against on these things. And I feel that the suggestions I have made will provide useful information.

I recognize that it's a big job, and I hope you will be free to just tear it all to pieces and suggest something better--something shorter and easier, or take it in progressive steps, if you like. But we certainly got to get this work under way.

When I accepted the appointment as the Federal Representative, I did it with the sole purpose of being able to accomplish something. Pardon me if I refer again to my contribution in the authorization of the Missouri. I consider that one of the greatest accomplishments in my life. And I figure there is just one more river basin development that is in my system, and that's the Colorado. I am very anxious to get something tangible that we can get our teeth into and go forward.

(Discussion off the record.)

THE CHAIRMAN: Suppose we recess for ten minutes, and you be prepared to introduce a resolution. Is that satisfactory?

COM. BISHOP: Okay.

THE CHAIRMAN: All right.

(2:50 p.m. Recess.)

(3:18 p.m. Meeting resumed.)

THE CHAIRMAN: Judge Stone.

COM. STONE: I move that for the purpose of providing basic factual information each state undertake as a first step to assemble for possible later agreement the following data, to be followed by further essential studies to the making of the compact:

1. Assemble the recorded information on streamflows of the main river and tributaries at key stations at Lee Ferry and upstream.

2. Segregate these streamflows at state boundaries.

3. Estimate channel losses from state boundaries to Lee Ferry.

4. Estimate the annual consumption of water in each state by tributaries for the study period.

5. Adjust state contributions for quantities of water consumed in each state.

6. Adjust state line outflows for study period to contributions at Lee Ferry under virgin or long-time average conditions.

Now, I wish to explain that I fully understand in making that motion that that does not cover all of the essential factual information which we will probably need to make a compact. But for the purpose of making

progress it seems that this information is essential and that it is information upon which we can probably largely agree and will be basic information which can more readily be followed by other factual matters which we may wish to bring into consideration.

COM. BISHOP: I will second the motion.

COM. WATSON: Mr. Chairman, may I ask Mr. Wallace to make a statement, Mr. William R. Wallace?

THE CHAIRMAN: If it is pertinent to the resolution, yes.

COM. WATSON: Yes.

MR. WALLACE: Mr. Chairman, this is a very important resolution. Personally, I agree with the statement made by you, that we should get all factual data together just as quickly as we can. We of Utah have had no opportunity of studying this resolution. The Governor is appointing a group of five as counselors to the State Engineer, and I very earnestly hope this resolution will not pass, but that we may have an opportunity to take some time to go over the entire matter with our counsel and then decide upon it.

But to take it at this moment, after the statement made by Judge Stone indicating clearly some of the things that he regards as of extreme importance in making the decision, I would certainly very much like to have an opportunity of a thorough study of this proposition before it is passed.

COM. STONE: I want to say that I have no thought in making this suggestion as to what the terms of a compact may be. But I offer it as indicating the information which is needed to make any compact. I don't know what it will result in, or the agreement. But I don't see how we can make any compact without this factual information.

COM. WATSON: Mr. Chairman, I offer an amendment to the resolution, that we consider this information as set out by Judge Stone as basic and important for the initial work to be done by this Commission, but that we adopt the Chairman's plan that he set out in the beginning as the ultimate objective of this Commission's work.

THE CHAIRMAN: Mr. Watson--

COM. BISHOP: I will second that if you add, "in so far as it is practicable to do so."

COM. WATSON: I will agree that that suggestion be added, "in so far as it is practicable to do so."

THE CHAIRMAN: Mr. Watson, as I understand, you offer that as an amendment to the resolution which has been introduced by Judge Stone and seconded by Mr. Bishop?

COM. STONE: I don't understand the purport of his motion. He said we adopted--may we hear that motion again?

COM. WATSON: The sense of my amendment was this: that we adopt your resolution setting out data that is basic and necessary, but that we accept the Chairman's plan that he set out, as our ultimate objective. In other words, that we adopt your plan as the initial work to be done, but that we adopt the plan of the chairman as the comprehensive objective.

COM. STONE: Mr. Watson, that is my thought, and if you remember, I put in there those very words, "as a first step." I don't intend it as being complete, nor do I intend that it forecloses the ultimate adoption possibly of the Chairman's suggestion. But that is merely a first step for essential information and--

COM. WATSON: My thought is this: It is better to adopt a general over-all plan and then eliminate as we see it is necessary, than to adopt a narrower, smaller plan and add to it as we progress. In other words, it is easier to eliminate than it is to add. Therefore I suggested the amendment that we in this resolution accept the Chairman's over-all plan as the ultimate objective of this Commission.

COM. BISHOP: In so far as it is practicable to do so.

COM. WATSON: In so far as it is practicable to do so.

COM. BISHOP: I don't see that that weakens your resolution any, Judge.

COM. STONE: I have so much doubt about that economic stuff, I don't like to see us determine questions of economics. I think I might be persuaded to let certain phases of economics come into it later, but at this moment to adopt your motion is tantamount to admitting such information is essential to the making of a compact. I can't quite see that we should do that. In my judgment it is not essential.

COM. WATSON: If it is not essential we can eliminate it easier than we can add to it. If we have already accepted it as a general plan and discover later on that we should eliminate it, we can cut out that which is not applicable.

COM. STONE: Your idea when you say "as far as practicable" is, so far as that full information may seem pertinent to making a compact? That is your idea?

COM. WATSON: That is right.

COM. STONE: "So far as practicable"--I think that ought to be cleared up to the wording "so far as pertinent to the making of the compact. I can't see where the economic data is pertinent to the making of a compact.

COM. WATSON: If it should develop in the course of our investigation that it is, we would still have it as part of the plan.

THE CHAIRMAN: Well, the Chair will have to admit he doesn't know how to put this matter before the Commission. If it can be stated as an amendment to the motion concisely, we will then endeavor to see if the amendment is accepted.

COM. WATSON: Could it be offered as a substitute motion?

THE CHAIRMAN: We are considering the motion of Judge Stone, and I think you have offered an amendment.

COM. STONE: It seems to me there is not much difference between Mr. Watson and me on the thing, only just the proposition that if we adopt his amendment to the motion we are recognizing at the outset the propriety of information which is not a sound basis in compact-making.

I can't see that economic considerations, the ratio of costs to benefits, and the costs of projects, are going to aid us. In the first place, how are we going to estimate the cost of projects?

We are investigating in our state, the Bureau of Reclamation is investigating projects, reports on which may be made some years in the future. And those costs are high now. Some time in the future they may be much less, and they may be higher. What has that got to do with the state's share of the water?

Now, this may be true, it may work against some states. Supposing that we have a project in Colorado where we have a fortunate situation, where the costs are very low as compared to the benefits, and that you have a project where your costs are very high. That shouldn't foreclose your state from your equitable share of the water. And I can't for the life of me see that it is good policy at this time for us to bring into this situation those economic phases.

COM. WATSON: Judge Stone--

COM. STONE: Now, if it should be necessary on particular projects as we go along, in considering them in this compact, we could well bring them in. But as a broad principle and a broad proposition, it is not for the best interests of any of these states.

COM. WATSON: Wouldn't it be a wise suggestion to put the motion this way, that we accept the Chairman's plan, with the reservation that your plan, that is, the data that you presented, be the initial work to be done, and that other work be taken on as is feasible and practicable?

COM. STONE: Couldn't we put it this way, Mr. Watson--which would be the same thing--that the Chairman's plan has been suggested, and that as an initial step or a first step for this study we adopt this suggestion, and that other portions of the Chairman's plan may be taken up as it becomes necessary or essential, if it appears essential and pertinent to the making of a compact?

THE CHAIRMAN: Gentlemen, I certainly am not wedded to any particular plan. I don't know whether the suggestion I have made is comprehensive enough for a program for the Commission. You may want to modify it from time to time.

I consider any party on any plan you decide to undertake at this time, you are not irrevocably bound all the way through. The economics was suggested for the reason that I felt that it would be of aid to the states in disposing of questions within their own boundaries. Certainly it is not contemplated under the Santa Fe Compact or the Boulder Canyon Adjustment Act that economics would play any part in the distribution of this water, but we may need it. If they are not needed, all right. It doesn't make any difference to the Chairman whether you take it or not. I threw it out to get you fellows at work, because you can't conduct these meetings on jawbone. Let's have some sort of resolution here we can agree on, and go ahead.

COM. STONE: Mr. Chairman, it is your conception, and I think you are entirely right about it, as we go along we may find other factual information which is very essential.

THE CHAIRMAN: Absolutely, Judge Stone.

COM. STONE: That's why we can't adopt any plan as to all the information, but we certainly can pick out the information we know at this time is essential. I want to frankly say to you that I have no thought in mind as

to how this information suggested by me will influence the making of the compact. That is a matter we have got to agree on, but very apparently it is essential, because it deals with that thing we are talking about, namely, the water supplies, and the use, the future use, of those water supplies.

COM. WATSON: Since we are laying the foundation for a broad plan and for a large amount of future work, why shouldn't we accept the plan as set out by the Chairman, with the economic features attached, but specialize on your suggestion and make it the initial problem, and then if we wish, go ahead with the other data when necessary, and if we find that it is impractical, eliminate it?

In other words, it is as broad as it is long. We are doing the same thing. Accept the plan and make your work initial.

COM. STONE: The only thing, we put a stamp of approval on that economic phase by adopting it. I don't feel like approving that, because I can't see how it will aid us in dividing the water. It could work against your state; it could work against any of our states.

COM. BISHOP: I don't think we are so far apart on it. The Chairman has suggested it was his idea that we use this in our own states. Now, in Wyoming we plan to use the information in the report to a large extent in determining as between our projects and all, and we don't propose--and going along with Mr. Watson on his amendment--I don't propose to present to this Commission an economic study for Wyoming. I think the explanation of the Chairman there ought to make it clear that that was all that was intended on the economic studies.

COM. STONE: I think all of us are going to make economic studies for the benefit of our own internal development. But so far as interstate matters are concerned, it seems to me they are not essential.

THE CHAIRMAN: I agree with you, Judge, they are not essential as far as interstate matters are concerned.

COM. STONE: And we have got enough to do in this Commission to get the essential things rather than to undertake the economic situations in each state, which each state must decide for itself after each state knows how much water it is entitled to under the compact.

THE CHAIRMAN: I am firmly convinced that if I was a State Engineer or a Compact Commissioner I would want this economic data. The reason why I included it in this hurriedly made group of suggestions was because I felt you would have to have it when you go to dealing with your own people in your own individual states. It is not pertinent to the deliberations of this Commission.

COM. STONE: If it is not pertinent, we have got so much to do, why should we do it? And then undertake that later, if we all agree later on it as helpful to the states.

THE CHAIRMAN: Well, we have had considerable discussion now. And, Mr. Watson, if you have an amendment to the resolution that was introduced by Judge Stone, will you state it, if you are offering an amendment?

COM. WATSON: It can be amended, or I can make a substitute motion.

THE CHAIRMAN: We would have to dispose of the motion before the Commission first.

MR. GILES: May I ask Judge Stone a question, Mr. Chairman?

THE CHAIRMAN: Yes, sir.

MR. GILES: Judge, it isn't your idea in presenting the basic features of a study here that if any state wants to offer some other factual data that the state feels is essential, they may not do so, even within the range of your resolution?

COM. STONE: Why, certainly.

MR. GILES: It is not all-inclusive, in other words?

COM. STONE: This is just a first step, and it doesn't foreclose any state offering anything it wishes here. That is something which is within the discretion of each Commissioner. And, after all, it is just a first step, to get started.

MR. GILES: And if, at the next meeting, a state should come here with a certain presentation of facts, it wouldn't be your position that was not within the purview of the resolution, hence it can't be considered?

COM. STONE: No. Each state would certainly have the privilege and right to offer for the consideration of the Commission any information or data which that state saw fit to offer.

MR. GILES: That is all I wanted.

COM. McCLURE: Mr. Chairman, I am not sure I understand who is to make these studies that the Judge has submitted in his motion.

COM. STONE: I think that is a pertinent question. I tried to word it with this in mind, Tom, I assumed that each state would want to make some studies of their own on these subjects.

Then I assume if it is brought in here and offered that either the members of the Commission or someone designated by the Commissioners, which would undoubtedly be an engineer since it deals with engineering, would confer and attempt to agree upon this factual information.

Now, what impelled that thought was just the experience which Colorado and Kansas had in the making of the Arkansas Valley Compact. There were one or two meetings where there was a good deal of acrimonious discussion about the division of water. It was soon clear that certain water data information was necessary. And so they picked out what was clearly essential at that point, and the engineers in each state began to work on it.

That developed later into these engineers getting together to try to agree upon it, and it appears they are going to agree on most of it. And I apprehend that this isn't much of a controversial matter; it is just to determine the factual information which clearly is essential. I apprehend we will probably agree on most of it, perhaps on all of it.

COM. McCLURE: You don't want five of us to come in here with all the streamflow records on the main stream and the tributaries? That would be identical.

COM. STONE: That might be, and I have no objection to staking out someone from each state to get together and assemble that information.

COM. McCLURE: That is the thing I was wondering. There is no need for five states to come here with the United States Geological stream gauging records of key stations on your main stem and your tributaries. Then, as I understood, the Chairman's plan was that he wanted the states to compile their individual information within their boundaries for each state. Is that right?

THE CHAIRMAN: That is the way it was suggested, yes.

COM. STONE: I think most of this information can be assembled by a small group of engineers. You will find, though, that there are certain questions here which I think will require some agreement.

Now, that first one is a matter which possibly you can agree upon. But, as has been pointed out here by Mr. Patterson, some figures have been used by the Bureau, as I understand it, and there are different figures available from the U. S. G. S. Now, some of your engineers could easily get together and get on that No. 1 problem.

COM. BISHOP: I think Mr. Riter here could give us the answer to most of that data right from the Bureau's report. In fact, most of it I have assembled. But I am sure Mr. Riter could give it to us right off the bat.

As far as I am concerned, I am willing to agree to the figures the Bureau has assembled. For instance, Mr. Riter---if it is proper at this time--may I ask you what the virgin flow over a long-time period is at Lee Ferry?

MR. RITER: We made an estimate of it and it is set up in the appendix of this report. That is our estimate prior to 1921.

COM. BISHOP: Could you give us that for the purpose of our record and see if we can agree on that?

THE CHAIRMAN: Pardon me just a moment. Let's keep on the beam here. You jump the fence and get clear off the reservation. I don't believe that we want to dispose of that question now.

If it is available, fine and dandy. It will be very easy. But let's determine what we are going to need in this proceeding.

COM. STONE: My thought was, some of these things are easily available.

THE CHAIRMAN: Who knows? Who is prepared to say they are all available or not available at this time? That is what we want to find out. If we don't have any program, we are going around in circles and fight windmills until everybody gets disgusted.

COM. STONE: I will say this, I put these down at the suggestion of my engineering advisers. In no--

THE CHAIRMAN: Off the record.

(Discussion off the record.)

COM. STONE: My engineering advisers tell me this is essential information; as to whether it is easily available or not is not the question. If it is easily available, then there is a way of getting it.

I asked Mr. Patterson--he is largely responsible with some others

for that information--and Mr. McClure asked the question: Take No. 1, for instance, why should each state prepare it when it is just a question of consulting the available records?

Now, perhaps you had better answer that.

MR. PATTERSON: My suggestion was not that each state prepare it separately. I asked you if it was your intention to try to work together to assemble, to understand and agree upon this information. My only suggestion is, it is one basic group of information concerning which you men all should have an understanding and should agree that this is information you are going to start work on.

If you don't do that, I am going to suggest that you are going to have people come up and say, from some other source of information, that you are making mistakes, that here is a different record, and your answer should be, "We considered all of the available information and decided that these figures that we have now agreed to were the best evidence we had to start with."

That is the only purpose, and it might be that right quick you could get that all straightened around as to why there are confusing published records on this one question.

COM. STONE: My idea, Mr. Chairman, was this: that one engineer from each of these states probably in a very short time could sit down and agree on this basic information which could be brought before this Commission, and to the extent we can't agree, then the Commission will have to decide.

COM. McCLURE: In other words, you plan to set a program and create an engineering advisory committee?

COM. STONE: An advisory committee such as you fellows did on the Rio Grande Compact. You remember that was very helpful. The engineers got together, worked together, and agreed upon basic information. We are doing it in the Arkansas River Compact.

Now, each state doesn't have to undertake this individually unless the state wishes to do so. But we have competent men from each of these states, if they were to sit down together with you, Mr. Chairman, or some engineer you designate, I imagine that most of this information they would get together on rather quickly, and we would have something to start with.

COM. McCLURE: I have been trying to get them together for two years on the Rio Grande and haven't got them together yet.

THE CHAIRMAN: Mr. McClure, from the progress we are making here on trying to arrive at something in the way of collecting data, it appears it will take two years to get together on what we are going to study.

COM. McCLURE: A point of order: I believe there is a motion before the Commission and an amendment to that motion. I think the second of the original motion has accepted the amendment. And if so, I think we are ready to vote on the motion as amended, are we not?

THE CHAIRMAN: I am not quite clear what the amendment to the motion is. Now, Mr. Watson, if you will state what the amendment to the motion is, we will vote on the amendment.

COM. WATSON: The amendment simply is--

THE CHAIRMAN: Please state the amendment the way you want it.

COM. WATSON: I amend Judge Stone's motion as follows: that we accept the data he suggested as basic and initial and that we also accept the Chairman's plan of considering available economic data as far as it is feasible.

THE CHAIRMAN: Is there a second to the amendment?

COM. BISHOP: I second the motion.

COM. McCLURE: Off the record.

(Discussion off the record.)

THE CHAIRMAN: Perhaps we can clarify the matter in order to make just a mite of progress by the Chair withdrawing his suggestions as to the collection of economic data at this time. I believe that is the privilege of the Chair, to withdraw. We have had considerable discussion and I believe in the interest of harmony and progress I will withdraw the proposals as to the collection of economic data.

COM. BISHOP: Mr. Chairman, I make a motion that we accept his withdrawal of that information.

THE CHAIRMAN: Let's wipe the slate clean and start over again. Off the record.

(Discussion off the record during which pending motion and amendment were stricken from the record.)

COM. McCLURE: I move that this Commission set up an Engineering Advisory Committee consisting of one engineer from each state and the Federal Representative's engineer; that these engineers meet between now and the next meeting of this Commission with an agreed program to present to the Commission for adoption, an engineering study of data on the record.

COM. BISHOP: Mr. Chairman, I will second that motion if you will include Mr. Riter or some other expert from the Bureau of Reclamation to sit in with this engineering committee to assist in--

THE CHAIRMAN: I believe that was covered in Mr. McClure's motion, Mr. Bishop.

COM. McCLURE: That is right.

COM. BISHOP: Oh, he stated the Chairman would name a Federal man.

MR. GILES: Mr. Chairman, in order to make it entirely clear, you engineering committee are merely to present a working plan, aren't they?

COM. McCLURE: A working plan. A program to be presented to the Commission for adoption.

COM. STONE: That is, a working engineering program.

MR. GILES: That is right.

COM. McCLURE: Of the necessary data and information that they feel is necessary for this Commission to arrive at an allocation of the waters.

COM. STONE: I would second that motion and I believe it is a good suggestion, because engineers ought to be able to agree upon what is essential information and how much of it can be gotten together and what progress we can make on it.

THE CHAIRMAN: Any discussion of the motion? (The question was called for. Thereupon a vote was taken and the motion of Com. McClure carried unanimously.)

THE CHAIRMAN: Perhaps then it is in order to discuss the time and place of the next meeting.

COM. STONE: Mr. Chairman, before you do that should we adopt a rule that unanimous action is necessary in all matters which come before this Commission? We have to unanimously agree in the end.

THE CHAIRMAN: Judge Stone, the Chair is unable to say just what you should adopt as a rule in a matter of that kind. I think that should be very carefully considered.

COM. McCLURE: We will have trouble.

COM. STONE: If we have a rule like that we will tend to get together rather than somebody being bound by something that is imposed by the majority. We have got to unanimously agree before we have the compact. That was my only thought.

THE CHAIRMAN: Off the record.

(Discussion off the record.)

COM. CARSON: Mr. Chairman, on matters of mere procedure don't you think that would be rather dangerous?

COM. STONE: I am not urging it. I am just raising the question.

COM. CARSON: Off the record.

(Discussion off the record.)

COM. BISHOP: Mr. Chairman, I think Judge Stone is absolutely right, that we should be unanimous before we pass on any question that affects the allocation of waters. I think it is desirable. But, on the other hand, it seems that it would hardly be fair to have some one member hold a proposition up that might be beneficial to everyone else and even that one member in the eyes of the others.

COM. STONE: I think that is entirely true, Mr. Bishop. I think it might be ill-advised to adopt such a rule at this time.

COM. BISHOP: I believe it would be better to go along understanding we are going to make it unanimous if possible and not have a rule.

COM. STONE: On the basis of this motion should we, in order to get these engineers busy, announce who the members of our Engineering Advisory Committee will be?

THE CHAIRMAN: I think that is in order, Judge Stone.

COM. McCLURE: Mr. Chairman, as far as I know now, John H. Bliss

will be the engineering adviser for New Mexico.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Professor H. T. Person of the University of Wyoming, Laramie.

THE CHAIRMAN: Arizona?

COM. CARSON: It will be R. Gail Baker.

THE CHAIRMAN: Colorado?

COM. STONE: C. L. Patterson.

THE CHAIRMAN: The engineer adviser of the Federal Representative will be J. R. Riter. Utah?

COM. WATSON: Mr. Fred Cottrell, Chief Deputy of the State Engineer.

COM. CARSON: Mr. Chairman, could I ask Mr. Riter, is that information contained in Judge Stone's resolution readily available?

MR. RITER: From the standpoint of Arizona, I don't think it is. I don't think there is anything for that little piece of Arizona there. There seems to be a complete lack of record there.

COM. CARSON: In other states?

MR. RITER: Key stations, yes. They have been operated for a number of years by the Geological Survey.

COM. CARSON: Off the record.

(Discussion off the record.)

THE CHAIRMAN: I am not clear as to how this Engineering Advisory Committee is to function. Is it at the wish of the Commission, they arrange their own time of conference, or that they convene at a certain date in the future?

COM. STONE: Don't you think it would be better to set our time of meeting with the understanding that this committee should arrange among themselves to meet sufficient time ahead of our meeting to have this report ready which is requested of them?

COM. BISHOP: Don't you think we could have a two-day meeting and have the engineers get their data presented the next day, and save so many meetings?

COM. STONE: I don't think so. I think if we leave it up to these engineers and tell them the date we are going to meet, they will have it ready.

THE CHAIRMAN: Perhaps you should consider the time and place of the next meeting at this juncture.

COM. McCLURE: Mr. Chairman, I would like to extend an invitation to come to Santa Fe. I would suggest the best time would probably be the week of the 15th, sometime during that week.

THE CHAIRMAN: 15th of what?

COM. McCLURE: Of September.

THE CHAIRMAN: Will you put that as a motion, Mr. McClure, so we can take some action?

COM. McCLURE: I would like to confer with Governor Dempsey on the exact date of that week. He suggested that they come to Santa Fe in September or October. Off the record.

(Discussion off the record.)

THE CHAIRMAN: For the record will you make a motion as to the place of the next meeting?

COM. McCLURE: I move that the Commission meet in Santa Fe, New Mexico, on the 17th and 18th of September.

THE CHAIRMAN: Do I hear a second?

COM. STONE: Second the motion.

THE CHAIRMAN: It has been moved and seconded that the next meeting be held in Santa Fe, New Mexico, on the 17th and 18th of September. Any discussion? (No response. Thereupon a vote was taken and the motion of Com. McClure carried unanimously.)

COM. McCLURE: Off the record.

(Discussion off the record.)

THE CHAIRMAN: Now the matter of the meeting of the Engineering Advisory Committee--has that been disposed of, the time and the place of that meeting?

COM. STONE: Would it be well for you, Mr. Chairman, to instruct the Engineering Advisory Committee to meet before that time so that they may have this report available, leaving it up to them?

THE CHAIRMAN: Off the record.

(Discussion off the record.)

COM. BISHOP: Mr. Chairman, I make a motion that they meet on the 30th and 31st of August at Cheyenne, Wyoming.

THE CHAIRMAN: You have heard the motion by Mr. Bishop. Is there a second?

COM. WATSON: Second.

THE CHAIRMAN: Moved and seconded that the Engineering Advisory Committee meet in Cheyenne--on what date?

COM. BISHOP: 30th and 31st.

THE CHAIRMAN: Any discussion on that? (Question called for. Thereupon a vote was taken and the motion of Com. Bishop carried unanimously.)

MR. GILES: Mr. Chairman, I have the matter of the record in mind. You have indicated you are going to require the services of a reporter.

(Discussion off the record and action deferred.)

THE CHAIRMAN: I suppose, Mr. McClure, that you will arrange the precise meeting place?

COM. McCLURE: Yes, sir.

THE CHAIRMAN: And that you will arrange for reporting the meeting?

COM. McCLURE: Yes.

THE CHAIRMAN: That's understood then.

COM. BISHOP: In Wyoming they will meet at my office.

THE CHAIRMAN: Off the record.

(Discussion off the record.)

THE CHAIRMAN: Any further business?

COM. BISHOP: Mr. Chairman, I move we adjourn.

THE CHAIRMAN: Is there a second?

COM. McCLURE: Seconded.

THE CHAIRMAN: It has been moved and seconded that we adjourn. Any discussion? Ready for the question? (Question was called for. Thereupon a vote was taken and the motion of Com. Bishop carried unanimously.)

THE CHAIRMAN: The meeting stands adjourned to meet at Santa Fe, New Mexico, September 17, 1946.

(4:32 p.m., July 31, 1946, meeting adjourned to September 17, 1946.)

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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5	I-1_pgs i-88	**21**	**AD**
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12	U-1_pgs i-60	28	AY-1_pgs i-103
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14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

L130
G9-1
V.1

RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Arizona - Colorado - New Mexico - Utah - Wyoming

•

NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

•

SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

WATER RESOURCES
CENTER ARCHIVES

MAR 1966

UNIVERSITY OF CALIFORNIA
BERKELEY

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by the
Commission

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UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME I

Record of Preliminary Governors' Meeting, and
for Commission Meetings No. 1-5, inclusive

FOREWORD

The Upper Colorado River Basin Compact Commission authorized this three volume compilation of its official Record of Proceedings. There is attached the certificate of the Chairman and Secretary of the Commission that the record is complete and correct.

The Upper Colorado River Basin Compact Commission was composed of commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and one commissioner appointed by the President of the United States to represent the Federal Government. After a preliminary meeting of the Governors of the States, the Commission commenced its negotiations at Salt Lake City, Utah, on July 31, 1946. As a result of its deliberations, the Compact, known as the Upper Colorado River Basin Compact, was signed at the Palace of Governors, Santa Fe, New Mexico, on October 11, 1948. Subsequently the Compact was ratified by the respective legislatures of the signatory States. The consent of the Congress of the United States, required by Article I, Section 10 of the Federal Constitution, was granted by Public Law 37, 81st Congress, First Session (63 Stat. 31), which was approved by the President of the United States on April 6, 1949. The Compact became effective and binding on the signatory States upon the latter date.

The Compact Commission did not adjourn sine die until August 5, 1949. It maintained its organization until that time to further the ratification of the Compact by the States and the approval of the Compact by the Congress and to perform certain other related duties and functions.

All of the States which negotiated and ratified the Upper Colorado River Basin Compact are signatories to the Colorado River Compact which was signed at Santa Fe, New Mexico, on November 24, 1922, and subsequently ratified by the seven States of the Colorado River Basin (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming). The Congress of the United States gave its consent to the original Compact by the Boulder Canyon Project Act (45 Stat. 1057) in 1928. The provisions of the 1948 Upper Colorado River Basin Compact are subject to the provisions of the 1922 Compact.

The Colorado River Compact of 1922 did not apportion Colorado River water, or its use, among the signatory States. Instead, it divided the beneficial consumptive use of Colorado River water between the Upper and Lower Basins. The division point between the two basins was fixed as Lee Ferry, Arizona, which is located a short distance south of the Arizona-Utah boundary line. The Compact placed an obligation on the Upper Division States (Colorado, New Mexico, Utah, and Wyoming) to deliver specified quantities of water at Lee Ferry for the use of the Lower Basin. Provision was made for the satisfaction of any subsequently created treaty obligations to Mexico. The use of surplus water, over and above that apportioned to the two basins, was reserved for future apportionment.

The Upper Colorado River Basin Compact apportioned among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming the beneficial consumptive use of the water apportioned to the Upper Basin by Article III (a) of the 1922 Compact (7,500,000 acre-feet annually). Provision was made as to the responsibility of the States of Colorado, New Mexico, Utah, and Wyoming in regard to their joint obligation to deliver water at Lee Ferry for use in the Lower Basin.

The 1948 Compact created an administrative agency known as the "Upper Colorado River Commission." This body, in addition to administering the Compact, is charged with the duty of expediting the development of the Upper Colorado River Basin. It is composed of five commissioners, one representing the United States of America, and one representing each of the States of Colorado, New Mexico, Utah, and Wyoming. Arizona is not represented on the Commission because of its relatively small area in the Upper Colorado River Basin. The Federal representative is chairman of the Commission. As an official body, it occupies the unique position of being able to expedite Upper Colorado River Basin development, to aid in shaping such development, and to integrate Federal and State activities and interests.

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Harry W. Bashore, for the United States of America, Chairman
Charles A. Carson, for Arizona
Clifford H. Stone, for Colorado
Fred E. Wilson, for New Mexico (1)
Edward H. Watson, for Utah (2)
L. C. Bishop, for Wyoming
Grover A. Giles, Secretary

(1) Replaced Thomas M. McClure who died during the time the compact was under negotiation.

(2) Was replaced by Harold A. Linke after the compact was signed but before the Commission adjourned sine die.

ENGINEERING ADVISORY COMMITTEE

J. R. Riter, for the United States of America, Chairman
H. P. Dugan, for the United States of America
R. Gail Baker, for Arizona
R. I. Meeker, for Arizona
Royce J. Tipton, for Colorado
R. M. Gildersleeve, for Colorado
Frank C. Merriell, for Colorado
John H. Bliss, for New Mexico
John R. Erickson, for New Mexico
C. O. Roskelley, for Utah
R. D. Goodrich, for Wyoming
H. T. Person, for Wyoming

Charles L. Patterson for Colorado, F. W. Cottrell for Utah and C. S. Jarvis for Utah served as members of the Committee during the early months of the negotiations.

LEGAL COMMITTEE

Charles A. Carson, for Arizona, Chairman
Jean S. Breitenstein, for Colorado
Fred E. Wilson, for New Mexico
W. J. Wehrli, for Wyoming
J. A. Howell, for Utah
J. G. Will, for the United States of America

EXPLANATORY NOTE

This compilation of the Record of the proceedings of the Upper Colorado River Basin Compact Commission is contained in three volumes, as follows:

Volume 1 - Containing the Record of the preliminary Governors' Meeting, and the Record of Meetings Nos. 1 to 5, inclusive, of the Commission.

Volume 2 - Containing the Record of Meetings Nos. 6 to 11, inclusive, of the Commission.

Volume 3 - Containing the Final Report of the Engineering Advisory Committee, and the Inflow-Outflow Manual.

These various meetings, in Volumes Nos. 1 and 2, are separated by blue insert-sheets, to indicate the division between meetings.

A Subject Index for meetings of the Commission appears at the beginning of Volumes Nos. 1 and 2. (See explanation for use, which prefaces the Subject Index). A separate Index for the Engineering Advisory Committee Report appears in Volume No. 3, as a part of that Report.

There appears in this compilation, at the beginning of each separate meeting of the Commission, a chronological Table of Contents, covering developments in each such meeting.

There were 11 official meetings of the Upper Colorado River Basin Compact Commission before it adjourned sine die at Salt Lake City, Utah, on August 5, 1949.

The schedule of all meetings pertaining to the Compact was as follows:

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Meeting No. 2	Santa Fe, New Mexico	Sept. 17-18, 1946	Volume 1
Meeting No. 3	Public Hearings	Oct. 28-30-31 and Nov. 2, 1946	Volume 1
Meeting No. 4	Cheyenne, Wyoming	Sept. 8, 1947	Volume 1
Meeting No. 5	Denver, Colorado	Dec. 1-2-3-4, 1947	Volume 1
Meeting No. 6	Denver, Colorado	Feb. 17-18-19-20-21, 1948	Volume 2
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Meeting No. 10	Salt Lake City, Utah	Feb. 17-18, 1949	Volume 2
Meeting No. 11	Salt Lake City, Utah	August 5, 1949	Volume 2

C E R T I F I C A T E

Harry W. Bashore, Chairman, and Grover A. Giles, Secretary, of the Upper Colorado River Basin Compact Commission, do hereby certify that the record and proceedings of such Commission, from the 31st day of July, 1946 to the 5th day of August 1949, when the Commission adjourned sine die, contained in the three volume compilation to which this certificate is attached, are a complete and correct reproduction of such record and proceedings, including the Final Report of the Engineering Advisory Committee and the "Inflow-Outflow Manual" approved and adopted by the Commission.

Harry W. Bashore
Chairman

Grover A. Giles
Secretary

SUBJECT INDEX

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* * * * This Subject Index is prepared according to a code number system in this manner: 1:5:21; 2:6:34-40; 2:7:141-142. Interpreted, this code means: Volume 1, Meeting 5, Page 21; Volume 2, Meeting 6, Pages 34 to 40; and Volume 2, Meeting 7, Pages 141 and 142.

In brief, the code is:

First figure	=	Volume Number
Second figure	=	Meeting Number
Other figures in series	=	Page Numbers

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UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD OF MEETING NO. 2

September 17-18, 1946

La Fonda Hotel

Santa Fe, New Mexico

MEETING NO. 2
Santa Fe, New Mexico
Sept. 17-18, 1946

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APPEARANCES

Commissioners present:

H. W. Bashore, Chairman
Grover A. Giles, Secretary
Ed H. Watson, Commissioner for Utah
Thomas M. McClure, Commissioner for New Mexico
Clifford H. Stone, Commissioner for Colorado
L. C. Bishop, Commissioner for Wyoming
Charles A. Carson, Commissioner for Arizona

Other Appearances:

Federal Representatives

J. R. Riter, Engineer, Bureau of Reclamation, Denver, Colorado. Adviser to Federal Representative.
H. P. Dugan, Engineer, Hydrology Division, Bureau of Reclamation, Denver, Colorado.
H. N. Bennett, Jr., Engineer, Branch of Project Planning, Bureau of Reclamation, Washington, D. C.
C. B. Jacobson, Engineer, Region IV, Bureau of Reclamation, Salt Lake City, Utah.

From Wyoming

H. T. Person, Consulting Engineer of the Engineering Staff, University of Wyoming.
Norman Barlow, Rancher and President, Green River Basin Development Company; Assistant Compact Commissioner of Wyoming.
Joe Budd, Rancher and Assistant Interstate Streams Commissioner of Wyoming.
E. B. Hitchcock, Agriculturalist and Treasurer of Green River Basin Development Co.; Assistant Commissioner of Wyoming.
David P. Miller, Supt., Water Div. No. 4, Secretary of Green River Basin Development Co., and Assistant Interstate Streams Commissioner.
L. J. O'Marr, Attorney General from Wyoming and Legal Adviser on Compact Commission of Wyoming.

From Utah

Fred W. Cottrell, Chief Deputy State Engineer.
William R. Wallace, Pres., Utah Water Users Ass'n.
Grover A. Giles, Attorney General of Utah.
Clarence Jarvis, Engineer, State Engineer's Office.
Thomas W. Jensen, Director, Utah Water Users Ass'n.
Mitchell Melich, Attorney and Utah State Senator.
A. W. Watson, Special Assistant Atty. General, Adviser to State Engineer's Office.
Gerald Irvine, Attorney, Salt Lake City, Utah; Counsel for Utah Power & Light Company.
E. W. Clyde, Special Assistant Atty. General, Adviser to State Engineer's Office.

From New Mexico

Fred E. Wilson, Special Assistant Attorney General and Legal Adviser to New Mexico Commission.

John H. Bliss, Engineer, New Mexico Interstate Streams Commission
I. J. Coury, Member Interstate Streams Commission.
J. E. Payne, Member Interstate Streams Commission.
Ed H. Foster, Pres., San Juan County Reclamation Ass'n.
George F. Bruington, Attorney, Special Master, San Juan River Adjudication Case.

From Arizona

R. Gail Baker, Arizona State Reclamation Engineer, Phoenix, Arizona.

From Colorado

C. L. Patterson, Chief Engineer, Colorado Water Conservation Board.
R. J. Tipton, Consulting Engineer, Colorado Water Conservation Board.
Jean S. Breitenstein, Attorney and Legal Adviser to Colorado Commissioner.
John Erickson, Sr. Engineer, Colorado Water Conservation Board.
Ralph L. Carr, Attorney, Gunnison Water Shed Ass'n.
Dan B. Hunter, Chairman, Southwestern Colorado Water Conservation District.
Dwight Sexton, Sec'y., Southwestern Colorado Water Conservation District.
D. W. Hott, Member, Southwestern Colorado Water Conservation District.
Glenn Saunders, Attorney, Denver Water Board.
Harry Potts, Engineer, Denver Water Board.
A. W. McHendrie, Attorney for Arkansas Valley Ditch Association.
Charles Beise, Attorney, Water Development Association of Southeastern Colorado.
Gail L. Ireland, Lawyer, Member of Arkansas River Compact Commission.

THE CHAIRMAN: As our Secretary is present and our Reporter, Mr. Romero, and all the Commissioners are seated, and it is now 10:15 A. M., we will now go into executive session unless the Commissioners decide this meeting to be an open meeting. By resolution passed at Salt Lake City it was decided that our sessions would be executive unless the Commissioners take action to decide otherwise. Your Chairman has prepared a program for this meeting. One of the first items on the program is submission by the Commissioners of the names of your advisers present, giving their profession and official position in the State, if any, and the water organization or group whom they represent. In order to save time on that, I suggest that each Commissioner supply the names of those present from his State. The Chair calls on the Commissioner for Arizona.

(Each Commissioner submits a list of appearances to reporter who has listed such above.)

COM. STONE: Frank C. Merriell, Engineer-Secretary, Colorado River Conservation District is unable to be here today but will attend future meetings. This appears to be a long list for Colorado but we have numerous interests in Colorado which will be affected by anything done on the Colorado River. It is our policy to have all these interests represented by consultants to the Commissioner for the State of Colorado.

COM. WATSON: Mr. Roskelley, who is temporarily in the U. S. Army will probably be here. He is an Assistant in the State Engineer's Office.

THE CHAIRMAN: You may list those that will be here tomorrow or you may wait until they come in. I have no intention of being arbitrary in the matter.

The Chair would like, at this point, to have a statement from the Commissioners as to the time of the next meeting of the legislatures, the length of session and whether there is a recess period; the rules for introduction of bills. It is possible that some of you are not prepared to do that. However, I would like to have it at this time, if possible. The Chair therefore calls on the Commissioner for Colorado.

COM. STONE: Mr. Chairman, the next general assembly convenes in the State of Colorado on the 1st Wednesday in January, 1947. The length of session is not controlled or limited by law. Sometimes the session lasts for three months and I know of one instance in 1937 when it ran five months. The average length, I could say, is three months. Under the Constitution of the State of Colorado, all bills except general appropriation bills must be introduced during the first fifteen days of the session. It has been the common practice to introduce bills by title and add the body of the bill later. The Supreme Court has never passed on the validity of such procedure, but in the minds of many lawyers, there is considerable doubt whether it would uphold such practice if a question were raised. It seems advisable in important matters of this kind that the bill be introduced within the fifteen day period, and that the body of the bill accompany the title. Therefore, I would say that in order for the legislature of the State of Colorado to act upon ratification of any compact negotiated by this Commission at its next session in 1947, the compact should be available to be incorporated in a bill for ratification not later than the 22nd day of January, 1947.

COM. CARSON: The legislature of the State of Arizona meets in regular session in January and it lasts for sixty days for which they get paid. After that, they don't.

THE CHAIRMAN: Is that a continuous session or is there an intermission?

COM. CARSON: No, it is continuous.

COM. McCLURE: In New Mexico, the regular session of the legislature convenes on the second Tuesday in January, 1947, for sixty days consisting of a split session of two thirty day periods. All bills must be introduced during the first thirty day period unless accompanied by a message from the Governor. There is a thirty day recess for consideration of all bills, after which recess they come up for passage or rejection during the last thirty days of the session.

COM. WATSON: The legislature of the State of Utah meets the second Monday in January, 1947, for sixty days continuous session. There is no recess. The rule is not to introduce any bill after the fortieth day except by unanimous consent.

THE CHAIRMAN: The Commissioner for Wyoming.

COM. BISHOP: I will ask Mr. O'Marr, Attorney General, to answer for Wyoming.

MR. O'MARR: The Wyoming legislature meets on the second Monday in January, which is the 13th. Under the law, the session is limited to one session of forty days. By rule, the legislature generally fixes the time of twenty, sometimes thirty days to introduce bills. After that, they can only be introduced by unanimous consent. Sometimes they introduce a bill as suggested by Judge Stone, by just introducing the title with a skeleton form, but I agree with Judge Stone that that is not the proper way to handle it. The bill should be complete and then changed in the regular way. These forty legislative days do not include Sundays or holidays. There is not a split session either.

THE CHAIRMAN: The next item to be considered I believe is the desire on the part of the Commissioner from Arizona to further clarify Arizona's position in connection with these deliberations. Mr. Carson, do you wish to make a statement at this time?

COM. CARSON: Yes, sir, I will just hand a copy to each one of you. As I said, it is Arizona's position, as suggested previously, to be put in the record.

THE CHAIRMAN: Without objection, this statement will be incorporated in the record of this meeting. Don't you think Mr. Carson should read that in order that everybody can hear it?

COM. CARSON: Arizona has about sixty-six hundred square miles in the Upper Basin. Under the compact this is the basis upon which Arizona is entitled to share in the waters apportioned to the Upper Basin. However, it does not share in the obligation to deliver at Lee Ferry. We have had engineers go out to that part of the State. Most of it is on the Indian Reservation, but they report that it isn't possible to divert water on that portion of Arizona that is in the Upper Basin from either main streams of the Colorado River or San Juan River. Therefore, I have prepared this short statement:

"There is hereby apportioned to the State of Arizona for beneficial consumptive use in that part of Arizona which is in the Upper Basin, as defined in the Colorado River Compact, all of the waters precipitated thereto, and in addition thereto 1000 acre feet from the Paria River."

"The Paria River rises in Utah and flows through Arizona into the Colorado River just above Lee Ferry. There is very little use of water in

that area; one dude ranch and there is possibility of other dude ranches. So 1000 acre feet from the Paria River would be ample. Arizona is also a Lower Basin State and very much interested in her rights as a Lower Basin State, more so than in her rights as an Upper Basin State.

"Arizona joins in these negotiations for the purpose of the allocation between the States of the Upper Basin of the use of water apportioned to the Upper Basin by the Colorado River Compact, and any Upper Basin Compact is without prejudice to any contention Arizona as a Lower Basin State may desire to make concerning the interpretation or construction of the Colorado River Compact, The Boulder Canyon Project Act, such Upper Basin Compact or any other agreement, or statute heretofore or hereafter made or enacted, or the proper definition of terms thereof, or the applicability thereof, and is without prejudice to Arizona's rights as such Lower Basin State to require delivery by each of the other States, parties to such Upper Basin Compact, jointly and severally, of the quantities of water they jointly are obligated to deliver at Lee Ferry under the terms of the Colorado River Compact."

That I think completely clarifies Arizona's rights and position.

The Paria River arises in Utah on the west side of the Colorado River. There is only about eighteen to twenty thousand acre feet annual discharge of the Paria River. In Arizona we have one dude ranch which has about one hundred acres under cultivation. There are possibilities of other dude ranches on that stream. That is about all we could ever use.

THE CHAIRMAN: Unless someone wishes to comment on that, we will now pass to the item of the special report of the engineers which was authorized at Salt Lake City, in the matter of preparing a program for the work of the Commission.

COM. WATSON: Mr. Chairman, is this statement that Mr. Carson has just read, part of the record at the present time?

THE CHAIRMAN: Yes, sir, it is part of the record. The Chair stated that unless there were objections, it would become so.

COM. WATSON: There is no acceptance by the Commission, it is just a part of the record.

THE CHAIRMAN: It is simply a part of the record. This group of engineers met at Cheyenne and in my opinion did a fine job of preparing a report for this Commission. You will observe that the report is in shape so that you may modify it or reduce it in detail. You may accept it as a whole or reject it as a whole, or accept it in part or modify it in part. I want to call to your attention the fact that the program outlined by the engineers involves considerable work and it will require time, and in the consideration of the report by the Commissioners, it would be well to bear in mind the situation in regard to the meeting of the legislatures. It is needless to say the compact might not be worked out in time for consideration of the legislatures as it will require time and call for cooperation by the Government. We might have to wait two years until the next regular session, and then it is your guess as to what the situation will be in Congress two years from now. You may be able to secure authorization for basin development or authorization for appropriations. So in your deliberations, pro and con, of the Engineering Committee Report, please keep the time element in mind.

The Chair calls on Mr. J. R. Riter to give the engineering report to the Commissioners.

MR. RITER: I submit to the Chair and to the Secretary a signed copy of the Report. We have other copies for each of the Commissioners. I think the best way to proceed is to read the report. There are one or two minor editorial changes that have been suggested and should be made. As we come to these, I will call them to your attention and you can mark your copies accordingly.

(Report of Engineering Advisory Committee as corrected.)

"Cheyenne, Wyoming
August 31, 1946

"REPORT OF ENGINEERING ADVISORY COMMITTEE
TO THE
UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Pursuant to the instructions received from the Commission, the Committee of Engineering Advisers listed below met at the State Engineer's Office in Cheyenne, Wyoming, August 30th and 31st, 1946 to discuss and recommend a program of engineering studies to assist the Compact Commission in negotiating a Compact among the Upper Colorado River Basin States.

Committee Members

J. R. Riter, Bureau of Reclamation, Denver, Colorado. (Chairman)
R. Gail Baker, State Land Dept., Phoenix, Arizona.
C. L. Patterson, 212 State Office Bldg., Denver, Colo.
John H. Bliss, State Engineer's Office, Santa Fe, N. M.
F. W. Cottrell, State Engineer's Office, Salt Lake City, Utah.
H. T. Person, Engineering Bldg., University of Wyoming, Laramie, Wyoming.

Others Present

F. C. Merriell, Colorado River Water Conservation District, Grand Junction, Colorado.
John R. Erickson, 212 State Office Bldg., Denver, Colo.
H. W. Bashore, Chairman and Federal Representative, Upper Colorado River Basin Compact Commission, Mitchell, Nebraska.
H. P. Dugan, U. S. B. R., Denver, Colorado.
L. C. Bishop, State Engineer, Cheyenne, Wyoming.
Earl Lloyd, Deputy State Engineer, Cheyenne, Wyoming.
C. O. Roskelley, Salt Lake City, Utah.
C. S. Jarvis, Salt Lake City, Utah.
E. C. Lorentzen, Salt Lake City, Utah.
E. H. Watson, State Engineer, Salt Lake City, Utah.

After discussion of the problems involved, the Committee recommends:

1. Preparation base maps for use by the Commission in its deliberations. The Bureau of Reclamation will furnish two copies to each of the States of the maps on a scale of 1:1,000,000 which show the present and potential irrigation developments within the Upper Basin. Maps of the individual States are now available and are to be fitted together and mounted on cloth. The Colorado Water Conservation Board has under preparation a base map which can be adapted for use in showing the locations of stream gauging stations and watershed areas upstream from Lee Ferry. In the interim, copies of this map on its present scale of 1 inch equals 12 miles will be made available for use by the Engineering Advisers. In the near future Colorado will furnish Van Dykes from which

copies of the map can be prepared on the scale of 1:1,000,000.

2. Studies to determine the water supply available from each State. This involves the following steps:

(a) Determination of historic stream flows at main stem gauging stations, and other stations located near the State lines and near the the mouths of tributaries which enter the Colorado, Green and San Juan Rivers in Utah, Arizona and New Mexico. The Bureau of Reclamation compilation of discharge records will be supplemented to complete the records for the following list of gauging stations:

Stream	Location
Colorado River	at Lees Ferry, Arizona
San Juan River	near Bluff, Utah
San Juan River	at Farmington, New Mexico
San Juan River	at Shiprock, New Mexico
McElmo Creek	near Cortez, Colorado
Mancos River	near Towoac, Colorado
La Plata River	at Colorado-New Mexico State Line
Animas River	near Cedar Hill, New Mexico
Animas River	at Durango, Colorado
Florida River	near Durango, Colorado
Animas River	at Farmington, New Mexico
Pine River	at Ignacio, Colorado
San Juan River	at Rosa, New Mexico
Navajo River	at Edith, Colorado
Paria River	at Lees Ferry, Arizona
Escalante River	below Escalante, Utah
Muddy River	near Hanksville, Utah
San Rafael River	at Hanksville, Utah Highway Bridge
Price River	at Woodside, Utah
Price River	at Heiner, Utah
Duchesne River	at Myton, Utah
Duchesne River	at Randlett, Utah
Uinta River	at Fort Duchesne, Utah
Ashley Creek	near Vernal, Utah
Brush Creek	near Jensen, Utah
Henrys Fork	at Linwood, Utah
Green River	near Linwood, Utah
Burnt Fork	near Wyoming-Utah Line*
Blacks Fork	near Wyoming-Utah Line*
East Fork of Smith Fork	near Robertson, Wyoming*
West Fork of Smith Fork	near Robertson, Wyoming*
Green River	at Green River, Wyoming
Green River	at Green River, Utah
Little Snake River	near Dixon, Wyoming
Little Snake River	near Lily, Colorado
Savery Creek	near Savery, Wyoming
Battle Creek	near Slater, Colorado
Yampa River	near Maybell, Colorado
White River	near Watson, Utah
Colorado River	near Cisco, Utah
Dolores River	at Gateway, Colorado
Gunnison River	near Grand Junction, Colo.
Plateau Creek	near Cameo, Colorado
Colorado River	near Cameo, Colorado

* Record to be compiled by the State of Utah.

(b) Extension of available discharge records, where necessary, by correlation with records at other stations. To secure a representative period, the records will be extended back in time as far as practicable. (If possible, back to 1914 and forward through 1946.)

(c) Estimation of runoff from areas which are not measured by comparison with similar areas on which records are available, and from precipitation and other available data.

(d) Estimation of present depletions above key gauging stations based on information pertaining to present irrigated acreages shown in the Bureau of Reclamation Report dated March 1946 and unit rates of depletion now incorporated in the Bureau's report, as they may be modified by subsequent studies.

(e) Estimations of channel losses along the main stream as follows:

Green River from the Wyoming-Utah line to the Junction with the Colorado River;
San Juan River from Rosa, New Mexico to the Junction with the Colorado River;
Colorado River from the Colorado-Utah line to Lee Ferry.

3. Studies of river and reservoir operations to determine the extent to which the Upper Basin can make use of its allocated water supply during drought cycles and still meet its compact obligation at Lee Ferry.

The Report of the Bureau of Reclamation has been consulted and referred to, and contains information of great value to the studies herein proposed and to the States of the Upper Colorado River Basin. It describes present developments and lists potential projects and possibilities the aggregate effect of which, if all were constructed, would deplete the flow of the Colorado River at Lee Ferry by an estimated 9,100,000 acre feet annually. Potential uses of water constitute important factors in dividing available supplies among individual States, and are considered to be involved up to the 7,500,000 acre feet heretofore allocated to the Upper Basin by the Colorado River Compact.

Respectfully submitted,

ENGINEERING ADVISORY COMMITTEE,

S/ John R. Riter Chairman
S/ R. Gail Baker Arizona
S/ C. L. Patterson Colorado
S/ John H. Bliss New Mexico
S/ F. W. Cottrell Utah
S/ H. T. Person Wyoming."

Lee Ferry is defined in the Compact as a point below the junction of the Colorado River and Paria River. Lees Ferry is a geological survey name for the gauging stations of the Colorado and the mouth of the Paria River.

Mr. Chairman, that constitutes the report. Is it your desire that we have some explanation? We have prepared and tacked on the wall a copy of the map which is to be furnished to each of the States. We have placed together all seven maps representing the entire Colorado River Basin. This Commission is interested in the Basin above Lee Ferry which is a point defined by the Compact on the Colorado River, below the junction of the Colorado River and Paria River. The Committee felt that an important consideration should be

the determination of the runoff originating in each State. The Committee also felt that in view of the record of runoff which has been accumulated at Lees Ferry and Paria River since 1922 and considering the obligation in the Compact for the States of the Upper Division to deliver water at Lee Ferry, or more correctly as the Compact reads, the States in the Upper Division shall not cause the flow at Lee Ferry to be depleted below an aggregate of 75,000,000 acre feet in any period of ten consecutive years. In addition, there may be some obligation under the Mexican Treaty for the Upper Basin to deliver water at Lee Ferry. That's a matter that has to be thrashed out and decided upon, but in any event, examination of the record shows that in a period such as from 1931 to 1940 inclusive, a ten year period, the recorded flow at Lee Ferry averaged about 10,000,000 acre feet annually. The virgin flow average for that period, 1931 to 1940 inclusive, is 12,000,000 acre feet. If the Upper Basin is to deliver an average of 7,500,000 acre feet annually, it does not leave the Upper Basin in such a ten-year period 7,500,000 acre feet; in other words, 12,000,000 less 7,500,000 is 4,500,000. The long time average virgin runoff at Lee Ferry is about 16,000,000 acre feet annually.

In order to beneficially consume as much as possible all of the water allocated to the Upper Basin and still meet the obligation of not depleting the flow at Lee Ferry in a low ten-year period such as from 1931 to 1940 inclusive, it becomes necessary to consider main stem storage. A number of sites have been surveyed, shown on the Bureau's report, along the main stem--Dark Canyon, Dewey Site, Rattle Snake, Desolation, Echo Park, Split Mountain, Flaming Gorge, Juniper--those are the principal sites. There is also a site on the San Juan at Bluff.

We felt that all the States have a common interest in this main stem portion of the River. That interest comes in several ways. In the first place, the engineers on the Committee felt that we all have a common interest in having reservoirs built so that we can store water in years of plentiful runoff and release it in drought periods, to avoid the depleting of the flow at Lee Ferry below the Compact requirements. In the second place, a computation of the contributions by the various States and losses in the main stem indicates that Wyoming is interested in the loss between the Wyoming-Utah line along the Green River and along the Colorado River to Lee Ferry. Colorado is interested in the loss of water between the State line of Colorado and Lee Ferry. Water from Colorado will reach Lee Ferry through any one of three routes: (1) From Yampa and White Rivers via Green River and the main stem of the Colorado River below the junction of Green River; (2) Colorado River; and (3) the San Juan River and Colorado River below the junction of the San Juan River. New Mexico is also interested in any losses in the San Juan River and from the tributaries which drain into the San Juan River from Colorado.

It is a very intricate study taking all these things into consideration to determine the origin of the waters. That involves tabulation of the historic flows at gauging stations and extension of such records by estimates and estimate of the depletions by reason of irrigation development on each of the streams by States. So far as Utah is concerned, the Committee felt it would be unfair to determine the water originating in Utah by subtracting from the flow at Lee Ferry the flow originating above the State line, thus throwing on Utah the burden of all the water loss along the main stem above Lee Ferry.

The Bureau of Reclamation has assembled the map which has been tacked on the wall. We will have other maps assembled as soon as they are available. We are getting prints of the new maps and will endeavor to assemble them and forward copies to each of the States.

At the request of the Commission in the meeting held at Salt Lake City, it was requested that each of the States be furnished with copies of the

historic records at each of the base gauging stations. Compilation of the historic flows have been made and mailed to each of the states last week.

The work outlined is a tremendous job. In carrying forth the program, it will take the joint effort of all of us. The Bureau of Reclamation is willing to do its share. We have assigned two men, Mr. Dugan and one helper, to devote full time to this particular problem. The Chairman apparently has ambitions of having a compact ready to present to the legislatures in January, 1947.

If these engineering studies are completed, we will need to have at least three men from each State and three men from the Bureau of Reclamation working continuously at this job for two months. That's a rough estimate of the time required to complete the studies outlined in the report, if the Commission should wish to proceed on that basis. In addition to the studies for determination of origin of water and losses in the main stems, the study involves the operation of reservoirs on the main stems. The Committee felt that the Commission should also consider the project potentialities. As quoted in the last paragraph of the Report, we also felt it would be useless to allocate water to a State in quantities greater than its possibilities for using that water. That is the reason the last paragraph was retained.

Mr. Chairman, that constitutes the report. I suggest you might find it advisable to call on the other Members or Advisers of the Committee to supplement my remarks in case I have overlooked important items.

COM. McCLURE: You suggested three men from each State.

MR. RITER: Yes, sir, it is just an estimate. That's eighteen men working for the Commission. I don't think that is too many with which to make this study. That is an average, maybe some of the States should have more than three, some less, depending upon the amount of work involved and how we spread it out.

THE CHAIRMAN: The Chairman now wishes the Commissioner from Arizona to ascertain from his Engineer Adviser if there is any further comment.

MR. BAKER: I have nothing.

COM. CARSON: I have one thought here. I think you have a good report, Mr. Riter. You ascertain the present use in each of these States but how about potentiality as to future use?

MR. RITER: I think, Mr. Carson, we anticipate that in Item 2 (d) of the Engineering Committee Report. Would it be your desire we insert in Item 2 (d) the words, "by states"?

COM. CARSON: I would like to know just the present uses of the various States and the potential uses.

COM. BISHOP: The Bureau will estimate all of that. If you want to add "by States" you can do that.

THE CHAIRMAN: I am sure that was the intention.

COM. STONE: Mr. Patterson, do you have any supplemental statement to make on this Report?

MR. PATTERSON: We have sort of an outline map of just the Upper Basin. It is a skeleton map showing the water courses, main streams and tributaries, above Lee Ferry. It is prepared on a larger scale than the

present map. My promise was to complete the map, which will show the location of each of the gauging stations mentioned in the Report of the Engineering Committee, and show the area commanded by each of the gauging stations. The map that Mr. Riter has been explaining, which was prepared by the Bureau of Reclamation, is pretty well covered up by lettering and green, red and yellow coloring. It is difficult to spot the gauging stations and the Basin drainage boundary lines on the Bureau map. It was believed better that we complete the map which had been started by the Colorado Water Conservation Board. We have agreed to furnish a copy of that map to each of the Members of the Engineering Committee and finally, when it is finished to the satisfaction of the Committee, negatives will be made for each State which can then reproduce as many copies as necessary. The original of the map will be for the use of the Commission if it so desires.

THE CHAIRMAN: On the general explanation that Mr. Riter made, I think he has pretty well outlined the problems which the engineers were confronted with. The only thought I want to leave is this: I want to emphasize that it is a big job. It isn't only a big job for any one group of men or six or eighteen or how many tackle it, but from time to time, there will be questions arising which are going to require careful discussion and debate because they involve elements of judgment and I am not trying to suggest taking additional time. All I want to say is that we had to start with something. This is not a complete list of all the engineering investigations which this Commission may desire as it works along, but it is a place to start, dealing fundamentally with water, its sources, its present status of development, how much gets down to Lee Ferry, and how losses are to be apportioned. There will be further studies to be made of the problem of dividing up water by this Commission. As to the matter of time Mr. Riter outlined in this Engineering Committee's Report, that is his own estimate.

MR. RITER: That is right, the Committee did not discuss the matter of time. I tried to meet the hopes and ambitions of the Chairman.

THE CHAIRMAN: Mr. Watson, Commissioner for Utah, does your Engineer Adviser have any comments?

MR. COTTRELL: I have nothing to add to what Mr. Riter and Mr. Patterson have already mentioned.

THE CHAIRMAN: Mr. McClure, Commissioner for New Mexico, has your Engineer Adviser any comments?

MR. BLISS: Nothing, except as an answer to Mr. Carson's question. It seems to me that in our analysis of virgin flows, we must necessarily cover one of the points he has brought up and determine the present uses on the River. These will have to be fully and thoroughly investigated. As far as future uses are concerned, estimates of some of these have been made and pretty fairly set out by the Colorado River Basin Report of the Bureau.

THE CHAIRMAN: The Commissioner for Wyoming.

COM. BISHOP: I have nothing to add.

THE CHAIRMAN: It appears to the Chairman that this is a basic study which must be made in whole or in part and I believe the Commissioners should now take appropriate action and decide whether they are going to accept or reject the Engineering Committee's Report.

COM. BISHOP: Mr. Chairman, I move acceptance of the Report of the Engineering Committee, with the understanding that additional

studies and revisions be made as are found necessary in future investigations.

THE CHAIRMAN: Is there any further discussion? Those in favor of the motion say "aye." Contrary, "no." The motion is unanimously carried.

COM. BISHOP: Mr. Chairman, for the purpose of the records, I would like to submit my credentials as a Member of this Commission.

THE CHAIRMAN: Very well, Mr. Bishop, that will be made a part of the record.

"Wm. 'Scotty' Jack
Secretary of State

A. E. Johnson
Deputy

STATE OF WYOMING
DEPARTMENT OF STATE
Cheyenne
July 30, 1946

TO WHOM IT MAY CONCERN:

I, WM. 'SCOTTY' JACK, SECRETARY OF STATE OF THE STATE OF WYOMING, do hereby certify that L. C. BISHOP is the duly appointed, qualified and acting STATE ENGINEER within and for the STATE OF WYOMING.

I FURTHER CERTIFY that by virtue of his office as STATE ENGINEER, he is the COMMISSIONER FOR WYOMING and is thereby authorized to represent the STATE OF WYOMING as provided in Chapter 102, Section 2, Session Laws of Wyoming, 1941. Such authority permits him to enter into compacts and agreements respecting the future use of and distribution of water of any interstate stream from Wyoming and all other matters as set forth in Section 1, Chapter 102, Session Laws of Wyoming, 1941.

(SEAL)

S/ WM. 'SCOTTY' JACK
Secretary of State."

THE CHAIRMAN: You have hear the report of the Engineering Committee and it has been emphasized that considerable work must be done. I think at this time the Commissioners should consider the organization of a permanent engineering committee, a committee that is going to do work and put in all the time that is necessary. I am afraid that if we allow the work of the Commission to drag along without some objective as to purpose and time, that the Members of this Commission will be looking for an alibi later. It is highly essential that everything be done at this time to work out a compact at the very earliest time. So far as the Bureau of Reclamation is concerned, I feel sure it will furnish all technical assistance that is necessary. I take it on myself to see that that is done.

I think the States realize the urgency of this matter. Whether you attain your objective as to time or not, nobody knows, but certainly, if this Commission doesn't set up an objective as to time required for the completion of this compact, the Lord only knows how long it will take to get the job done. If the Commission fiddles around with a meeting once a month for a couple of days, I don't think any of us will live long enough to see its consummation.

COM. STONE: Mr. Chairman, I move that the Commission set up a permanent engineering committee consisting of representatives of the compacting States and of representatives of the Federal Government, the State Commissioners and the Federal Representative to be responsible for designating their respective members on such committee, and that as a matter of expressed objective and intent, this committee be advised by the Commission

hat it is its desire that the work be accomplished as soon as practicably possible.

THE CHAIRMAN: You have heard the motion; do I hear a second?

COM. BISHOP: I second the motion.

THE CHAIRMAN: Any discussion?

COM. WATSON: I would like to ask a question, if there will be any limit to the number of members chosen by each of the respective States.

THE CHAIRMAN: I think at this time the Chair will entertain a motion for adjournment. You can think about this proposition during the lunch period. Perhaps you might wish to make a change on it, but we will adjourn until 1:00 o'clock. Do I hear a motion to that effect?

COM. STONE: I move that we recess until 1:30 p.m.

COM. BISHOP: I second the motion.

THE CHAIRMAN: It has been moved and seconded that we recess until 1:30 p.m.

(Motion was put to a vote and unanimously carried.)

(1:30 p.m., September 17, 1946.)

THE CHAIRMAN: The meeting will now come to order.

COM. STONE: Mr. Chairman, in further explanation of my motion which was made prior to adjournment for lunch, I should like to say that with respect to that part of my motion which left the question to each State as to the number of members on the Committee, such motion was made with this in mind:

1st. That we must recognize that this Committee is merely advisory to the Commission.

2nd. That we want to bring to bear in these engineering studies the best engineering judgment available.

3rd. That the facts are not determined on the basis of votes by the members of the Engineering Committee.

4th. If there is any disagreement as to the facts in the report to this Commission, the final determination, in any event, will be determined by the vote of the Commission.

With further reference to my motion, I wish to state that we would not like as far as Colorado is concerned to be limited to one man. I should like to say that each Commissioner understands better than anyone else the condition in his own State, and the procedure which will bring about a most satisfactory situation with respect to the compact negotiations. After a compact is negotiated, we have the important hurdle in each of these States, namely, the ratification of the compact. Colorado has many interests and often diverse interests. We must proceed cautiously in the way of bringing about an acceptable understanding of any compact that is negotiated. I recognize that a small committee is a most workable committee and where desirable a committee should be kept small, yet, so far as my State is concerned that is not entirely satisfactory. I make this explanation so as to indicate that there is no desire on the part of Colorado either to delay or to bear undue influence in any engineer-

ing studies. Our desire is to assist and aid in every way possible in arriving at the facts and bring to bear the best engineering judgment we have in representing the various factions and interests within my State.

COM. McCLURE: I am opposed to any time limits of these negotiations to the utmost. Unfortunately, New Mexico is involved in another compact, negotiations which have been going on for several years on the Pecos River. We finally arrived at a point where Texas is naming an engineer which we hope will take the facts and try to reach some kind of agreement. We are more or less obligated at the present time to make certain studies.

There is one observation that I want to make and that is the final action on this compact is going to be with your State legislature and each one of us as Commissioners are going to have to go into that legislature with full convictions that we have got a compact that can be passed and ratified. Regardless of how much we might want to expedite getting this matter, we still can't go in there with a half-baked agreement. I think, if we look to an agreement, it is one that is going to have to be satisfactory to the Commissioners themselves so that they can show to their legislatures that it is an equitable agreement--uses of water in the various States on an equitable basis and that their advisers that have worked with them can do the same thing, we will save a great deal more time than if we try to hurry some of these things. I would like to see a compact negotiated this afternoon if possible. I have had enough experience in negotiating these compacts--going a little bit slower, have matters ironed out on a sound basis.

THE CHAIRMAN: I have heard no expression to the effect, by any Commissioner, that this work is to be slighted in any way by expediting it. We have no intention of sacrificing thoroughness.

Why not have the motion read again in order to have it clear in mind?

(The Reporter repeats Judge Stone's motion.)

THE CHAIRMAN: You have heard the motion read by the Reporter. The motion has been seconded. Any further discussion of the motion as read? Question has been called for. Those in favor of the motion will respond by saying "aye." Contrary "no." The "ayes" have it and the motion is carried unanimously.

COM. STONE: I now move that Mr. J. R. Riter, who served as Chairman in the Engineering Committee set up to make the engineering studies program, be designated by the Commission as Chairman of this permanent Engineering Committee.

COM. WATSON: I second the motion.

COM. BISHOP: I believe it would be more orderly if the Chairman would call for the names of the representatives of the various States and if this group wants to designate the chairman, rather than have us designate who is going to be the chairman.

COM. STONE: I am willing to hold my motion in abeyance until the representatives are designated, Mr. Bishop.

THE CHAIRMAN: The Chairman will now call on the Commissioners to name their engineers to this permanent Engineering Committee. Arizona?

COM. CARSON: R. Gail Baker, State Land Department, Phoenix, Arizona.

THE CHAIRMAN: Colorado?

COM. STONE: C. L. Patterson, Chief Engineer, Colorado Water Conservation Board, Denver, Colorado; R. J. Tipton, Consulting Engineer, Colorado Water Conservation Board; Frank C. Merriell, Colorado River Water Conservation District, Grand Junction, Colorado.

THE CHAIRMAN: New Mexico?

COM. McCLURE: John H. Bliss, Engineer Adviser, New Mexico Interstate Streams Commission.

THE CHAIRMAN: Utah?

COM. WATSON: Fred W. Cottrell, Chief Deputy, State Engineer's Office, Salt Lake City, Utah.

THE CHAIRMAN: Wyoming?

COM. BISHOP: H. T. Person, Engineering Bldg., University of Wyoming, Laramie, Wyoming, Consultant for the Wyoming Commission.

THE CHAIRMAN: The Chairman designates Mr. J. R. Riter of the Bureau of Reclamation as his Engineer Adviser.

COM. STONE: I don't know whether my motion was acted upon.

COM. CARSON: I think it would be better if we designated Mr. Riter so that he will feel the responsibility of getting things expedited.

COM. WATSON: I seconded Judge Stone's motion.

THE CHAIRMAN: You have heard the motion, duly seconded. Are you ready for the question? Question has been called. Mr. Reporter, will you read the motion as made by Judge Stone?

(The Reporter repeats Judge Stone's motion.)

THE CHAIRMAN: You have heard the motion, duly seconded. All in favor of the motion will say "aye," contrary, "no." Motion carried unanimously.

It is the understanding of the Chairman that the gentlemen mentioned are to carry the burden of these investigations, but that wherever necessary, additional help will be furnished by the States, if the States are able to do it. Is that a correct interpretation of the matter? Is that your understanding, Mr. Bishop?

COM. BISHOP: Yes, sir.

COM. CARSON: Yes, sir.

COM. WATSON: Yes, sir.

COM. McCLURE: Yes, sir.

COM. STONE: Yes, sir.

THE CHAIRMAN: A motion is now in order for this Engineering Committee to organize and come back later during these meetings and report to this Commission.

COM. BISHOP: Mr. Chairman, I move that the Chairman direct Mr. Riter to assemble his Committee for organizing and report back to the Commission, with an estimate of the time and personnel required to carry out the program which has been approved by this Commission.

COM. WATSON: I second the motion.

THE CHAIRMAN: A motion has been made and seconded. All in favor will signify by saying "aye," contrary, "no." Motion carried.

In accordance with the motion just passed, the Chairman directs Mr. Riter and his group of Engineers to retire, find a suitable place to organize and to come back and report to this Commission by 10:00 a.m. tomorrow, Wednesday. Is there any further business to come before the Commission today?

COM. STONE: May we save time by taking up some of the details while the Engineering Committee is out? There is the matter of the correction of the record of the Salt Lake City meeting which will take some time and other questions which we could dispose of this afternoon while the Committee is out, and save time.

THE CHAIRMAN: That's a very good suggestion by Judge Stone. The Chair would like to make this suggestion also: During the time that will be required for these engineers to prepare this data, this Commission might want to hold some meetings in some of the States in order to acquaint the people with the work of the Commission. I don't know what the idea of the Commissioners might be on that, but I offer that for your consideration. I see no real reason for having another meeting of the Commission to consider factual data which these engineers will prepare, within the next fifty or sixty days. I can see a useful purpose by possibly having some meetings in various points in the States. You may consider that and take it up at the proper time, or discard it if you wish.

In order to get this business before the Commission, Judge Stone, do you have in mind a resolution?

COM. STONE: It is just a matter of procedure, Mr. Chairman.

At the organization meeting in Salt Lake City, one action which was taken I thought appeared to be inequitable. You will recall that we decided that the expense incident to reportorial services including the cost of transcripts was to be borne equally among the five States. Four of the States have a major interest in these compact negotiations. The State of Arizona has a minor interest. It seems to me unfair to ask Arizona to bear one-fifth of that expense. May I suggest that we reconsider that action. It would be appropriate for Mr. Carson to make an expression as to what he thinks would be an equitable share.

COM. CARSON: We have a very minor interest and we don't have a very large appropriation from which this expense can be paid. It seems to me that we should pay for one copy of the transcript and not share in any of the other expenses, traveling expense or otherwise.

COM. McCLURE: I move that the expense of the Commission be divided equally among the four States of the Upper Division; that if any State of the Upper Basin desires a copy of the transcript, such State will pay for the same at the rate per page to the reporter. If Arizona desires a copy of the transcript, it will be furnished at a per page rate.

COM. STONE: I second the motion.

THE CHAIRMAN: You have heard the motion made by Mr. McClure. Any further discussion? Those in favor of the motion will say, "aye." Contrary, "no." The motion is carried unanimously.

COM. STONE: I suggest that we proceed to correct the record of the Salt Lake City meeting.

COM. McCLURE: I am inclined to believe, Mr. Chairman, that our record of the transcript of these meetings is going to be better if we can employ a reporter to handle all of it. In Salt Lake City, at the meeting Miss Price submitted an estimate of what the cost would be. Since that time she has revised those costs and I would like to hear some discussion by the other States in regard to accepting her proposal as made under the revision which is as follows: $10.00 per day for reporting proceedings, 30¢ per page for copies of the transcript and actual expense for traveling and subsistence. I am under the impression that the same reporter for all meetings will be far better than having different reporters at different places. In some of the places we might be unable to obtain them.

COM. BISHOP: I agree with Mr. McClure. I make a motion that we accept the proposal of Miss Price.

COM. WATSON: I second the motion.

THE CHAIRMAN: Those in favor of the motion will respond by saying, "aye." Contrary, "no." Motion is carried unanimously.

MR. GILES: Mr. Chairman, at the Salt Lake City meeting, the Commission passed a motion that the Secretary of the Commission would come here prepared to make recommendations as to the correction of that transcript. I am ready to suggest corrections at this time if the Commission so desires.

THE CHAIRMAN: There has just been handed to the Chairman a copy of the credentials of the Commissioner for New Mexico. It is a letter from Commissioner McClure to Grover A. Giles, Secretary of the Commission, dated August 20, 1946. If there is no objection, that will be made a part of the record.

"August 20, 1946

"Hon. Grover A. Giles, Secretary
Upper Colorado River Basin Compact Commission
c/o Attorney General's Office
Salt Lake City, Utah

Dear General Giles:

I am herewith submitting for the record of the Upper Colorado River Basin Compact Commission, an excerpt, from the minutes of the August 9th, 1946, meeting of the New Mexico Interstate Stream Commission, which will constitute my credentials as representative for New Mexico on the Upper Colorado River Basin Compact Commission.

I quote from the above mentioned minutes:

'The matter of appointing a permanent Commissioner for the Upper Colorado Basin States Compact Commission was taken up. Chapter 77, Article 33, New Mexico Statutes, 1941 Annotated, is the Statute creating the New Mexico Interstate Stream Commission. Chapter 77, Section

3303, New Mexico Statutes 1941 Annotated, reads as follows, in part:

"General Powers of Commission - Interstate Compact Employees - Attorney General's Duties. Said Commission is hereby authorized to negotiate compacts with other states to settle interstate controversies or looking toward an equitable distribution and division of waters in interstate stream systems, subject, in all cases, to final approval by the legislature of New Mexico."

'Acting under the above quoted authority, Mr. Phillips moved that Mr. Thomas M. McClure be named as Commissioner to represent the State of New Mexico on the Upper Colorado River Basin States Compact Commission in the negotiations for allocating the waters of the Colorado River Compact to the interested States. The motion was seconded by Mr. Rodey and upon being placed to a vote was carried unanimously.'

This I believe will complete the record regarding my credentials as stated on page 12 of the transcript of the July 31st meeting of the Commission in Salt Lake City.

With kindest personal regards, I am

Very truly yours,

TMM/mt

THOMAS M. McCLURE, Commissioner
Upper Colorado River Basin
States Compact Commission."

(At this point the Commissioners considered a revision of the transcript of the Cheyenne meeting.)

COM. McCLURE: Mr. Chairman, I move that the transcript as revised, of the Governor's conference in the matter of the Upper Colorado River Basin Compact hold at Cheyenne, Wyoming on July 22, 1946 become a part of the record of this Commission and be considered as a preliminary organization meeting, at which time the States agreed to compact negotiations, and that the Salt Lake City meeting of July 31, 1946 be designated as the Number 1 or first meeting of the Upper Colorado River Basin Compact Commission.

COM. WATSON: I second the motion.

THE CHAIRMAN: You have heard the motion which has been seconded. Is there any further discussion? Those in favor will signify by saying, "aye," contrary, "no." The motion is carried unanimously.

COM. STONE: I suggest that we proceed with the correction of the transcript of the first meeting of the Upper Colorado River Basin Compact Commission held at Salt Lake City on July 31, 1946.

COM. BISHOP: I second the motion.

THE CHAIRMAN: You have heard the motion duly seconded; is there any discussion? All those in favor of the motion will signify by saying, "aye," contrary, "no." The motion carried unanimously.

(Meeting of the Commission reconvened on Wednesday, September 18th, 1946.)

THE CHAIRMAN: The meeting will come to order. We have several matters to dispose of today. First, to hear the Report of the Permanent Engineering Committee and second, to dispose of the question as to whether or not the Commissioners will hold meetings in the field and when. Without objection, we will now hear from the Chairman of the Engineering Committee.

MR. RITER: Our Committee made the following conclusions:
(Mr. Riter reads following report.)

REPORT TO UPPER COLORADO RIVER BASIN COMPACT COMMISSION
By PERMANENT ENGINEERING ADVISORY COMMITTEE

Pursuant to instructions, the Members of the Engineering Advisory Committee listed below met at the La Fonda Hotel on September 17th to determine the time and personnel required to carry out the engineering studies approved by the Commission.

Committee Members

J. R. Riter, Chairman, U.S. Bureau of Reclamation
R. Gail Baker, Arizona
C. L. Patterson, Colorado
R. J. Tipton, Colorado
John H. Bliss, New Mexico
F. W. Cottrell, Utah
H. T. Person, Wyoming.

Others Present:

John R. Erickson, Colorado
H. P. Dugan, U.S. Bureau of Reclamation
C. S. Jarvis, Utah

After discussion of problems involved, the Committee made the following conclusions:

1. The Bureau of Reclamation will complete the assembly of maps for the Colorado River Basin and forward copies to the States by October 1.

2. Mr. Patterson of Colorado distributed to each State and to the Bureau of Reclamation, copies of the base map of the Upper Colorado River Basin. Each State is to review the location of gauging stations and the watershed areas shown thereon and make corrections as may be found necessary and return the needed information for preparation of a final map, to Mr. Patterson of the Colorado Water Conservation Board not later than October 3.

3. It was agreed that the monthly discharge records will be compiled to show runoff to the nearest 100 acre feet. The tables previously compiled by the Bureau will be checked by the Bureau of Reclamation and the annual totals made equal to the sum of the monthly quantities. Utah will tabulate and furnish to each of the other States and to the Chairman, copies of the monthly discharge records of Burnt Fork, Blacks Fork, East Fork of Smith Fork and West Fork of Smith Fork. Mr. Baker of Arizona will tabulate the monthly discharges of Moenkopi Wash near Tuba City and of Little Colorado River near Grand Falls. These data will be used in estimating the flow of some unmeasured areas. This work to be completed before October 3.

4. Mr. Tipton of Colorado will make available on September 23rd for

review by the Committee, a study which Colorado and New Mexico made about 1934, of stream flow records on the San Juan River. The Bureau will assemble, before October 3, and review for usability in the Committee's studies, computations previously made by the Denver and the various field offices of the Bureau of Reclamation.

5. The Committee will meet in Denver on October 4th and 5th, and on the basis of information which has been gathered up to that date, will formulate specifications and procedures for the following items of work:

(a) Extension of discharge records at the selected key gauging stations.
(b) Estimation of runoff from areas which are not measured.
(c) Estimation of past and present depletions by States above key gauging stations.
(d) Estimation of channel losses along the main streams.
(e) Operation of main stem reservoirs.

Members of this Committee and their staffs will make studies of these problems between now and the October 4 meeting and come to the meeting prepared to discuss intelligently the problems involved with a view of formulating procedures, which can be unanimously adopted by the Committee and applied to the problem.

Some discussion was had of personnel which can be assigned by each of the States. Definite commitments will be made at the October 4th and 5th meeting.

Tentatively, the following personnel will be assigned to the studies:

Arizona,	Mr. Baker and possibly 1 other.
Colorado,	C. L. Patterson, R. J. Tipton, John R. Erickson, a draftsman and a Computer.
New Mexico,	John H. Bliss
Utah,	C. S. Jarvis and 1 other
Wyoming,	H. T. Person and students
Federal,	J. R. Riter, H. P. Dugan and such other helpers as can be used effectively. We will also solicit help from Region IV.

THE CHAIRMAN: Gentlemen, you have heard the report. Are there any questions?

MR. RITER: We talked in generalities and brought up a number of ideas. We will have to give a lot of earnest, concentrated effort in order to agree upon one line of action.

THE CHAIRMAN: Was there any discussion or estimate made on how long it would take to get the job done?

MR. RITER: We discussed this problem with the other engineers. None of the engineers were prepared to make any alternate estimate than the one I presented to the Commission yesterday of thirty-six man-months. At the October meeting, we will make definite plans, including time schedules.

MR. TIPTON: The engineers had no further idea that is materially different as to man-months, but they had a definite idea as to how many. Yesterday, Mr. Riter estimated the time at eighteen men working two months,

that is thirty-six man-months. It is quite obvious that eighteen men cannot be placed upon this job and work effectively. In the first place, you couldn't get eighteen men to do this kind of work. If you did, you couldn't do the work effectively in such little time. While thirty-six man-months might be correct, yet most members of the Committee felt it was entirely inadequate so far as the length of time was concerned. Thirty-six man-months might be correct--two months is entirely inadequate.

MR. RITER: The Bureau has made a number of studies. I don't know to what extent its studies are going to be used by the Committee. We will have those studies assembled and digested and will be prepared to discuss them with the Committee and find out to what extent if any, they will be found usable. That is one thing we can't tell at this time. That is one of the things we are going to discuss at the October meeting. We realize the urgency and the desire to bring this to a conclusion.

THE CHAIRMAN: The Chair is wondering what degree of accuracy the Engineering Committee expects to obtain after all of these calculations and studies, realizing, or accepting, if you will, the fact that there are compensating errors in any of these calculations and estimates.

MR. RITER: It is our desire to give the Commissioners the best information we can with the data we have available.

MR. TIPTON: Mr. Chairman, this Commission has appointed an Engineering Committee. This Commission is expecting from the Engineering Committee something on which the Commission can rely. In the appointment of an Engineering Committee, I think the Committee has a right to assume that the Commission has confidence in that Committee, as to methods to be used and as to the degree of accuracy that the Committee feels should be applied to the studies, so that the Commission will have something upon which it can rely. I, as a Member of that Committee am not willing to turn out something on which I myself cannot rely and upon which I cannot say to this Commission that it could rely. So, I think that the Commission has to place some confidence in the Committee.

THE CHAIRMAN: As far as the Chairman is concerned, there is no question about your statement, but nevertheless, we have got to have our objectives which we are going to try to get, and I think you would say, Mr. Tipton, that some of these studies are not possible of exact determination. I had in mind River losses. I have a notion that that is not possible of exact determination.

Any further comments or questions?

COM. BISHOP: If there is no further discussion, I move the adoption of the report of the Engineering Committee.

COM. WATSON: I second the motion.

THE CHAIRMAN: Is there any further discussion? If not, all those in favor of the motion will signify by saying, "aye." Contrary, "no." The Report is unanimously accepted.

It appears to the Chairman at this time, that the next item for consideration is that of the time and place of the next meeting of the Commission.

COM. WATSON: I think that the Chairman suggested yesterday that we consider holding meetings in the Basin, continuing the meetings over any given period, in order to acquaint the people with the problems of the Commission and also acquaint ourselves with the problems in the field, and in view of that

fact, I think that we should adopt that idea and act accordingly.

I make a motion that we hold meetings as follows: Starting at 1:00 p.m. October 28th, 1946, the first meeting will be held at Rock Springs, Wyoming. On October 29th we travel to Grand Junction and hold the next meeting at 10:00 a.m. on Wednesday, October 30th, at Grand Junction, Colorado. On Thursday, October 31st, at 2:00 p.m. we hold our next meeting at Price, Utah, it isn't far there. Then we will allow all day Friday, November 1st, to travel to Farmington, New Mexico, and we will hold the meeting at Farmington, New Mexico, on Saturday, November 2nd, at 10:00 a.m.

COM. BISHOP: I second that motion.

THE CHAIRMAN: Those in favor of the motion will signify by saying, "aye." Contrary, "no." The "ayes" have it and the motion is unanimously carried.

COM. STONE: Is it not necessary to act upon the revision of the Salt Lake City meeting, the revision of the transcript?

THE CHAIRMAN: Yes.

COM. STONE: I move that the transcript of the meeting of the Commission held at Salt Lake City on July 31st be approved as revised at a meeting of this Commission yesterday, and that the Secretary be instructed to revise the transcript in accordance with the action of this Commission and that he furnish each Member of the Commission one copy.

COM. BISHOP: I second the motion.

THE CHAIRMAN: You have heard the motion. Is there any discussion? If not, those in favor will indicate by saying, "aye." Contrary, "no." The motion is unanimously carried.

This transcript made by Mr. Romero will be forwarded to Mr. Giles.

COM. STONE: It is understood that the transcripts of the Commission meetings and any other documents or material dealing with this Commission are to be placed in the hands of the Secretary, who is responsible for the record and the distribution of copies of the record.

MR. GILES: We will need an original and six copies of the transcript of this meeting.

COM. STONE: Let the record show that any expense of the Commission, any expense incurred for the Commission in the way of reporter's fees and other necessary expense shall be billed and submitted to the Secretary who shall apportion that expense in accordance with the action heretofore taken by the Commission and send such bills directly to each Commissioner who will see to it that such expense is paid by his State.

THE CHAIRMAN: Does the Chair hear any objection? If not, the statement stands as approved. This meeting will be officially designated as Meeting No. 2 of the Commission. We can't fix the time for Meeting No. 4 until the engineers indicate they are ready to report. Don't you think that the record should be closed with some sort of statement concerning that?

COM. McCLURE: At the end of Meeting No. 3, which will be this series of meetings in the field, we may be in a position to designate the time.

COM. STONE: Let the record show that following the next meeting, which is meeting No. 3 of this Commission, meeting No. 4 will be held at a time to be fixed when the Commission is advised that the Engineering Committee is ready to report; that the Secretary be instructed to advise the Chairman of the Engineering Committee to inform him when the report is ready; that when the report is ready the Secretary shall then communicate with the Members of the Commission and arrange the time for holding meeting No. 4 of the Commission, at which meeting, the report of the engineers will be considered by the Commission, and that such meeting No. 4 of this Commission be held at Denver, Colorado.

THE CHAIRMAN: Let the record show that meeting No. 3 is a series of field hearings agreed to by the Commission.

COM. BISHOP: Mr. Chairman, if there is no further business to come before this Commission, I move that we adjourn.

COM. STONE: I second the motion.

THE CHAIRMAN: It has been moved and seconded that the meeting of this Commission adjourn. Do I hear any discussion? If not, all those in favor will signify by saying, "aye." Contrary, "no." The motion is carried and we will adjourn.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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RECORD

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Arizona - Colorado - New Mexico - Utah - Wyoming

●

NEGOTIATION OF

UPPER COLORADO RIVER BASIN COMPACT

●

SIGNED AT SANTA FE, NEW MEXICO, ON OCTOBER 11, 1948

WATER RESOURCES
CENTER ARCHIVES
MAR 1966
UNIVERSITY OF CALIFORNIA
BERKELEY

●

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UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD

VOLUME II

Record of Commission Meetings No. 6-11, inclusive

UPPER COLORADO RIVER BASIN COMPACT COMMISSION

OFFICIAL RECORD OF MEETING NO. 7

July 7 - 21, inc., 1948

Field House of Natural History
Vernal, Utah

MEETING NO. 7
Vernal, Utah
July 7 - 21, 1948

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J. W. Gillman	Member, Utah Water and Power Board, Orem, Utah.
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L. B. Johnson	Member, Utah Water and Power Board, Randolph, Utah.
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Geo. A. Cheever	Utah County Commissioner, Payson, Utah.
Sylvan W. Clark	Utah County Commissioner, Lehi, Utah.
Reed J. Knudson	Utah County Commissioner, Provo, Utah.
S. E. Forrest	City Councilman, Nephi, Utah.
James Lloyd	Duchesne County Commissioner, Roosevelt, Utah.
L. J. Gilbert	Duchesne County Commissioner, Arcadia, Utah.
Wm. H. Case	President, Duchesne County Water Users Ass'n., Duchesne, Utah.
H. L. Allred	President, Moon Lake Water Users Ass'n., Roosevelt, Utah.
John H. Haslem	Dry Gulch Irrigation Company, Roosevelt, Utah.
Forrest Goodrich	Chairman, Uintah County Commissioners, Vernal, Utah.
Ashel Manwaring	Uintah County Commissioner, Vernal, Utah.
B. H. Stringham	Mayor of Vernal, Vernal, Utah.
Francis Feltch	State Representative, Vernal, Utah.
C. J. Neal	Oil Operator, Vernal, Utah.
J. H. Ratliff	Engineer, Humphreys Phosphate Co., Vernal, Utah.
G. E. Untermann	Echo Park Dam Committee, Vernal, Utah.
Judge W. S. Henderson	Vernal, Utah.
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R. D. Goodrich	Engineering Consultant, Laramie, Wyoming.
H. T. Person	Consulting Engineer, Laramie, Wyoming.
H. Melvin Rollins	Assist. Compact Commissioner, Cheyenne, Wyoming.
Norman W. Barlow	Assist. Compact Commissioner, Cora, Wyoming.
Joe L. Budd	Assist. Compact Commissioner, Big Piney, Wyoming.
Ernest B. Hitchcock	Assist. Compact Commissioner, Rock Springs, Wyoming.

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R. H. Rupkey	Hydraulic Engineer, Indian Service, Phoenix, Arizona.
J. E. Stenberg	Indian Service, Fort Duchesne, Utah.

PROCEEDINGS

The meeting was called to order by Chairman Bashore at ten o'clock a.m., Wednesday, July 7, 1948, in the Field House of Natural History at Vernal, Utah.

THE CHAIRMAN: Will the meeting please come to order. It will be recalled that in the meeting of the Commission held in Denver in December several questions were directed by the Commission to various Federal agencies. Since that time replies have been received by the Chairman of the Commission and copies of those replies have been furnished to each member of the Commission. Only today a copy of a letter from the Acting Secretary of the Army, dated February 17, 1948, is being furnished to the members of the Commission.

It will be recalled that maybe a year or a year and a half ago the Commission appointed an Engineering Advisory Committee and assigned to that committee the task of working out solutions of various problems. It will also be recalled that at the February meeting of the Commission held in Denver there was assigned by the Commission to the Legal Advisory Committee, which had been previously appointed, a number of questions, and the idea of preparing a skeleton draft of the compact after consultation with the Engineering Advisory Committee for the consideration of the Commission at this meeting. Last week from Tuesday to Saturday, inclusive, the Engineering Advisory Committee and the Legal Advisory Committee met in Denver for the purpose of carrying out the wishes of the Commission. A joint meeting of the two committees was held and your chairman was asked to act as chairman of those meetings. In the opinion of your chairman a lot of excellent work was accomplished at these meetings in Denver.

Now while five days were used in Denver by the two committees I doubt if over a day and a half was used in a formal meeting, but what happened was that problems would come up in the meeting, then the meeting would adjourn and different groups would go to their respective rooms or offices and try to do some work. That seems to be an excellent way of doing work.

The report of the Engineering Advisory Committee will be rendered later and also the report of the Legal Advisory Committee. I don't know when we will get to those reports. It will depend on how much discussion is brought forth by the rendition of each of them--I think the Engineering report undoubtedly should be given first--but, before we get to the submission of those reports and in view of the possibility of some modification being necessary on those reports we are going to hear from the representatives of the Office of Indian Affairs who are here at the suggestion of the Secretary of the Interior and at the invitation of your chairman. I don't know what more these men can add to the information which has been given in regard to the rights of the Indians but we certainly want to hear from them and we want to hear from any Federal agency, so far as that is concerned, in case it is felt that the interest of that particular agency hasn't been adequately presented or additional information is available.

So at this time we have with us Mr. Humpherys of the Office of Indian Affairs. Mr. Humpherys is a very well informed lawyer, recognized as an authority on Indian rights; and also Mr. Rupkey, an engineer of the Office of Indian Affairs, men of unquestioned attainments in their field.

At this time the Chairman will ask Mr. Humpherys to take the floor and make any remarks that he may feel appropriate.

MR. HUMPHERYS: Mr. Chairman and ladies and gentlemen: I think your chairman has very fittingly introduced what I might say by stating that he didn't know that there was much that could be said, and I don't either.

As I understand it, at some time the Commission through the Chairman requested the Department to express its views regarding the Indian rights. I do not have a copy of that letter but I do have a copy of the letter from the Assistant Secretary dated June 11th and which transmitted a memorandum from the Acting Commissioner of Indian Affairs to your Chairman and through him to the Commission, setting forth briefly the position of the Indian Bureau with reference to the water rights of the American Indians, who have been using water for some two thousand years at various places in the United States.

I understand that your chairman has distributed to each of you copies of Mr. Warne's letter of June 11th, 1948, together with a memorandum to the Secretary from the Acting Commissioner of Indian Affairs, covering the proposed recognition of Indian water rights in the Upper Colorado River Basin, and the other documents which accompanied that letter.

It would serve no useful purpose for me to try to summarize what was stated either in that memorandum or the accompanying documents. I think it would be appropriate to call attention in an oral statement to some suggested language that was contained in the memorandum of the Acting Commissioner of Indian Affairs to the Secretary of the Interior, and as heretofore indicated transmitted by Assistant Secretary Warne to you through your chairman on June 11th of this year. That language reads as follows:

> "In compliance with Mr. Bashore's request, I have hereinafter set forth a paragraph or provision which I believe, if included in the proposed Upper Colorado River Basin Compact, would protect the water rights of the Indians as defined in the enclosed memorandum and as briefly summarized herein."

The proposed language reads as follows:

> "Apportionment of water for which provision is made in this compact is subject to the first and prior water rights reserved for Indians, for Indian tribes, and for Indian reservations whether such first and prior water rights of the Indians are inchoate or covered by Federal court decrees."

I might add that many of the rights are already covered or at least some of them are already covered by Federal Court decrees in the several states.

Some of the data sheets which were submitted along with the memorandum submitted by the Secretary contain the Indian Service's best estimate of the reasonable requirements for irrigation and domestic uses for the Indians in the several states using water from the Colorado River or its tributaries in the Upper Basin.

Unless there are some other questions I doubt if it would serve any useful purpose for me to prolong my remarks or add anything further to what the Commissioner has already said and which as I understand it is already in your hands together with the Secretary's letter.

THE CHAIRMAN: Thank you very much, Mr. Humpherys.

COM. STONE: Mr. Chairman, in order that the Commission may know what is before it with respect to the presentations of the Federal agencies, it would seem to me appropriate that the Federal representative, the Chairman of our Commission, would indicate to the Commission those letters and statements presented by Federal agencies and which have not yet been considered by the Commission and made a part of the record.

I recall that you sent out a number of statements since our last meeting and today we understand there is a further statement and it would seem to me that those statements ought to be indicated and that after being indicated they be made a part of the record of the Commission and that we go over them. I have in mind particularly the statement made by Mr. Humpherys. He refers to a statement by the Secretary of the Interior dated June 11th which contains a number of matters and which has attached to it the statement of the Commissioner of Indian Affairs.

THE CHAIRMAN: Judge Stone, I think that is an excellent suggestion and the Chair hereby appoints you as a committee of one to enumerate to the Commission and for the record a list of the letters which have been received and distributed, and in that connection I herewith hand you for distribution to the members of the Commission, copies of a letter dated February 17, 1948, from the Acting Secretary of the Army.

COM. STONE: Mr. Chairman, I hesitate to list those statements because I am not certain that my files are complete, I was just looking over them, and I assumed you had the originals and they would be the best evidence of those letters. I have mimeographed copies of only two of them here but I am quite sur that is not a complete list. I thought the originals you had in your possession would be the most complete list.

THE CHAIRMAN: Judge Stone, I do not have the originals with me but I think I have a complete set of the copies and if you will be kind enough to read those that you have I will endeavor to check it and I will ask that other member of the Commission do likewise.

COM. STONE: It appears that the following letters are now presented to the Commission and have not heretofore been made a part of the record:

One from the Department of the Army dated February 17, 1948. This is the letter which has just been distributed.

Second, there is a letter or memorandum dated June 11th, 1948, from the Secretary of the Interior to which is attached a memorandum to the Secretary of the Interior from the Acting Commissioner of Indian Affairs.

THE CHAIRMAN: That letter is undated, I believe.

COM. STONE: That memorandum appears to be undated. As a part of tha letter from the Commissioner of Indian Affairs is a memorandum heretofore presented to the Commission and I believe made a part of the record dated November 25, 1946.

MR. HUMPHERYS: Judge Stone, may I ask, as to that one I assume you are referring to the one from the Commissioner of Indian Affairs to Mr. Hoyt, Executive Officer, Water Resources Committee, Department of the Interior?

COM. STONE: That is correct. That was attached and is dated Novembe 25, 1946.

THE CHAIRMAN: And to that letter, Judge Stone, was attached a tabula tion?

COM. STONE: Yes, attached to that letter is a "Summary Indian Irriga tion Projects, Upper Colorado River Basin, Based upon Surveys to Nov. 1, 1946, Estimated Diversions and Stream Depletions in Acre Feet."

Then, Mr. Chairman, there were other letters as I recall it which wer supplied to the members of this Commission since our last meeting and I believe

the Chairman should state what those are. My record in this file seems to be incomplete because I recall some others that don't appear to be here.

THE CHAIRMAN: There is one letter, Judge Stone, dated June 16, 1948, from the Chairman of the Upper Colorado River Basin Compact Commission to the Secretary of the Interior inviting attendance at the meeting of the Compact Commission by the Office of Indian Affairs and by representatives of Regions 4 and 7. So far as I can recall that constitutes the essential list of letters.

COM. STONE: Mr. Chairman, I move that these letters which have been mentioned be made a part of the record of this Commission.

COM. WATSON: Second the motion.

THE CHAIRMAN: Any discussion of the motion? (No response.) (Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

(Letters referred to are as follows:)

"DEPARTMENT OF THE ARMY
WASHINGTON, D. C.

17 FEB 1948

Mr. Harry W. Bashore
Federal Representative and Chairman
Upper Colorado River Basin Compact Commission
Mitchell, Nebraska

Dear Mr. Bashore:

Reference is made to your letter of 15 December 1947 in which you stated that you had been requested at a meeting of the Upper Colorado River Basin Compact Commission held in Denver, Colorado, on 2 December 1947, by a motion duly made and seconded and unanimously carried to 'direct a letter to all of the Federal agencies that have heretofore been contacted by the Chairman, asking them to answer two specific questions, namely: What right, if any, to the use of Upper Colorado River water does the agency have or claim on behalf of the United States? What particular provision and what particular language should be incorporated in any Upper Colorado River Basin Compact to protect the right, if any, to the use of Upper Colorado River water held or claimed by an agency on behalf of the United States?' You requested in your letter a statement in response to the questions set forth by the Commission.

The Corps of Engineers of the Department of the Army is at present engaged in the preparation of a preliminary examination and survey report on the Colorado River above Lees Ferry, Arizona, under authority of the Flood Control Act approved 28 June 1938. This report is now under preparation by the District Engineer, Corps of Engineers, Los Angeles, California, under the general supervision of the Division Engineer, South Pacific Division, Oakland, California. Although the results of this investigation will not be available for sometime, it can be stated that they will not affect the question of right to the use of water of the Upper Colorado River Basin by the Department of the Army. The Department does not now have or claim on behalf of the United States any right to the use of Upper Colorado River water and does not, therefore, require any particular provision or language to be incorporated in any Upper Colorado River Basin Compact.

Sincerely yours,

(Signed) William H. Draper, Jr.

Acting Secretary of the Army."

"UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

June 11, 1948.

My dear Mr. Bashore:

In your letter of December 15, 1947, you requested a statement of what right, if any, to the use of Upper Colorado River Water the Department of the Interior has or claims on behalf of the United States. You also asked, 'What particular provisions and what particular language should be incorporated in any Upper Colorado River Basin Compact to protect rights, if any, to the use of Upper Colorado River water held or claimed by an agency on behalf of the United States?' The matter of Indian rights is treated in a separate letter.

Your questions were answered in part by our letter of November 12, 1946. In that letter it was pointed out that 'Water rights involving the use of 62.50 second-feet of water in the 17 National Park Service areas have been perfected to the stage of permit, license, or decree, in conformity with the water laws of the several States.' Some general suggestions were also made in that letter which are reiterated here:

(1) The National Park Service favors a flexible compact which will not prematurely determine the allocation of land and water to the multiple purposes for which developments are being made.

(2) The natural water courses are the most important single factor in the wildlife habitat of the Upper Colorado River Basin. Hence, any plan for allocation and development of water, to be truly comprehensive, must give full consideration to conservation and enhancement of fish and wildlife values.

(3) The Geological Survey suggested that inclusion in the proposed compact of a paragraph similar to Article V of the Colorado River Compact, which provides for the collection of water data by the heads of the Bureau of Reclamation and the Geological Survey and appropriate officials of the States concerned, would be helpful in dealing with problems of the Upper Basin.

You are, I am sure, aware of the importance of taking account of extensive filings made in the name of the United States pursuant to Section 8 of the Act of June 17, 1902 (32 Stat. 388) and other laws. We hope, of course, that the framers of the compact will not attempt to affect adversely existing uses of the waters of the Colorado River System. There must also be borne in mind rights and claims made by water users and others to water for projects to be constructed by the Bureau of Reclamation. Protection of the interests of the United States should not, however, be limited to cases where filings have been or may be under State law.

The compact should not attempt, in our judgment, to define, limit, or

in any manner to determine the powers of the United States in, over, or to the waters of the Colorado River System. The extent to which those powers should be exercised is a matter for determination by the Congress.

Sincerely yours,

(Signed) William E. Warne

Assistant Secretary of the Interior

Mr. Harry W. Bashore
Federal Representative and Chairman
of the Upper Colorado River Basin
Compact Commission
Mitchell, Nebraska."

(Attachment to preceding letter.)

"UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF INDIAN AFFAIRS
WASHINGTON 25, D. C.

(Not dated.)

Memorandum

To: Secretary of the Interior

From: Acting Commissioner - Indian Affairs.

Subject: Proposed letter to Harry Bashore re recognition of Indian water rights in the Upper Colorado.

In a letter of December 15, 1947, Mr. Bashore requested that our views be set forth concerning whatever rights to waters of the Upper Colorado River the agencies of the Department may have and that suggested language be submitted for inclusion in the proposed Upper Colorado River Basin Compact, a provision which would protect such rights.

As you know, the Indians have a paramount right to use enough water from the Colorado River and its tributaries to irrigate their lands. Their usufructuary rights have been recognized in practice, defined and recognized in numerous judicial decisions irrespective of whether the creation of their reservations resulted from treaties, Acts of Congress, or Executive Orders made pursuant to the provisions of law. The leading case defining the basis and extent of their water rights is Winters v. United States, 207 U. S. 564. Many cases have been decided since that one, both in the lower Courts and the United States Supreme Court wherein the principles of the Winters case have been followed and reaffirmed. Briefly, their rights as defined by the courts and this Department are: that the Indians, or their sovereign guardian for them, are entitled to divert and use waters from streams bordering on or running through or arising on their reservations, with a priority not later than the date their respective reservations were created and that such right of usufruct carries a water duty sufficient to irrigate their lands adequately. A more detailed statement of these rights was set forth in my memorandum of November 25, 1946, to Mr. W. G. Hoyt, Executive Officer of the Water Resources Committee, to which was attached a tabular summary of information concerning

Indian irrigation projects and water requirements therefor in said basin. (A copy of that memorandum is enclosed).

In compliance with Mr. Bashore's request, I have hereinafter set forth a paragraph or provision which I believe, if included in the proposed Upper Colorado River Basin Compact, would protect the water rights of the Indians as defined in the enclosed memorandum and as briefly summarized herein.

'Apportionment of water for which provision is made in this compact is subject to the first and prior water rights reserved for Indians, for Indian tribes, and for Indian reservations whether such first and prior water rights of the Indians are inchoate or covered by Federal court decrees.'

The Indian Service will be glad to meet with Mr. Bashore and the Upper Basin Compact Commission at the convenience of Mr. Bashore and the Commission to discuss further the problems involved.

Acting Commissioner.

Enclosure 95
6 meg 11

Copy to:
Mr. Harry W. Bashore,
Federal Representative & Chairman,
Upper Colo. River Basin Compact Commission,
Mitchell, Nebraska.

Law Division."

(The memorandum dated November 25, 1946 and tabulation referred to in the above undated memorandum and attached thereto is set forth in the Official Record of Meeting No. 5.)

"Mitchell, Nebraska
June 16, 1948

Honorable J. A. Krug
Secretary, Department of the Interior
Interior Building
Washington, D. C.

My dear Mr. Secretary:

Receipt is acknowledged of the letter, with the accompanying materials, of Assistant Secretary W. E. Warne relating to the Upper Colorado River Basin Compact negotiations.

I suggest, and strongly urge, that a representative or representatives of the Office of Indian Affairs attend the meeting of the Commission which convenes at Vernal, Utah, on July 7, 1948.

It is assumed that representatives of the Bureau of Reclamation, including representatives of Region 4 and 7, will be in attendance at this Compact Session. As you no doubt know, John R. Riter, Chief, Hydrology Division, Branch of Project Planning, and J. G. Will, of the legal staff of

the Bureau, are respectively chairman of the Engineering Committee of the Commission and legal adviser to me. It is expected that both of them will attend this compact meeting.

Respectfully yours,

Harry W. Bashore
Federal Representative and Chairman, Upper Colorado River Basin Compact Commission."

COM. STONE: Mr. Chairman, would it be appropriate because of the importance of the participation of the Department of the Interior and the Bureau of Reclamation in the development of the Colorado River Basin to in more detail review that letter from the Secretary of the Interior dated June 11, 1948?

THE CHAIRMAN: That will be entirely satisfactory, Judge, in just a moment. The Chair wanted to call on Mr. Rupkey in case he wishes to say anything in addition to what Mr. Humpherys has said.

MR. RUPKEY: Mr. Chairman, I believe I have nothing in addition to what Mr. Humpherys has said.

THE CHAIRMAN: Very well. Thank you. Now reverting to Judge Stone's suggestion for a more detailed consideration of the letter of June 11, 1948, from the Department of the Interior, signed by William E. Warne, Assistant Secretary of the Interior--that is the one to which you have reference, is it not, Judge?

COM. STONE: Yes.

THE CHAIRMAN: I suggest that our secretary read the letter. Mr. Giles.

(Mr. Giles reads letter.)

THE CHAIRMAN: Now, gentlemen, you have had this letter in your possession for sometime, you have heard it read by Mr. Giles; are there any comments on the letter at this time that anyone wishes to make?

MR. HUMPHERYS: Mr. Chairman, I hate to bother but am I mistaken in my assumption that the Assistant Secretary also wrote a letter dated the 11th with which he transmitted the memorandum of the Acting Commissioner of Indian Affairs to the Secretary of the Interior to which I referred in my remarks?

THE CHAIRMAN: You were correct. That is another letter of June 11th. Perhaps that letter should also be read. Unless there is objection the secretary will read that letter.

COM. STONE: That letter, Mr. Chairman, is attached and it is in the form of a memorandum addressed to the Secretary of the Interior.

MR. GILES: Addressed to the Secretary, Judge Stone? Does it commence by saying, "In a letter of December 15th.."?

COM. STONE: Yes.

(Mr. Giles reads undated memorandum.)

COM. STONE: Mr. Chairman, I recall that since the last meeting you sent out a letter from the Department of Agriculture which lists in acre feet water which is to be required by the Forest Service. You have that letter I am sure and I am also certain that it has not been made a part of the record. It seems to me it ought to be presented at this time.

THE CHAIRMAN: I think you are entirely correct, Judge Stone. I have the original of that letter here and each Commissioner has a copy and we will again ask our secretary to read that letter.

MR. GILES: This is a letter dated March 25, 1948, from the Department of Agriculture, Washington, signed by Charles F. Brannan, Assistant Secretary, and addressed to our chairman, Harry W. Bashore:

"This letter replies to your communciation of December 15, 1947 asking for our answers to two specific questions regarding possible claims to the use of Upper Colorado River water.

With respect to the acquisition of water rights in the Western States in which the doctrine of prior appropriation prevails, the long continued policy of the Department of Agriculture, based in part upon court decisions and supported to some extent by the provisions of Federal laws, has been to recognize the authority of the States to control the use and disposition of the waters within their boundaries. In conformity with this policy the agencies of the Department have always proceeded in strict accordance with State laws and procedures in appropriating waters for use by them in administering Federal projects. In view of this well-established policy, and in the absence of Congressional action to the contrary, it is the Department's position that its claim on behalf of the United States to rights for the use of water of the Upper Colorado River are confined to those it has acquired or may acquire under State appropriation laws.

The Department's interests in water resources of the Upper Colorado River are substantial, as represented by the following tabulation:

Water Rights in Upper Colorado River (in acre feet per annum)

	Claimed by Forest Service, U. S. Department of Agriculture (including adjudicated rights and rights being perfected)	Additional water needed for future development of the Forests (including domestic, stock watering, irrigation, recreation, camps and other N.F. uses)
Colorado	56,608.3	90,000
Wyoming	1,408.9	6,000
Utah	4,572.8	14,000
	62,590.0	110,000

Of these water requirements a considerable proportion is for stock watering and irrigation on National Forest range land; some 20 percent is estimated to be needed for water supplies for ranger stations, guard stations, organization camps and recreational uses. A small amount of water is also required for preserving fish life by maintaining a minimum summer flow in certain streams and for other miscellaneous needs that are essential to the beneficial utilization of the National Forests. The estimated future needs

are subject to revision, probably upward, as use of the Forests increases.

It will not be necessary, in our opinion, to incorporate in any Upper Colorado River Basin Compact any particular provision or language for the protection of rights to the use of Upper Colorado River water acquired by the Department of Agriculture under State appropriation procedures. We regard such rights as standing upon the same footing as those obtained by any other appropriator under State laws. We do recommend including in any such compact such provisions as will tend to assure the allocation between the several interested States of an adequate supply of Upper Colorado River water to meet the present and future needs of the Department within each of such States.

We trust that this reply will adequately answer your inquiry. If you desire additional information, we shall be glad to hear from you at any time.

Sincerely,

(Signed) Charles F. Brannan

Assistant Secretary."

THE CHAIRMAN: In accordance with the action of the Commission this letter as well as other letters will be a part of the minutes and the official record of the Commission. Probably we should have read the letter from the Acting Secretary of the Army. Mr. Giles, will you please read the letter dated February 17, 1948, addressed to the Chairman of the Upper Colorado River Basin Compact Commission and signed by William H. Draper, Jr., Acting Secretary of the Army.

(Mr. Giles reads letter referred to.)

COM. STONE: Mr. Chairman, those other letters from the Bureau of Mines and Federal Power Commission were previously considered by the Commission. However, we have heard much discussion recently concerning the activities of the Atomic Energy Commission and we know that certain preliminary investigations under the direction of that Commission have been made in the Colorado River Basin. I fear that we may have overlooked a possible comment which that Commission may desire to submit to this Compact Commission. I merely mention it for whatever action the Commission or the Federal representatives wishes to take.

THE CHAIRMAN: Well, Judge Stone, it undoubtedly would be a good idea for the Chairman to direct a letter to the proper official if he can find out where that official is located and who he is, soliciting their views as to what they think should be incorporated in the compact to further their activities or to protect any interests the United States might have in the results of their activities, and if that is the wish of the Commission it will be done. (Confers.)

Mr. Will calls to my attention the fact that I have overlooked, and apparently the members of the Commission have overlooked that a letter was directed to the Bureau of the Budget with the request that they circularize all Federal agencies that might be interested in the outcome of this compact, and I am certain that we had no reply from the Atomic Energy Commission.

Now that isn't altogether an oversight of this Commission or of the Chairman but it is the duty of the Bureau of the Budget to notify the Commission; but perhaps it is an oversight on the part of the Bureau of the Budget and we might as well chase the thing down to a finality and solicit a statement from the Atomic Energy Commission.

COM. STONE: Mr. Chairman, in line with your remarks and recognizing the fact that the Nation as a whole is conscious of that activity, I move that it be suggested to the Chairman that he solicit any comments which the Atomic Energy Commission desires to make with respect to the proposed Upper Colorado River Basin Compact.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion has been made and seconded. Are there any comments on the motion? Any discussion? (No response. Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

Now are there any further questions or suggestions concerning the letters which have been read? I don't want to stop any discussion but we must move along.

COM. STONE: I assume that these comments of the Federal agencies will be considered in due course when the Compact is under preparation. For instance, the suggestion of the Indian Service as to language and any further comments of Federal agencies will be considered. It would serve no purpose at this moment to discuss those letters.

THE CHAIRMAN: They undoubtedly should be considered when the final draft of the compact is being worked out, but if anyone has any suggestion for the benefit of the Commission members at this time I think those suggestions are in order. Of course I think what you mean, Judge Stone, is that we are not simply passing these comments of the Federal agencies at this time as a final disposition of them. They will be taken up again in executive session of the Commission.

Are we now ready to have the rendition of the report of the Chairman of the Engineering Advisory Committee, Mr. J. R. Riter? (Confers.)

The Secretary has raised the question about the right of any individual in this gathering to ask a question or to make any comment. Now as long as this Commission is not in executive session anybody here is perfectly welcome to say anything that they have to say for the guidance and benefit of the Commissioners. You are not barred from saying what you have to say now because the Commission is not in executive session at this time. I hope you will all understand that; otherwise I don't know why you came here.

Before Mr. Riter makes his report to the Commission you will all please understand that this is a report for the Commission and not for circularization in the press. It is not a report that has been accepted by the Commission. It is a report of the Engineering Advisory Committee for what it is worth and I think we should all be very careful that we don't get matters in the newspapers in a way that they appear to be final because until this compact is ready for signature there is nothing final. I hope you will all bear that in mind.

Unless there is an objection we will now hear the presentation of the Engineering Advisory Committee report by the chairman of the Committee, Mr. Riter. Mr. Riter is also engineer advisor to the Federal Representative.

MR. RITER: Mr. Chairman, I present the Chairman a signed copy of the document.

(Distributes document to Commissioners.)

THE CHAIRMAN: Before you give your report, Mr. Riter, it is assumed by the Chairman that at the conclusion of your report, or rather at the conclusion of the discussion of your report, a motion will be made by some member of the Commission as to the disposition of this report, whether or not it be included in the minutes and in the final official record of the Commission. Please bear that in mind.

MR. RITER: This is a report dated at Vernal, Utah, July 7, 1948:

"To Upper Colorado River Basin Compact Commission

Gentlemen:

On December 1, 1947, there was submitted to you a progress report of the Engineering Advisory Committee. Since that time the Committee has completed the work assigned to it on September 17, 1946, at the Santa Fe meeting of the Commission. The purpose of this letter is to present a brief summary of the results and conclusions of the work of the Engineering Advisory Committee.

Assignment

The work assigned to the Engineering Committee was:

(a) Preparation of base maps to show the locations of present and potential irrigation developments within the limit of the Colorado River system upstream from Lee Ferry and stream gaging stations and drainage areas.

(b) Determination of water contributions by States, involving the tabulation of stream flow records at key gaging stations, the extension of records by estimates, and estimation of runoff from unmeasured areas.

(c) Estimation of present depletions above key gaging stations, State Lines and Lee Ferry.

(d) Estimation of channel losses along the main Colorado River and principal tributaries above Lee Ferry.

(e) Determination of the extent to which the Upper Basin can make its apportioned water uses during drought cycles and still meet its compact obligation at Lee Ferry.

Maps

The progress report transmitted to you on December 1, 1947 contains copies of maps of the states of Arizona, Colorado, New Mexico, Utah and Wyoming prepared by the Bureau of Reclamation and published as part of the report on "The Colorado River" (House Document 419, 80th Congress, first session). These maps show the location of present irrigated areas and potential irrigation projects, as envisioned by the Bureau of Reclamation, within the Colorado River Basin. The progress report of the Engineering Advisory Committee also contains a general map, prepared by the Colorado Water Conservation Board, showing drainage areas and the locations of gaging stations.

Drainage Areas

The table of drainage areas previously submitted has been revised to correct a few minor errors. The total drainage area above the Lee Ferry compact point is 109,889 square miles (instead of 108,989 square miles, previously reported). The drainage areas are shown on the attached Table 1.

Historic Stream Flows

The progress report of December 1947 contains tables showing the recorded and estimated stream flows at key gaging stations for the years 1914-1945, inclusive. That report also contains an explanation of the methods used to estimate stream flows at the various gaging stations during the period of non-record. The average annual stream flows at key gaging stations for the period 1914-1945, inclusive, are shown on the attached Table 1.

Historic Runoff at State Lines

The runoff per square mile from ungaged drainage areas within each state was determined by computing the net gain between gaging stations, adding the estimated channel losses and dividing by the drainage areas. The average annual flows (period 1914 to 1945, inclusive) at State Lines are estimated to be as follows:

AVERAGE ANNUAL HISTORIC FLOWS
AT STATE LINES (1914-1945, incl.)

	1000 A.F.
Arizona	
Ungaged area tributary to San Juan River	86.5
Ungaged area tributary to Colorado River	46.8
Arizona share of main stem channel losses within State	-0.1
Net flow at State Line	133.2
Colorado	
Little Snake River (at mouth)	226.9
Yampa River (exclusive of Little Snake River)	1,172.5
White River	576.2
Ungaged area tributary to Green River	27.4
Colorado River including Gunnison River	5,469.9
Dolores River	762.3
San Juan River above Rosa	929.9
Pine River	294.7
Animas River	807.2
LaPlata River	30.9
Mancos River	48.2
McElmo Creek	51.1
Ungaged area tributary to San Juan River	13.5
Colorado share of main stem channel losses within State	-2.3
Net flow at State Line	10,408.4
New Mexico	
Ungaged area tributary to San Juan River	192.1
New Mexico share of main stem channel losses within State	-6.0
Net flow at State Line	186.1

Utah	1000 A.F.
Tributaries of Green River above Linwood	158.8
Henry's Fork	66.8
Brush Creek near Jensen	36.0
Ashley Creek near Vernal	78.0
Duchesne River near Randlett	653.3
Price River at Mouth	87.6
Ungaged area tributary to Green River	127.4
Dolores River	23.2
Ungaged area tributary to Colorado River above Cisco	17.7
Paria River	18.1
Ungaged area tributary to Colorado River below Green River, Bluff and Cisco	777.3
Ungaged area tributary to San Juan River at Bluff	29.2
Utah share of main stem channel losses within State	-50.6
Net flow at State Line	2,022.8

Wyoming	
Green River above Linwood	1,364.4
Little Snake River (at State Line)	249.8
Ungaged area tributary to Green River below Linwood	15.1
Wyoming share of main stem channel losses within State	-18.7
Net flow at State Line	1,610.6
Sum of flows at State Lines	14,361.1

Channel Losses

Average annual channel losses used in the studies reported herein were estimated by the application of appropriate evaporation and consumptive use rates to areas of channel exposed, such areas being estimated from available maps. Channel losses were computed for reaches from Lees Ferry, Arizona, to Granby, Colorado, on the Colorado River; from the mouth to Rosa, New Mexico, on the San Juan River; from the mouth to Green River, Wyoming, on the Green River; and on major tributaries to state lines or to headwater areas. This method of computing channel losses was deviated from only on the Colorado River between the gaging stations at Cisco, Utah, and Cameo, Colorado These gaging stations indicate a depletion of the river greater than the sum of the calculated irrigation depletions and evaporation channel losses reduced by a nominal inflow from the intervening drainage area. Since the records of streamflow, calculated irrigation depletions, and inflow estimates are believed to be reasonable, the additional depletion was charged to channel losses in that reach of river.

The channel losses adopted by the Committee were compared with those calculated by hydrographic analysis and other methods were applicable, and are believed to be reasonable.

A comparison of the annual streamflows, with the annual channel losses, estimated by means of differential hydrographs at Lees Ferry and the combined flows of Colorado River at Cisco, Utah; Green River at Green River, Utah, and San Juan River at Bluff, Utah, shows that the channel losses are not uniform each year, but that they vary with the streamflow, being smaller than average in years of less than average streamflows. Similar variations in annual channel losses were found in the studies of the various reaches of the San Juan River. It is assumed that on the other tributaries annual channel losses similarly will vary with the annual runoff.

Historic Contributions at Lee Ferry

Estimated channel losses and unmeasured inflows between state lines and key gaging stations were used to compute the contributions at state lines. The channel losses on water conveyed out of the state to Lee Ferry were proportioned to the state on the basis of the proportionate part of the total quantities of water carried through the channels. The aggregate amounts of such out-of-state channel losses and the estimated contributions by states of the historic flow (average 1914-45, inclusive) at Lee Ferry are as follows:

State	Historic Flow at State Lines acre-feet	Out of state losses acre-feet	Historic Contribution to Flow at Lee Ferry	
			Acre-feet	% of Total
Arizona	133,200	1,000	132,200	0.96
Colorado	10,408,400	455,600	9,952,800	72.18
N. Mexico	186,100	7,700	178,400	1.29
Utah	2,022,800	6,000	2,016,800	14.63
Wyoming	1,610,600	102,200	1,508,400	10.94
Total	14,361,100	572,500	13,788,600	100.00

Streamflow Depletions

To determine the virgin (or reconstructed) streamflow at state lines and at Lee Ferry, it is necessary to add to the historic flows the effect at these points of the past upstream depletions caused by the activities of man. The principal cause of such past depletions is irrigation development within the Colorado River Basin. Other causes of streamflow depletion are trans-mountain diversions outside of the basin, evaporation losses from reservoirs, and consumptive use of water by cities, towns, etc.

The depletion at Lee Ferry was estimated as follows:

(1) The man-made depletions at the sites of use were estimated. For irrigation this involved the determination of (a) the irrigated area; (b) the crop distribution; (c) the areas and character of lands in addition to crop lands, such as canals, drainage ways and incidental seepod areas adjacent to irrigated crop lands which consume water because of man's activities; (d) the estimation from climatic data, irrigation practices and experimental data of rates of consumptive use of irrigation water.

(2) The man-made depletions at the sites of use by cropped land and by incidental water consuming areas were routed downstream through the appropriate channel sections to determine the reduction in channel losses which have taken place due to the decrease in streamflow caused by such depletions between the sites of use and Lee Ferry.

Irrigated Areas

The following tabulation shows the average irrigated areas for the study period, 1914-1945, inclusive, and the present irrigated areas adopted by the Engineering Committee. The figures presented herein supersede those shown in the progress report of December 1, 1947.

State	Irrigated Areas - Acres: Average for 1914-1945, incl.	Present
Arizona	3,770	9,840
Colorado	790,606	790,600*
New Mexico	39,000	43,620
Utah	288,520	303,977
Wyoming	228,700	236,675
Total	1,350,596	1,384,712

* Assumed to be same as average for period, 1914-1945.

Incidental Areas

The areas of non-cropped land adjacent to and consuming irrigation water incidental to the irrigation of the crop lands were estimated by inspection of the Bureau of Reclamation land classification sheets, field inspection, availabel aerial surveys and other detail and general maps of the irrigated areas. The incidental areas adopted by the Committee are as follows:

(Average for Study Period, 1914-1945, inclusive)

Arizona	Negligible
Colorado	106,812 Acres
New Mexico	6,482 "
Utah	48,625 "
Wyoming	28,600 "
Total	190,519 "

Rates of Depletion

Field experimental data within the Colorado River Basin to determine unit rates of consumptive uses are available for the New Fork Area, Wyoming, and Uncompahgre Project, Colorado. Similar data are available at other experimental plots outside of the Colorado River Basin. To transfer the consumptive use data to various sites of use within the Colorado River Basin, empirical relationships between the experimental data and climatological data were used. The method developed by H. F. Blaney of the Department of Agriculture, who is an authority on consumptive use, was adopted. Arrangements were made to secure the services of Mr. Blaney and Wayne Criddle of the Department of Agriculture to study the problem. A field inspection trip over the Colorado River Basin was arranged so they could inspect the various areas and interview local water masters, water commissioners, water users, personnel of the Soil Conservation Service and the Bureau of Reclamation, and others regarding data on irrigation practices and adequacy of water supply in the various areas of the basin. With these data appropriate rates of consumptive use of irrigation water at the sites of use were selected.

Past Man-made Depletions at Sites of Use

The rates of consumptive use of irrigation water for various crops and types of native vegetation were applied by the Engineering Advisory Committee to the irrigated and incidental areas to secure the past man-made depletions at sites of use. The past man-made depletions at sites of use are summarized in the following table:

Man-made Depletions at Sites of Use
Averages for 1914-1945, incl.
Acre-feet

Type of Use	Ariz.	Colorado	N. Mex.	Utah	Wyoming
Cropped Lands	3,790	821,378	56,174	384,043	183,620
Incidental Areas	---	178,662	14,993	81,001	40,750
Transmountain Diversion	---	43,713	---	79,000	---
Res. Evap. Losses	200	10,000	---	13,500	2,200
Domestic Use	---	9,000	1,000	3,000	1,100
Less Water Supplied from Importations	---	---	---	4,000	---
Totals at Sites of Use	3,990	1,062,753	72,167	556,544	227,670
Total for Basin					1,923,124

"Salvaged" Channel Losses

The depletions at the sites of use were routed downstream to Lee Ferry to determine the change in channel losses resulting from man-made depletions. The differences between average past channel losses and the channel losses as they would have been had the depletions not been made represent "salvaged" channel losses as follows:

Average 1914-1945

State	Salvaged Channel Losses (acre-feet) Within state	Out of state	Total
Arizona	0	0	0
Colorado	20,000	26,700	46,700
New Mexico	900	1,800	2,700
Utah	11,700	500	12,200
Wyoming	1,300	10,400	11,700
Totals	33,900	39,400	73,300

Estimate of Man-made Depletions at States Lines and at Lee Ferry

Deducting the salvaged channel losses from the man-made depletions at the sites of use results in depletions at state lines and at Lee Ferry as shown in the following table. For convenience this table also shows the estimated depletions at the sites of use.

Man-made Depletions
(Units Acre-feet) Rounded to Nearest 100 AF
Averages for 1914-1945, incl.

State	At Sites of Use	At State Lines	At Lee Ferry
Arizona	4,000	4,000	4,000
Colorado	1,062,800	1,042,800	1,016,100
New Mexico	72,200	71,300	69,500
Utah	556,500	544,800	544,300
Wyoming	227,700	226,400	216,000
Total	1,923,200	1,889,300	1,849,900

For convenient reference there is attached hereto a tabulation showing the past depletions at state lines by tributaries.

Virgin Flow at Lee Ferry

Virgin streamflow contributions at state lines and at Lee Ferry were obtained by adding to the historic contributions the man-made stream depletions estimated at these sites. The following table shows the virgin contributions at state lines and Lee Ferry and also the out of state channel losses which were estimated for average undepleted flow conditions.

Virgin Flows at State Lines and Lee Ferry

State	Virgin flow at state lines acre-feet	Out of state losses acre-feet	Contribution to virgin flow at Lee Ferry acre-feet	Contribution to virgin flow at Lee Ferry % of total
Arizona	137,200	1,000	136,200	0.87
Colorado	11,451,200	482,300	10,968,900	70.14
New Mexico	257,400	9,500	247,900	1.58
Utah	2,567,600	6,500	2,561,100	16.38
Wyoming	1,837,000	112,600	1,724,400	11.03
Total	16,250,400	611,900	15,638,500	100.00

Main Stem Reservoir Operations

The flow of the Colorado River is not uniform but varies from year to year. At Lee Ferry the historic flow has ranged between a minimum of about 4,400,000 acre-feet in 1934 to a maximum of about 21,900,000 acre-feet in 1917. The average historic flow for 1914-1945, inclusive, was 13,788,600 acre-feet. In the 10-year period of lowest historic flow, 1931-40, inclusive the average annual flow at Lee Ferry was 10,151,000 acre-feet.

In the absence of replacement reservoirs the Upper Basin, under the terms of the Colorado River Compact, during such a period as 1931 to 1940, inclusive, could deplete the virgin flow of the Colorado River at Lee Ferry by only about 4,300,000 acre-feet. To permit full use of the Upper Basin allocation of 7,500,000 acre-feet annually during drought cycles, holdover reservoirs must be constructed in the Upper Colorado River Basin to impound water in years of high runoff and to release such stored water in critical periods of low runoff, such as 1931-40, to help meet the Upper Basin obligation at Lee Ferry.

Such reservoirs will deplete the flow at Lee Ferry by reason of evaporation losses. The amount of holdover storage capacity required to regulate the streamflow and the depletion of flows at Lee Ferry due to reservoir evaporation losses can only be approximated until alternative storage sites have been studied in detail and the locations and capacities of reservoirs selected. One important factor, which cannot now be precisely evaluated, but which will have a marked influence on the holdover storage capacity needed is the effect of upstream development of future irrigation projects and storage reservoirs. Such projects will furnish some equation of streamflows and will decrease the storage capacity needed in the holdover reservoirs, shown in the studies reported herein.

Operation studies were made, assuming that all holdover storage would be provided at the Glen Canyon site on the Colorado River. For simplification in operation it was assumed that the flow at Lee Ferry would be maintained at an annual rate of 7,500,000 acre-feet during the period of drawdown and refilling of the reservoir and that increased upstream depletions would be at a uniform rate of 5,174,100 (7,500,000 represents allocated water, minus 1,849,900 which represents our estimate of present depletions,

minus 476,000 which represents our estimate of evaporation losses from holdover reservoirs) acre-feet annually. It was also assumed that 5,000,000 acre-feet of storage capacity would be reserved as dead storage for power head and sediment.

These studies show a required storage capacity of 34,200,000 acre-feet (live capacity 29,200,000 acre-feet) to regulate the flow of the Colorado River in the manner indicated. The average annual stream depletions due to reservoir losses are estimated to be about 476,000 acre-feet.

During a closed cycle (by "closed cycle" I mean the streamflow at the end of 1945 is the same as 1914) operation for the 32-year period such a reservoir would perform in the following manner:

(a) Be at dead storage level at the end of 1940.
(b) Refill during the period from 1941 to 1945 and from 1914 to 1920.
(c) Be generally full and spilling from 1920 to 1929, inclusive.
(d) Be drawn down during the period, 1930 to 1940, inclusive.

The reservoir operation studies described herein show the average annual use of the virgin flow at Lee Ferry as follows: (average 1914-1945)

Depletion of flow at Lee Ferry by irrigation, etc. in Upper Colorado River Basin.	7,024,000 AF
Depletion of flow at Lee Ferry by evaporation losses from holdover reservoirs.	476,000 AF
Sustained flow at Lee Ferry for Lower Basin	7,500,000 AF
Spill from reservoir (would largely occur in 7 years)	638,500 AF
Total average virgin flow	15,638,500 AF

Respectfully submitted,

Engineering Advisory Committee

(Signed)	J. R. Riter	Chairman
	H. P. Dugan	U.S.B.R.
	R. I. Meeker	Arizona
	R. J. Tipton	Colorado
	F. C. Merriell	Colorado
	R. M. Gildersleeve	Colorado
	John H. Bliss	New Mexico
	J. R. Erickson	New Mexico
	C. O. Roskelley	Utah
	H. T. Person	Wyoming
	R. D. Goodrich	Wyoming."

There are attached to the document two tables.

THE CHAIRMAN: Pardon me, Mr. Riter. I believe you should mention a few other eminent engineers who have participated in the preparation of this report in order that the record may be complete.

MR. RITER: That is all.

THE CHAIRMAN: There are no names to add?

MR. RITER: We have acknowledged the help of Mr. Blaney and Mr. Criddle, who were a very great help to us in selecting the consumptive use rates. All the Bureau of Reclamation offices concerned with the use of water in the Colorado River Basin have participated and have furnished information useful to the Committee. While Mr. E. O. Larson, Director of Region 4, has not had time personally to attend our meetings he has made available to us the services of C. B. Jacobson, his Regional Hydrologist. He has made available to us the services of his field men, Mr. C. H. Jex at Grand Junction, John J. Hedderman at Durango, and Mr. Palmer DeLong at Kemmerer, Wyoming. These men accompanied the Engineering Committee on the field inspection trip and made available a large share of the field records.

I think at this time the Engineering Committee should express its deep debt of gratitude to F. C. Merriell, who is a constant inspiration to us and who worked very hard and diligently. As a matter of fact he worked so hard on this that I think that was part of the reason for the breakdown of his health. I am sure that without his work the report would not have been completed. I wish to acknowledge that at this time.

Mr. Patterson, who was formerly a member of the Committee, worked with us up to the time of the submission of the Progress Report in December 1947. He has not been with us since then.

Mr. Gail Baker of Arizona was a member of the Committee but he has had other duties. I asked him if he wanted to sign the report but he decided that if Ralph Meeker's name was on it he was satisfied. Mr. Baker did read the report, however.

There are attached to the report two tables, which I will not read but which will be available for study. Table 1 is the table of streamflows at key gaging stations and the drainage areas in square miles. There is a total of 46 stations for which we have tabulated historic flows, the averages, from 1914 to 1945.

(Table 1 above referred to is as follows:)

"UPPER COLORADO RIVER BASIN KEY GAGING STATIONS

	Streamflow Station	Mean Historic Flow Water Years 1914-1945 1000 A.F.	Drainage Areas Square Miles
1.	Green River at Green River, Wyo.	1260.5	7670
2.	Blacks Fork near Millburne, Wyo.	113.2	156
3.	East Fork of Smith Fork near Robertson, Wyo.	32.5	53
4.	West Fork of Smith Fork near Robertson, Wyo.	16.3	37
5.	Green River near Linwood, Utah	1501.6	14300
6.	Burnt Fork near Burnt Fork, Wyo.	25.1	53
7.	Henrys Fork near Lonetree, Wyo.	32.4	55
8.	Henrys Fork at Linwood, Utah.	66.8	530
9.	Little Snake River hear Dixon, Wyo.	423.5	1028
10.	Little Snake River near Lily, Colo.	472.4	3680
11.	Yampa River at Steamboat Springs, Colorado	345.1	604
12.	Yampa River near Maybell, Colorado	1189.5	3410
13.	Brush Creek near Jensen, Utah	36.0	255
14.	Ashley Creek near Vernal, Utah	78.0	101
15.	Duchesne River at Myton, Utah	439.5	2705
16.	Duchesne River near Randlett, Utah	653.3	3820

17.	White River near Meeker, Colorado	461.7	762
18.	White River near Watson, Utah	582.0	4020
19.	Price River near Heiner, Utah	92.6	430
20.	Green River at Green River, Utah	4658.4	40920
21.	Colorado River at Hot Sulphur Springs, Colo.	*	782
22.	Colorado River at Glenwood Springs, Colorado	2080.4	4560
23.	Roaring Fork at Glenwood Springs, Colorado	1028.0	1460
24.	Colorado River near Cameo, Colo.	3505.0	8055
25.	Plateau Creek near Cameo, Colo.	186.3	604
26.	Gunnison River near Grand Junction, Colorado	2054.9	8020
27.	Dolores River at Gateway, Colo.	788.1	4350
28.	Colorado River hear Cisco, Utah	6186.0	24100
29.	Sum of San Juan, Rio Blanco and Rito Blanco Rivers at Pagosa Springs, Colorado	399.5	379
30.	Navajo River at Edith, Colorado	131.8	165
31.	Piedra River at Arboles, Colorado	380.6	650
32.	San Juan River at Rosa, New Mexico	956.6	1990
33.	Pine River at Ignacio, Colorado	256.4	448
34.	San Juan River near Blanco, N. Mex.	1260.2	3558
35.	Animas River at Durango, Colorado	654.7	692
36.	Animas River near Cedar Hill, N. Mex.	806.7	1092
37.	Animas River at Farmington, N. Mex.	753.8	1360
38.	San Juan River at Farmington, N. Mex.	2111.4	7245
39.	La Plata River at Colorado-New Mexico State Line	30.9	331
40.	San Juan River at Shiprock, N. Mex.	*	12876
41.	Mancos River near Towaoc, Colo.	52.0	550
42.	McElmo Creek near Cortez, Colo.	41.0	233
43.	San Juan River near Bluff, Utah	2275.6	23010
44.	Paria River at Lees Ferry, Arizona	25.3	1550
45.	Colorado River at Lees Ferry, Arizona	13763.3	108335
46.	Colorado River at Lee Ferry, Arizona	13788.6	109889

* Mean for Water Years 1914-1945 not computed.

Table 2 was referred to in the text. It is depletions at state lines by principal tributaries. There is one little explanation in Colorado that might be in order. For McElmo Creek a depletion of 65,500 acre feet is shown. Actually that depletion results from water that is transferred from the Dolores River Basin into the San Juan Basin. A large share if not all of that depletion comes from the water from the Dolores River, which averages about 100,000 acre feet annually and is taken from the Dolores River into McElmo Creek for the irrigation of lands.

(Table 2 above referred to is as follows:)

Averages for 1914-1945, Inclusive

Depletions at State Lines by Principal Streams - Acre-feet (rounded)

State	Stream	Depletion
Arizona	All	4,000
Colorado	Little Snake	11,300
	Yampa River	52,100
	White River	33,700

Colorado	Colorado River	723,000
	Dolores River	39,200
	San Juan above Rosa	13,600
	Pine River	41,500
	Animas River	30,000
	LaPlata River	20,400
	Mancos River	11,400
	McElmo Creek	65,500
	Miscellaneous, small	1,100
	Subtotal Colorado	1,042,800
New Mexico	San Juan Basin	71,300
Utah	Green above Linwood	C
	Henry's Fork	11,300
	Other tributaries above Green River, Utah	415,200
	Colorado River & tributaries above Cisco, Utah	0
	San Juan above Bluff	9,000
	Remainder of State	105,300
	Import	4,000
	Subtotal Utah	544,800
Wyoming	Green River above Linwood	193,500
	Little Snake River	19,300
	Miscellaneous areas	13,600
	Subtotal Wyoming	226,400
	Total for Upper Basin	1,889,700

That completes the submission except for such questions or explanations that might be requested.

COM. STONE: Mr. Chairman, as a matter of procedure--Colorado, and I am sure it is true of other states, has certain water officials here. In the case of Colorado we have three members of the Colorado Water Conservation Board here. And it seems to me that this report ought to be duplicated or reproduced in sufficient number for the use of those representing the various states, particularly in an official capacity. I understand that these typewritten reports are limited in number and have been distributed to the members of the Commission. May I inquire whether it would be agreeable to the Chairman and the Commission for this report, today if possible, to be reproduced in such number as each state may indicate for its use here.

THE CHAIRMAN: It is certainly agreeable to the Chairman provided the facilities are available for complying with your request, Judge Stone.

This is a very important report in the deliberations of this Commission. It is signed by the most eminent engineers that you can find in the West. And they proceeded in the knowledge of the Chairman, not as representatives of any state, but as a group. There was no jockeying and juggling around for advantage in the data presented in this report. It is a factual presentation and in the opinion of the Chairman it is extremely important that this report receive the consideration to which it is entitled. The Chairman made the statement a while

ago that some very excellent work had been done. As far as the Chairman is concerned this is evidence in support of his statement and further evidence will be submitted later.

It is assumed then that the report of the Engineering Advisory Committee will be reproduced in sufficient number to pass around among the advisers to the State Commissioners.

MR. TIPTON: Mr. Chairman and the chairman of the Engineering Committee, I think it should be made clear for the record, and I think it is rather important--it is not completely clear in the report--that the rates of depletion at points of use that results from man's activities were worked out entirely by Mr. Blaney and Mr. Criddle. The aid that was given to those gentlemen was furnishing information as to irrigation practices, adequacy of water supply, and then the mechanical aid of assisting them in working out certain arithmetical computations.

THE CHAIRMAN: Thank you, Mr. Tipton. It is the intention of the Chairman later to call on you for repetition of your most excellent presentation made at the meeting in Denver last week and at an appropriate time we will call on you for that. It may be that now is the appropriate time but that is up to the--

MR. TIPTON: I would suggest, Mr. Chairman, that that come in the regular order of procedure at the time some of the basic matters which will be presented by the Legal Advisory Committee are under consideration by the Commission.

THE CHAIRMAN: You would prefer your presentation be deferred then until the chairman of the Legal Advisory Committee has made his report?

MR. TIPTON: I prefer it come within the context of the Legal Advisory Committee's report.

THE CHAIRMAN: Very well.

MR. WALLACE: Mr. Chairman, may I ask a question of Mr. Riter? Apparently there has been no study made of reservoir locations?

MR. RITER: There have been a number of studies made. Region 4 of the Bureau of Reclamation is continuing those studies but they have not advanced to the point where the committee is in a position to select reservoir sites. We secured and studied information on rates of evaporation losses and assumed that the entire holdover capacity would be provided at the Glen Canyon site. This assumption was made for the purpose of arriving at a figure on the amount of evaporation losses.

Mr. Larson is endeavoring to find combinations of reservoirs which will have a minimum of reservoir loss per acre-foot of storage capacity, which will have opportunities for development of hydroelectric power and which will serve multiple uses.

Those studies have not reached a point of investigation where the information that will be developed by them is available to the Committee.

In the absence of detailed data, we made an estimate which was 476,000 acre feet stream depletion from reservoir losses. That is new losses over and above present losses in the reservoirs sites.

COM. STONE: Mr. Riter, following up Mr. Wallace's question may I ask

this: Would the assumed loss at Glen Canyon be the maximum loss of such hold-over storage?

MR. RITER: When you try to project yourself into the future you always get in trouble. I think it represents a reasonable estimate of reservoir losses.

MR. WALLACE: Mr. Riter, what about the estimate of losses of 831,000 acre feet contained in the Bureau report?

MR. RITER: We don't estimate losses quite that high. The Bureau itself in its most recent studies has found losses. When we compiled the Bureau report we listed the reservoir sites for which we had information at that time. Since 1946 Mr. Larson in his studies has reviewed the matter and eliminated some reservoir sites because they were heavy evaporators. You will recall that we listed the Dewey Reservoir Site, for a capacity of some five or six million acre feet. When that Dewey Reservoir is compared with other reservoir sites I think it will not be among the recommended reservoirs because of its high rate of evaporation loss. The Glen Canyon site is an efficient reservoir from the standpoint of evaporation losses.

Going back to Judge Stone's question: We have tried to be as careful as we can in estimating the future reservoir losses. There is always a possibility which cannot be accurately foreseen that the reservoir losses may be worse than we anticipate. There are other reservoirs built in the Southwest--I particularly refer to the Elephant Butte Reservoir on the Rio Grande and to the McMillan Reservoir on the Pecos. At the time those reservoirs were planned nobody ever anticipated extremely high losses from them. In the meantime, however, very thick growths of salt cedars have occurred at the backwaters of those reservoirs. The reservoir losses have far exceeded the first engineer's estimate.

In travelling through the Colorado River Basin we have noted several instances where salt cedars are growing along the Colorado River and its tributaries. We cannot accurately foresee future conditions. It is entirely possible, however, that if some of these growths should take place in the delta area at the backwater of the reservoirs, the losses will be larger than we anticipate.

MR. WALLACE: What is the additional loss over your original estimate?

MR. RITER: On what?

MR. WALLACE: Because of this salt cedar situation?

MR. RITER: We have made no attempt, Mr. Wallace, to make an estimate of that in this particular case. I do not know. We have no means of making a forecast on that. That is one of the things the future will have to settle for us.

Now there is another factor: In making these studies we took the historic streamflow the way they had occurred; then we assumed that the increased rates of depletion at upstream sites would be uniform. We know that assumption is not entirely correct. We know for example that there will need to be additional reservoirs above the sites of use to regulate the streams to make water available in years of low runoff. The effect of such upstream reservoirs and the effect of return flows from upstream irrigation developments will be to create a partial regulation of the streamflow.

We haven't tried to make a precise evaluation of that factor. The Engineering Committee believes that the effect of such upstream irrigation

developments and storage developments will be quite marked and we believe the effect will be to reduce somewhat the requirements of the downstream regulating reservoirs, and if we reduce the requirements, we therefore reduce the evaporation loss. We have to make so many assumptions that I don't think the results would be materially different from reported study. Such requirements would be pretty much of an academic study.

I would like to propose the use of a round figure of about a half million acre feet. For comparison, our report shows 476,000 acre feet.

Judge Stone, that discussion was directed in response to your question; does it answer you satisfactorily?

MR. TIPTON: I think, Mr. Chairman, the most important item that would tend to reduce that would be the last item that the Chairman of the Engineering Advisory Committee mentioned, the equation of the streamflow by future development in the Basin. It would be a physical impossibility for the Basin to utilize 7,500,000 acre feet during such a period as 1931 to 1940 without substantial regulation to make available water at points of use. Such regulation will have a very marked effect on the equation of the flow of the stream, reducing substantially the indicated amount of replacement capacity as shown in the engineers' report.

So that the rate of reservoir loss on these main stream reservoirs may be greater than assumed by the Engineering Committee due to growth of salt cedars and other water-loving plants; however, there is the other counteracting factor, namely, there will be lower losses at those reservoirs used by projects and project areas if you assume those rates will be somewhat less because those reservoirs will be located at higher elevations at points where temperatures are less than on the main stream.

THE CHAIRMAN: Gentlemen, it is now twelve o'clock. Do you wish to recess until about one-thirty, or shall we continue the discussion of this report?

Are there any objections to recessing until two p.m. today? (No response.) We will now stand recessed until two p.m.

(12:00 Noon, Recess.)

(2:00 p.m., Meeting resumed.)

THE CHAIRMAN: Will the meeting please come to order. In about five minutes we will have the mimeographed copies of the report of the Legal Advisory Committee ready for distribution. Of course it is expected that that will be handled wisely and not taken as something to be scattered to the four corners of the United States as a decision of this Commission. It is merely a report.

Now in the meantime the Chair proposes the following procedure: The Commission will hereafter have regular sessions beginning at nine-thirty in the morning and ending at twelve-fifteen p.m. each day. That is right before lunch. This will afford time during the afternoons for work by committees and technicians. Of course, should it be found desirable at any time to change this schedule and to hold meetings of the Commission in the afternoon, that can be done.

How do you like that proposed procedure? Personally I think it is a

very good idea for this reason: As I mentioned to you this morning, the best work done in Denver at a meeting of the Legal and Engineering Advisory Committees was not in joint meeting but in the law offices around Denver and in the rooms in the hotel. Judge Wilson, you are looking very seriously about the matter; do you have any objection to that procedure?

COM. WILSON: I very seriously believe it is good procedure.

THE CHAIRMAN: The Chairman is waiting to hear objections. (No response.) Without objections that will be our procedure during the remainder of our negotiations here in Vernal.

Now you gentlemen may relax for a few moments until we can have available for us the report of the Legal Advisory Committee unless there is something else that some member of the Commission or some adviser wishes to submit at this time.

Mr. Carson, are you now ready to submit for the consideration of the Commission the report of the Legal Advisory Committee?

COM. CARSON: Yes, sir. The report of the Legal Advisory Committee has been mimeographed and I think copies are available. The report of the Legal Advisory Committee is in two parts: One is the report of the Committee itself; and one is headed "Attachments", which are proposed articles, proposed for the consideration of the Commission. I think it would be helpful probably if I read the report:

"The Upper Colorado River Compact Commission at its Meeting No. 6 referred to the Legal Advisory Committee ten matters, some of which were to be considered jointly by the Legal Advisory Committee and the Engineering Advisory Committee, and to the Engineering Advisory Committee alone one matter.

The Legal Advisory Committee met in Denver June 29th, 30th, and July 1st, 2nd and 3rd. At each of the meetings of the Legal Advisory Committee there were present:

J. G. Will, Legal Adviser to the Federal Representative;
Judge Fred E. Wilson of New Mexico;
Jean S. Breitenstein, and at some of the meetings,
James D. Geissinger, of Colorado;
W. J. Wehrli of Wyoming;
Judge J. A. Howell and Edward W. Clyde of Utah; and
Charles A. Carson of Arizona.

On the days on which the Legal Advisory Committee met with the Engineering Advisory Committee it is our understanding that the report of the Engineering Advisory Committee will show the names of the engineers who participated.

It must be understood that this report as well as the previous report of the Legal Advisory Committee and the compact provisions suggested for consideration by the Compact Commission are necessarily tentative. Decisions yet to be made by the Commission on both substantive and administrative matters will necessarily affect the proposals here made. The Legal Advisory Committee and each of the members thereof may desire to make further or different recommendations after further progress has been made in forming a compact.

The matters referred to the Legal Advisory Committee for consideration and the matters referred to the two committees jointly, as well as the one

matter referred to the Engineering Advisory Committee alone, were as follows:

1. Shall the allocation of beneficial consumptive use be subject to future adjustment in the event that any state does not make full beneficial consumptive use of its allotted share within a stated period. Rejected by Commission. (Tr. 48) Reallocation principle was approved and the item was referred to the Legal Committee for suitable language. (Tr. 280)

2. Provisions for periodic review of compact terms and conditions. Referred to Legal Committee. (Tr. 221)

3. Shall compact contain any provision relating to the delivery of water at Lee Ferry for the use of Mexico in the event there is not sufficient surplus water to supply the Mexican share. Commission recognized Mexican obligation and referred item to Legal Committee for drafting of suitable language. (Tr. 243)

4. Should the compact contain any provision relative to extraordinary drought in order to take advantage of the applicable provisions of the Mexican Water Treaty. Referred to Legal Committee. (Tr. 245)

5. What general provision should be incorporated in the Upper Basin Compact to recognize the validity and the applicability of the Colorado River Compact. Validity and applicability of Compact recognized and item referred to Legal Committee for suitable language. (Tr. 250)

6. Should the definitions contained in Article II of the Colorado River Compact be incorporated without change in the Upper Basin Compact. Referred to Legal Committee and deferred as one of the later items on the agenda to include other possible definitions that might be required. (Tr. 254)

7. Should paragraphs (f) and (g) of Article III of the Colorado River Compact relating to the apportionment of unapportioned water be carried over into the Upper Basin Compact. Referred to Legal Committee to draft appropriate language to protect Upper Basin States' rights in unapportioned water. (Tr. 262)

8. What provision shall be made with relation to the existing LaPlata River Compact. Referred to Legal Committee for appropriate language incorporating the LaPlata Compact provisions in the Upper Basin Compact. (Tr. 283)

9. Definition of term "beneficial consumptive use". Referred to Legal and Engineering Committees. (Tr. 322)

10. Method of measuring beneficial consumptive use, consideration of method of treatment of conveyance losses, consideration of method of treatment of so-called salvage water, and the determination of general type of formula for defining obligations of the states to make deliveries at Lee Ferry. Referred to Engineering Committee. (Tr. 323)

11. Recommendation of Legal Committee, Charging Reservoir Losses, referred to Engineering Advisory Committee to consult with Legal Advisory Committee for consideration of clause at a later date. (Tr. 209)

Your Legal Advisory Committee on the matters referred to it reports as follows:

1. In considering Item No. 1 as hereinabove set forth the Legal

Advisory Committee concluded that its consideration of that matter should be deferred for further instruction from the Commission itself because the instruction was not clear to the Committee, and because also the Commission had previously tentatively decided to apportion water to individual states in perpetuity. However, the Committee did prepare one proposed article which would make it clear that the water apportioned to any state should be in perpetuity and that that state's failure to utilize the water should not constitute any abandonment of its right. (See Attachment "M".)

2. The Legal Advisory Committee also concluded to defer consideration of Item No. 2 listed above, which indicated that the Commission referred to the Legal Advisory Committee the question of whether or not there should be a periodic review of compact terms and conditions. Such a provision seemed to the Legal Advisory Committee to be inconsistent with the decision of the Commission to apportion water in perpetuity and it seemed to the Legal Advisory Committee that such a provision would render uncertain the allocations which may be agreed upon.

3. The Legal Advisory Committee without specifically referring to the delivery of water at Lee Ferry for the use of Mexico it is believed has sufficiently covered the matter in the proposed article which for purposes of identification is marked "A" and attached to this report.

4. The Legal Advisory Committee suggests for the consideration of the Commission the addition to the "Powers" of the administrative agency to be known as the Upper Colorado River Commission, contained in the previous report of the Legal Advisory Committee, of subdivision 10, which would necessitate changing the numbers of the present 10 to 11, and of the present 11 to 12. The proposed additional subdivision 10 is attached to this report and marked "B" for identification. Further recognition is given to the obligations of the United States under the treaty with the United Mexican States in the proposed article marked for identification "C", which is attached to this report.

5. The Legal Advisory Committee suggests the language contained in the proposed article which is marked "D" for identification, which is attached to this report, as appropriate for recognition of the validity and applicability of the Colorado River Compact.

6. The Legal Advisory Committee considers that the appropriate definitions contained in Article II of the Colorado River Compact should be incorporated without change in the Upper Basin Compact but concluded that the article containing the definitions should be deferred until it is ascertained whether or not any other terms used in the Upper Basin Compact should be defined in such proposed article.

7. The Legal Advisory Committee suggests the language in the article marked "E", which is attached to this report, as the appropriate language to provide for any further apportionment that may be made under paragraphs (f) and (g) of Article III of the Colorado River Compact.

8. The Legal Advisory Committee considered a provision recognizing the validity of the La Plata River Compact and suggests for the consideration of the Commission, the article marked "F" attached to this report.

9. The Legal Advisory Committee and the Engineering Advisory Committee considered together the question of whether or not the compact should contain a definition of the term, "beneficial consumptive use", and concluded that it would be unwise to incorporate in the Upper Basin Compact a definition of that term. However, the Legal Advisory Committee was unable to reach

agreement as to whether or not the Upper Basin Compact should contain any definition of the term, "use". No formal vote was taken upon the article herewith submitted for the consideration of the Commission which undertakes to define "use". However, it was apparently the opinion of the majority of the members of the Legal Advisory Committee that such definition should not be included in any Upper Basin Compact. It is referred to the Commission for its consideration and instruction. It is believed that the article referred to, which is marked "G" and hereto attached, is clear as to its purpose.

10. Item No. 10 was referred to the Engineering Advisory Committee alone. However, the Legal Advisory Committee and the Engineering Advisory Committee considered this question as being closely related to No. 9 as herein set out. One of the engineers prepared a proposed article designed to comply with the instruction of the Commission, which article is hereto attached and marked "H" for identification. The Legal Advisory Committee considers that the proposed article correctly sets forth the principle which in the mind of the engineer preparing it should be adopted, but the Legal Advisory Committee has not carefully gone over the language of the article because it considered it unnecessary to do so until the Commission had indicated whether or not it desired to adopt the principle.

11. The Legal Advisory Committee and the Engineering Advisory Committee considered language relating to the charging of reservoir losses referred to the two committees by the Commission under No. 11 above recited. The Legal Advisory Committee prepared an article which is hereto attached marked "I". At a joint meeting with the Engineering Advisory Committee there was some discussion and apparent differences of opinion as to whether or not the proposed article should contain any provisions relating to reservoir losses resulting from the storage of water for the generation of electrical energy. It appeared that some thought the Commission should undertake to make provision for the apportionment of benefits of any electrical energy that might be generated in the Basin and others thought that the Commission should confine itself to the apportionment of the water among the states. The question of the consideration of reservoir losses resulting from the storage of water for the purpose of generating electrical energy has therefore not been covered except as such storage of water may be for the purpose of and utilized in making deliveries of water at Lee Ferry. If the Commission desires anything further as to the charging of reservoir losses which may result from the storage of water for the generation of electrical energy, as distinguished from consumptive uses in the Upper Basin and as distinguished from consumptive uses in the Upper Basin and as distinguished from the purpose of making deliveries of water at Lee Ferry, then the further instruction of the Commission is desired.

In addition to the instructions of the Compact Commission at its meeting No. 6 the Legal Advisory Committee has prepared for the consideration of the Commission an article relating to preferential uses of water, which is taken from the Colorado River Compact and is hereto attached marked "J".

Also the Legal Advisory Committee has prepared for the consideration of the Commission articles marked "K", "L", "M", "N", "O", and "P", which it is believed are self-explanatory.

The Legal Advisory Committee has also prepared for the consideration of the Commission a skeleton article relating to gaging stations, which is marked "Q" and attached hereto.

The Legal Advisory Committee also prepared an article relating to the curtailment of use if necessary, which has already been referred to in connection with Item 3 above and is attached hereto marked "A", which is believed to be self-explanatory.

It must be understood that each member of the Legal Advisory Committee as well as the Committee proposes the articles hereto attached for the consideration of the Commission and each member of the Committee and the Committee itself realize that it may be necessary to change completely any one or all of the articles proposed for the consideration of the Commission and reserve the right to make any further or different recommendations after the Commission has made the necessary decisions and issued the necessary instructions.

Respectfully submitted,

LEGAL ADVISORY COMMITTEE

By Charles A. Carson
Chairman."

(The attachments referred to in the foregoing are as follows:)

Attachment "A"

ARTICLE _____

In the event curtailment of uses by the States of the Upper Division shall at any time become necessary in order that the flow at Lee Ferry shall not be depleted below that required by Article III of the Colorado River Compact, the amount of curtailment of consumptive use of water apportioned to each of the States of the Upper Division by Article _____ hereof, to be made by each of the States of the Upper Division shall be sufficient to deliver at Lee Ferry an amount of water which bears the same relation to the deficiency to be made up as the consumptive use being made by the particular state bears to the aggregate consumptive use of water of the Colorado River System being made at the time by the States of the Upper Division under the apportionment of Article _____ hereof; provided that for the purpose of computing the curtailment that must be made by any state as required by this paragraph, all consumptive uses existing prior to the 24th day of November, 1922, shall be excluded; and provided further that if any state of the Upper Division in the ten years immediately preceding the year in which such curtailment is required to be made shall have consumptively used more water than it was entitled to use under the apportionment made by Article _____ hereof, such state shall be required to supply at Lee Ferry an amount equal to such excess before demand is made on any other state.

Attachment "B"

10. In the event of extraordinary drought or serious accident to the irrigation system in the Upper Basin thereby making it difficult for the Upper Basin to deliver any amount of water which it may be required to deliver in order to satisfy the Water Treaty between the United States of America and the United Mexican States dated February 3rd, 1944, the Commission shall make findings of fact in regard thereto and report such findings to the United States Section of the International Water and Boundary Commission with the request that the water allotted to Mexico under Division III of such treaty may be reduced.

Attachment "C"

ARTICLE _____

Nothing in this compact shall be deemed

. . . . . .

(b) To affect the obligations of the United States of America under the Treaty with the United Mexican States.

. . . . . .

(For complete suggested article see Attachment "K".)

Attachment "D"

ARTICLE _____

Each of the signatory states recognizes the validity of the Colorado River Compact, that it is in full force and effect, and all of the provisions hereof are subject thereto.

Attachment "E"

ARTICLE _____

The use of water as such use is apportioned in perpetuity to the Upper Basin and available for use by the States of the Upper Basin under the Colorado River Compact is hereby apportioned among the States of the Upper Basin, subject to the provisions and limitations appearing therein and herein, as follows:

Arizona	_____	per cent
Colorado	_____	per cent
New Mexico	_____	per cent
Utah	_____	per cent
Wyoming	_____	per cent

The apportionment made to each state shall include all water necessary for the supply of any rights which may now exist.

No apportionment is hereby made, or intended to be made, of such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact, and any apportionment of such uses shall be made in accordance with the terms of such paragraphs.

Attachment "F"

ARTICLE _____

Each of the signatory states recognizes the validity of the La Plata River Compact entered into between the States of Colorado and New Mexico and dated the 27th day of November, 1922, and this compact shall not affect the

apportionment made thereby; provided that water uses made by either Colorado or New Mexico under the La Plata River Compact shall be chargeable to the state in which such water uses occur in determining the use made by such state of water apportioned by Article _____ of this compact.

Attachment "G"

ARTICLE_____

For the purpose of measuring the amount of water used by each of the signatory states and of determining whether any such state may have exceeded the apportionment herein made to it, the use of water is defined to be that by which the water supply of the Upper Colorado River Basin, the use of which is herein apportioned among the signatory states, is consumed through the activities of man and shall include water consumed by evaporation from any canal, ditch, or irrigated area and from any reservoir except as hereinafter provided, and shall include the full amount of water diverted above Lee Ferry and exported from the drainage area of the Colorado River System to the basin of any other stream measured as nearly as may be at the point of departure from the drainage area of the Colorado River System.

The definition in this Article contained is for the sole purpose of measuring the relative use of water by the signatory states under this Compact, and has no relation to or bearing upon the term "exclusive beneficial consumptive use" as employed in paragraph (a) of Article III of the Colorado River Compact.

Attachment "H"

ARTICLE _____

The following table shows the relation between the measured runoff in the 10-year progressive series at the inflow index stations, corrected for man-made depletion above those stations, for the Upper Colorado River Basin and the virgin flow at Lee Ferry.

Index Inflow	Virgin Flow at Lee Ferry
_____	_____
_____	_____
_____	_____

The Commission shall determine for each successive 10-year period the relationship between the measured actual flow at the inflow index stations for the Upper Colorado River Basin corrected for man-made depletions above those stations and the actual measured flow at Lee Ferry corrected for change in storage in the replacement capacity of main stream reservoirs. The extent to which this relationship departs from the relationship indicated in the above table shall be considered as the beneficial consumptive use being made of the water of the Colorado River and its tributaries by the Upper Basin.

The following tables indicate the relationship between the flow at the index inflow stations for each state and the virgin flow at the outflow

stations for that state.

_____	_____
_____	_____
_____	_____

For each successive 10-year period the Commission shall determine the relationship between the actual measured flow at the inflow index stations for each state, after being corrected for man-made depletions being made in that state above those stations, and the measured flow at the outflow stations for that state, and shall determine the magnitude of the departure of that relationship from the relationship shown in the above applicable table. This departure shall be considered to be the beneficial consumptive use within the state.

The relationship between the flow of the main stream and the major tributaries below all present and prospective major irrigation development in the Upper Colorado River as measured at Bluff, Utah, on the San Juan, at Cisco, Utah, on the Colorado River, and the Green River at Green River, Utah, and the actual flow at Lee Ferry is represented by the following table.

_____	_____
_____	_____
_____	_____

The Commission shall determine in each successive 10-year period the relationship between the flow as measured at the above stations and the actual flow at Lee Ferry corrected for change in storage in the replacement capacity of main stream reservoirs located below the inflow stations. The change in this relationship from that shown in the table shall be credited or charged to each state in proportion to the relation between the increase in beneficial consumptive use within the state since 1922 and the aggregate increase in beneficial consumptive use of Colorado River water and its tributaries in the Upper Basin since 1922. The beneficial consumptive use within each state, modified in accordance with the state's proportion of the change in depletion along the main channels, as referred to in the preceding sentence, shall be considered the total beneficial consumptive use being made by the state at the time of the determination.

Attachment "I"

ARTICLE _____

The storage capacity of reservoirs and the water stored therein for the purpose of and utilized in making deliveries of water at Lee Ferry in compliance with the provisions of Article III of the Colorado River Compact shall be considered to be for the common benefit of the states of the Upper Division, and water so stored for such purpose shall not be earmarked for nor charged to any individual state.

Reservoir losses resulting from the storage of water for the joint benefit of such states in making deliveries of water at Lee Ferry shall be charged to the States of the Upper Division in proportion to the consumptive use of

water in each state of the Upper Division during the year for which the charge is made.

Reservoir losses resulting from the storage of water for consumptive use apportioned by Article _____ hereof by one or more states shall be charged to the state or states for whose benefit the water is so stored in proportion to the consumptive use of water by each of such states from said storage.

Attachment "J"

ARTICLE _____

(a) Inasmuch as the Upper Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of the Upper Colorado River Basin, the use of its waters for the purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding.

(b) Subject to the provisions of this compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

(c) The provisions of this article shall not apply to or interfere with the regulation and control by any state within its boundaries of the appropriation, use, and distribution of water.

Attachment "K"

ARTICLE _____

Nothing in this compact shall be deemed

(a) To affect the obligations of the United States of America to the Indian Tribes.

(b) To affect the obligations of the United States of America under the Treaty with the United Mexican States.

(c) To affect any rights or powers of the United States, its agencies or instrumentalities in or to the use of waters of the Upper Basin of the Colorado River, nor its capacity to acquire rights in and to the use of said waters.

(d) To subject any property of the United States, its agencies or instrumentalities to taxation by any state or subdivision thereof, nor to create any obligation on the part of the United States, its agencies or instrumentalities by reason of the acquisition, construction or operation of any property or works of whatever kind, to make any payments to any state or political subdivision thereof, state agency, municipality or entity whatsoever, in reimbursemrnt for the loss of taxes.

(e) To subject any property of the United States, its agencies or instrumentalities, to the laws of any state to an extent other than the extent to which such laws would apply without regard to this compact.

Attachment "L"

ARTICLE _____

The use of water by the United States or any of its agencies, instrumentalities or wards shall be charged to the state in which the use is made.

Attachment "M"

ARTICLE _____

The failure of any state to use the water or any part thereof allocated to it for use under the terms of this compact shall not constitute any relinquishment of such water or the right to use the same, to the Lower Basin or to any other state, nor shall it constitute any forfeiture or abandonment of the right to such use.

Attachment "N"

ARTICLE _____

(a) Subject to the provisions of this compact the water of the Upper Basin of the Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes, and shall not interfere with or prevent use for such dominant purposes.

(b) The provisions of this Article shall not apply to or interfere with the regulation and control by any signatory state within its boundaries of the appropriation, use and distribution of water.

Attachment "O"

ARTICLE _____

Nothing in this compact shall be construed to limit or prevent any state from instituting or maintaining any action or proceedings, legal or equitable, for the protection of any right under this compact or the enforcement of any of its provisions.

Attachment "P"

ARTICLE _____

This compact may be terminated at any time by the unanimous agreement of the signatory states. In the event of such termination all rights established under it shall continue unimpaired.

Attachment "Q"

ARTICLE _____

The Commission shall cause to be maintained and operated a stream gaging station equipped with an automatic stage recorder at each of the following points, to wit:

_____

_____

_____

Stations _____ to _____ shall be considered as inflow index stations for the Upper Colorado River Basin. The station at Lee Ferry shall be considered as the outflow station for the Upper Colorado River Basin.

The inflow index stations and the outflow stations for each main tributary in each of the states shall be as shown in the following table:

State	Tributary	Inflow Index Stations	Outflow Stations
Wyoming	Green River	Green River at Warren Bridge near Daniel	Green River near Linwood, Utah
		New Fork River Near Boulder	
		Fontenelle Cr. near Fontenelle	
		_____	
		_____	
		_____	

COM. CARSON: I don't know, Mr. Chairman, how the Commission would like to proceed on the consideration of any of these proposed articles. I would like to call the attention of the Chairman to the fact that Judge Howell of Utah, who participated in the meetings, is not yet here. I understood from him he would be here either tonight or tomorrow morning.

THE CHAIRMAN: Is it your suggestion, Mr. Carson, that the scrutiny of each of these articles be deferred until Judge Howell is present?

COM. CARSON: I believe we would make time by doing that and in the meantime let each Commissioner look them over with his own people or in groups as they may desire.

THE CHAIRMAN: Gentlemen, you have heard the report of the Legal Advisory Committee as submitted by the chairman, Mr. Carson.

COM. STONE: Mr. Chairman, I move that the report of the Engineering Committee made this forenoon by Mr. Riter and the report of the Legal Committee

which has just been made by Mr. Carson as its chairman, be received by the Commission and made a part of the record for further consideration by the Commission.

COM. WATSON: Second the motion.

THE CHAIRMAN: The Chair understands that the motion was not to accept the report but to receive it.

COM. STONE: I am glad you mentioned that. The motion that was made by me purports merely to receive the report, make it a part of the record, and refer it to the Commission for further consideration, which does not mean that the reports are either approved or disapproved but merely received and made a part of the record for the consideration of the Commission.

THE CHAIRMAN: Is there further discussion of the motion? The motion is to receive the reports, which has been seconded.

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

THE CHAIRMAN: Now it would seem to the Chairman that the members of the Commission and their advisers have considerable to digest and that perhaps it might be digested better by groups and it might be well to adjourn at this time. However, perhaps some of you are better prepared than I anticipate and may wish to discuss the engineering report or the legal report at this time.

COM. STONE: Mr. Chairman, it seemed to me that everyone would be better prepared to discuss particularly the report of the Legal Committee and the suggested articles and clauses of the compact after an opportunity had been afforded to give them some study. I think many of us could discuss them perhaps endlessly but perhaps not too wisely until we have studied them.

THE CHAIRMAN: I am wondering if this is an appropriate time to have Mr. Tipton discuss the question of depletion at point of use?

MR. TIPTON: I would suggest again, Mr. Chairman, that that come up at the time the Commission has under consideration Attachments "G" and "H".

THE CHAIRMAN: You would prefer to defer it?

MR. TIPTON: It isn't up to me to say; it is for the Commission to say. But I think that would be at the proper place when we come to that point. It is perfectly all right with me to lift those out and make those come first. I think that might be well. On some of these other matters probably there would be no difference of opinion and they would need little discussion. It would be perfectly all right with me to take it up in any order you want but I think it would be well to have that as a part of the discussion of those items of the report. In addition to that it requires some exhibits and I would like to ask of the Chairman that all the exhibits that I used in presenting the subject to the Legal Committee and the Engineering Committee be presented to the Commission.

THE CHAIRMAN: Well, it is the opinion of the Chairman that you should use all the exhibits that you have available for use because I think that is very instructive.

COM. CARSON: Then, Mr. Chairman, I move we adjourn until nine-thirty tomorrow morning.

COM. WATSON: Second the motion.

THE CHAIRMAN: It has been moved and seconded that we adjourn until nine-thirty tomorrow morning. (Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

(2:45 p.m., Wednesday, July 7, 1948, recess until 9:30 a.m., Thursday, July 8, 1948.)

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Vernal, Utah
July 8, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order. This morning we will hear a very interesting discussion from a distinguished engineer, a man who is high in the councils of the American Society of Civil Engineers and who has been urged by his friends to be a candidate for the office of vice president of the American Society. This man is tops so far as the ability to analyze and study the water supplies of the United States is concerned. His professional attainments and ability have been recognized by foreign governments and they have retained him in various capacities. He has performed valuable services for the United States. He has been retained by the State of Colorado as consultant but in the opinion of the Chairman he has rendered valuable service to the Upper Basin in the analyses and studies which he has made.

Now, Mr. Tipton, we will be glad to hear from you and your remarks will be incorporated in the record of the Commission and I hope that you will take the time that you need in order to fully explain to the members of the Commission and their advisers the conclusions which you have reached in your studies. Mr. Tipton.

MR. TIPTON: Mr. Chairman, members of the Commission and advisers. Mr. Chairman, you make me blush.

THE CHAIRMAN: I don't think I have exaggerated at all. If I have I will stand corrected.

MR. TIPTON: I am going to talk about two phases of one subject. The subject has to do with the water that was apportioned to the Upper Basin by the Colorado River Compact. The first phase of the subject goes to the question of what is it that this Commission at this session is going to apportion among the States? The only thing that the Commission can apportion is that which was apportioned to the Upper Basin by the original Colorado River Compact Commission in the present Colorado River Compact.

The second phase of the subject which I shall discuss is the means of measuring that which the Commission here will apportion among the States, and the means of measuring that which was apportioned to the Upper Basin by the original Commission.

First let me make this plain: I am not speaking for the State of Colorado alone. I am considering this problem from the standpoint of the Upper Basin as a whole. The subject which I shall discuss is of importance to each State of the Upper Basin and to the Upper Basin as a whole.

In my opinion the record is crystal clear to the effect that the Colorado River Compact Commission in 1922 apportioned a certain part of the virgin flow of the Colorado River between the two basins. The record in my opinion is clear that that which was apportioned to the Upper Basin was 7,500,000 acre feet of the virgin flow of the Colorado River at Lee Ferry.

What we now term "virgin flow", in 1922 was called "reconstructed flow." Both terms mean the flow of the river as it was in the state of nature before man entered the picture. In my opinion under the apportionment that was made by the original Commission the Upper Basin has the right to deplete by man's activities the virgin flow of the Colorado River at Lee Ferry by 7,500,000 acre feet per year.

There is considerable difference between 7,500,000 acre feet of depletion of virgin flow at Lee Ferry and 7,500,000 feet of depletion of the waters of the Colorado River and its tributaries at the places where man is using those waters. There are two main reasons for this difference. The first reason is because of the consumption of water by nature on some of the lands now irrigated, or to be irrigated. The second reason is because of channel losses that are salvaged by man's activities.

On some of the land that is now being irrigated by man, a loss of water was occurring in a state of nature. On an appreciable part of the land that will be irrigated by man in the future, there is now being consumed water by natural processes. That is particularly true on native hay lands that are now irrigated, in the Green River Basin in Wyoming and in some parts of Colorado. A good example of this in Colorado is the Middle Park area near Kremmling. Those lands were irrigated by Nature during the flood season. Man came into the picture and all he did was to start to cut the hay. There isn't a major ditch in that area at the present time. Man cuts the hay and the next season Nature irrigates the lands as she did in the past.

Consumption of water was taking place on those lands before man came into the picture. The water which was being consumed in the state of nature never did reach Lee Ferry. It never was a part of the water which was apportioned by the Colorado River Compact Commission to the Upper Basin.

Man, on that type of land in some instances, has increased somewhat the depletion. In some cases he has constructed ditches and has extended the irrigation season thereby causing a greater depletion of the stream flows than was occurring in the state of nature.

On other types of land there were cottonwood trees and other water-loving plants growing before man cleared the lands. The depletion that is being caused by man at the point of use by the irrigation of such lands is not the full depletion that results from the irrigation of those lands because in the state of nature some of the waters of the streams were being lost. Those waters never did reach Lee Ferry. They never were a part of the water supply that the Commission apportioned to the Upper Basin.

The other factor already mentioned that is important is the salvage of channel losses. Assume that man by his activities on a certain tract of land in the Upper Basin is depleting the flow of a stream at that particular point by 100,000 acre feet. He is not depleting the flow at Lee Ferry by 100,000 acre feet because if the 100,000 acre feet were left in the river and man didn't take it out and burn it up at the point of use, all of it wouldn't get to Lee Ferry; some of it would be lost in transit. That which in the state of nature was lost in transit was not a part of the water that was apportioned by the Commission because it was not a part of the virgin flow at Lee Ferry.

This principle possibly can be illustrated best by considering an hypothetical transmountain diversion. Assume 500,000 acre feet being diverted from the Colorado River Basin to some basin outside of the Colorado River Basin. By man's activity the tributary from which that water is being diverted is being depleted at the point of diversion by 500,000 acre feet. The flow at Lee Ferry is not being depleted by 500,000 acre feet because, if that 500,000 acre feet were left in the river, all of it would not reach Lee Ferry. The amount that would not reach Lee Ferry was not a part of the water that was apportioned by the Colorado River Compact Commission.

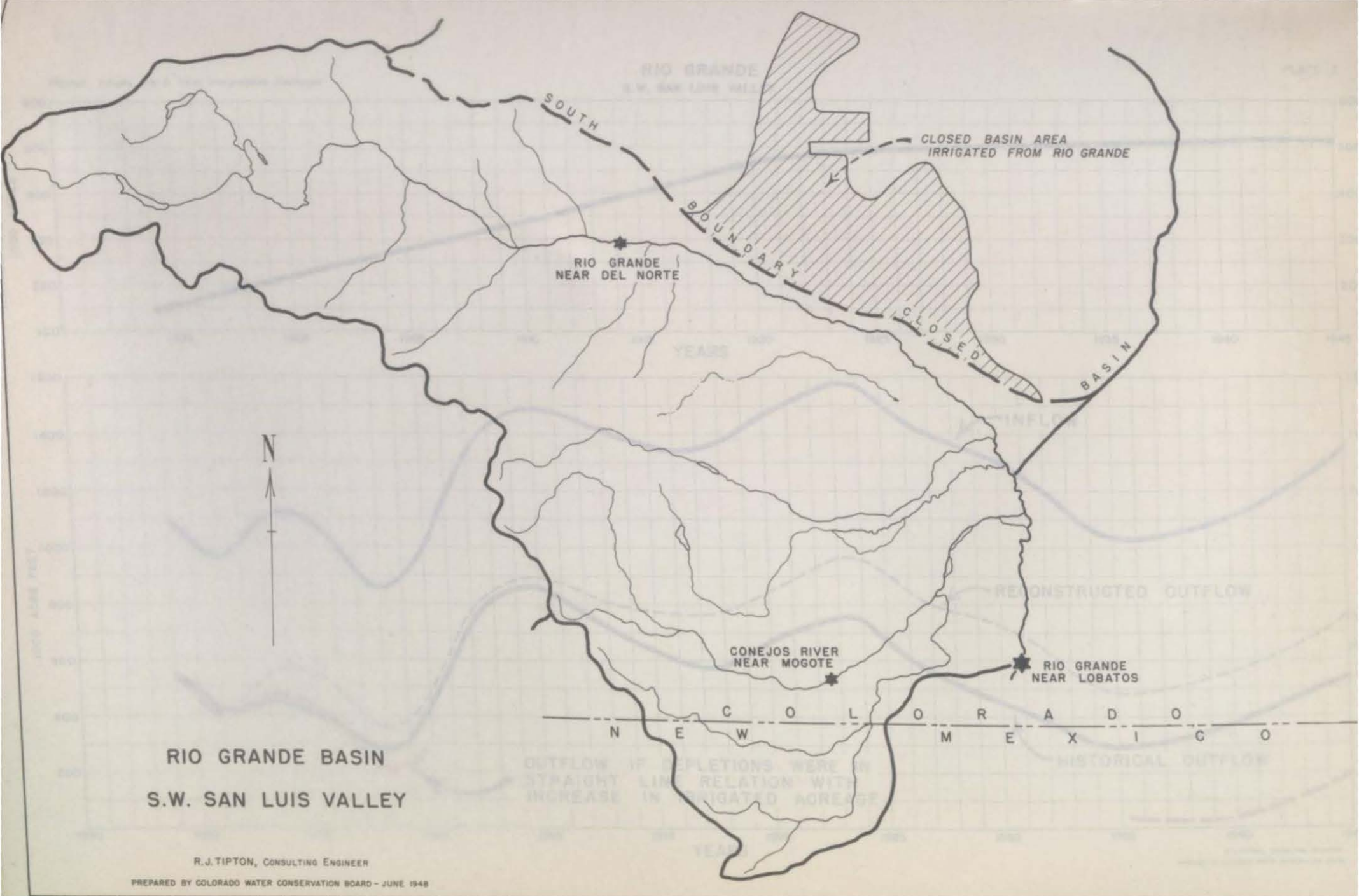
The principles that I am outlining first began to be recognized by some of us in the last Supreme Court case over the Arkansas River, Colorado vs. Kansas, decided December 6, 1943. Kansas alleged that because Colorado had increased its irrigated acreage by some 200,000 acres since the original Kansas vs. Colorado suit was being heard in the early 1900's, the flow across the Stateline had been depleted by an average of 300,000 acre feet per year. The stream flow records of the Arkansas River did not support such claim. Although Colorado had increased its irrigated acreage from about 300,000 acres at the time the testimony in the original suit was closed in 1905 to something over 500,000 acres at the time the last suit was being heard, the increase in acreage did not increase the depletion of flow at the Stateline between Kansas and Colorado. We were able to show this to the satisfaction of the court. To study the principles involved, we considered the performance of a number of river basins. It became apparent that the depletion of the flow of a stream at some point downstream was not in direct relation with the increase in development caused by man at some point upstream. We have prepared a number of exhibits which bring up to date some of the matters which we presented to the Supreme Court in that case.

I shall illustrate the principle I have been discussing by pointing out what has happened on a few of the typical rivers of the inter-mountain region. The principle is the same on all although it varies in degree with a particular river. I shall indicate the rivers and areas we have studied and then I shall describe in detail only one or two.

The rivers and areas studied are: The southwest Rio Grande area in Colorado; The Mesilla Valley in New Mexico; The Rio Grande area between Elephant Butte and El Paso; The Rio Grande between El Paso and Ft. Quitman; The entire South Platte River in Colorado; and The South Platte River above Kersey at a point below its confluence with the Cache la Poudre.

The first area I shall describe is the Southwest Rio Grande area in Colorado. The results of the study are shown on Plate No. I. There appears on this plate two graphs. On the upper graph is indicated by 5 year progressive means the irrigated acreage for the years 1890 to 1945, inclusive. On the lower graph are placed several lines to indicate stream flow. The upper blue line represents a measure of the virgin flow to the area. I say, "a measure of the virgin flow" because obviously all of the inflow cannot be measured. Certain gaging stations have been established in this particular area on the main stream and the main tributaries which measure about 75 percent of all the inflow. The sum of the runoff at these gaging stations is therefore a very accurate index of the virgin inflow to the area. The values represented by the blue line are in five year progressive means. It is interesting to note the rather wide fluctuations of the virgin flow indicating natural fluctuations because of difference in precipitation from period to period.

The black line, on the lower part of the graph, indicates the historic outflow from the basin which has resulted after man has carried on his development. The mean irrigated acreage for the five year period 1890 to 1894 was 145,000 acres. For the period 1941 to 1945 the mean irrigated acreage



RIO GRANDE BASIN

S.W. SAN LUIS VALLEY

R. J. TIPTON, CONSULTING ENGINEER

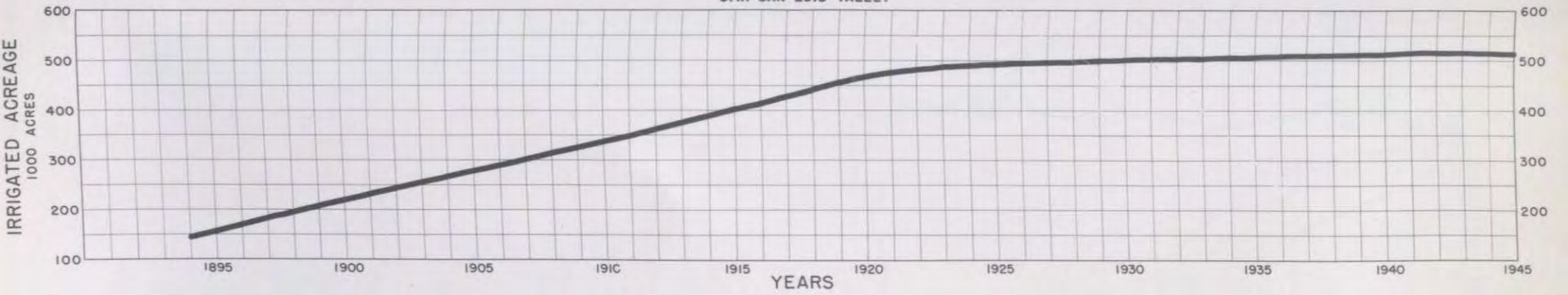
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948

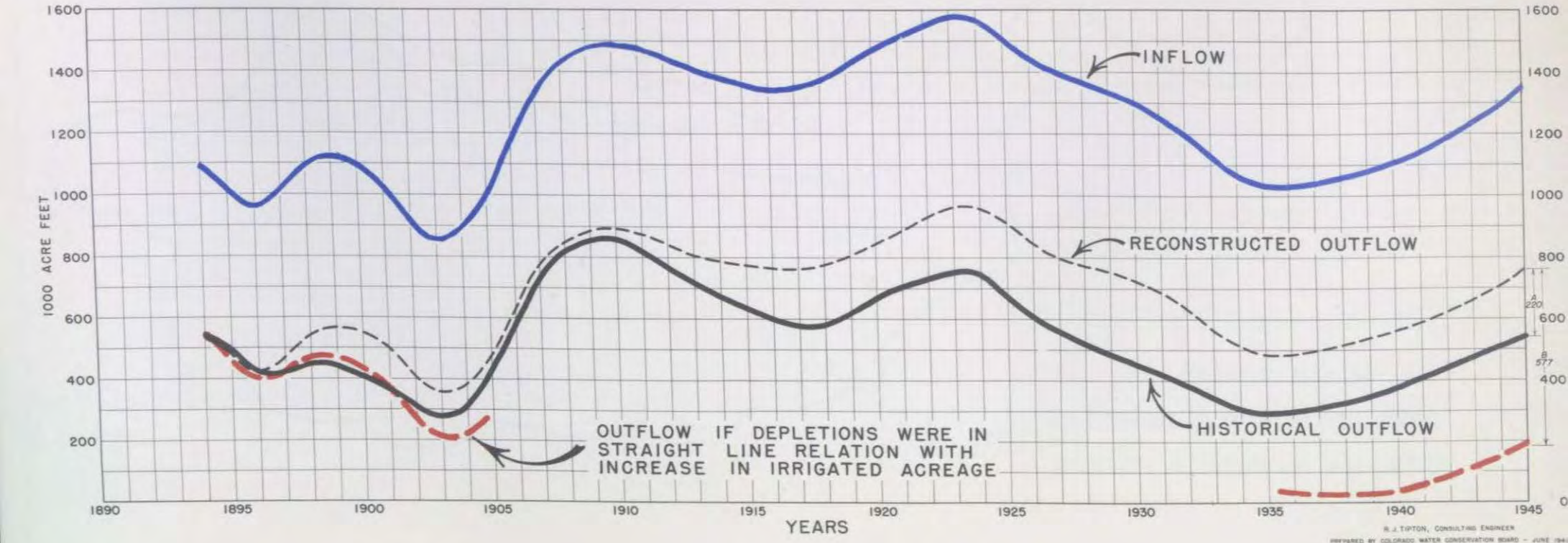
Plotted Values are 5 Year Progressive Averages

RIO GRANDE

S.W. SAN LUIS VALLEY

PLATE I





R. J. TIPTON, CONSULTING ENGINEER

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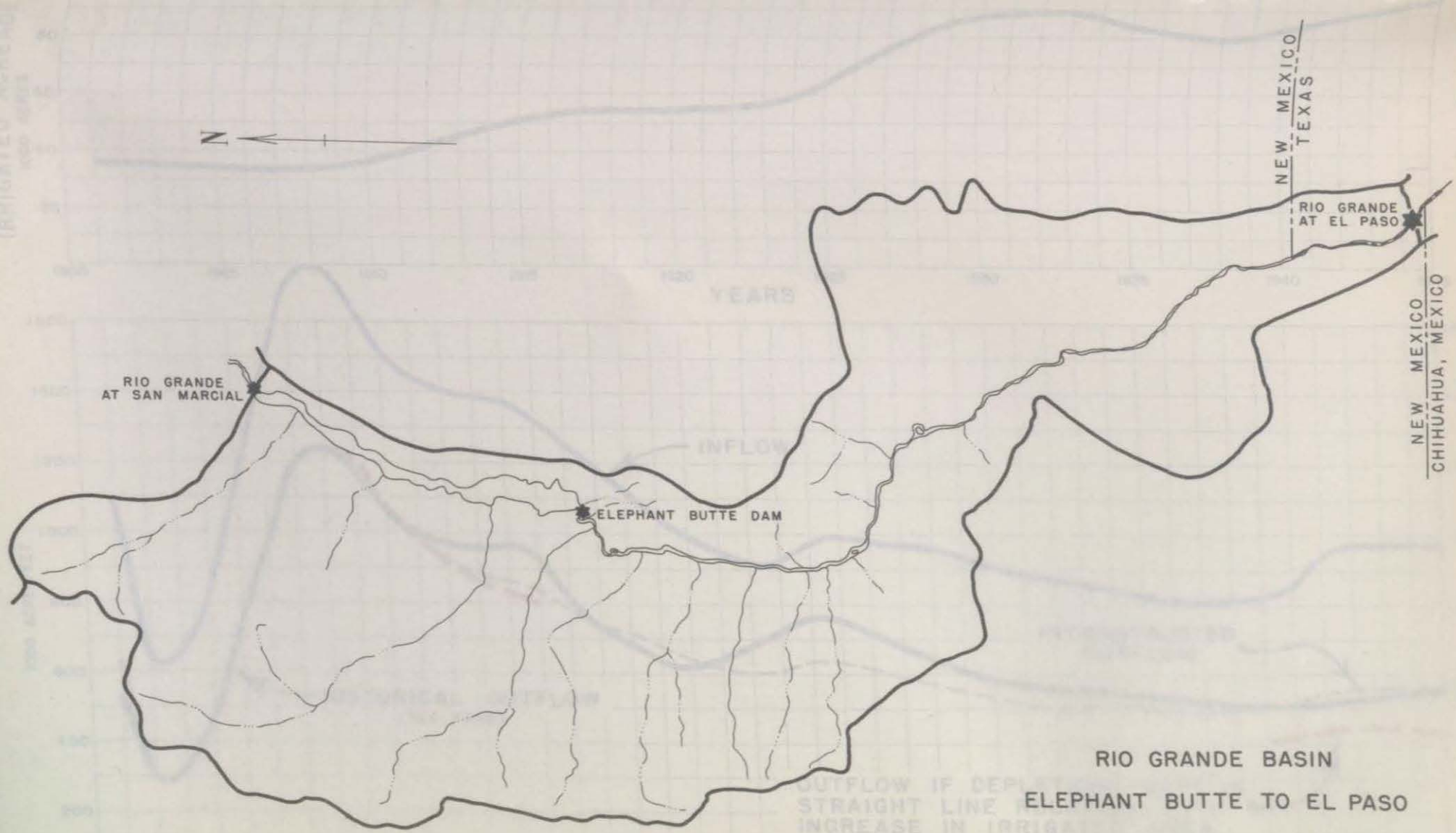


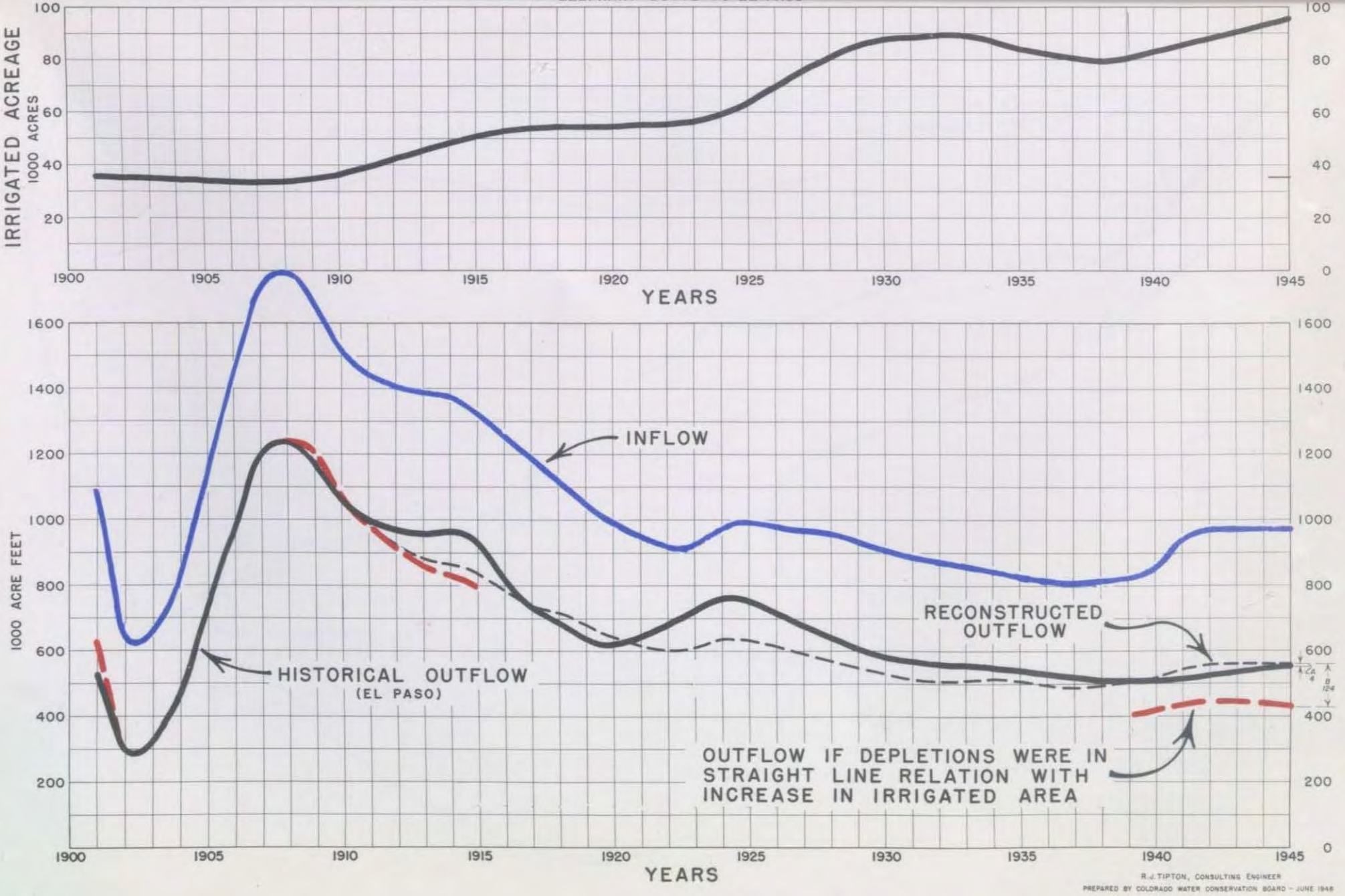
RIO GRANDE BASIN

ELEPHANT BUTTE TO EL PASO

(RINCON & MESILLA VALLEYS)

R. J. TIPTON, CONSULTING ENGINEER

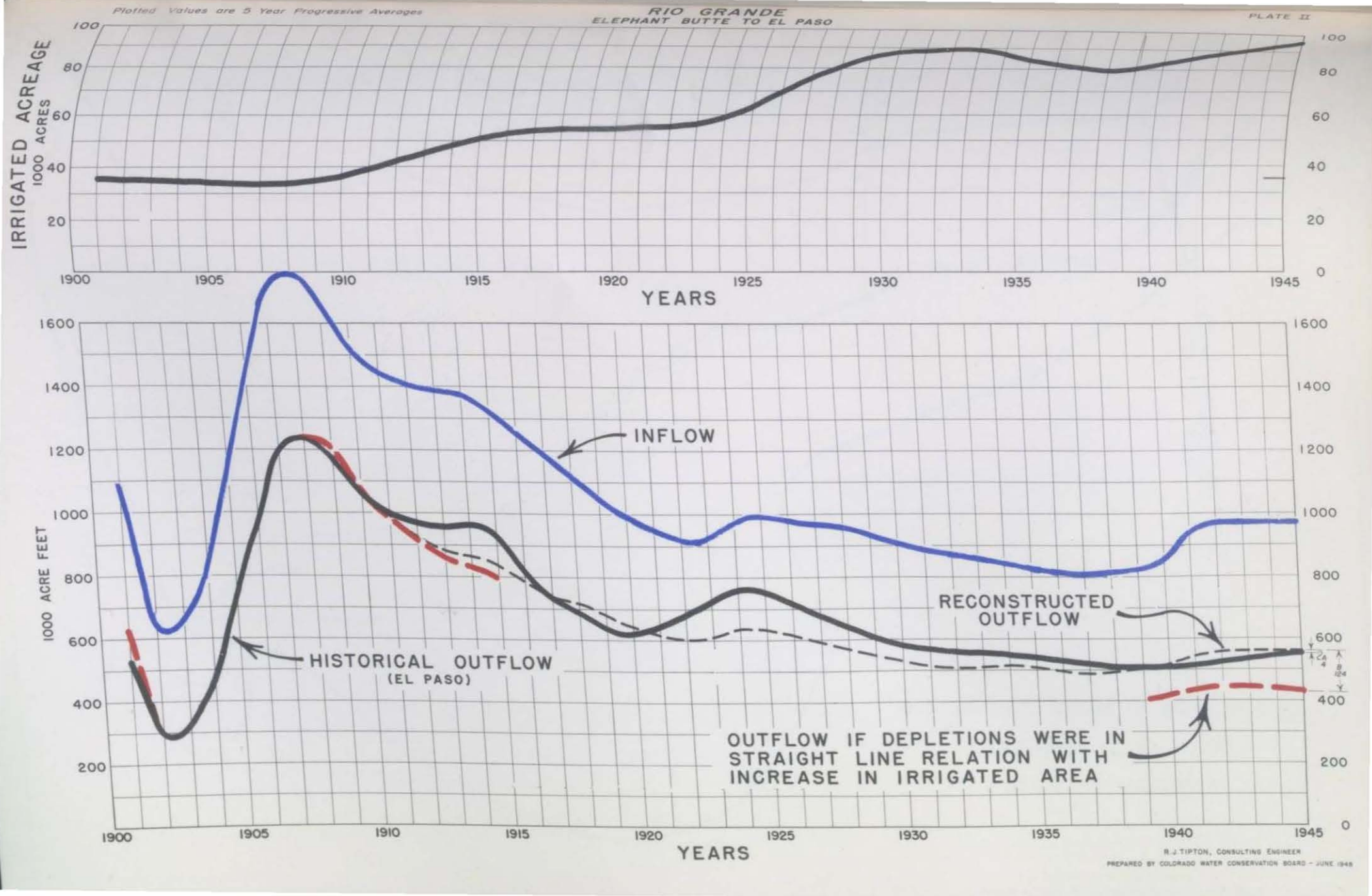
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


IRRIGATED ACREAGE
1000 ACRES
100
80
60
40
20
0
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
YEARS
1600
1400
1200
1000
800
600
400
200
0
1000 ACRE FEET
INFLOW
RECONSTRUCTED OUTFLOW
HISTORICAL OUTFLOW
(EL PASO)
OUTFLOW IF DEPLETIONS WERE IN STRAIGHT LINE RELATION WITH INCREASE IN IRRIGATED AREA
YEARS
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948

Plotted Values are 5 Year Progressive Averages

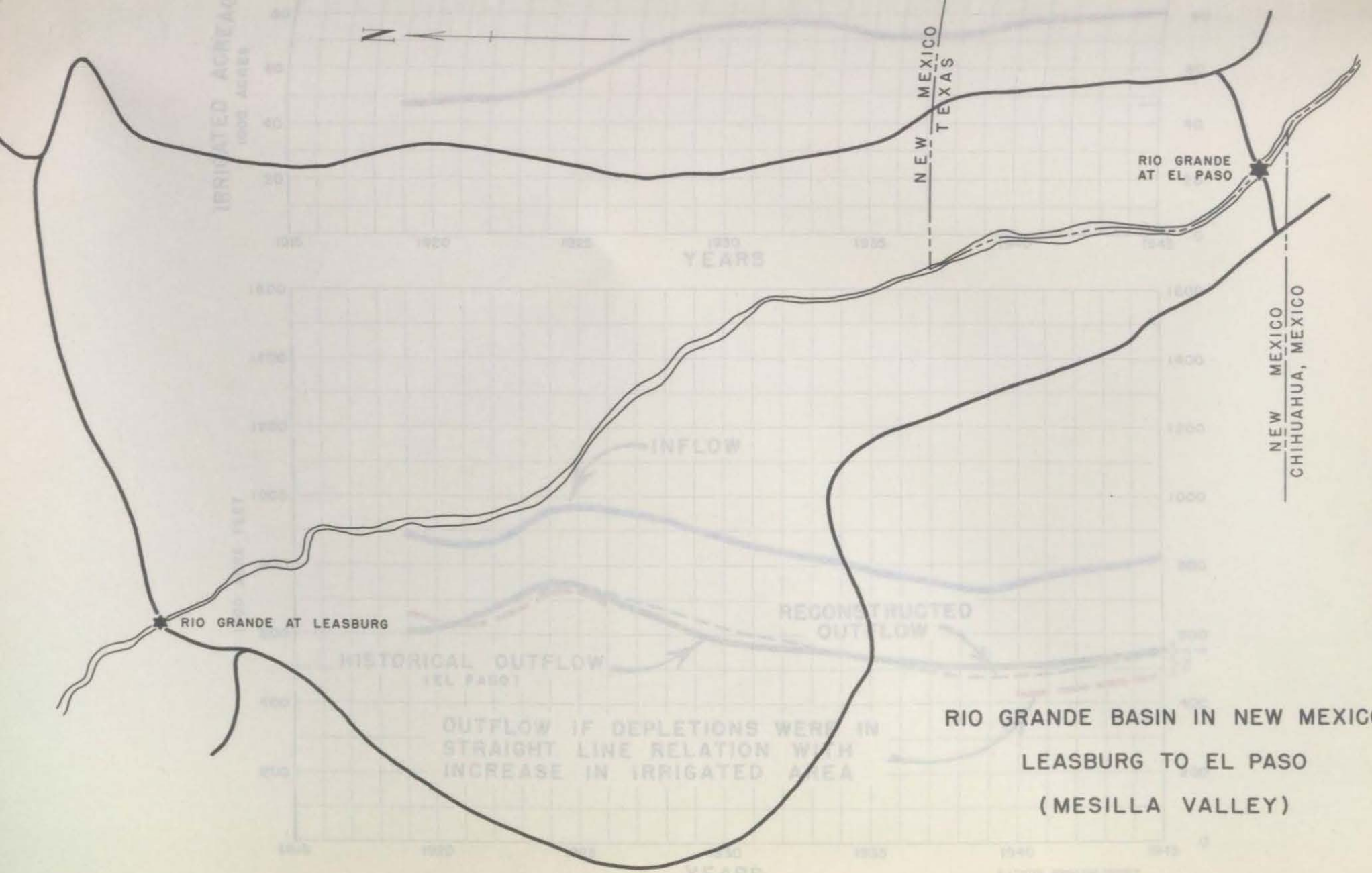
RIO GRANDE
ELEPHANT BUTTE TO EL PASO

PLATE II



R. J. TIPTON, CONSULTING ENGINEER

PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948



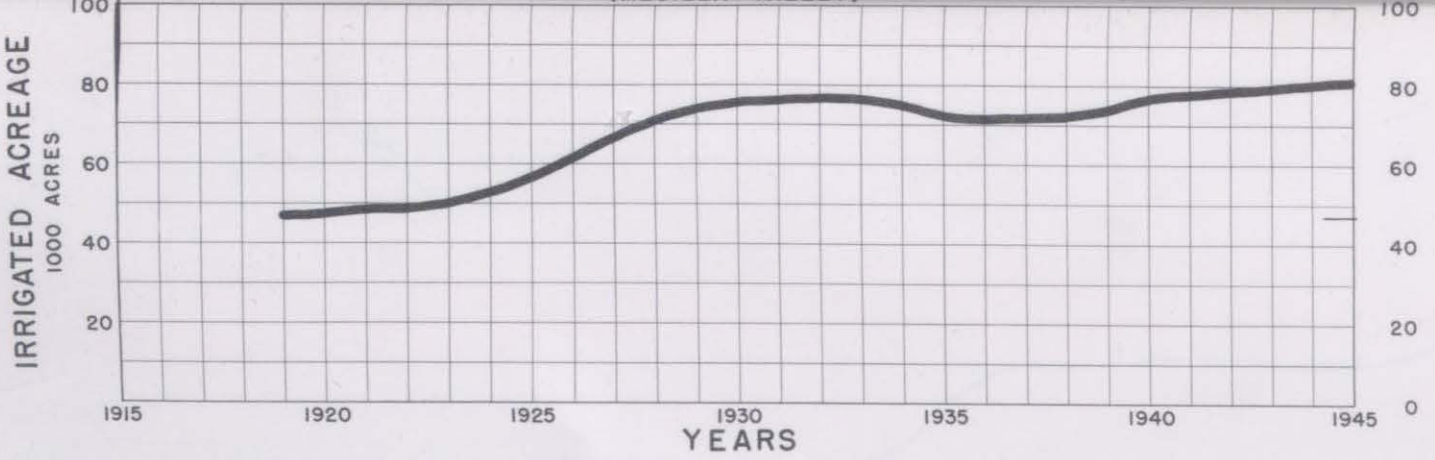
RIO GRANDE BASIN IN NEW MEXICO

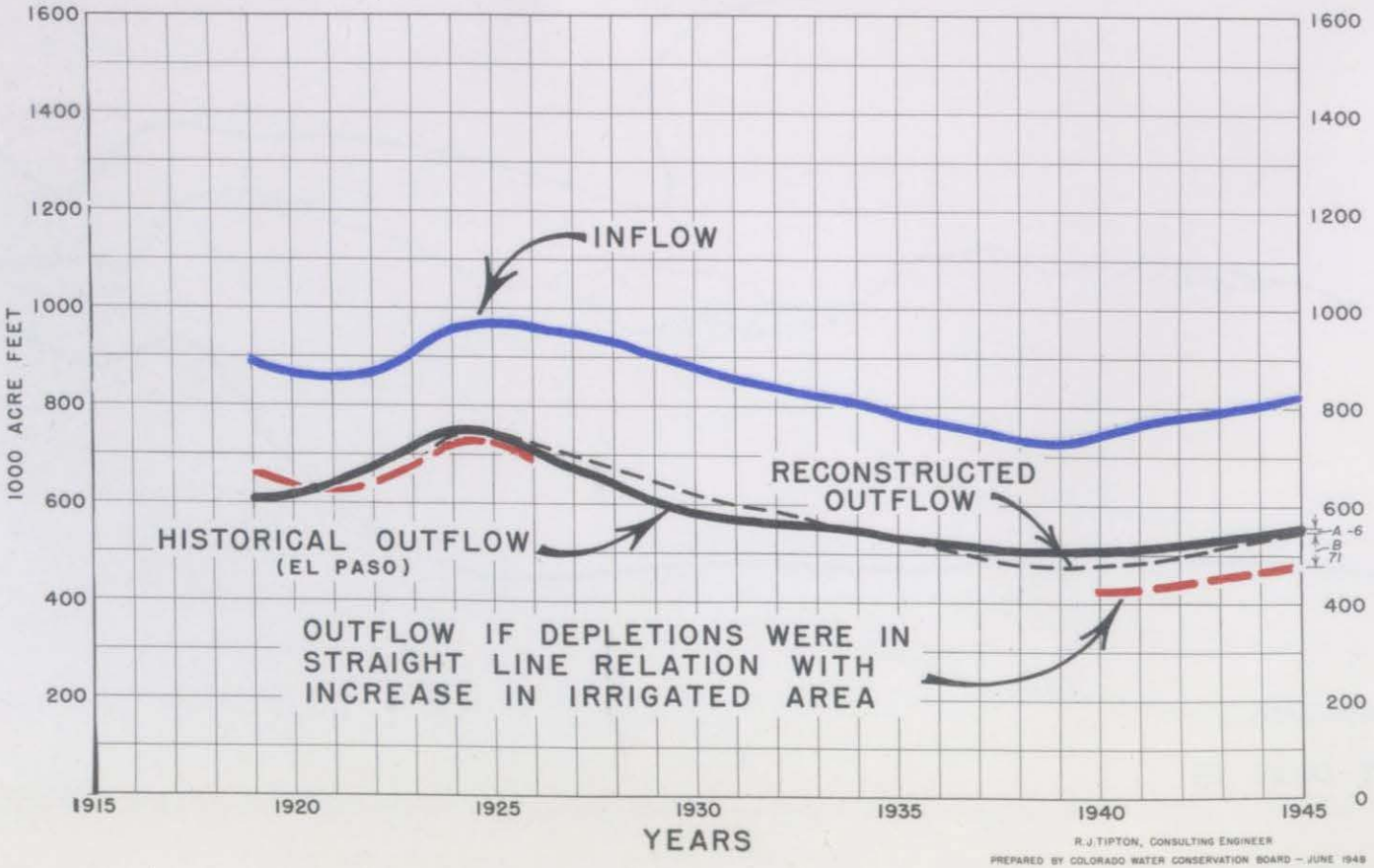
LEASBURG TO EL PASO

(MESILLA VALLEY)

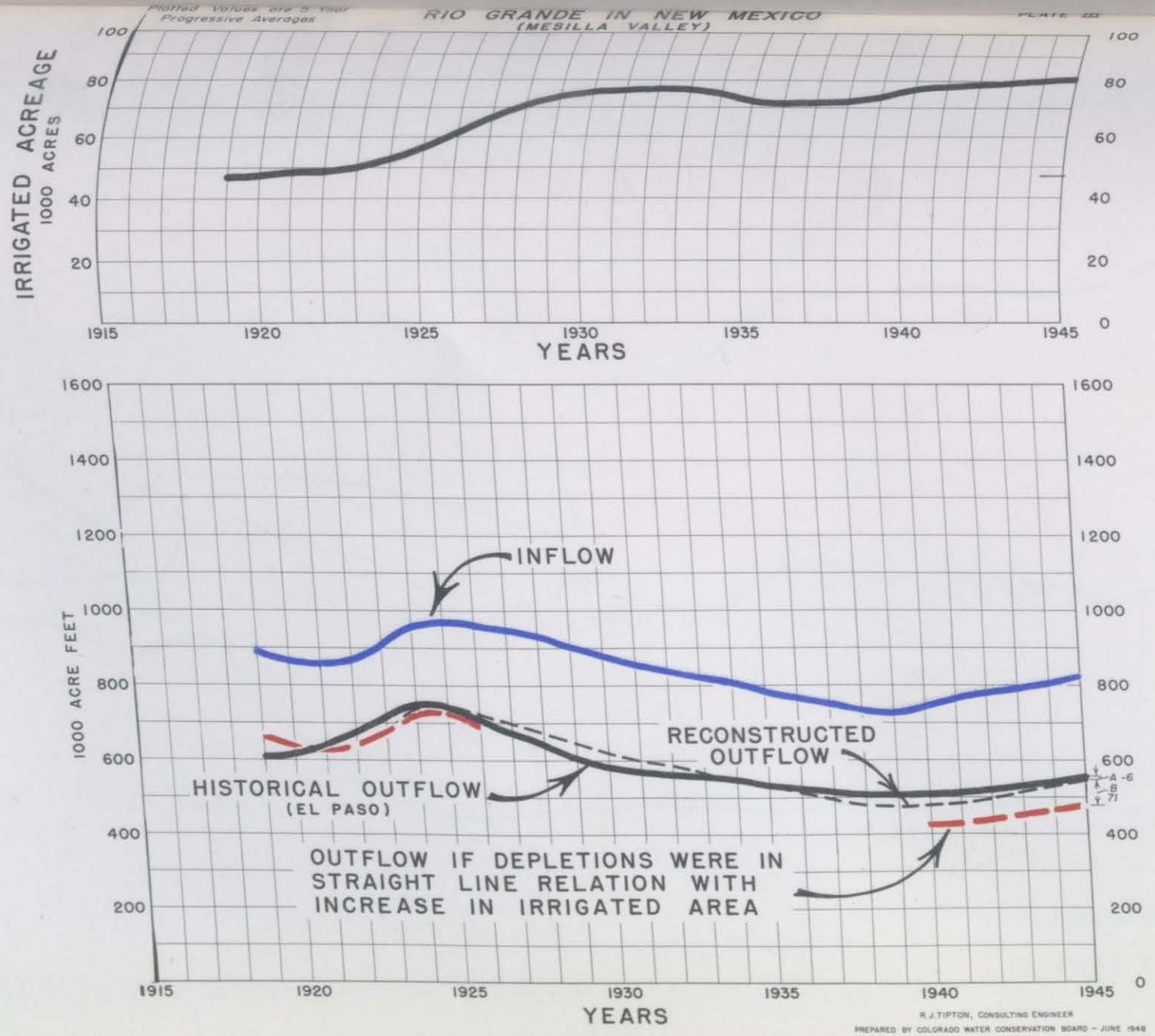
R. J. TIPTON, CONSULTING ENGINEER

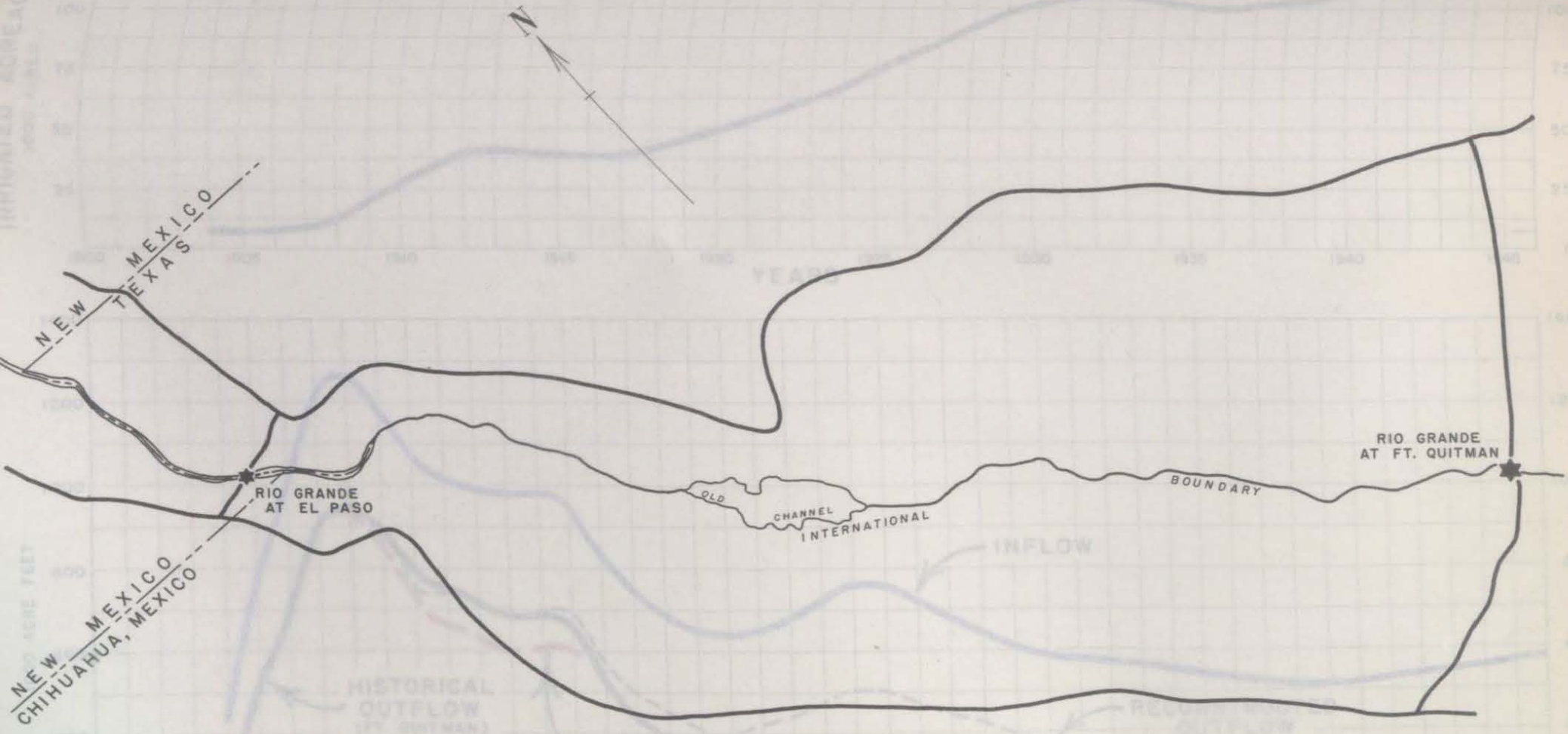
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948





R.J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD — JUNE 1948


Plotted Values are 5 Year Progressive Averages
RIO GRANDE IN NEW MEXICO
(MESILLA VALLEY)
PLATE III
IRRIGATED ACREAGE
1000 ACRES
100
80
60
40
20
0
1915
1920
1925
1930
1935
1940
1945
YEARS
1000 ACRE FEET
1600
1400
1200
1000
800
600
400
200
0
INFLOW
HISTORICAL OUTFLOW
(EL PASO)
RECONSTRUCTED
OUTFLOW
OUTFLOW IF DEPLETIONS WERE IN
STRAIGHT LINE RELATION WITH
INCREASE IN IRRIGATED AREA
A -6
B
71
YEARS
R.J.TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948



RIO GRANDE BASIN

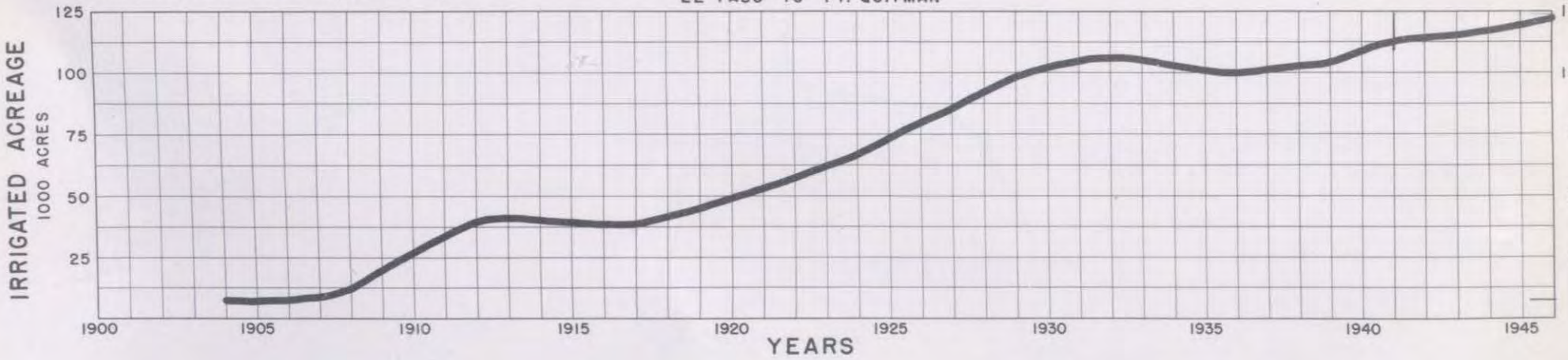
EL PASO TO FT. QUITMAN

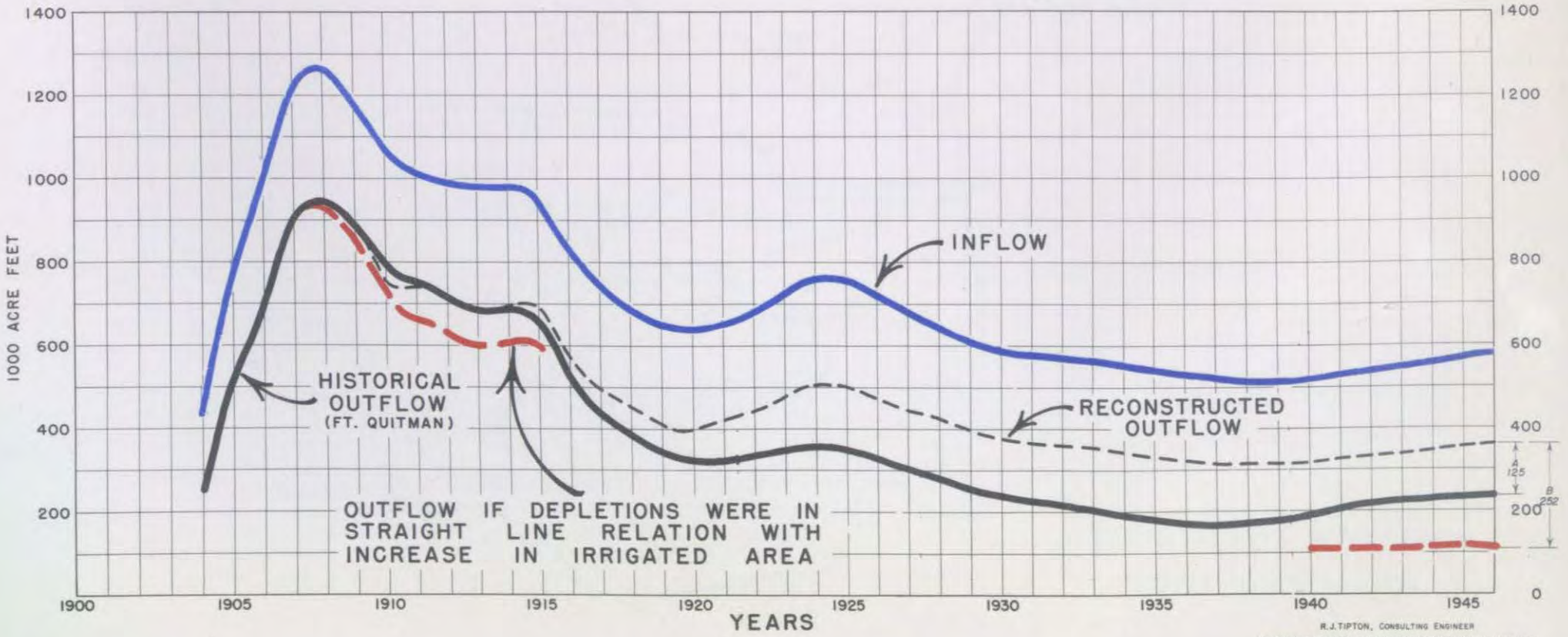
R. J. TIPTON, CONSULTING ENGINEER

PREPARED BY COLORADO WATER CONSERVATION BOARD – JUNE 1948

Plotted Values are 5 Year Progressive Averages

EL PASO TO FT. QUITMAN





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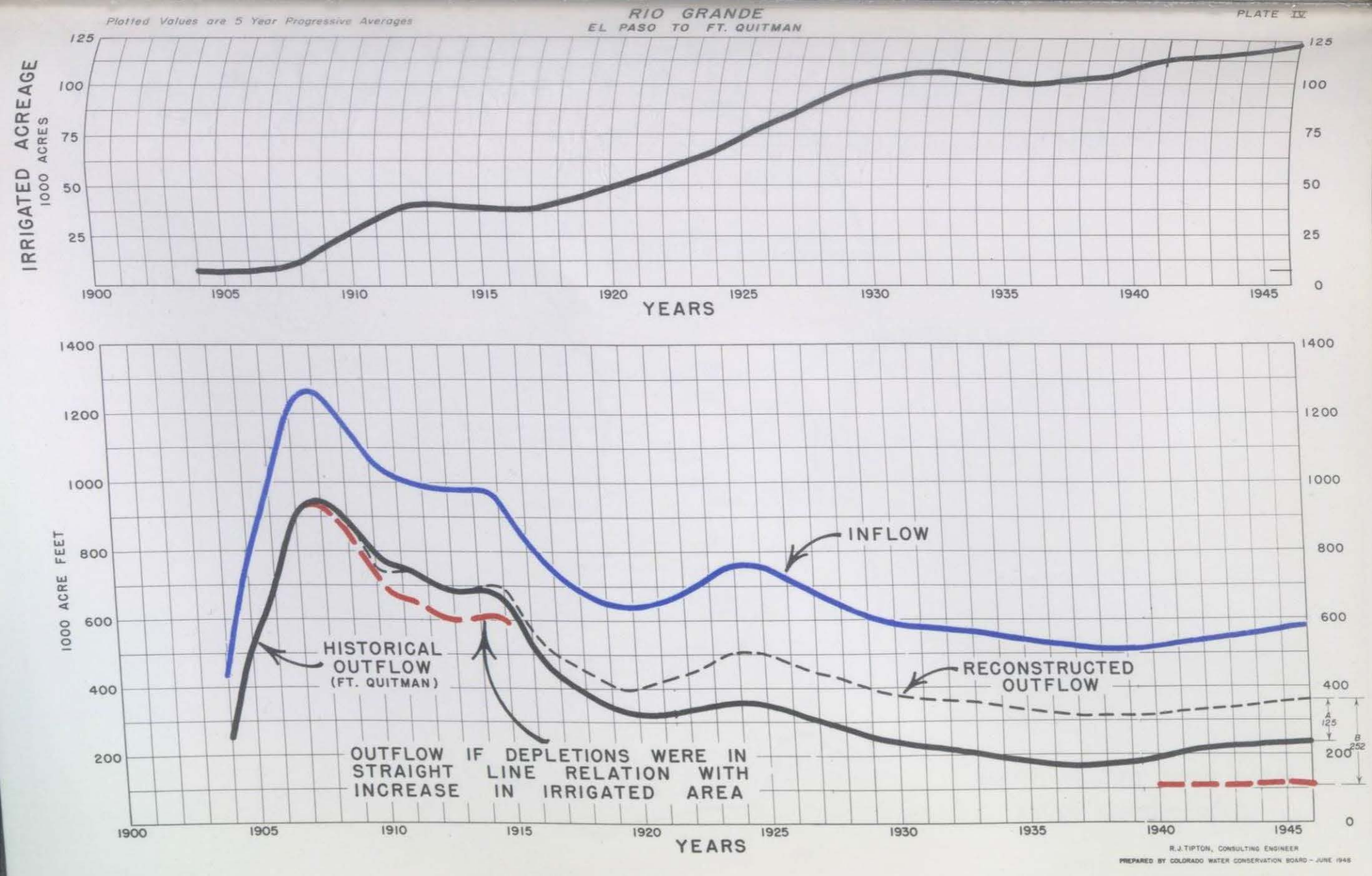
Plotted Values are 5 Year Progressive Averages

RIO GRANDE
EL PASO TO FT. QUITMAN

PLATE IV



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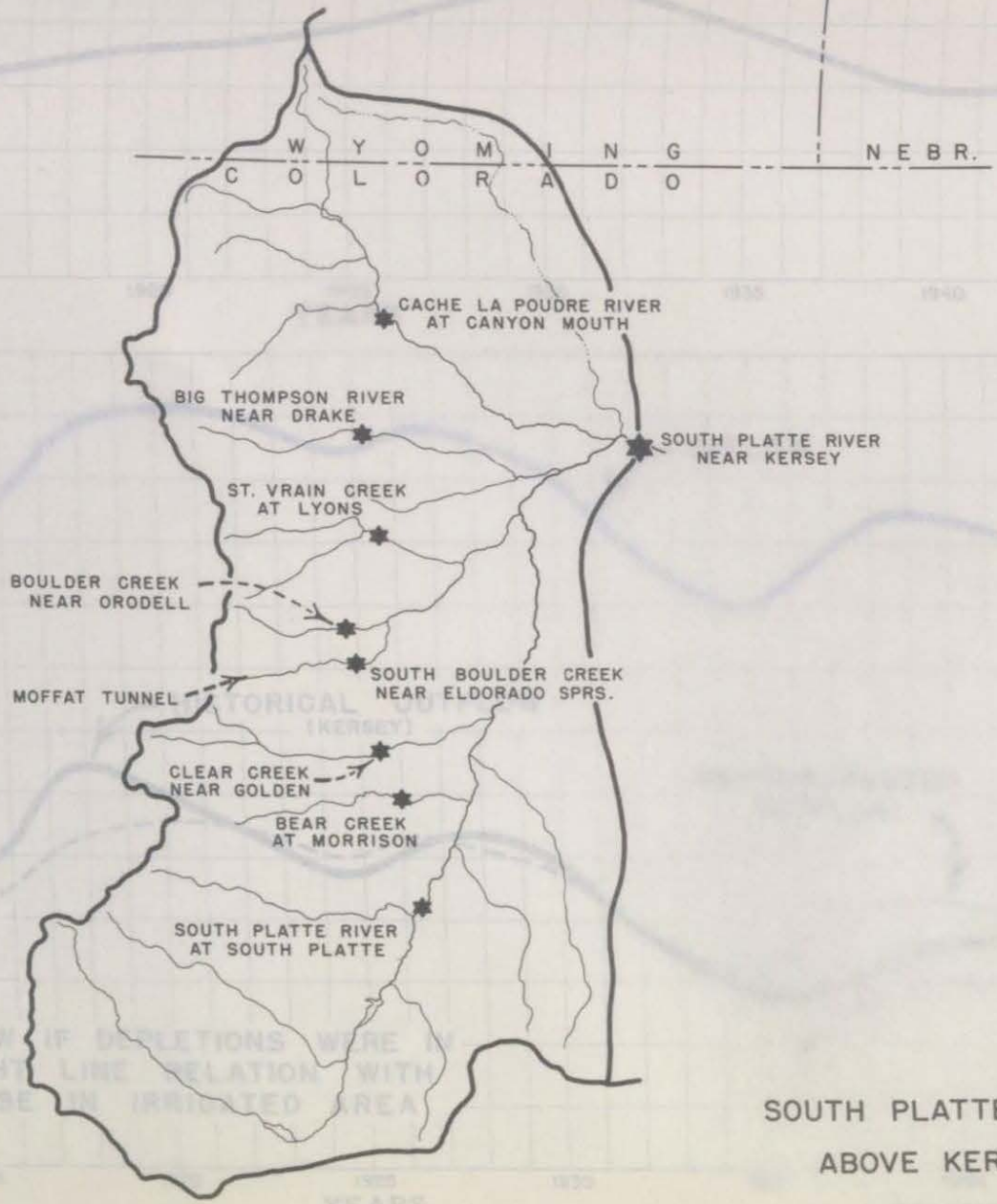
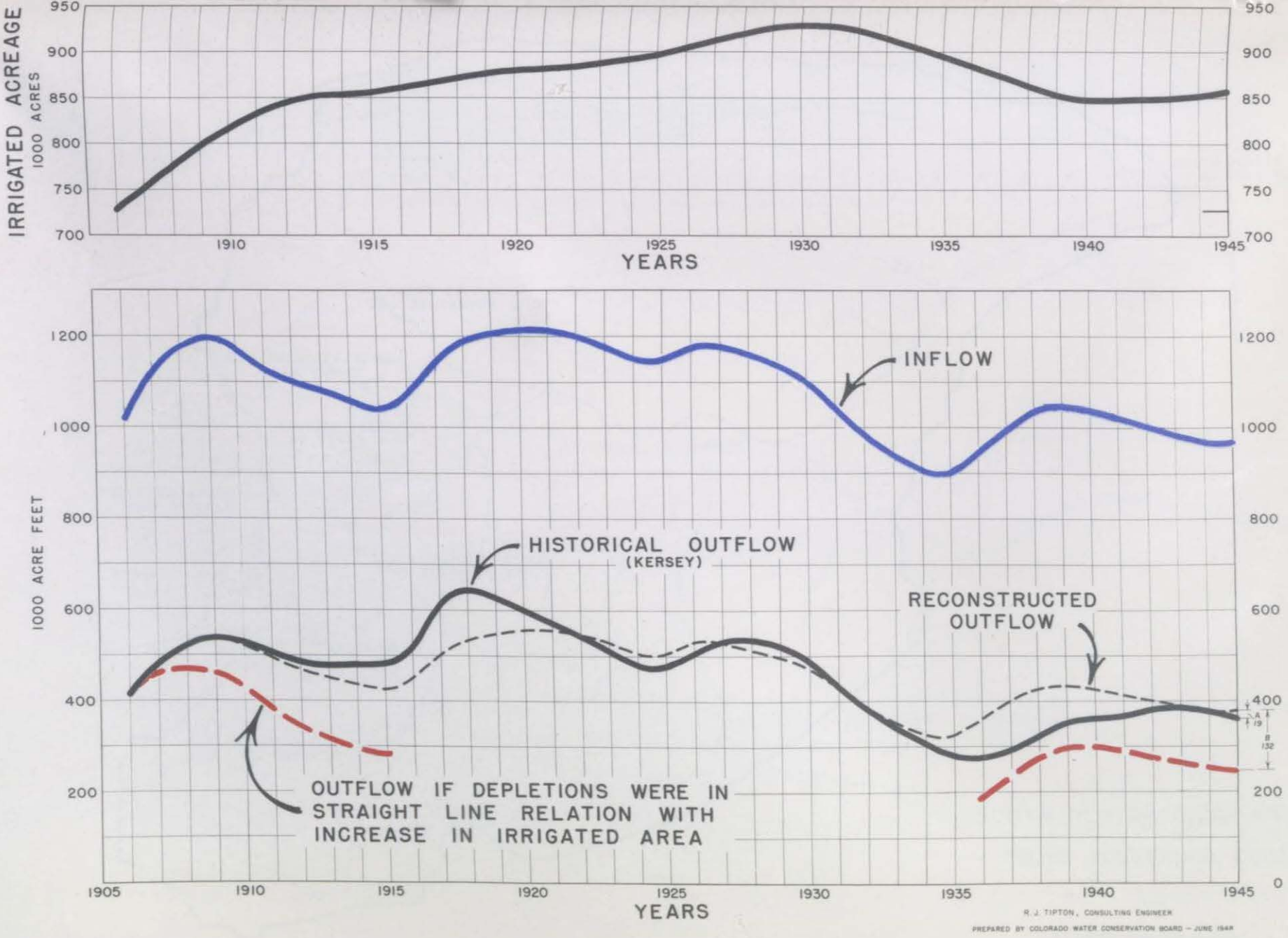


SOUTH PLATTE RIVER BASIN
ABOVE KERSEY, COLO.

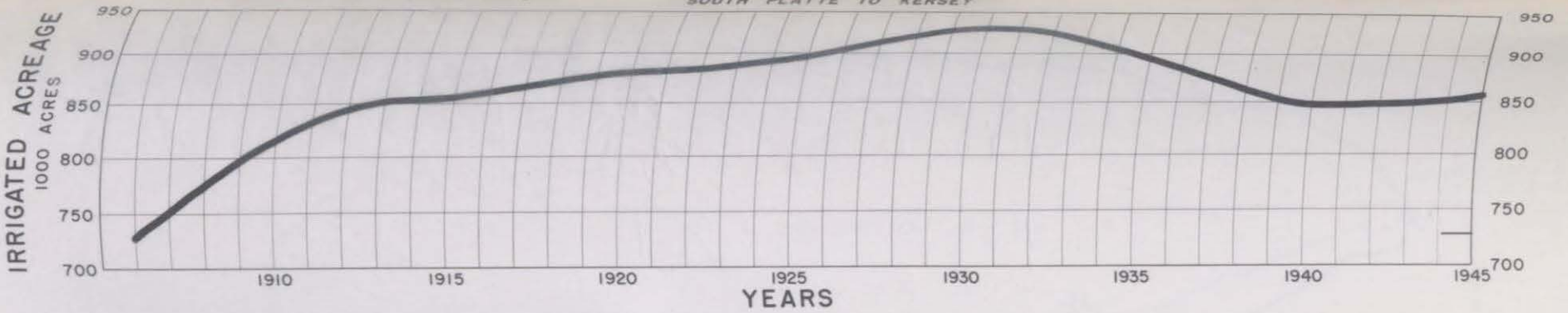
R.J. TIPTON, CONSULTING ENGINEER

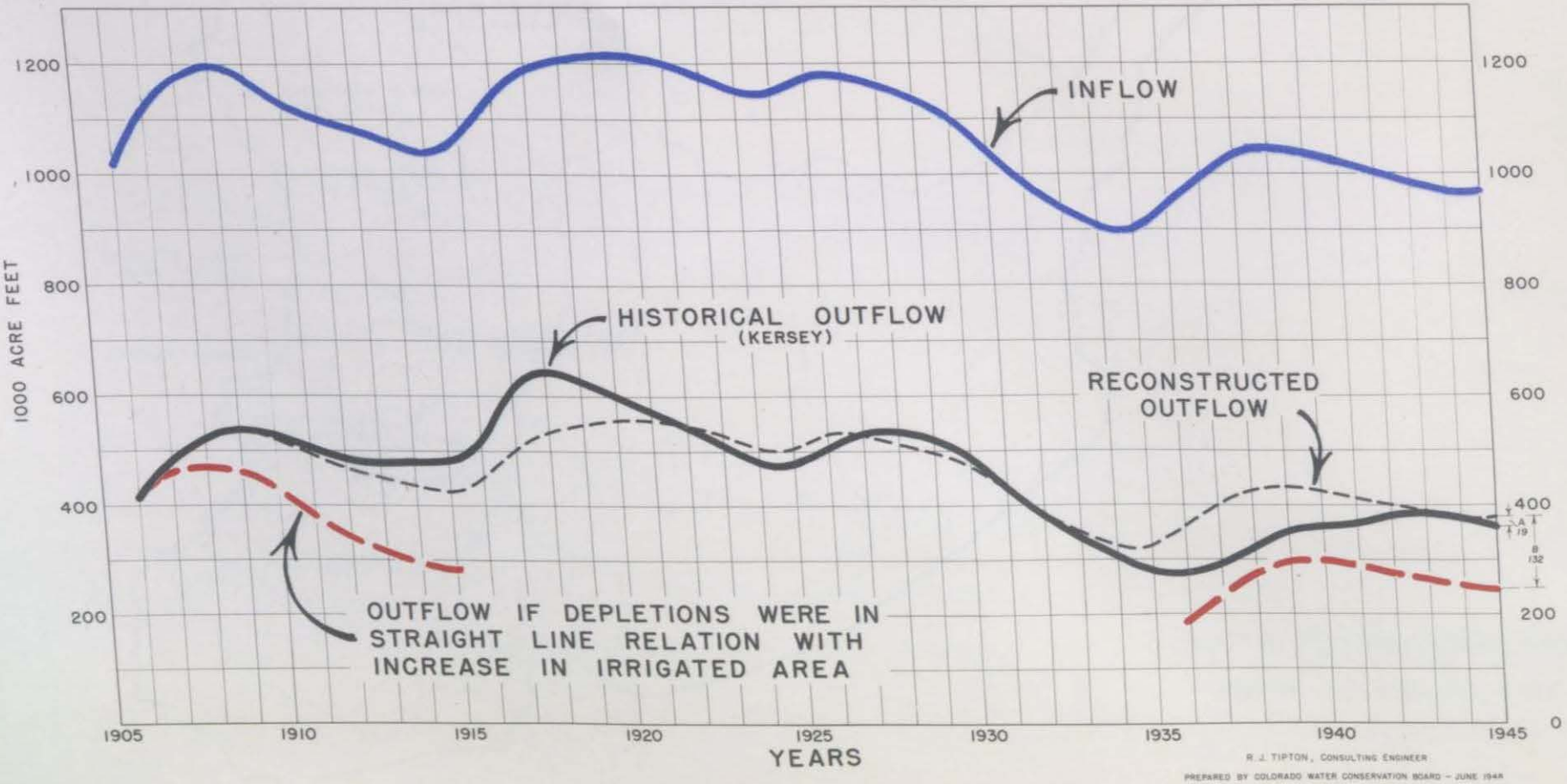
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


IRRIGATED ACREAGE
1000 ACRES
950
900
850
800
750
700
1910
1915
1920
1925
1930
1935
1940
1945
YEARS
1000 ACRE FEET
1200
1000
800
600
400
200
0
INFLOW
HISTORICAL OUTFLOW
(KERSEY)
RECONSTRUCTED
OUTFLOW
OUTFLOW IF DEPLETIONS WERE IN
STRAIGHT LINE RELATION WITH
INCREASE IN IRRIGATED AREA
A
19
B
132
1905
1910
1915
1920
1925
1930
1935
1940
1945
YEARS
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD — JUNE 1948

Plotted Values are 5 Year Progressive Averages

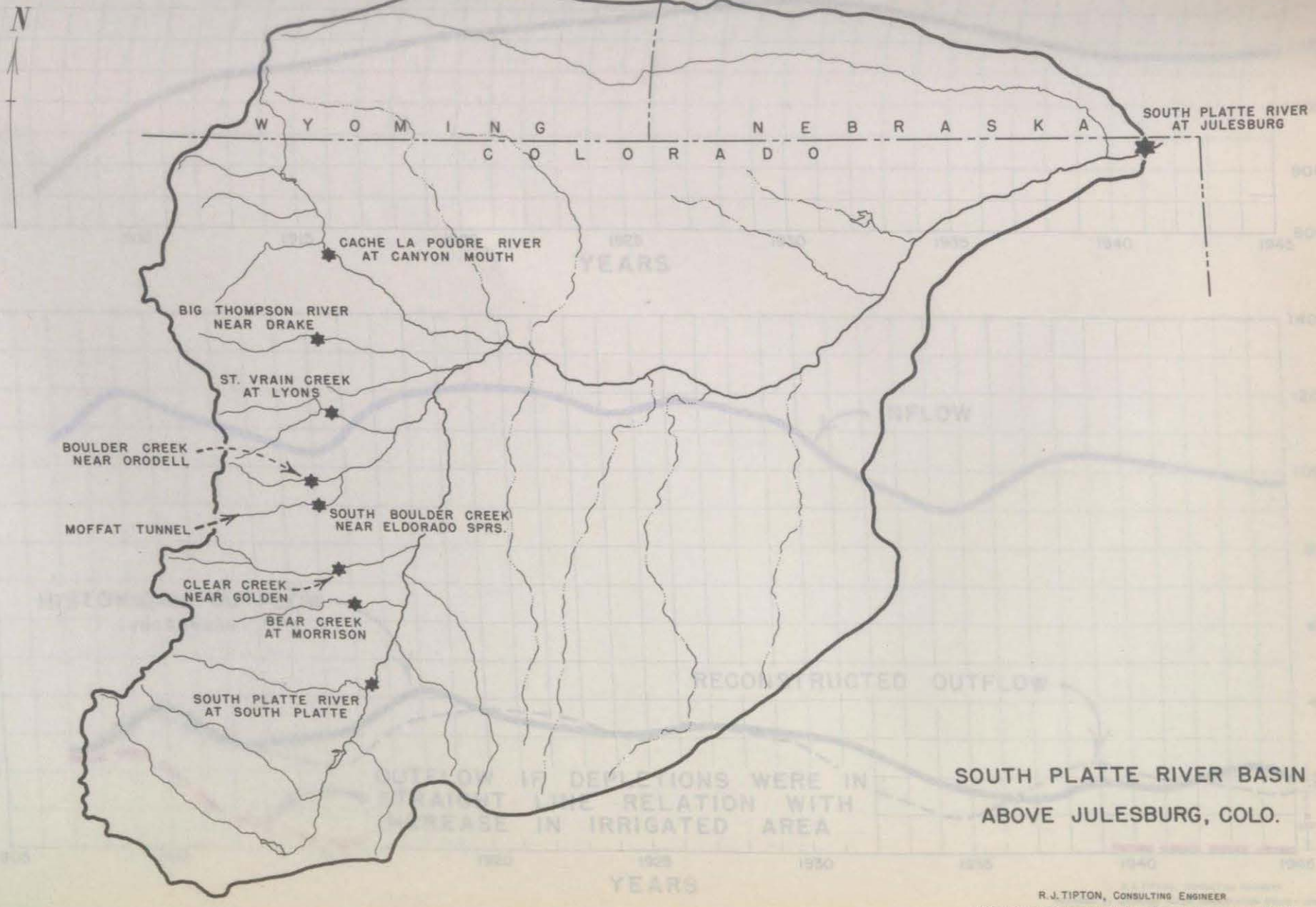
SOUTH PLATTE RIVER
SOUTH PLATTE TO KERSEY





R. J. TIPTON, CONSULTING ENGINEER

PREPARED BY COLORADO WATER CONSERVATION BOARD — JUNE 1944

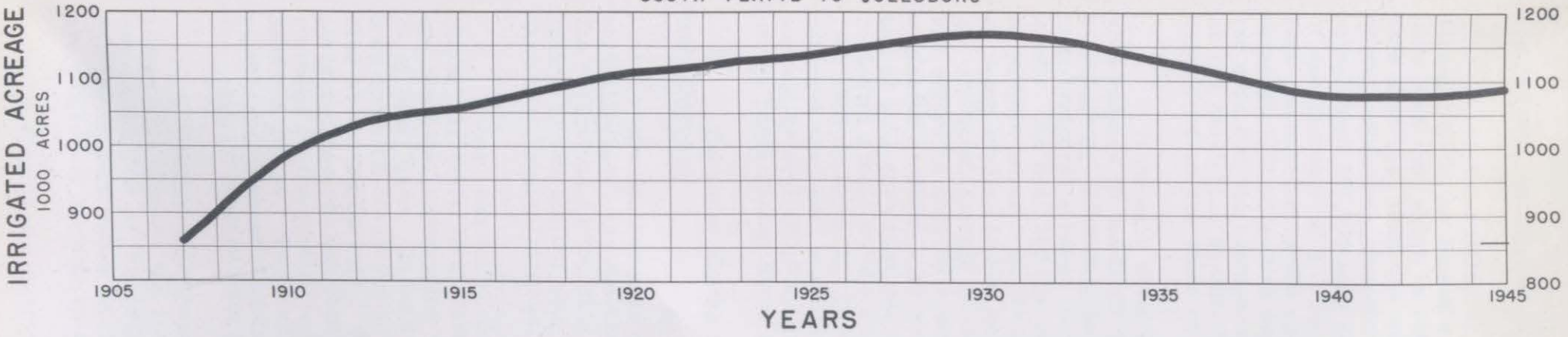


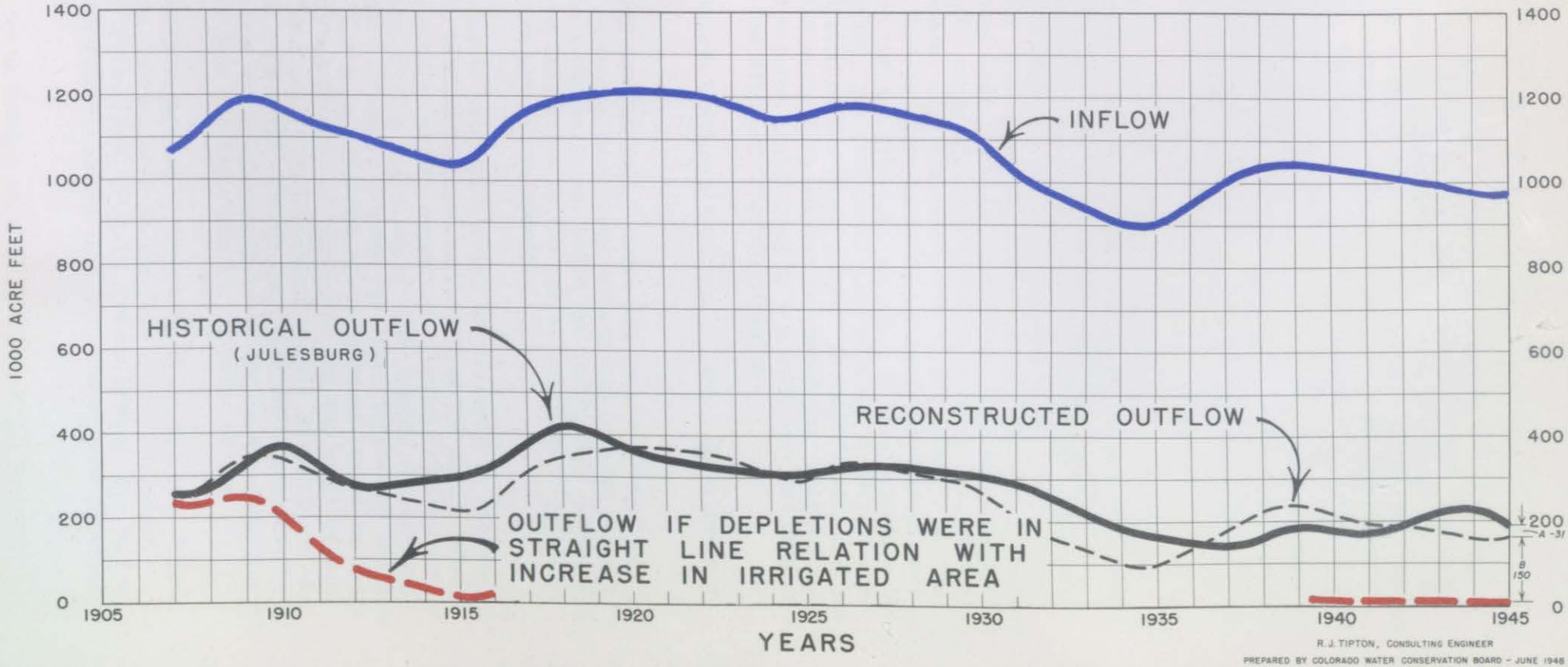
SOUTH PLATTE RIVER BASIN
ABOVE JULESBURG, COLO.

R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948

Plotted Values are 5 Year Progressive Averages

SOUTH PLATTE TO JULESBURG



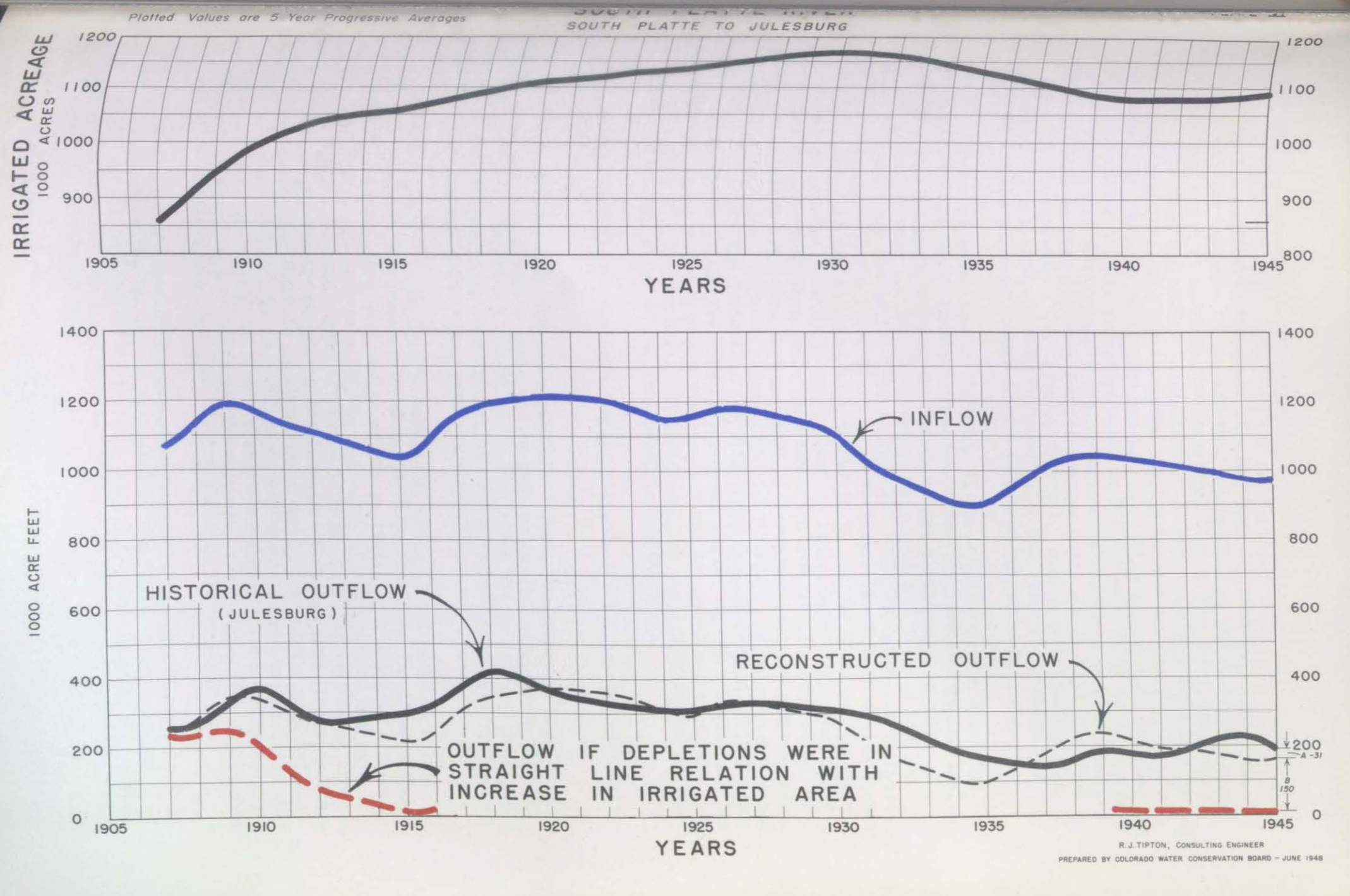


R. J. TIPTON, CONSULTING ENGINEER

PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948

Plotted Values are 5 Year Progressive Averages

SOUTH PLATTE TO JULESBURG



R. J. TIPTON, CONSULTING ENGINEER

PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948

was 515,000, an increase of 370,000 acres.

If the outflow at the state line had been depleted in a direct relationship with the increase in the acreage, the outflow at the state line would have been that which is shown by the dashed red line on the chart, or 357,700 acre feet less than the outflow actually is. In other words, during this period of time when man increased the irrigated acreage in that area by 370,000 acres, he salvaged 357,700 acre feet. The man-made depletion at the state line because of the increase of 370,000 irrigated acres is 220,000 acre feet, or 0.58 acre feet per acre while the consumption or depletion at the point of use is estimated at 1.47 acre feet per acre for the average year, and at 1.56 acre feet per acre for the average of the 1941-1945 period. Man is depleting the flow at the state line by 220,000 acre feet and he is consuming water which was being lost in the state of nature in the amount of 357,700 acre feet.

I now call attention to Plate No. VI which indicates the situation with respect to the South Platte in Colorado above the Stateline gaging station at Julesburg. The results shown by this chart are almost unbelievable. The mean irrigated acreage for the five year period, 1902 to 1907, was 860,000 acres. The mean for the period 1940 to 1945 was 1,088,000 acres, an increase of 228,000 acres. On the lower graph which indicates the situation with respect to water supply, it may be noted that the historic outflow after man increased the irrigated acreage by 228,000 acres does not depart materially from what it was before he made such increases. The depletion rate at the point of use is estimated at about 1.10 acre feet per acre of irrigated land per average year and at 1.01 acre feet per acre for the 1940-1945 period. If this depletion had reflected itself at the Stateline, the flow would have been about 181,000 acre feet less as shown by the red line on the lower graph. In other words, man has salvaged that much water by his activities and has increased the irrigated acreage by over 200,000 acres without diminishing by one acre foot the outflow of the South Platte River at the Nebraska-Colorado Stateline.

The other Plates indicate similar situations. I shall describe only one other one.

Mr. Wallace asks about the rainfall. There has been no change in rainfall except the ordinary variation as between seasons and between periods. The variations in the blue lines on the Plates which are indicies of the virgin inflow to the basins, are, some indication of the variations in precipitation, that is, the precipitation which causes the runoff.

One item that I do want to point out, which is indicated on all the Plates, is the wide difference between the line representing the index inflow and the line representing the outflow at the beginning of the period represented by each Plate. In each case, at the beginning of such period, man had not made too much development. The difference between the index inflow and the outflow at the beginning of the period is a measure of the natural losses that are occurring between the point of measurement of the inflow and the point of measurement of the outflow. To this indicated difference should be added the unmeasured inflow. It is out of this large natural loss that man automatically salvages some water when he makes his development, resulting in the depletion at the point of outflow much less than the depletion at the point of use.

I shall now describe the situation portrayed by Plate No. IV. I have chosen this because the inflow, as indicated on the Plate, does represent practically all of the inflow to the area. The difference between the inflow and the outflow shows the large natural losses that take place, some of which are subject to salvage by man.

This Plate portrays the situation in that portion of the Rio Grande

basin lying between El Paso, Texas and Fort Quitman. The average irrigated area for the five year period, 1900 to 1904, was 7,300 acres. During the five year period, 1941 to 1946, the irrigated acreage has been increased by 114,500 acres to 121,800 acres. The rate of depletion in the basin at the point of use by irrigated land is estimated at 2.40 acre feet per acre per average year, and at 2.20 acre feet per acre for the 1941-1946 period. The increase in depletion at the point of use during the 46 year period is therefore estimated at 251,900 acre feet. By comparing the reconstructed outflow with the historic outflow, it may be noted from the Plate that the actual depletion at Fort Quitman has been only 125,000 acre feet. In other words, there was a salvage of about 127,000 acre feet, which is more than one-half of the depletion at the point of use. The difference between the location of the blue line shown on the lower graph of Plate No. IV, and the black dotted line, indicates the amount of natural loss that occurs in this reach of river. This loss amounts to some 200,000 acre feet. Man, by his activities, has salvaged a considerable portion of that natural loss.

I shall not take the time to discuss in detail the results shown on any of the other Plates, however, I shall summarize those results as well as the results shown on the Plates which I have described as follows:

Plate No.	Basin	Period	Increase in irrigated acreage during period	Increased depletion during period-A.F. At point of use	Increased depletion during period-A.F. At outflow point	Salvaged water acre feet
1	2	3	4	5	6	7
I	Rio Grande					
I	S.W. Area San Luis Valley, Colorado	1890-1945	370,000	577,200	219,500	357,700
II	Elephant Butte to El Paso	1897-1945	59,500	124,000	4,400	119,600
III	Mesilla Valley New Mexico	1920-1945	33,400	71,000	-5,600	76,600
IV	El Paso to Fort Quitman, Tex.	1900-1946	114,500	251,900	124,800	127,100
	South Platte					
V	Above Kersey	1902-1945	129,000	131,600	18,800	112,800

Particular attention is called to the large difference between depletion at the point of use in the various basins studied and the depletion at the outflow point occasioned by the activities of man. Attention is also called to the relations between the amount of water salvaged and the depletion at the point of use.

What does this principle mean to the Upper Basin and the States of this basin? It is the difference between the concept that the allocation to the Upper Basin means 7,500,000 acre feet at the point of use and the concept that the allocation to the Upper Basin means the depletion of the virgin flow at Lee Ferry by 7,500,000 acre feet.

If we should go on the theory that that which the Colorado River Compact

Commission was apportioning was the use of the water at the point of use, it would be necessary to add up all the increments of depletion at the point of use, including transmountain diversions, and when that sum reached 7,500,000 acre feet, the Upper Basin would have reached the limit of its apportionment. By that process the basin would have been charged with all of the water that man will have salvaged automatically, water that never did reach Lee Ferry or the Lower Basin in the state of nature, and water that was not available at Lee Ferry subject to apportionment.

The Engineering Committee has given some consideration to the extent of probable salvage in the Upper Basin. None of us know what it might be. We only know that in other river basins it has been a significant amount. It has varied in amount in accordance with the characteristics of the particular stream. We do know that there will be channel loss salvage of 200,000 acre feet up to 400,000 acre feet. That is in addition to the salvage on the land itself, in other words, the loss that Nature was causing on the land itself. I personally think the salvage will be substantially more than 400,000 acre feet but that is neither here nor there. We are dealing in principles rather than quantities. We are trying to determine what it was that was apportioned to the Upper Basin.

The question has been asked: What is better for the Upper Basin regardless of principle? Let's disregard entirely what it was that the Compact Commission was apportioning, and consider what would be better for the Upper Basin from the standpoint of useable water first on the assumption that the Upper Basin has a right to deplete the virgin flow of the river at Lee Ferry by 7,500,000 acre feet, and second on the assumption that the Upper Basin has only the right to deplete the flow of the river and the tributaries at the points of use by 7,500,000 acre feet. The Engineering Committee by request gave some consideration to that problem.

Taking a most pessimistic viewpoint of three factors which would dominate the problem, the Engineering Committee came up with this conclusion: that if the virgin flow at the International Boundary were only 17,000,000 acre feet--(the Bureau estimated it at 17,720,000 acre feet)---if the channel loss salvage in the Upper Basin were only 200,000 acre feet, which seems to be the absolute minimum; and if that during such a low period of runoff there was being delivered to Mexico its full amount of 1,500,000 acre feet (an unwarranted assumption): then at that point the Upper Basin would be just about as well off under one situation as the other; it wouldn't be quite so well off under the theory that the measurement should be at the point of use, because in the quantities I have given there is no recognition of the amount of water that is salvaged on the land itself, which is a significant amount of water.

Then at almost precisely the point described there enters the picture another factor which controls the situation regardless of the theory of what beneficial consumptive use is or what was apportioned to the Upper Basin, and that is the obligation of the Upper States to deliver to the Lower Basin ' 75,000,000 acre feet in successive ten year periods. When such a severe condition is reached that the results of both theories on the Upper Basin would be equal, immediately the condition passes to one where the compact delivery at Lee Ferry controls the amount of water that can be used in the Upper Basin.

The importance of the matter can be illustrated further by changing our thinking from a basin-wise standpoint to a state-wise standpoint. Let us for a moment consider conditions in the State of Wyoming, which state might be most affected percentagewise by the one theory, as opposed to the other theory.

The Bureau of Reclamation in its report estimated the present consumptive uses in Wyoming to be, as I remember it, some 347,000 acre feet per year.

The Engineering Committee after considering this entire matter in a very logical fashion and in a fashion which we believe cannot be attacked, came up with a use by Wyoming, that is, a depletion of the stream by man's activities at the point of use, of 226,400 acre feet. That is a difference of about 120,000 acre feet per year. That is up at the point of use. Some of that difference, not all of it but some of that difference is due to the recognition of the salvage of water on the land itself, in other words, not charging Wyoming with water that was being consumed on the land in the state of nature. There is an additional salvage of channel losses from the state line to Lee Ferry of about 10,400 acre feet. So under the one theory Wyoming immediately would be charged with the 10,400 acre feet of present channel salvage loss plus some part of the 126,000 acre feet which represents salvage on the land.

To illustrate further let us start with rainfall itself. If one has cisterns big enough to catch the rainfall before it started to run off he would salvage about eighty percent of the precipitation that falls on the watersheds. He would have about five times the amount of water that he now has to use if he could start the point where precipitation falls and catch it in cisterns and begin to utilize it.

MR. WALLACE: What percentage of rainfall over the entire Colorado River Basin reaches the Mexican border? Can you make that calculation?

MR. TIPTON: Mr. Wallace, I will not attempt to give you that for the entire basin. I can give you a rough estimate for the Upper Colorado River Basin. Taking a straight average of all of the recorded precipitation, without weighing it for areas, and multiplying that by the drainage area, the results indicate a total average precipitation a year in the Upper Basin of about 75,000,000 acre feet. The Engineering Advisory Committee estimates that the virgin runoff from the basin is slightly over 15,000,000 acre feet. Therefore, in the state of nature, only about twenty percent of the original precipitation reached Lee Ferry.

MR. WALLACE: That is saved and confirms your--

MR. TIPTON: Nature begins to take a toll immediately rainfall touches a leaf or touches the ground.

MR. WALLACE: Eighty percent of the rainfall is consumed in a state of nature before it gets to Lee Ferry as runoff?

MR. TIPTON: Yes sir. A tremendous tonnage of rainfall falls on the Basin and not too much tonnage reaches Lee Ferry or the Gulf of Lower California in the state of nature.

Regardless of what theory the Commission might adopt comes the question: How shall that which is going to be apportioned among the states here at this session be measured? How is the Upper Basin apportionment as made by the Colorado River Compact Commission to be measured?

I am following through now on the theory that I am suggesting, that that which was apportioned to the Upper Basin was the right to deplete the virgin flow of the Colorado River at Lee Ferry by 7,500,000 acre feet. How can that depletion be measured? In my own opinion it can best be measured by the change in relation between the runoff at certain key gaging stations located around the rim of the basin above the major development and the outflow from the basin as measured at Lee Ferry.

These rim stations can be considered index inflow stations. I will define that. It is not possible physically to measure all of the inflow to a basin. It is possible to measure a very substantial part of the inflow. It can be very safely assumed that the streams that are not measured will fluctuate percentage-wise in the same fashion as the natural measured inflow. The test of that to a considerable extent is the degree of correlation found to exist between the recorded flow at such stations and the recorded flow at the outflow station.

I have investigated that means of measurement for the Colorado River Basin as a whole above Lee Ferry and for a number of the sub basins. I have had a number of charts prepared which show the results of that study. It is realized that more stations must be installed in order that the results be satisfactory for compact administration. However, some of the relationships which I found, even with the stations in existence, are not bad. The charts which I have had prepared, and which I shall describe, do illustrate the principle. For each basin, there have been prepared three exhibits: The first is an outline map of the area involved on which has been indicated the stream system and the gaging stations used in the study. The second chart shows the indicated relationship between the stream runoff as recorded at the inflow stations and the runoff as recorded at the outflow stations. The third chart in each series shows the relationship between index inflow and the outflow in progressive ten year means.

In my description, I shall start with the Upper Colorado River Basin as a whole. Twenty-six gaging stations located near the rim of the basin above which there is little man made depletion were chosen as index inflow stations. In the process I am describing, the man made depletion occurring above the index inflow stations should be added to the recorded runoff at those stations in order that the indicated runoff shall represent the virgin flow at those particular points. The twenty-six stations are shown on the attached map entitled, "Upper Colorado River Basin." The outflow station is the single station at Lee Ferry. The sum of the recorded inflow at the twenty-six index inflow stations was plotted against the actual recorded outflow at Lee Ferry, which resulted in the relationship shown on the diagram following the map. The scale on the left of the diagram indicates Colorado River index inflow above Lee Ferry, in terms of 1,000 acre feet. The scale at the bottom of the diagram represents the runoff of the Colorado River at Lee Ferry in units of 1,000 acre feet. Each black point represents the index inflow, this being the sum of the flow at the twenty-six stations, as measured on the scale at the left diagram and the corresponding outflow at Lee Ferry as measured on the scale on the bottom of the diagram. Each black point is designated by the particular year which was involved.

There are some departures from what would be considered as an average line. The departure in some years can be very well explained. The year 1935 departs from what would be considered an average line because it was a fairly good year following the extremely low year of 1934. Ground waters being depleted in 1934, some of the runoff during that 1935 went to replenish ground water storage. The same thing happened in the years 1940 and 1941. 1941 was a good year following an extremely low year of 1940.

The values represented by the points on this diagram were averaged in ten year progressive means and were plotted on the next diagram.

Consideration of ten year progressive series is entirely consistent with the Colorado River Compact because of the provision of the delivery at Lee Ferry in progressive ten year series. It will be noted that the correlation between the ten year progressive series of index inflow as measured at the twenty-six stations, and the outflow as measured at Lee Ferry is excellent.

If the method I am suggesting should be adopted, there would be drawn on a diagram similar to this one the relationship between virgin index inflows and the virgin flow at Lee Ferry. The Engineering Committee has estimated the virgin flow at Lee Ferry for a certain period, 1914 to 1945. We know what the index inflow during that period was. There would be indicated at that inflow point the virgin flow at Lee Ferry and there would be projected through that point a curve showing the relationship between the virgin index inflow and the virgin outflow. Then as time went on, the administrative body that is set up to administer this compact each year would determine the relationship between the past ten year average runoff at the index inflow stations and the actual outflow at Lee Ferry. Gradually that relationship would depart from the virgin relationship. The curve would move to the left, and when at the average point that curve deviated from the virgin condition by 7,500,000 acre feet, at that point would the Upper Basin have reached the limit of its apportionment under the Colorado River Compact.

This inflow-outflow method integrates all factors. It accounts for all of the new losses in the channels. It accounts for the depletions that man is causing to be made at Lee Ferry. There is no guess about it. There is no routing of the depletions down the river. It takes everything in one fell swoop and integrates the changes that are taking place in the Basin due to man's activities.

The other sets of charts consisting of one map and two diagrams each indicate the same type of information for the Green River Basin above Linwood, Utah, the Green River Basin above Green River, Utah, the Colorado River Basin above Cameo, Colorado, and the Colorado River Basin above Cisco, Utah, and the San Juan River Basin above Bluff, Utah. I am not going to describe each of these in detail.

In the Green River Basin above Linwood, only three inflow index stations were used as indicated on the map. Nevertheless, a very good relationship was found to exist between such index inflow and outflow of the Green River near Linwood both on a single year basis and on a ten year progressive means basis. A good relationship also exists between the index inflow stations that were used for the Green River Basin above Green River, Utah, and the outflow of the Green River at Green River, Utah.

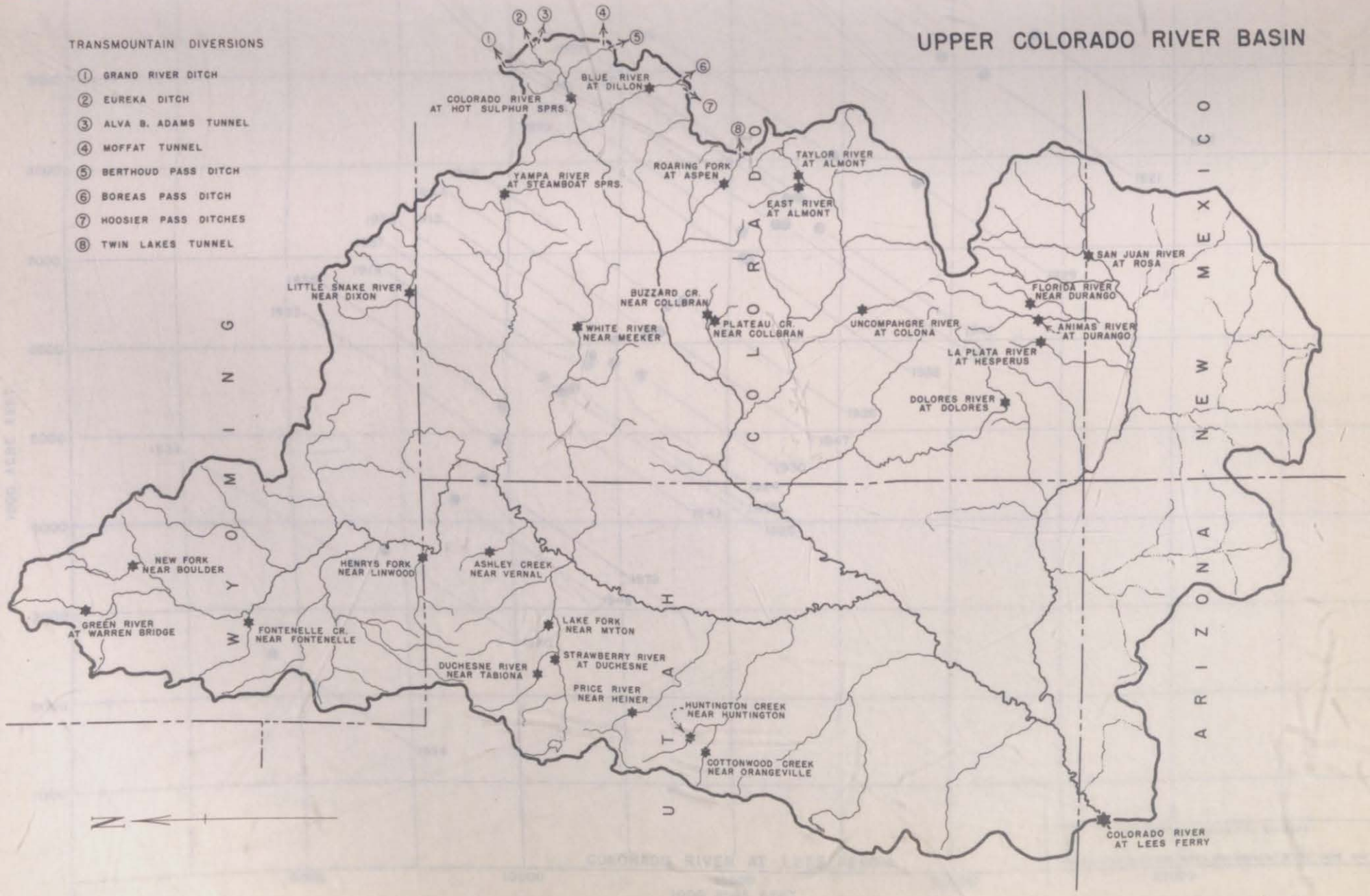
The single year relationship for the Colorado River Basin above Cameo is not particularly good, but ten year progressive mean relationship can be considered as excellent. The same can be said for the Colorado River Basin above Cisco, Utah.

The most unsatisfactory relationship that was found with the ten year progressive mean was for the relationship between San Juan River index inflow above Bluff, and the San Juan River near Bluff. This relationship is not as good as the single year relationship.

Attachment H is intended, in very rough fashion, to suggest a framework for the inflow-outflow means of measurement of the apportionment which will be made to each state and the apportionment that has been made to the Upper Basin. I shall not describe the attachment in detail because it has been suggested merely as a guide for considering administrative provisions of the compact should the inflow method of measurement be adopted.

Now, Mr. Chairman, if there are any questions.

MR. WALLACE: Mr. Chairman, I wonder if Mr. Tipton would discuss somewhat for our benefit the right to the use of the surplus water.



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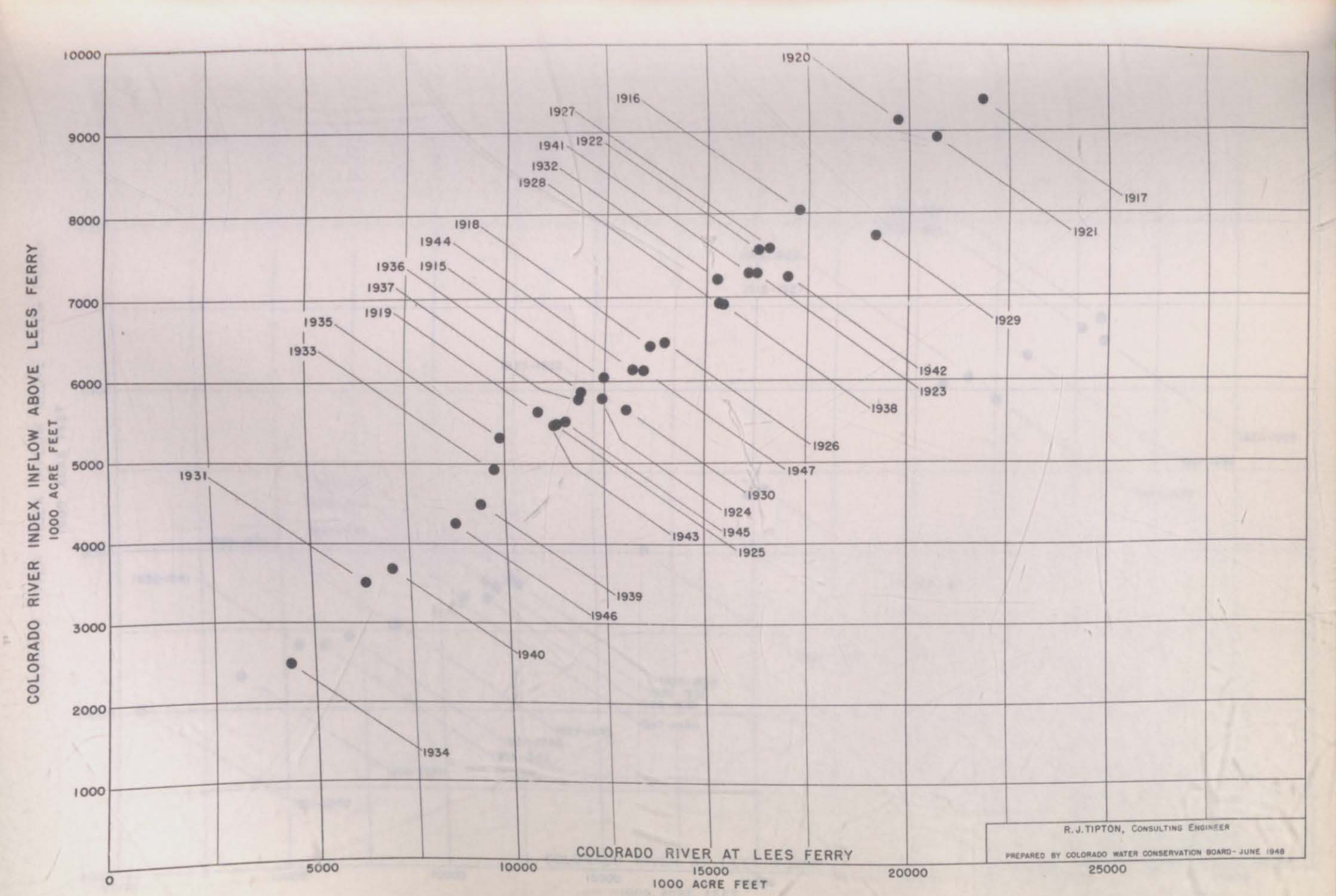
COLORADO RIVER INDEX INFLOW ABOVE LEES FERRY
1000 ACRE FEET
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
5000
10000
15000
20000
25000
COLORADO RIVER AT LEES FERRY
1000 ACRE FEET
1920
1916
1927
1941
1922
1932
1928
1917
1921
1918
1944
1936
1915
1937
1919
1935
1933
1929
1942
1923
1938
1926
1947
1930
1924
1945
1943
1925
1931
1939
1946
1940
1934
R. J. TIPTON, CONSULTING ENGINEER
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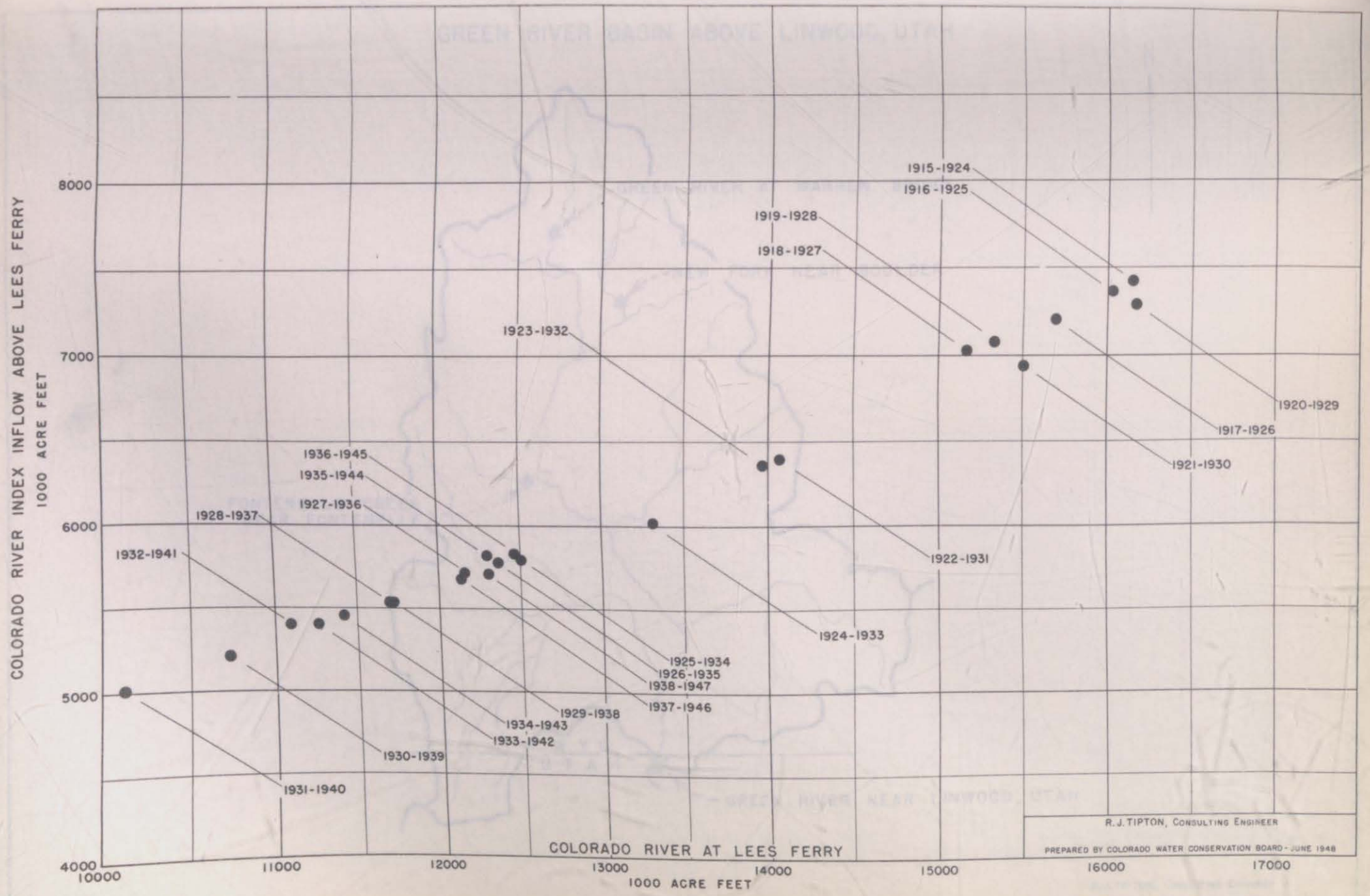
COLORADO RIVER INDEX INFLOW ABOVE LEES FERRY
1000 ACRE FEET
8000
7000
6000
5000
4000
10000
11000
12000
13000
14000
15000
16000
17000
1000 ACRE FEET
1915-1924
1916-1925
1919-1928
1918-1927
1923-1932
1920-1929
1917-1926
1921-1930
1922-1931
1924-1933
1936-1945
1935-1944
1927-1936
1928-1937
1932-1941
1925-1934
1926-1935
1938-1947
1937-1946
1929-1938
1934-1943
1933-1942
1930-1939
1931-1940
COLORADO RIVER AT LEES FERRY
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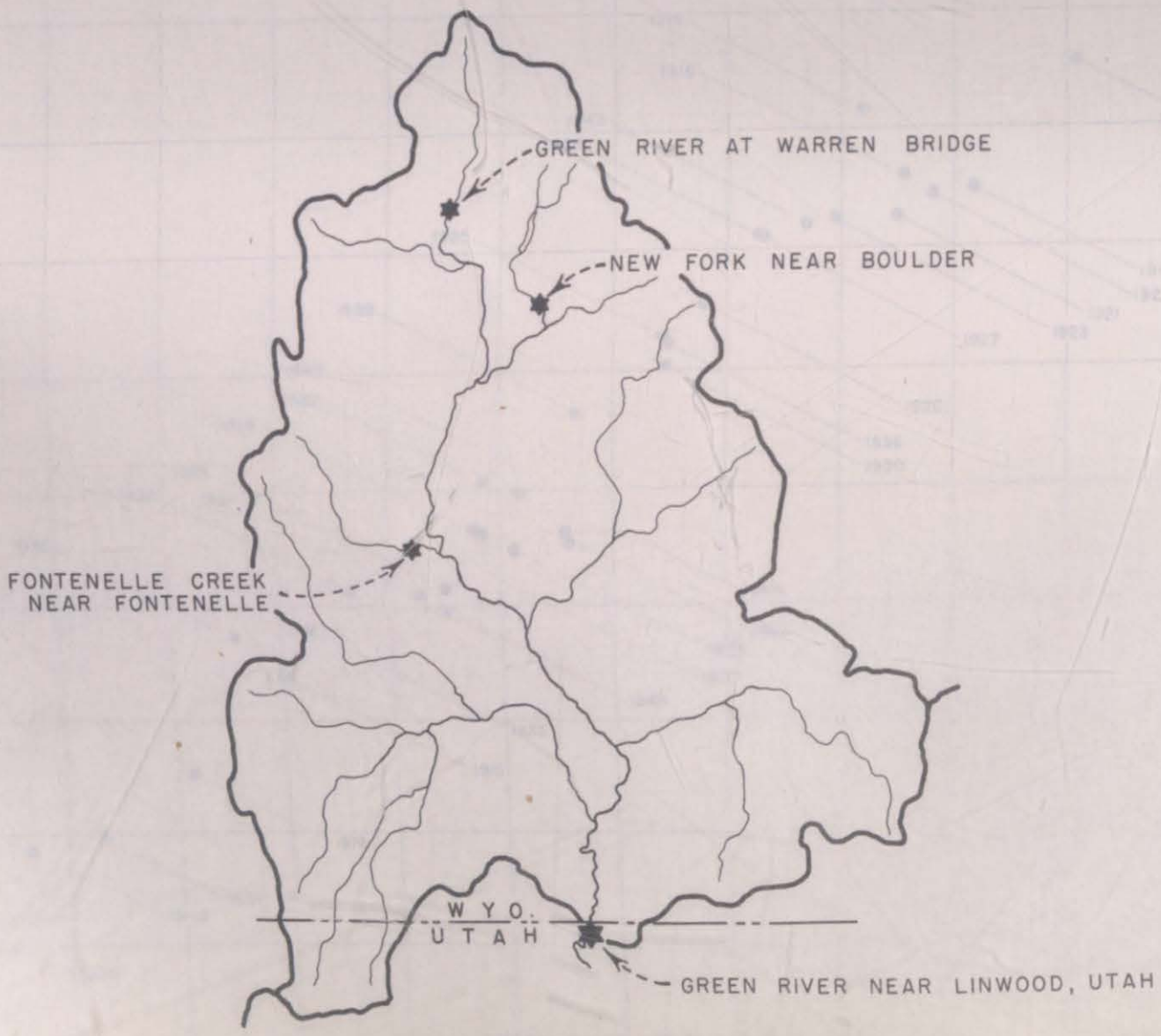
GREEN RIVER BASIN ABOVE LINWOOD, UTAH



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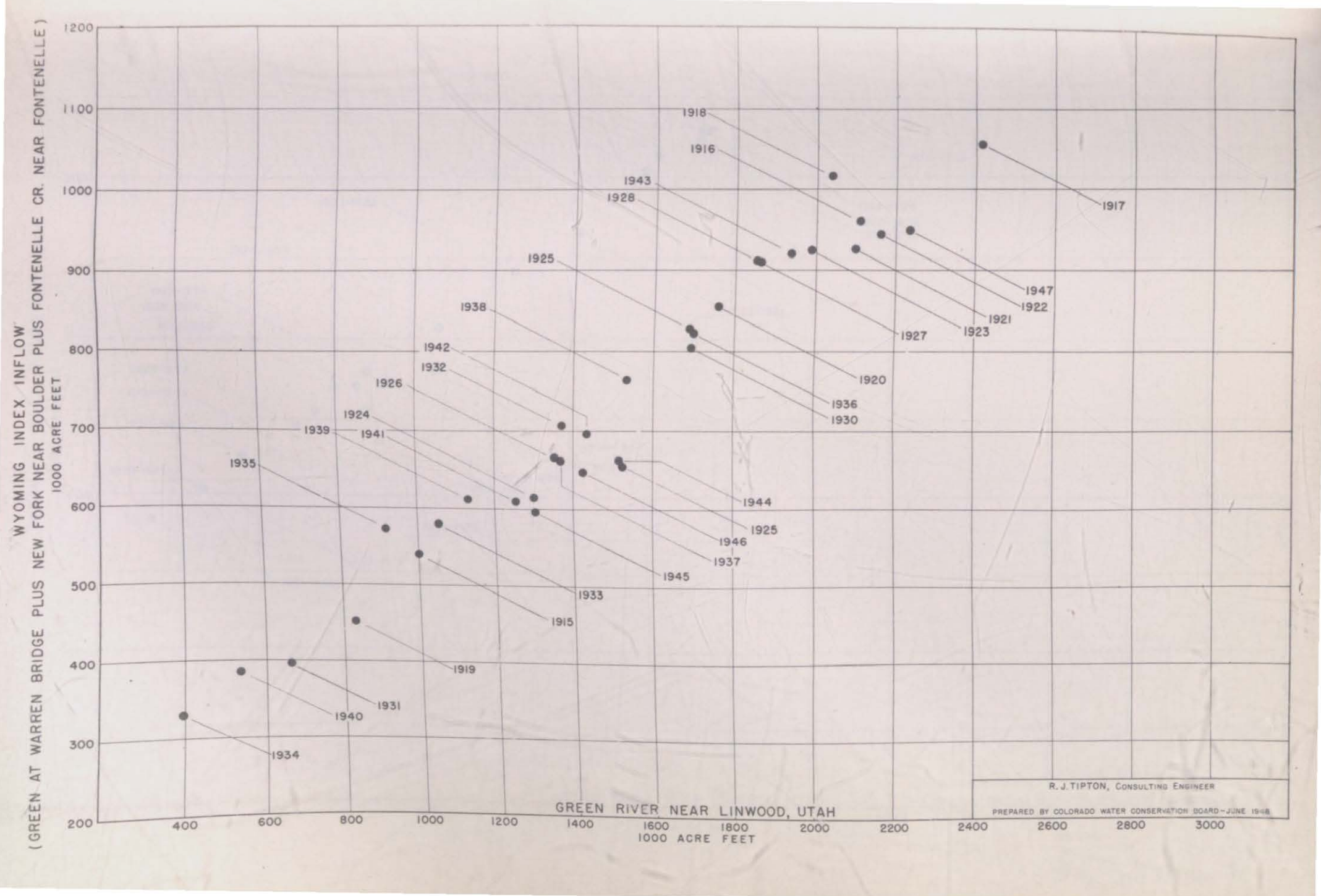
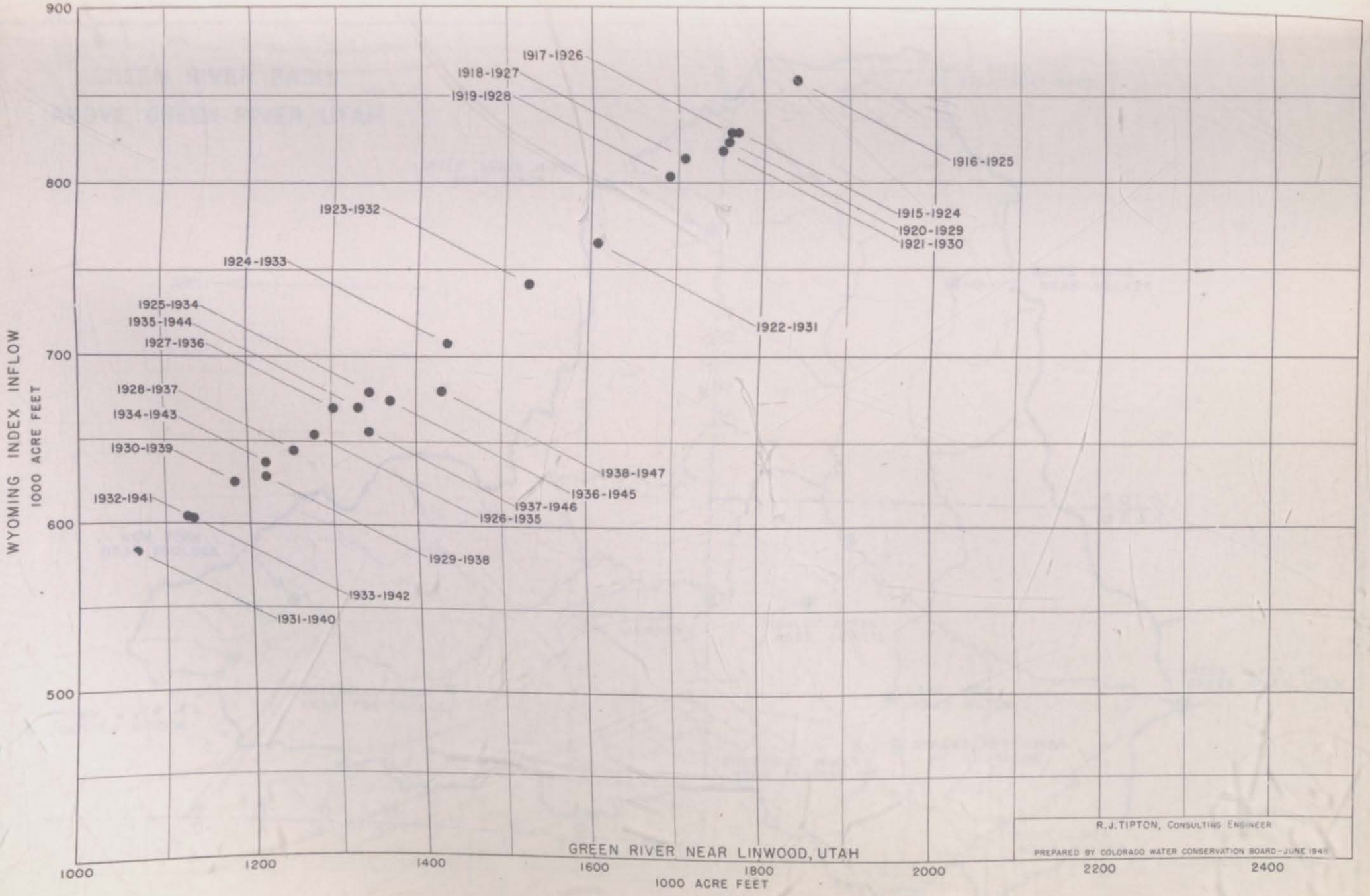
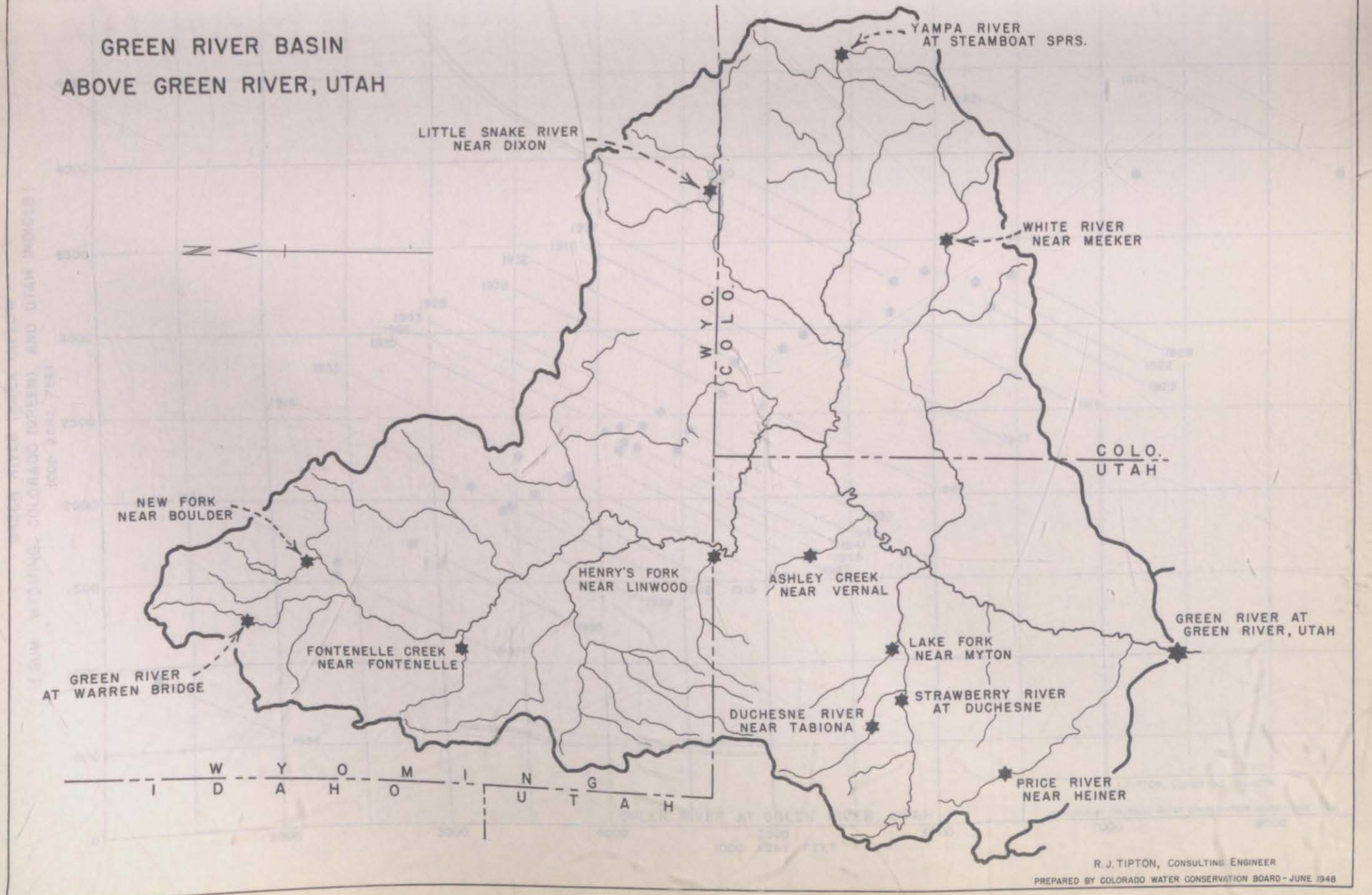
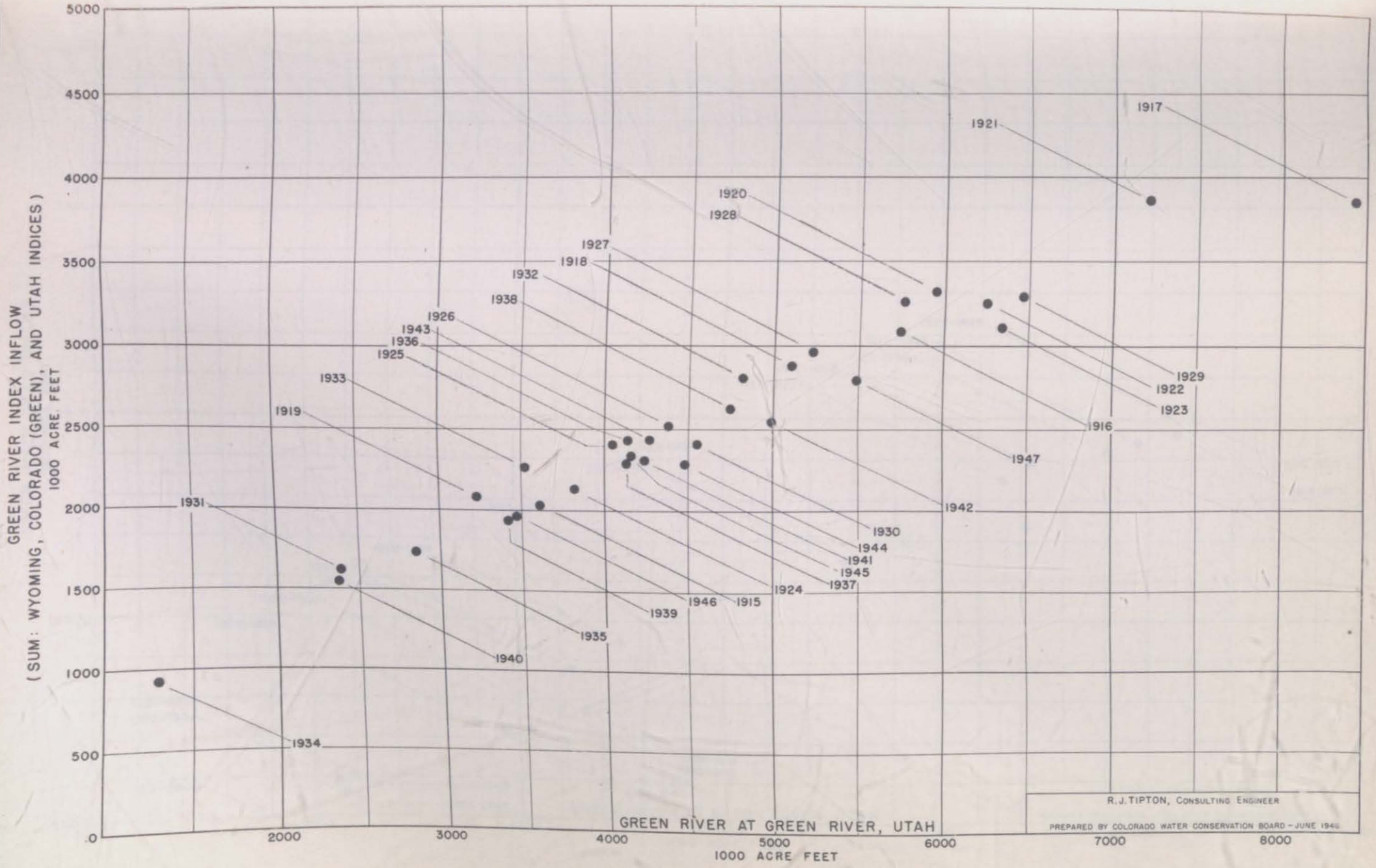
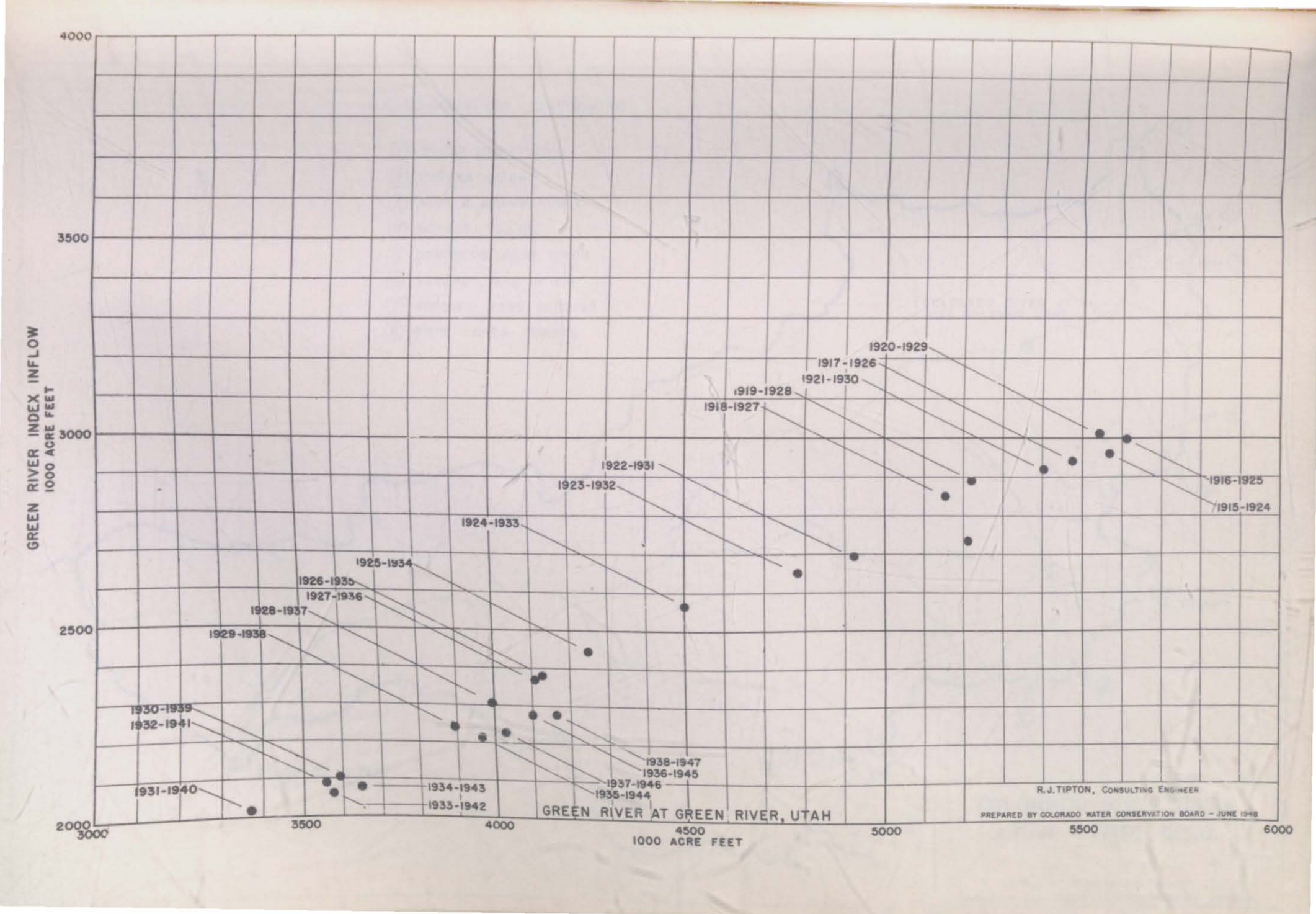
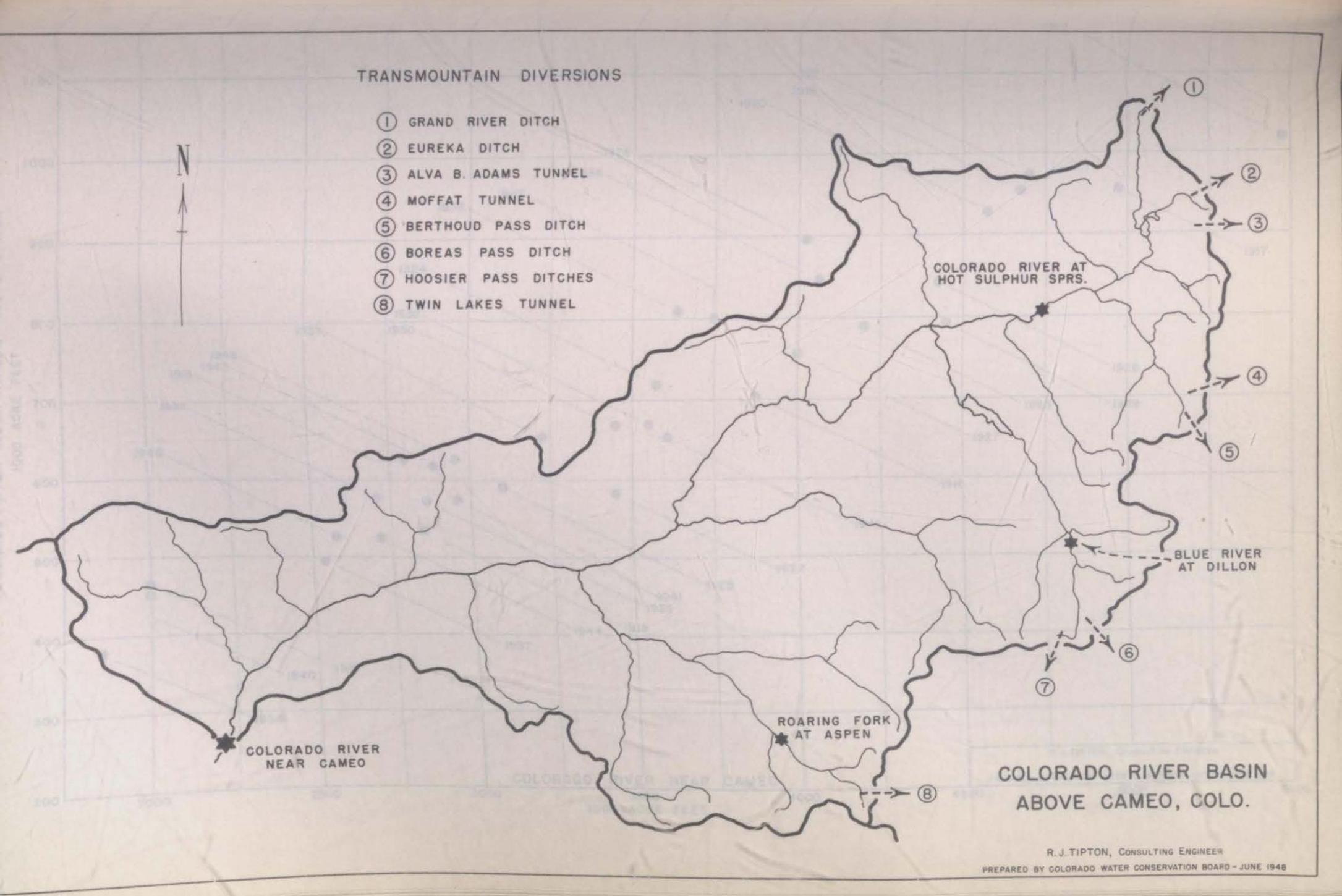

WYOMING INDEX INFLOW
(GREEN AT WARREN BRIDGE PLUS NEW FORK NEAR BOULDER PLUS FONTENELLE CR. NEAR FONTENELLE)
1000 ACRE FEET
1200
1100
1000
900
800
700
600
500
400
300
200
1918
1916
1943
1928
1925
1938
1942
1932
1926
1924
1939
1941
1935
1947
1922
1921
1923
1927
1920
1936
1930
1944
1925
1946
1937
1945
1933
1915
1919
1931
1940
1934
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
GREEN RIVER NEAR LINWOOD, UTAH
1000 ACRE FEET
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948

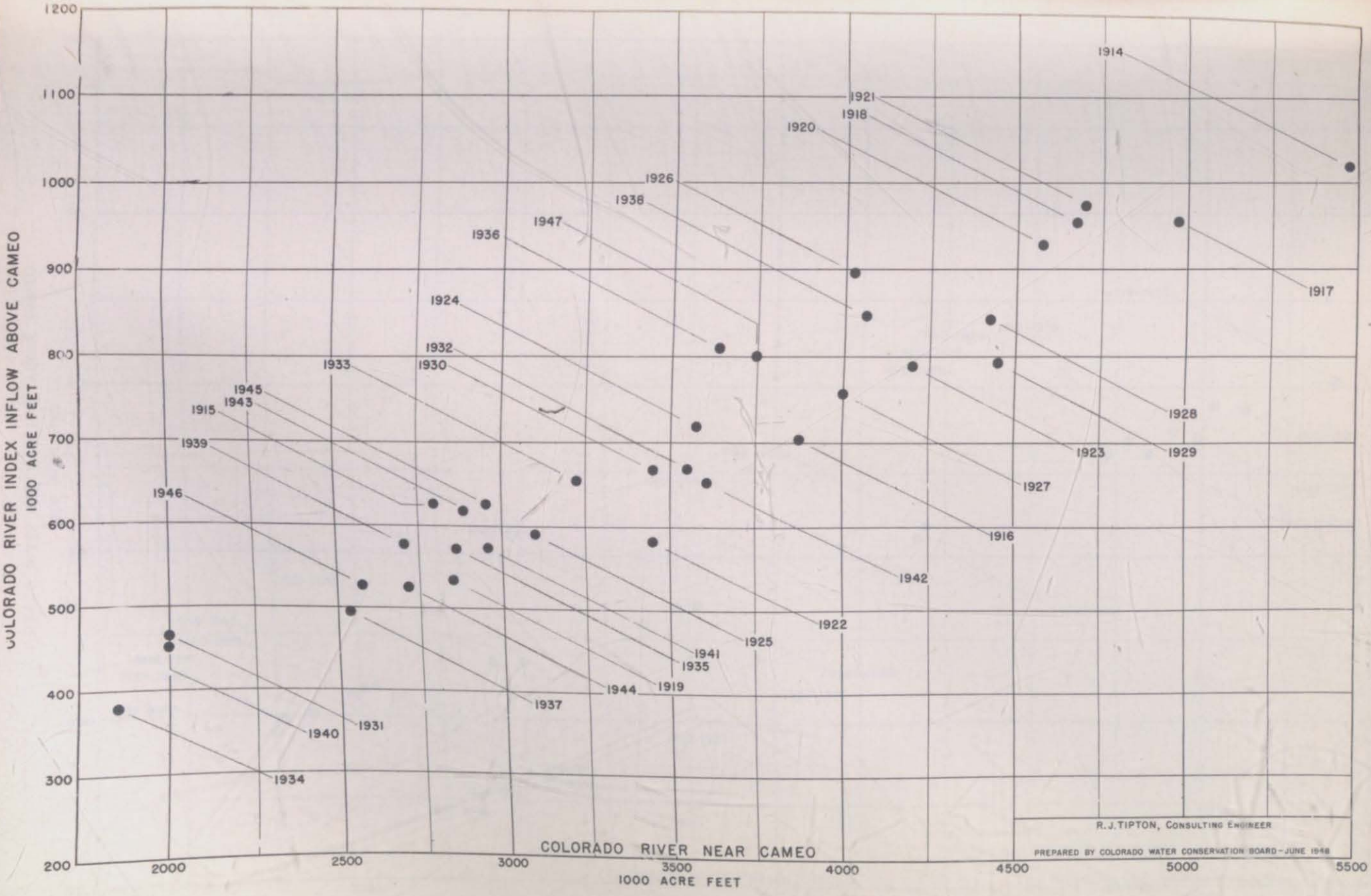

WYOMING INDEX INFLOW
1000 ACRE FEET
900
800
700
600
500
1000
1200
1400
1600
1800
2000
2200
2400
1000 ACRE FEET
1917-1926
1918-1927
1919-1928
1916-1925
1915-1924
1920-1929
1921-1930
1923-1932
1924-1933
1922-1931
1925-1934
1935-1944
1927-1936
1928-1937
1934-1943
1930-1939
1938-1947
1936-1945
1937-1946
1926-1935
1932-1941
1929-1938
1933-1942
1931-1940
GREEN RIVER NEAR LINWOOD, UTAH
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1941

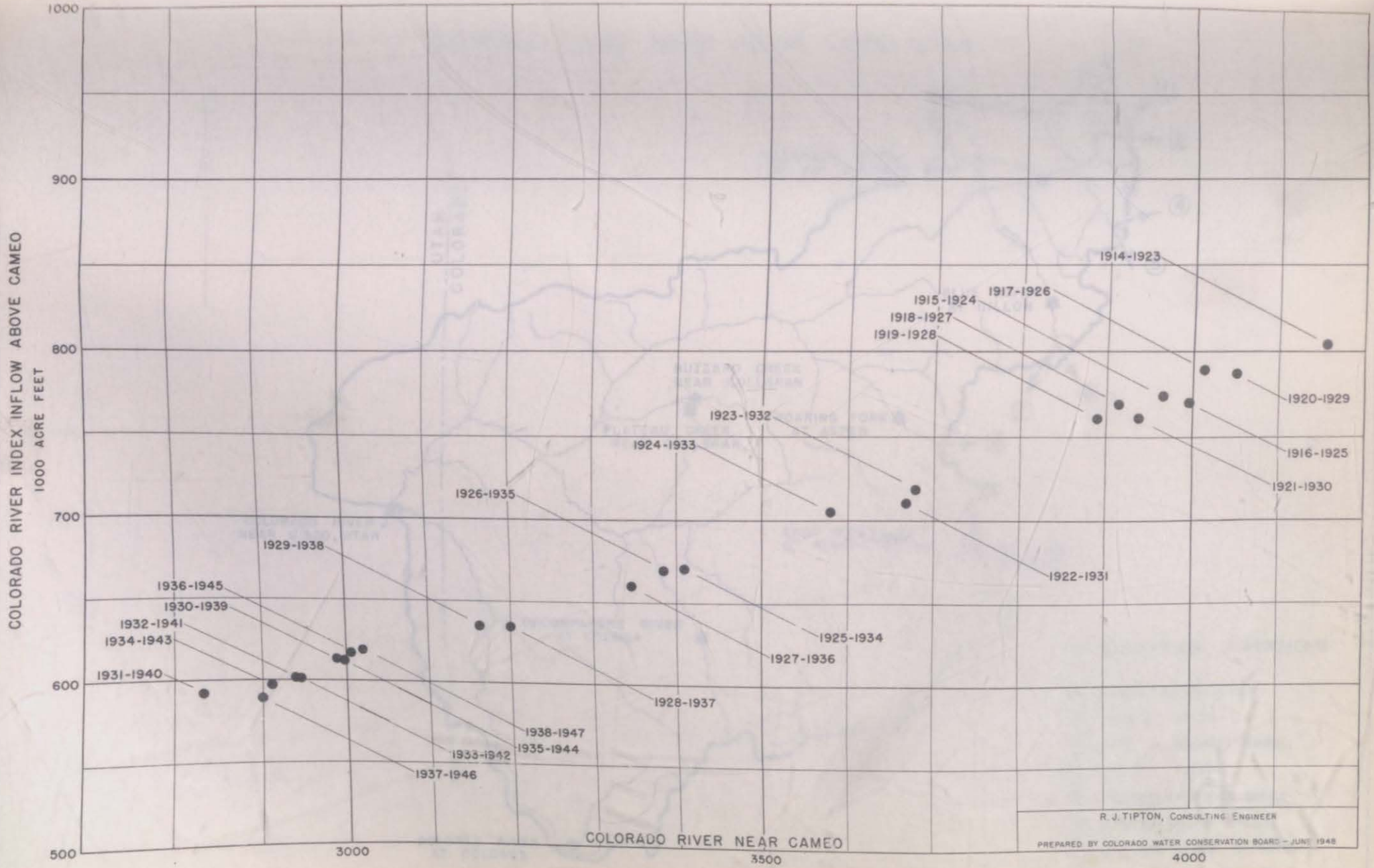

GREEN RIVER BASIN
ABOVE GREEN RIVER, UTAH
YAMPA RIVER
AT STEAMBOAT SPRS.
LITTLE SNAKE RIVER
NEAR DIXON
WHITE RIVER
NEAR MEEKER
N
WYO.
COLO.
COLO.
UTAH
NEW FORK
NEAR BOULDER
HENRY'S FORK
NEAR LINWOOD
ASHLEY CREEK
NEAR VERNAL
GREEN RIVER AT
GREEN RIVER, UTAH
LAKE FORK
NEAR MYTON
FONTENELLE CREEK
NEAR FONTENELLE
GREEN RIVER
AT WARREN BRIDGE
STRAWBERRY RIVER
AT DUCHESNE
DUCHESNE RIVER
NEAR TABIONA
PRICE RIVER
NEAR HEINER
IDAHO
WYOMING
UTAH
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


GREEN RIVER INDEX INFLOW
(SUM: WYOMING, COLORADO (GREEN), AND UTAH INDICES)
1000 ACRE FEET
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2000
3000
4000
5000
6000
7000
8000
1000 ACRE FEET
GREEN RIVER AT GREEN RIVER, UTAH
1917
1921
1920
1928
1927
1918
1932
1938
1926
1943
1936
1925
1933
1919
1931
1934
1940
1935
1939
1946
1915
1924
1937
1945
1941
1944
1930
1942
1947
1916
1923
1922
1929
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1946

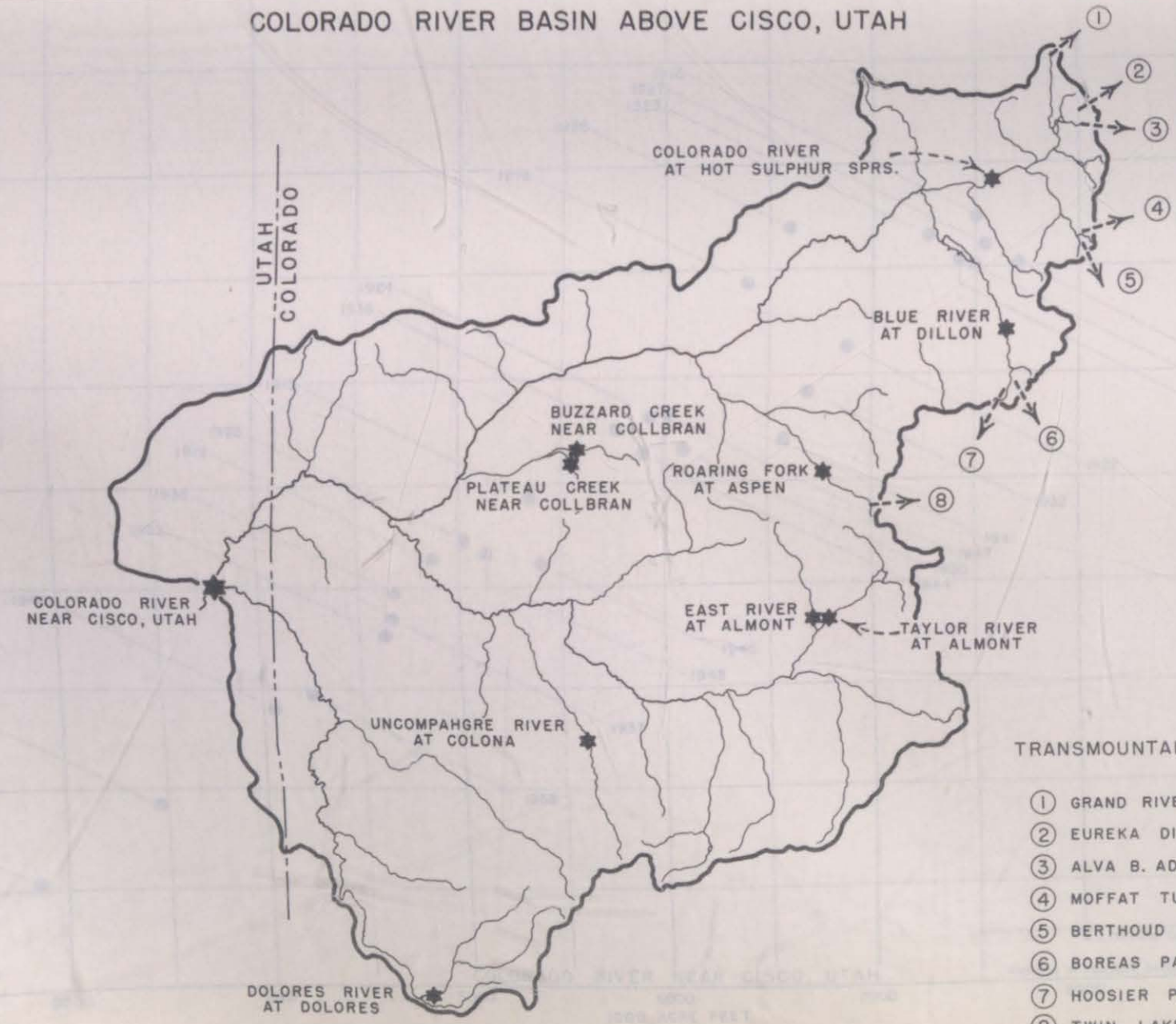

GREEN RIVER INDEX INFLOW
1000 ACRE FEET
4000
3500
3000
2500
2000
3000
3500
4000
4500
5000
5500
6000
1000 ACRE FEET
1920-1929
1917-1926
1921-1930
1919-1928
1918-1927
1916-1925
1915-1924
1922-1931
1923-1932
1924-1933
1925-1934
1926-1935
1927-1936
1928-1937
1929-1938
1930-1939
1932-1941
1931-1940
1934-1943
1933-1942
1938-1947
1936-1945
1937-1946
1935-1944
GREEN RIVER AT GREEN RIVER, UTAH
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


TRANSMOUNTAIN DIVERSIONS
① GRAND RIVER DITCH
② EUREKA DITCH
③ ALVA B. ADAMS TUNNEL
④ MOFFAT TUNNEL
⑤ BERTHOUD PASS DITCH
⑥ BOREAS PASS DITCH
⑦ HOOSIER PASS DITCHES
⑧ TWIN LAKES TUNNEL
N
COLORADO RIVER AT HOT SULPHUR SPRS.
BLUE RIVER AT DILLON
ROARING FORK AT ASPEN
COLORADO RIVER NEAR CAMEO
COLORADO RIVER BASIN ABOVE CAMEO, COLO.
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


COLORADO RIVER INDEX INFLOW ABOVE CAMEO
1000 ACRE FEET
1200
1100
1000
900
800
700
600
500
400
300
200
2000
2500
3000
3500
4000
4500
5000
5500
COLORADO RIVER NEAR CAMEO
1000 ACRE FEET
1914
1921
1918
1920
1926
1938
1947
1936
1924
1932
1933
1930
1945
1943
1915
1939
1946
1928
1923
1929
1927
1916
1942
1922
1925
1941
1935
1919
1944
1937
1931
1940
1934
R.J.TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


COLORADO RIVER INDEX INFLOW ABOVE CAMEO
1000 ACRE FEET
1000
900
800
700
600
500
3000
3500
4000
COLORADO RIVER NEAR CAMEO
1914-1923
1917-1926
1915-1924
1918-1927
1919-1928
1920-1929
1916-1925
1921-1930
1923-1932
1924-1933
1926-1935
1922-1931
1929-1938
1936-1945
1930-1939
1932-1941
1934-1943
1931-1940
1925-1934
1927-1936
1928-1937
1938-1947
1935-1944
1933-1942
1937-1946
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948

COLORADO RIVER BASIN ABOVE CISCO, UTAH



TRANSMOUNTAIN DIVERSIONS

1. GRAND RIVER DITCH
2. EUREKA DITCH
3. ALVA B. ADAMS TUNNEL
4. MOFFAT TUNNEL
5. BERTHOUD PASS DITCH
6. BOREAS PASS DITCH
7. HOOSIER PASS DITCHES
8. TWIN LAKES TUNNEL

R. J. TIPTON, CONSULTING ENGINEER

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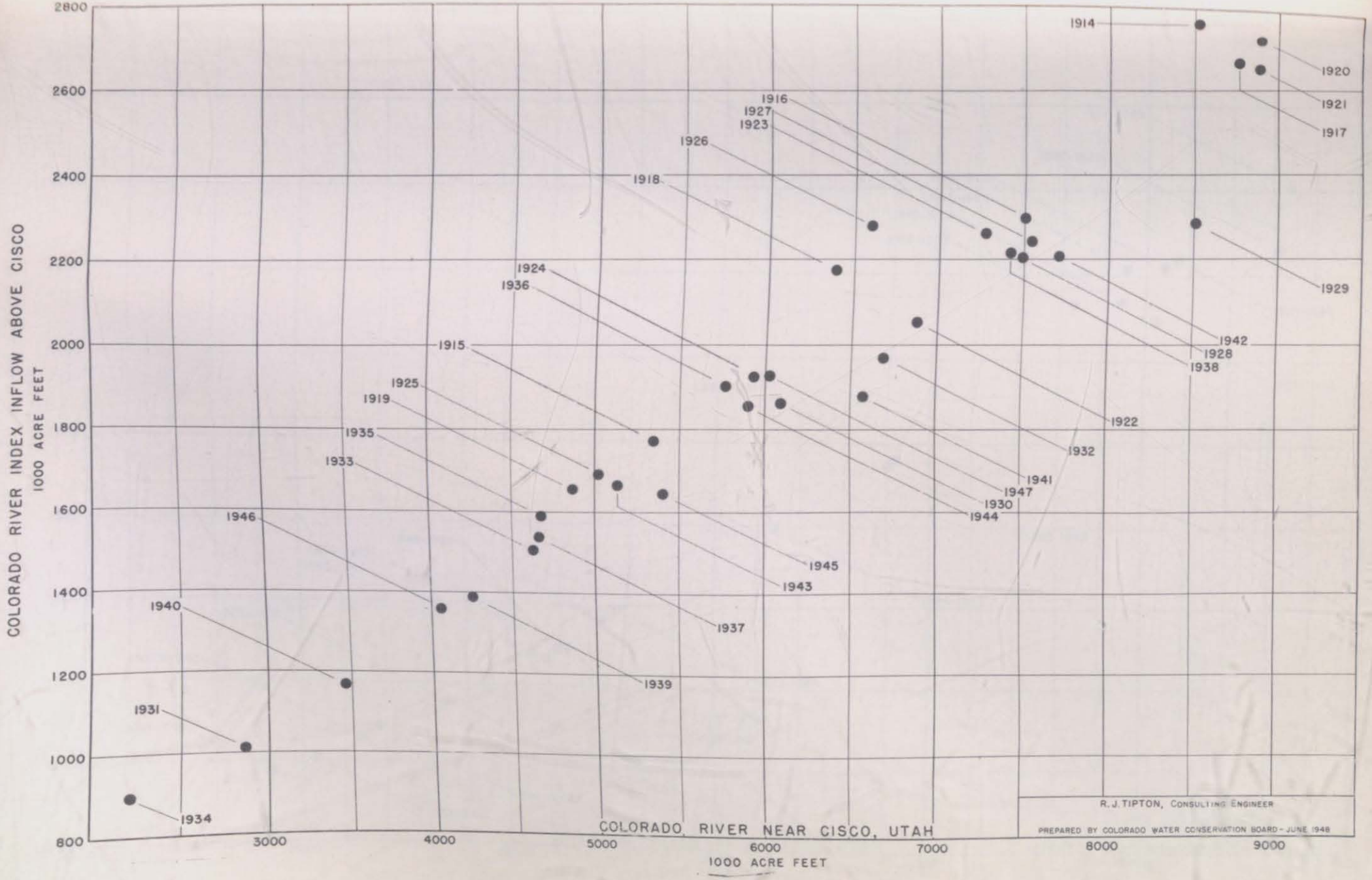
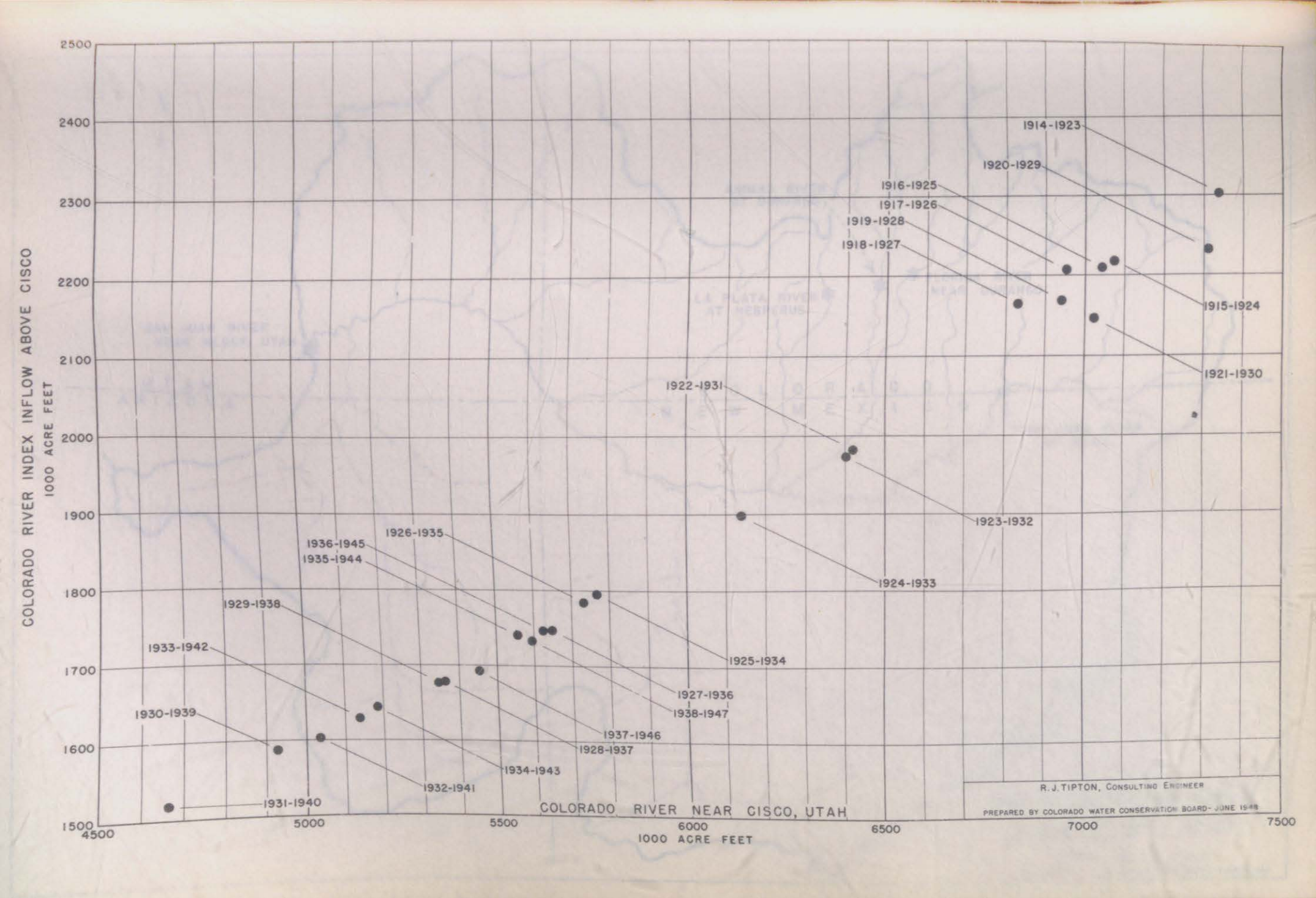
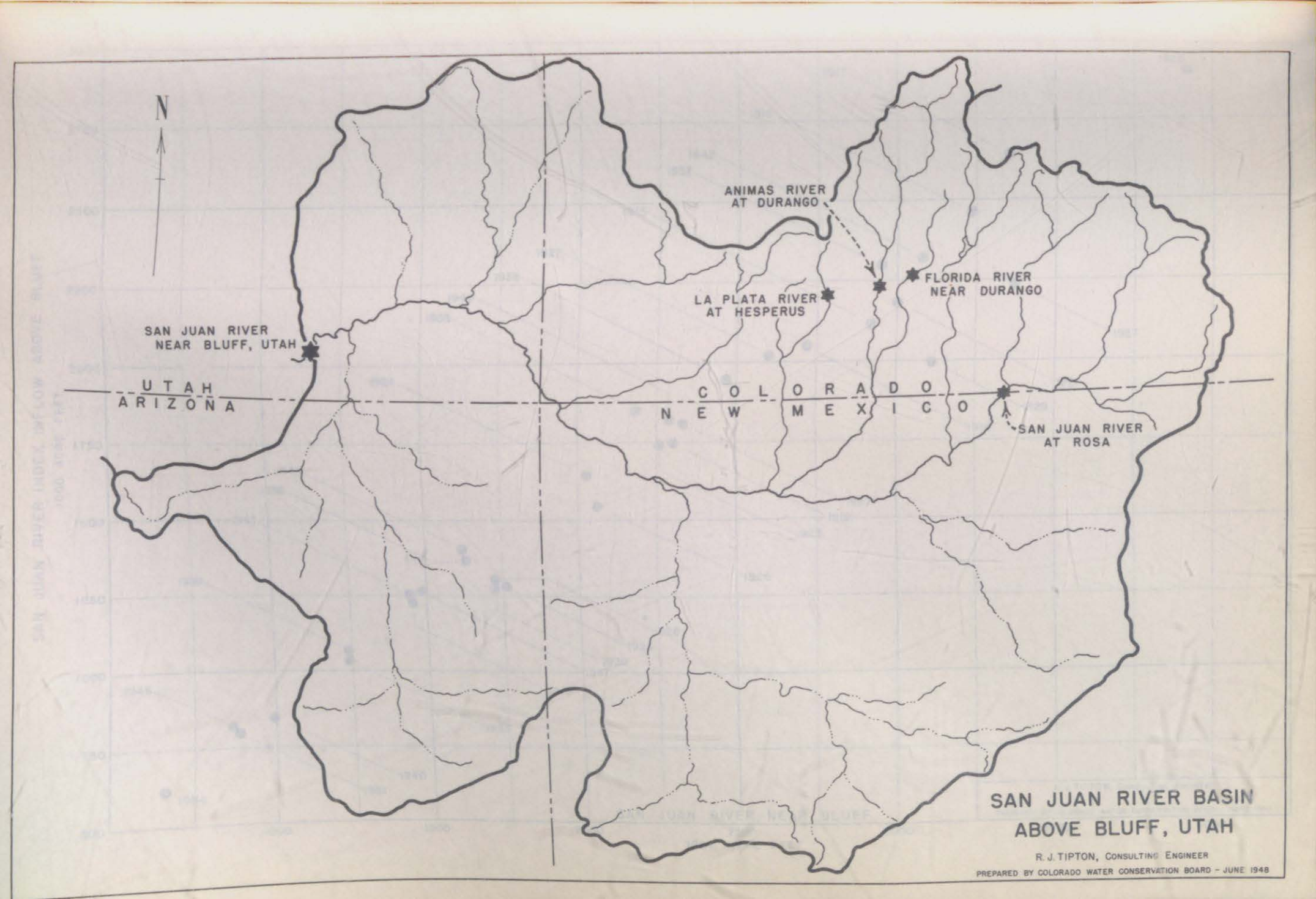
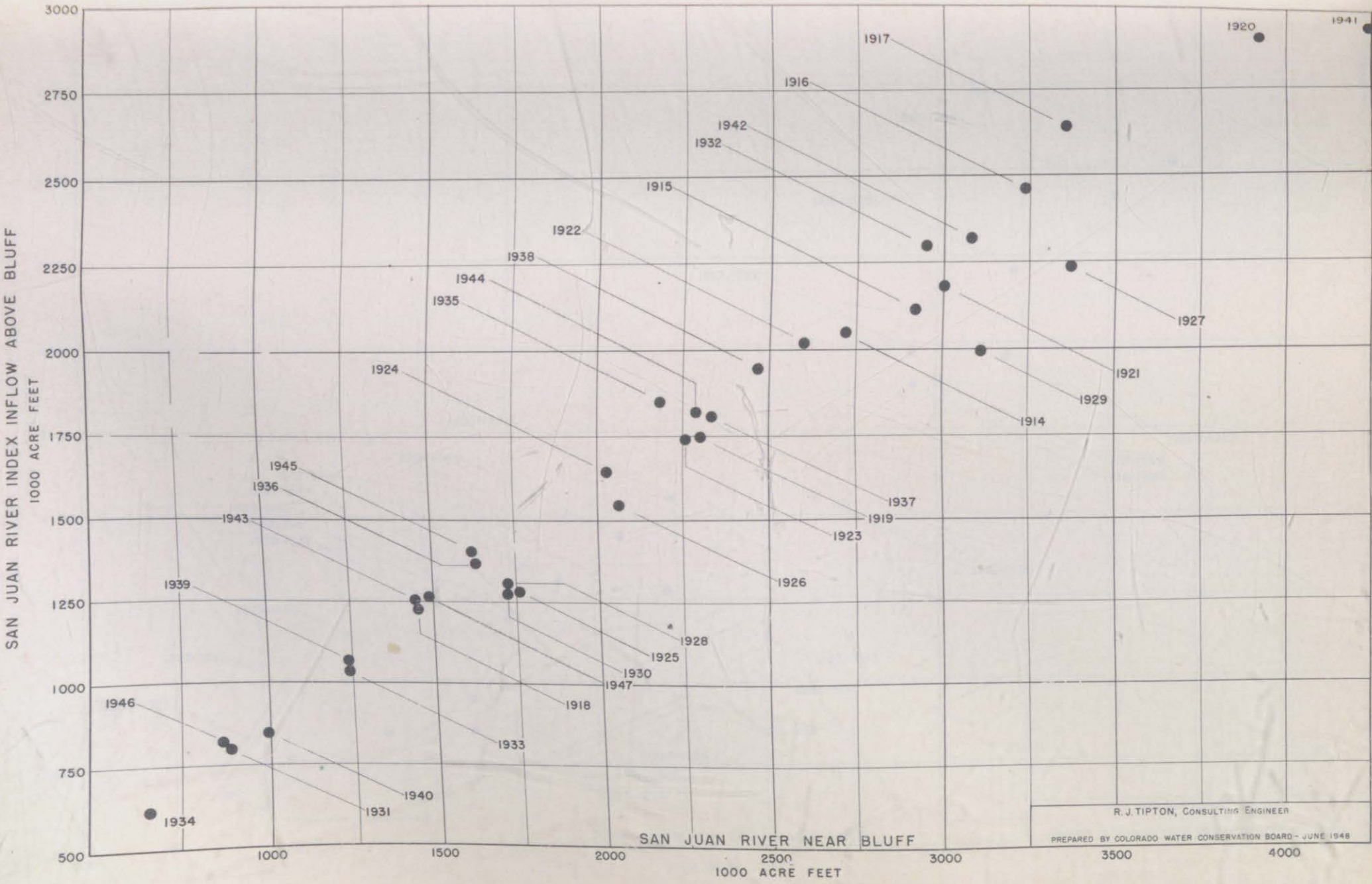

COLORADO RIVER INDEX INFLOW ABOVE CISCO
1000 ACRE FEET
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
3000
4000
5000
6000
7000
8000
9000
1000 ACRE FEET
1914
1920
1921
1917
1916
1927
1923
1926
1918
1929
1924
1936
1942
1928
1938
1915
1922
1925
1919
1935
1933
1932
1941
1947
1930
1944
1946
1945
1943
1940
1937
1939
1931
1934
COLORADO RIVER NEAR CISCO, UTAH
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


COLORADO RIVER INDEX INFLOW ABOVE CISCO
1000 ACRE FEET
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
4500
5000
5500
6000
6500
7000
7500
1000 ACRE FEET
1914-1923
1920-1929
1916-1925
1917-1926
1919-1928
1918-1927
1915-1924
1921-1930
1922-1931
1923-1932
1924-1933
1926-1935
1936-1945
1935-1944
1925-1934
1929-1938
1927-1936
1938-1947
1933-1942
1937-1946
1928-1937
1930-1939
1934-1943
1932-1941
1931-1940
COLORADO RIVER NEAR CISCO, UTAH
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948


N
ANIMAS RIVER AT DURANGO
FLORIDA RIVER NEAR DURANGO
LA PLATA RIVER AT HESPERUS
SAN JUAN RIVER NEAR BLUFF, UTAH
UTAH
ARIZONA
COLORADO
NEW MEXICO
SAN JUAN RIVER AT ROSA
SAN JUAN RIVER BASIN ABOVE BLUFF, UTAH
R. J. TIPTON, CONSULTING ENGINEER
PREPARED BY COLORADO WATER CONSERVATION BOARD - JUNE 1948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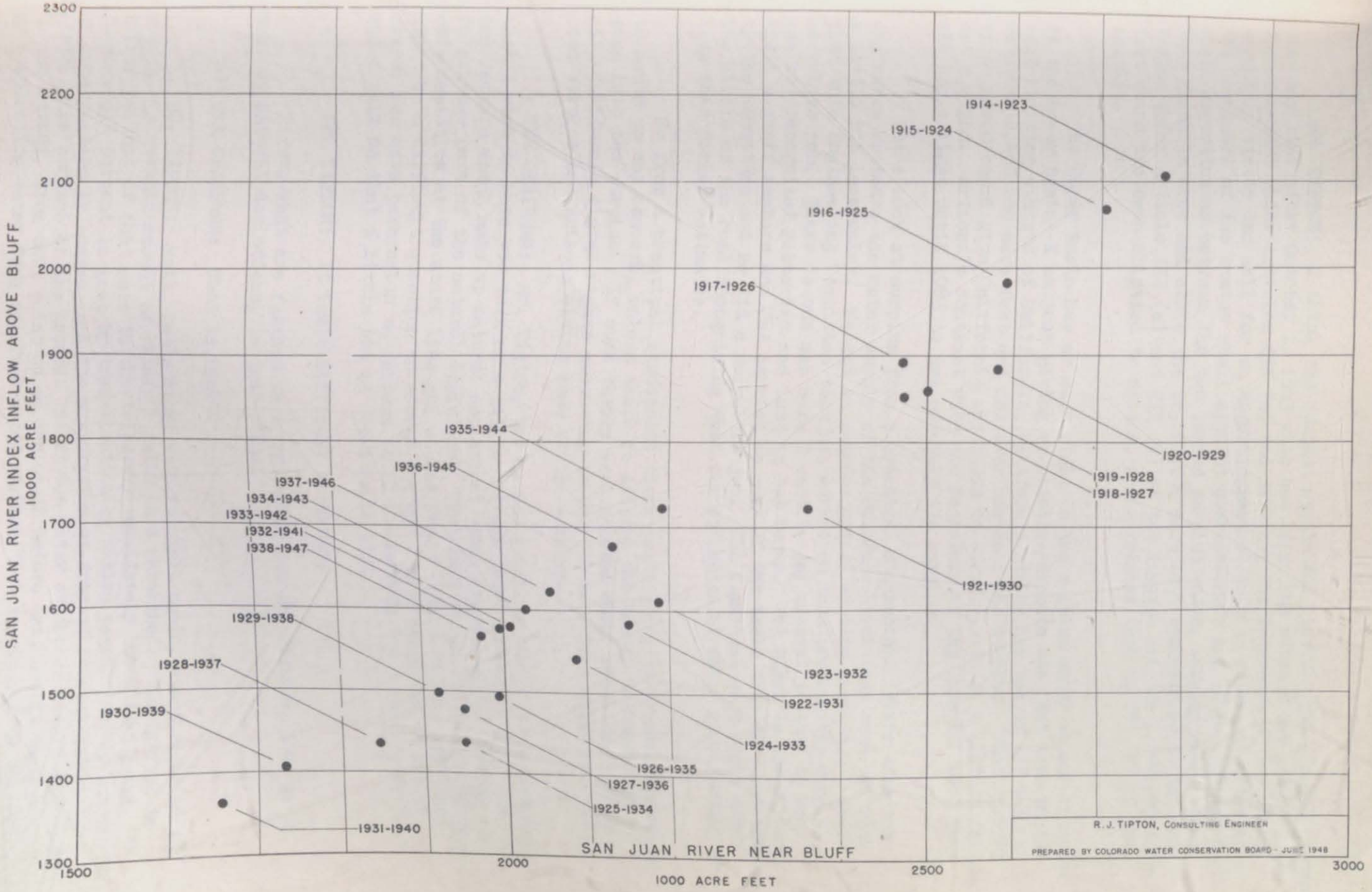
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MR. TIPTON: I think the compact speaks for itself. The compact states that any time after October 1, 1963 when one basin has reached the limit of its apportionment under Articles III (a) and III (b), the Governors of two of the signatory states can call for an apportionment of surplus water, at which time the Governors of the states shall appoint commissioners and those commissioners shall apportion as between the two basins surplus water, surplus water being that which is over and above the 16,000,000 acre feet apportioned to the two basins under Article III (a) and III (b) of the compact and the 1,500,000 acre feet which has been allotted to Mexico, which relates back to III (c) of the compact.

The Upper Basin has as much right to the surplus water as any interest in the Lower Basin--I am just giving my opinion--despite the fact that in the self-limiting statute of California, California limits her use of III (a) water to 4,400,000 acre feet and not over one-half the surplus. That statute by no means could give California any claim on surplus. It is a limitation and not a right. Arizona's contract with the Secretary of the Interior said that she has a right until 1963 to use one-half the surplus.

Let's look at surplus from a practical standpoint. Every time the engineers estimate the water supply of the Colorado River they come out with a little bit less water. We get on sounder ground as time goes on. I think that this Engineering Committee that has worked on this problem has done a marvelous job. There is one man here I want to pay special tribute to who was not recognized yesterday and that is Pat Dugan. Pat Dugan is one of Randy Riter's staff members and Pat carried on many of the tasks that were outlined by the Committee and he did a marvelous job. The Committee went right down the middle of the road recognizing that our estimates of water supply would be less than former estimates.

So from a practical standpoint there isn't going to be enough surplus to cause us any concern, unless there is adopted the theory salvaged water goes into the surplus. If such theory were adopted where would the surplus go? California claims rights amounting to 962,000 acre feet which must come from surplus and Arizona claims some of the surplus.

THE CHAIRMAN: Mr. Tipton, before you conclude I have three questions that I wish to have you talk on a little bit and those questions are: What are the factors which make up natural depletion? What are the things done by man to salvage part of the natural depletion? Then what is the definition of man-made depletion at the state line and at Lee Ferry? Now I realize that that might be a difficult question to answer the way I have projected it but of course you have permission to correct it in the record; but I believe if you would talk on that a little bit it would be in line.

MR. TIPTON: It isn't difficult to answer.

First, what are factors as I understood it, Mr. Bashore, that go to make up natural depletions, is that right?

THE CHAIRMAN: That is right.

MR. TIPTON: Well, let's start with rainfall again, start right at the source. A certain amount of rainfall falls on a watershed. Twenty-five to thirty percent of that gets to the tributary immediately below that point. The 70-some-odd percent is lost by transpiration by native vegetation, by evaporation, by interception by leaves, and the evaporation of some of it even before it strikes the surface of the ground. After the water evidences itself as runoff in the stream, from that point on to the ocean Nature continually takes a toll by evaporating water from the free water surface that is exposed to the elements,

by transpiration by native vegetation that is growing along the stream, some of which is very water-loving, such as cottonwood trees and tules--that kind of plant will consume much more water than will an irrigated crop--and the loss of water from seeped areas along the river banks.

I can give an outstanding example which happens to be very close to the Chairman's home. The Chairman lives at Mitchell, Nebraska. He, I think will confirm this. The Platte River below North Platte, Nebraska, flows through a broad, sandy channel. On hot, windy summer days the river can have a fairly good flow at North Platte and be dry shortly below North Platte and on down for a considerable distance. There can come a day when the clouds cover the sun, the weather gets somewhat chilly, and 2,000 second feet will evidence itself in that reach immediately. I have seen it happen. Two thousand second feet were being lost by Nature in that broad river channel by native vegetation and evaporation. When the evaporation rate was reduced by the sudden change in weather, that which was naturally being lost evidenced itself as streamflow.

I can give another good example which is interesting. One time my firm was installing an 84-inch pipe line. It was at 9,000 feet elevation where evaporation is not very high. The contractor laying the pipe had considerable difficulty in figuring out why he laid pipe in a wet trench at night and a dry trench in the daytime. That is a good example of what I am talking about. In the daytime Nature was taking a certain amount of water by evaporation and transpiration. The plants along side of that trench were active in the daytime. At night they were somewhat dormant. The temperatures were down and the water came up in the trench. In the daytime Nature was taking that water.

I shall cite another good example. On the Arkansas River, I have made a series of studies of flood flows past various gaging stations down the stream. Flood flows in any river system will flatten out. The peak will become smaller on account of valley storage. But in taking the total quantity of water in those flood flows, not just the peak flow, but taking the actual acre feet during the flood period there is a very marked reduction in the amount of water that passes station after station. That water is being taken by Nature. The water is going out over the banks, flooding the area. There is abnormal evaporation from the surrounding area, and abnormal transpiration by the native vegetation. All of those factors are factors which are parts of the depletion caused by Nature of streamflow.

The next question, Mr. Bashore?

THE CHAIRMAN: Things done by man to salvage natural depletion.

MR. TIPTON: I will have to repeat some of the statements I made before. On the land which man is now irrigating there was being consumed in varying degrees in the state of nature some water. On some of the bench lands there was very little being consumed except precipitation.

With respect to lands along the river bottoms, which were the first lands that were irrigated in the West along each of the streams, there was a large salvage of water at the point of use when man came into the picture. In other words, on those lands there was being consumed water from the river by transpiration by native vegetation; there was being consumed water by overflow in floods which later were controlled by the construction of reservoirs for irrigation purposes. The extent to which man is utilizing for his own good that water which formerly was lost in the state of nature, to that extent is he making a salvage.

In some instances he may not be placing any additional burden on the stream whatsoever. If he goes out and cuts out a cottonwood grove or drains a tule swamp, he is not only not putting any additional burden on the stream, but he is actually putting back into the stream more water than there was before he came into the picture because that kind of vegetation consumes more water than do irrigated crops.

The next item of salvage of water by man is the reduction in channel losses. We have found in our studies of the Colorado River, and it is common with all rivers, that channel losses vary in accordance with the quantity of water being carried in the river. The greater the amount of water, the greater the loss. If a channel were precisely a box canyon that might not be true; and if it had no vegetation growing along it and it had no seeped areas, that might not be true. The channels are not of that character. The surface area will be smaller with the lesser amount of water. The amount of water made available for transpiration by native vegetation will be smaller the less the amount of water carried, and the extent of saturated areas on either side of the stream will be less the lesser the quantity of water. So that if man takes out a certain amount of water up at the point where he is using water that means there is less water flowing in the stream from that point clear on down in this case to Lee Ferry. That lesser amount of water will result in a lesser channel loss. So man can burn up that much more water at the point of use without his affecting at all the flow at the downstream point.

There are those two major sources of salvage by man's activities: (1) The conversion at the point of use of some of the water that was being lost by Nature, conversion to his use; (2) The reduction in channel losses by causing to be in the channel less water than there was formerly.

There is a reverse process in connection with this in some of our river basins. The Pecos River, above Lake McMillan, is an outstanding example. There, on account of man's activities at Lake McMillan, there has grown on the delta some twelve to fifteen thousand acres of salt cedars. Those cedars are consuming approximately 55,000 acre feet per year. That is an increase in loss by nature on account of man's activities, but it is a matter that can be solved by physical means.

I think the next question was the man-made depletion at state lines and at Lee Ferry.

THE CHAIRMAN: That is correct.

MR. TIPTON: Let's put one other in there: The man-made depletion at point of use and the man-made depletion at the state line and the man-made depletion at Lee Ferry.

The man-made depletion at the point of use is the extent to which man at that point is causing the stream at that point to be diminished. The salvage that is involved there is the conversion on his land of the water that was being lost in the state of nature to his own use. That is the man-made depletion at the point of use.

The man-made depletion at the state line is the extent to which man is depleting the flow at the state line by his use at the point of use. In other words, there comes into the picture there the salvage of channel losses between his point of use and the state line.

Let's take again a hypothetical transmountain diversion. Let's assume again 500,000 acre feet are taken out of the river in Colorado up at the

Continental Divide. That is depleting the flow of the river and the tributaries at that point by 500,000 acre feet. That is the depletion by man at the point of use. If that water were left in the river all of it would not have reached the state line between Utah and Colorado because some of it would have been lost in transit. So man-made depletion at the state line in that instance would have been 500,000 acre feet minus the channel losses that would have been salvaged between that point of use and the state line.

Going on down with the same example to Lee Ferry, say at the state line, that became 425,000 acre feet; all of that 425,000 acre feet at the state line, had it been left in the river, would not have reached Lee Ferry because some of it would have been lost in transit by evaporation from the surface of the stream, by transpiration by native vegetation, and by evaporation from seeped areas. Say there had been salvaged 25,000 acre feet more, then the man-made depletion at Lee Ferry would have been say 425,000 acre feet. In other words, by taking out 500,000 acre feet up at the point of use he may be depleting the flow at Lee Ferry by only 450,000 acre feet and that is what I term man-made depletion at Lee Ferry.

We start out with man-made depletion at the point of use, then we have the man-made depletion at the state line, then the man-made depletion at Lee Ferry. Does that make it fairly clear?

THE CHAIRMAN: Thank you very much, Mr. Tipton. It is clear to the Chairman, and I assume everybody else can understand it.

MR. WALLACE: I just want to say this word or two: First, I would like to thank the State of Colorado for giving to this meeting this remarkable exhibition of experience and knowledge and the judgment that will enable us greatly to emphasize our position. And I would like to pay tribute to Mr. Tipton and say that I believe he is the best experienced and most skillful man and the best advised man in the entire United States to lead us in this matter. And I would like to say in behalf of all this organization, I think you ought to stand up for a moment, all of you, and say thank you to Mr. Tipton. I would like you to do it. (All present stand and applaud.)

MR. TIPTON: Mr. Wallace, when I consider that coming from you, I sincerely appreciate it.

THE CHAIRMAN: Gentlemen, we will recess for five minutes to give our reporter a little bit of rest.

(11:00 a.m. Recess.)

(11:15 a.m. Meeting reconvened.)

THE CHAIRMAN: The meeting will come to order. Gentlemen, there is a gentleman here who was formerly Dean of the Engineering Department of the University of Wyoming who is now Dean Emeritus, who has participated in these studies and given us the benefit of his advice and assistance. Dean Goodrich now has a question to ask Mr. Tipton.

MR. GOODRICH: Mr. Tipton, my question is: Is it your suggestion or recommendation that definite figures as to index flow and virgin flow quantities be inserted in this article, Attachment "H"? And further, the second question: In Attachment "Q" is it also your recommendation that the index stations as listed here and the additional ones in the 26 more or less stations that have been utilized thus far, be made a matter of record and use in the final compact?

MR. TIPTON: Dean Goodrich, I think that is a good question and I think

probably the record should be cleared somewhat on that point. I was discussing principles and I was suggesting a means of measurement, which if the principle were adopted by the Commission the Commission could do whatever it chose as to devising the proper means.

Now, I did not have in mind that this would be hard and fast--that is my own opinion--and could be handled in one of three ways.

If the principle were adopted by the Commission, the administrative body could be instructed what to do. There would have to be set up a virgin flow at the present time, but it would be instructed as to what to do after more records of index inflow had been obtained from present stations and more stations. That is one way to handle it.

Another way to handle it would be to put in the definite amounts now and say, "That is it and those are the only index inflow stations that will be considered." I personally would be 100 percent opposed to that kind of procedure.

A third way of handling it would be to put in the relationships which the engineers could consider as acceptable between present index inflow stations and outflow stations, recommending others be established, put those in the compact at the present time, leaving it up to the Commission to establish any more they think should be established in the future; and then put in instructions as to how the records from the new stations should be covered into the relationships which would be put in at the present time.

There are those three ways it could be handled. I did not have in mind myself that categorically we would put in at this time relationships from indicated index inflow stations and say that is the end. Do I make myself clear?

MR. GOODRICH: Thank you.

THE CHAIRMAN: In Mr. Tipton's statement he made the assertion that the Colorado River Compact Commissioners apportioned the virgin flow of the Colorado River. We have a gentleman with us who has been participating in the deliberations of the Engineering Committee and I believe this man is in a position to support or deny your statement. I will now call on Mr. Meeker, an engineer of some forty-five years' experience in handling water matters in the West for his comments on Mr. Tipton's assertion.

MR. MEEKER: Mr. Chairman, Commissioners: In working out the flow of the river that had to be divided at Lee Ferry in the '22 Compact, the term was used there of reconstructed flow, which is the equivalent of the virgin flow--the same thing, no difference.

And in arriving at that figure we took the irrigated lands and applied the appropriate consumptive use rates based on information then available and arrived at the depletion, the consumption on the lands, and then added that to the Lee Ferry historic flows and arrived at the total or reconstructed flow.

So I am in perfect accord with Mr. Tipton's statement as to the apportionment of the virgin flow in 1922.

THE CHAIRMAN: Mr. Meeker, were you present at the negotiations of the Colorado River Compact or to what extent did you participate in them?

MR. MEEKER: I participated I think in every session. I was present for fourteen days and nights and I know the background and foundation. I had

the census data and Mr. Hoover instructed Mr. A. P. Davis and myself to reconstruct the river flow based on that information and the information we used was the accepted practice at that time.

THE CHAIRMAN: Thank you, Mr. Meeker.

COM. WATSON: Mr. Meeker, were you present during the last eight meetings at Bishop's Lodge?

MR. MEEKER: That is where I was, yes.

COM. WATSON: You were present at those meetings?

MR. MEEKER: Yes, sir.

MR. WALLACE: Mr. Chairman, the charts that have been prepared by Mr. Tipton seem to be of very great value and I think if I were Mr. Tipton I would pretty nearly copyright them. But Judge Stone has volunteered to have those charts prepared in such a way that they may be a part of the record of this meeting. I think it is a very generous offer and I trust it may be accepted and I so move, Mr. Chairman, that we accept those from Colorado. Does that motion receive a second?

COM. WILSON: Second the motion.

THE CHAIRMAN: Is there a discussion of the motion? (Thereupon a vote was taken and Mr. Wallace's motion carried unanimously.)

Mr. Meeker, you have a further statement?

MR. MEEKER: Yes, I wish to make this added statement: that what was apportioned at Lee Ferry, the 7,500,000 acre feet to the Upper Basin is measured by the depletion at Lee Ferry.

COM. STONE: Mr. Chairman, many of us value Mr. Meeker's experience and observation during the time the Colorado River Compact was negotiated, and that is partly due to the fact that he was not a mere onlooker but I think the record should show that he was there in an official capacity as engineering adviser to one of the Compact Commissioners. May I ask Mr. Meeker if that statement I just made is correct?

MR. MEEKER: Yes.

COM. WATSON: Mr. Chairman, we have another gentleman here, Dr. Widtsoe, who was also at those Compact meetings and attended all of them at Bishop's Lodge in November 1922.

THE CHAIRMAN: I am glad you mentioned that, Mr. Watson, and I think tomorrow the Chairman will call on Dr. Widtsoe. It doesn't appear appropriate to do so right now although Dr. Widtsoe is well informed on all these matters, but this is probably too abrupt to ask a man to go back in history and remember things. I would certainly appreciate it and I know all the Commissioners will appreciate a statement from Dr. Widtsoe after he has had time to review the matter. I presume you would prefer to do that tomorrow, Dr. Widtsoe?

DR. WIDTSOE: Yes, I would.

THE CHAIRMAN: Well then tomorrow sometime we will have a statement from Dr. Widtsoe. Now are there any further observations or questions on the presentation made by Mr. Tipton?

MR. CLYDE: I simply wanted to make one comment on the matter of principle which I think is too often perhaps coming into the discussion. I think that as the states come here to consult with one another as to what they are going to do with Upper Division water, they are going to have to decide what the Upper Basin States think is fair as among ourselves and is perhaps legally right and that we ought not merely because some Lower Basin State might object to the compact, write one that is unsatisfactory to us merely to eliminate from the compact something that the Lower Basin might object to. I don't think we are attempting to write a compact to please any Lower Basin State; we are trying to write one that will equitably apportion the water among the Upper Basin States. We ought to examine it on its merits. If we think it is right legally, if we think it is adaptable to the problems of the Upper Basin, we ought to take it and then defend it to our own legislatures and if some Lower Basin State wants to object to it, we will have to let them object.

If we try to devise a compact here now that will meet every conceivable objection of every Lower Basin State we won't get one we can defend and want in the Upper Basin. And therefore I personally completely ascribe to the philosophy that Mr. Tipton has given that if the idea of depletion is the thing that the Upper Basin wants, let us adopt it regardless of what some Lower Basin State might think about it.

THE CHAIRMAN: Mr. Wehrli.

MR. WEHRLI: Subparagraph (a) of Article III of the Colorado River Compact provides:

> "There is hereby apportioned from the Colorado River system in perpetuity to the upper basin and to the lower basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist."

I realize there are many other provisions in the Compact but to sustain the view of Mr. Tipton, which may be correct, you have got to place some interpretation upon beneficial consumptive use as employed in that paragraph.

Now if the Compact Commissioners in 1922 had intended to apportion as it is said they did, depletion at the lower end of the Upper Basin and at the lower end of the Lower Basin, it seems to me that they probably would have said something like this:

> "There is hereby apportioned from the Colorado River system in perpetuity to the upper basin an amount of water which will deplete the flow at Lee Ferry not to exceed 7,500,000 acre-feet and an amount of water to the lower basin which will deplete the flow at the International Boundary not to exceed 7,500,000 acre-feet."

I don't mean to say that my language is entirely appropriate but I wish to point out that the Compact Commissioners in 1922 used the term, "beneficial consumptive use", when they apportioned to the Upper Basin 7,500,000 acre feet and to the Lower Basin 7,500,000 acre feet and did not in the paragraph making that apportionment, use the term, "depletion", at any point on the river. I am not taking the position that we ought to construe in this compact we are about to make the term, "beneficial consumptive use", as "use" arising from man-made depletions at the point of use; but I do take the position that we ought not construe it or attempt to construe it as depletion at Lee Ferry.

I don't disagree with the value of these charts. I do not disagree with the value and use of inflow and outflow methods of determining consumptive

use except in the situation that we are confronted with in the making of this compact. I doubt they ought to be used in relation to transmountain diversions for reasons I will be glad to state later if that becomes important.

It seems to me that we ought to deal realistically with the facts. There isn't any use of talking in generalities and without getting at the meat of the question. Most of us know, and those of us who do not know might as well learn, that of course there is a controversy about the meaning of this term, "beneficial consumptive use", as it appears in Article III (a) of the Compact and that is a controversy between the states of California and Arizona with relation to the use of water in the Lower Basin. I think it is a substantial question. I have great respect for Arizona and the position that Arizona takes and the ability with which Arizona has advanced her position.

On the other hand, speaking from a legal standpoint and from the standpoint of what appears within the Colorado River Compact, there may be considerable substance to the position taken by California.

Now pursuing the matter a little bit farther and looking at it from the standpoint of the Upper Basin and the Lower Basin, as I view it I think it is an unwarranted assumption that the construction that is proposed by Mr. Tipton will necessarily benefit the Upper Basin. I believe no one can assume that you can construe the term, "beneficial consumptive use", in Article III (a) of this Compact as meaning depletion at Lee Ferry for the Upper Basin without at the same time construing it as meaning depletion at the International Boundary for the Lower Basin. I don't believe that it will be possible to accept one construction for the Upper Basin and have a different one apply in the Lower Basin. Ultimately probably this question will reach the Supreme Court of the United States. And I am inclined to the view that whatever is determined by that court will be something that is determined for both the Upper and the Lower Basin.

Coming then to the question of whether or not this may be an entirely unmixed blessing, the figure has been given that by construing the Colorado River Compact as depletion at Lee Ferry, the Upper Basin will enjoy an additional 400,000 acre feet of water at the site of use. Our Engineering Committee has not worked out the relative figure for the Lower Basin, at least it has not inserted it in any report, but I understand the Committee has agreed that under such an interpretation the Lower Basin will acquire at the site of use an additional amount of water of 2,150,000 acre feet.

So that while the construction of depletion at the lower end of the Basin will permit the Upper Basin to use an additional amount of 400,000 acre feet of water at the point of use, the same construction applied to the Lower Basin will permit in the Lower Basin the use of 2,150,000 acre feet, which of course is not an exact figure any more than the 400,000 at site of use in the Upper Basin.

How then may that affect the Upper Basin? Paragraph (c) of Article III of the Compact provides that:

> "If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River system, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then, the burden of such deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver

at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d)."

In other words, the obligation under the Mexican Treaty, which has now become a fact, will be impinged upon the Upper and the Lower Basin after each basin has used the quantities it is permitted to use in paragraphs (a) and (b). And if we by the construction that is proposed add 400,000 to the Upper Basin at point of use, 2,150,000 to the Lower Basin at point of use, the Upper Basin at point of use will be permitted to consume 7,900,000 acre feet while the Lower Basin at point of use under paragraph III (a) will be entitled to use 9,600,000 acre feet, and it will be after such use has been made in the Lower Basin that the obligation will arise against it to supply water for Mexico while in the Upper Basin the obligation will arise after we have used 7,900,000. In addition to that there is the III (b) water, which is another million acre feet which the Lower Basin has the right to use under the terms of the Compact.

There is also in Article III of the Colorado River Compact the provisions which relate to a surplus and providing that if there is any surplus over the III (a) and III (b) apportioned water and the water required for Mexico, such surplus may be divided after 1963. I am unable to say that there is any surplus but I think it quite obvious that if you adopt the depletion theory there will not be any surplus and if the Upper Basin has any possible expectation of sharing in any surplus water, that will be foreclosed by the adoption of the proposed construction.

Therefore, as Wyoming sees it, and this is not just my personal viewpoint because it has been discussed between the Wyoming representatives, it is a rather serious question as to whether or not this theory of construing the Colorado River Compact in terms of depletion at Lee Ferry is beneficial or detrimental to the Upper Basin.

A great deal has been said by Mr. Tipton about the Wyoming situation. Wyoming being farther away the channel losses between the Wyoming line and Lee Ferry are greater proportionately than those for any other state and the inference seems to be that Wyoming would therefore benefit more than any other state if this proposed theory is adopted. Of course we would only benefit more provided we had the right to use the water and we haven't had any discussion as yet in these compact negotiations as to how much water any state may be permitted to use. The amount that we can salvage will be dependent upon the amount we are permitted to use and we don't know yet, haven't any intimation, as to what that might be.

The meeting of this Commission in February adopted some provisions creating an administrative agency and defining certain powers of this administrative agency. Among the powers of the administrative agency in paragraph 6 are the following: Make findings as to the amount of and report on the beneficial consumptive use of water each year in the Upper Colorado River Basin and in that portion of each state lying within this basin; and 7, make findings as to the amount of and report on the water deliveries at Lee Ferry each year and the amount of such water supplied by each state of the Upper Division. There is ample authority in those provisions to do everything that is proposed by Mr. Tipton, but of course without Mr. Tipton's proposal there would not be in the compact a definition of theory or of principle, whatever you may want to call it.

In order to make Wyoming's position in this matter entirely clear we do not propose to have anything adopted or inserted in the compact that will adopt one theory to the exclusion of the other. We see no necessity for it. The Upper Basin States will get the amount of water to which they are entitled under the Colorado River Compact regardless of what we say about it in this compact or what may be said by anyone else in the negotiation for this compact.

The Supreme Court of the United States at some time will probably say what the Colorado River Compact means, and when that has been said, then we will know which of these theories has been adopted.

Wyoming is desirous of staying completely out of the controversy between Arizona and California, Lower Basin States. We do not wish to take any position in favor of one or against the other, nor do we wish to be placed in a position in making this compact which would make it inevitable for us to become a protagonist of one or an antagonist of the other. In addition to that, we feel that the possibility of getting this compact approved in the legislature and in the Congress will be materially better if we simply leave the Colorado River Compact as it is without attempting to put a construction on it that might favor someone and disfavor someone else.

I have talked rather at length upon this matter of principle here, but that is the way that we view the situation. There are some other questions that of course will be considered.

One very important question is the bearing that the approval of this principle may have upon the apportionment of water in the States of the Upper Basin. Naturally it is going to have some effect upon that apportionment. As far as we are concerned we would be very reluctant to adopt this principle without first having discussed what the apportionment might be and the impact of the adoption of this principle upon that apportionment. Thank you, Mr. Chairman.

THE CHAIRMAN: Gentlemen, in accordance with our conclusions yesterday it is now time for adjournment until tomorrow morning.

MR. BREITENSTEIN: If we are going to adjourn now I would like to ask Mr. Wehrli a question so we can be thinking about his answer before the next session.

THE CHAIRMAN: Very well.

MR. BREITENSTEIN: I think Mr. Wehrli concedes there must be some method of measuring consumptive use of water in order that it may be known whether or not the Upper Basin or any state in the Upper Basin is exceeding its share. I would like to know how he proposes that consumptive use be measured.

MR. WEHRLI: If it is the desire of this Commission ultimately to say anything more than the granting of the power to the administrative commission to make that determination, our proposal is contained in Attachment "G" of the report.

MR. BREITENSTEIN: Well, Attachment "G", Mr. Wehrli, contains no method of measurement. It contains a suggested definition of the term. It does not say what procedure shall be followed in applying that definition.

MR. WEHRLI: I am afraid you are not quite correct on that Mr. Breitenstein, because Attachment "G" does say how transmountain diversions shall be measured.

MR. BREITENSTEIN: Take transmountain diversions out. Take use within the Basin.

MR. WEHRLI: Use within the Basin under Attachment "G" could be measured by the inflow and outflow method or any other method adopted by the Commission.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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16	Y-1_pgs i-81	32	BG, BH, BI

MR. BREITENSTEIN: Do I understand you approve the inflow-outflow method for all uses except transmountain diversions?

MR. WEHRLI: I don't say I approve it or disapprove it. I say under Attachment "G" the inflow-outflow method could be used.

MR. BREITENSTEIN: I am not clear on that. It seems to me that the situation then is you would use the inflow-outflow method for all uses except exportation.

MR. WEHRLI: That might be a very sensible thing to do, and as I said in my remarks a little while ago I would be glad to go into that at any time. Briefly I would simply say this: There is an accurate, easy, dependable way of measuring transbasin diversions, in other words, measuring the water when it leaves the basin, and I doubt that it is advisable for the Commission to adopt some other method, when you have such an easy and accurate method which has no involvement as to returns or any of these various judgments and assumptions you have to make in an inflow-outflow system.

COM. WATSON: Mr. Meeker, what were the gaging stations that were in existence at the time the Colorado River Compact was written in 1922? I understand that the Lee Ferry gaging station was installed according to my reading in 1921, and that the Yuma gaging station was installed about 1904. Am I right, Mr. Carson?

COM. CARSON: Approximately.

COM. WATSON: May I ask, Mr. Meeker, what method was used to integrate the flow at Lee Ferry?

MR. MEEKER: We were using the records of the Geological Survey as combined for the Green River at Green River, the San Juan at Bluff, and the Colorado River at the lowest station then in existence. I don't recall off hand just what that was.

COM. WATSON: There was one at Yuma?

MR. MEEKER: And then some records were carried back from Yuma. That had been worked out by some of the Geological Survey, some Reclamation engineers, and a figure set up for the Lee Ferry flow.

COM. WATSON: Was this Green River, Utah?

MR. MEEKER: Yes. You see, summing up those three major stations would give a reasonably close viewpoint on how much water there was.

COM. CARSON: Mr. Chairman, I don't desire to go into this much now but I desire to call Mr. Wehrli's attention to the fact that his calculations on the Lower Basin are in error to a great degree. Apparently he assumed that the million acre feet of III (b) water is unapportioned and part of the surplus.

MR. WEHRLI: I do not assume that, Mr. Carson.

COM. CARSON: Then your figure of 2,150,000 acre feet cannot be justified in my view by any other theory. I would like to have your engineers talk with our engineers and get that straight because I think you are entirely wrong.

MR. WEHRLI: They will be glad to do that.

COM. STONE: Mr. Chairman---

THE CHAIRMAN: Gentlemen, the question is, are we going to depart from the procedure outlined yesterday or are we going to recess now. I think you can do much more if you get together in groups. I don't mean Wyoming is to get in a huddle alone, and Utah alone and so on, but talk to the other states and come in with their ideas clarified. Judge, I didn't want to cut you off.

COM. STONE: I just had a very brief statement. At the commencement of these deliberations as one of the Compact Commissioners it was my desire at the beginning to look at fundamental questions as this, first, on a basin-wide aspect, and to consider the arguments on the positions taken by the various states on important questions such as this one. It does involve a fundamental principle. It concerns us here not only as five states negotiating an Upper Basin Compact, but it concerns us too as signatories to an existing compact.

For that reason it seems to me that we ought to proceed on such questions as this with an open mind and without states taking an immediate position until the cards are down and we have given an opportunity to everyone to weigh the arguments and views of all those present. I think it is the only way in which we can resolve questions here which are, first, for the common benefit of the entire Upper Basin and, second, which adequately protect the rights and interests of the individual states and, third, which square with positions which we must inevitably take as time goes on and which we have taken in the past with respect to our being signatories to an existing compact. For that reason it seems to me that this question ought to be carefully considered and everyone ought to be in the position, if desirous, of weighing carefully the views of all the commissioners and their advisers who appear here.

COM. WATSON: How would it be to meet again this afternoon?

THE CHAIRMAN: If you are asking that question of the Chairman the Chairman is of the firm belief that you accomplish much more if you go to your offices or your rooms and discuss this matter freely among yourselves and come back here with your ideas somewhat crystallized. Now the Chairman doesn't pretend to tell the Commission what to do but I am giving you my idea and you can adopt any procedure that you wish. We can continue right now for the rest of the day if you so desire or you can meet again this afternoon or whatever disposition you want to make is entirely satisfactory to me.

COM. WILSON: Mr. Chairman, I will state at this time that I am in thorough agreement with the Chairman that for the time being we should follow the procedure agreed to yesterday.

Now this discussion has been going on and I think the record will reflect there is nothing before the Commission. I think the discussion is proper and desirable. We started out hearing Mr. Tipton explain this theory and there is nothing before the Commission. At some appropriate time the Commission will be called upon to act upon adopting in principle this theory or adopting in principle the opposing theory. Those two ideas will be presented to the Commission by the report of the Legal Committee, which has already been filed containing articles describing in a way each theory.

I think it is very appropriate that these discussions should be carried on but at some appropriate time. When the discussion is over I assume a motion will be made by someone that the Commission adopt in principle one or the other theory. And when that time comes, I think each state should be permitted to express their entire views on the matter and we can proceed in that way. That is why I have said nothing this morning. I have been enjoying and have been enlightened somewhat by the explanations that have been made.

As I conceive it, the Commission will have to determine, first, shall it adopt either theory in principle? And second, will we make any attempt to define uses or consumptive uses? Shall we leave it wide open and leave it all up to the administrative body we have created to determine without any instructions from the Commission? Those are the questions that my mind hasn't acted upon or thought much about but I do think we can adopt in principle one or the other of these theories after the discussion is over.

COM. WATSON: I withdraw my suggestion, Mr. Chairman.

THE CHAIRMAN: The meeting is now adjourned until nine-thirty tomorrow morning.

(12:20 p.m., Thursday, July 8, 1948, recess until 9:30 a.m., Friday, July 9, 1948.)

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Vernal, Utah
July 9, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: Gentlemen, the meeting is now open for further discussions, questions and observations.

COM. STONE: Mr. Chairman, Colorado desires to make this statement:

The experience of Colorado in the negotiation of interstate compacts has convinced the Colorado representatives that the solution of interstate problems, arising out of the desire for and necessity of an equitable apportionment of the benefits derived from the flow of interstate streams, requires a mutual agreement between the affected states upon the principles to be incorporated in a compact before any endeavor is made to agree upon an allocation to individual states. This thought has been paramount in the minds of Colorado's Commissioner and his advisers.

During the deliberations of the Commission it has become increasingly apparent that there are those who firmly and in good faith believe that an agreement on apportionment must precede, or be considered in conjunction with, an agreement on principles. While Colorado still rejects such procedure as an unsound method of negotiation, Colorado is unwilling to let its ideas as to procedure stand in the way of effective progress towards the end which all desire, that is, the successful consummation of a compact which is fair to all and under which the development of the entire basin may proceed.

Accordingly, after careful consideration the Colorado Commissioner and his advisers yesterday afternoon determined that in the interest of harmony and for the purpose of expediting the work of this Commission, Colorado should make a statement of the apportionment which it is willing to accept and the conditions under which that apportionment will be accepted by it.

If--and this is the offer and conditions--the principles hereinafter stated are agreed to and incorporated in an Upper Basin compact, the State of Colorado offers to accept as its share of the apportionment made to the Upper Basin by Article III of the Colorado River Compact an amount equal to 56% thereof.

This offer is conditioned upon the incorporation into an Upper Basin compact of provisions making effective the following:

1. The principle that consumptive use, for the Upper Basin as a whole and for each state of the Upper Basin, shall be measured in terms of stream depletion at Lee Ferry;

2. The principle that consumptive use, for the Upper Basin as a whole and for each state of the Upper Basin, shall be measured by the inflow-outflow method described generally by Mr. Tipton in his presentation to the Commission on July 8, 1948;

3. Reservoir losses shall be charged to individual states in accordance with Attachment "I", Report of Legal Advisory Committee;

4. The obligation of each state of the Upper Division to make up deficiencies in Lee Ferry deliveries in order to comply with the Colorado River Compact shall be determined by the method set forth in Attachment "A", Report of Legal Advisory Committee.

It must be definitely understood that in presenting this statement Colorado does not intend to approach the making of an Upper Basin compact on the basis of a horse trade. The proposal made is not presented for bargaining purposes. It is made with the expectation that it will be seriously and carefully considered by each and every state. Colorado will give full consideration to comments of the United States or other states.

Mr. Chairman, we do not now have copies of this statement but if the Commission desires we shall hand it to our secretarial staff and ask that sufficient copies be prepared for distribution to the members of the Commission and their advisers.

THE CHAIRMAN: Judge Stone, I take it for granted that there will be requests for a number of copies of your statement, and it is assumed by the Chairman that you will have them made.

MR. WEHRLI: Mr. Chairman, I wonder if I might have a moment before we proceed any farther in order to get into the record in close proximity to the statements which I made yesterday one correction.

Inadvertently and through my own mistake in the use of figures I applied a figure of 2,150,000 acre feet as the difference between depletion at the International Boundary and depletion at sites of use in the Lower Basin. The figure that I intended to use and which I should have used was 1,500,000 acre feet. I later used a round figure of 2,000,000 acre feet instead of the 2,150,000. I should have used throughout the figure, 1,500,000 acre feet. Necessarily that changes the figures that I did use that were based upon the 2,000,000 acre feet.

In addition to that I wish to clarify one other matter. I thought I had made it clear that any figure that I had used was not a figure which had been agreed upon by the Engineering Committee. There seems to be some doubt about that. Let me make it clear that as far as I know, the Engineering Committee has not agreed upon any figure which represents the difference between depletion at the International Boundary and consumptive use at sites of use in the Lower Basin, and that the figure that I used is not based upon any report of the Engineering Committee or upon any agreement between the engineers.

THE CHAIRMAN: I believe it will be interesting to the Commission and its advisers to have Mr. Larson, Director Region 4 Bureau of Reclamation,

take about ten or fifteen minutes to give us the benefit of some of his studies in regard to reservoir operations on the Colorado River and the flow at Lee Ferry.

MR. LARSON: I haven't anything to submit to the Commission at this time except to submit a chart which Region 4 office has prepared of the historic flow at Lee Ferry and give the Commission some idea of the moving 10-year average, how it occurs and how it may affect long-time holdover.

You will notice the chart shows the historical flow at Lee Ferry from 1897 to 1947, inclusive, and as most of you know, the flow is merely estimates up until, I believe, about 1921, after which date we have records by the Geological Survey.

This chart has been prepared with the figures we have in the Colorado River Report and for the purposes of explaining the chart, we have added onto the top the depletion that we had in the Colorado River Report so that it would give some idea of the virgin flow at Lee Ferry.

You will note too that the flow by years is erratic. We have some years when the historic flow, the flow that is left, was way below 5,000,000 acre feet. We have other years when the historic flow and the virgin flow was about 26,000,000 acre feet. So that all in all over a long period of years, the flow is erratic. All but two years of this period the virgin flow exceeded 7,500,000 acre feet. That should be noted.

Now I will take off one part of this. (Removes portion of chart.)

The flow that is left on that sheet now is the flow that you are trying to allocate among the Upper Basin States, and under the Colorado River Compact you are not to cause the flow to be less than 75,000,000 acre feet at Lee Ferry in any 10-year period. I am not going into those provisions; they are all well known to you.

We have placed on a red line here the 10-year period. We drop a year and add another year as we progressively go through the period of years. And as you take the ten years from 1897 you get the first red line, which is a trifle more than 7,500,000 acre feet.

Now in saying that this is the water to be allocated I should mention too that we have made no attempt to take out of there the amount of water that might have to be turned down to meet the provisions of the Mexican Treaty. We have not tried to do that. We have simply taken off the 7,500,000 acre feet to the Lower Basin. Neither have we tried to identify the surplus flow that is mentioned in the Colorado River Compact.

You will note that in any 10-year period the river produced more than 7,500,000 acre feet over and above what is allocated to the Lower Basin in all consecutive 10-year periods until we get over to 1934. Then in each consecutive 10-year period from that date on the unregulated river would not have produced 7,500,000 acre feet. In fact, the 10-year average ending in 1940 is less than 5,000,000 acre feet.

THE CHAIRMAN: Now the Chairman would like to ask a question if you are now talking about the yield above the fundamental limits to the Lower Basin at Lee Ferry.

MR. LARSON: I have taken that off and started with zero here to show the amount above the 7,500,000 allocated to the Lower Basin.

THE CHAIRMAN: I wanted to be sure I understood that.

MR. LARSON: We will assume as the first assumption that we will have a dry cycle, a very bad one like we had from 1897 to 1906. Supposing we have a dry cycle like that from 1947 on. That 10-year average would go up above the 7,500,000 for two or three years and then drop down and then go back up to it again.

We also have the right to assume that we may have a very wet cycle come in, say the cycle from 1914 to 1923. Then what would happen to the moving 10-year average? Beginning 1948 then it would keep on going until it even exceeded 10,000,000 acre feet if we had such a cycle as that.

Where it will be of course nobody knows, but taking the long span of years it does show this, and I think that is of interest to your Compact Commission in negotiating this compact and the reason why we are making the explanation: It clearly shows that for the Upper Basin States to get the most out of the river that you must have long-time holdover reservoirs. As Mr. Riter stated yesterday in his preliminary study he had arrived at a figure of live storage of 29,200,000 acre feet. That agrees with out study which is about 30,000,000 acre feet of live storage. So if you had to take five or ten million for silt storage in the reservoirs, it would mean that you would get up around maybe 40,000,000 acre feet of storage capacity that would be desirable for upstream regulation.

And it clearly shows that you would have to store water over in these wet years when the moving 10-year average went above 7,500,000 acre feet, way above, and keep that water for a period of years to bring your 7,500,000 acre-foot yield over in this long period of years from 1934 up to 1946.

THE CHAIRMAN: May I ask how long you are calculating that you are going to carry that holdover?

MR. LARSON: Twenty to 30 years. Now we would have a spill in the year 1929. We would naturally spill in our reservoir operations. So there would be some spills but our studies so far show that we need a long-time holdover from 20 to 30 years.

But that does give you a picture. I won't say any more. It does show you that when a dry year like 1934 does hit you that your moving 10-year average doesn't take the low point until we get way over here to 1940, six years after. I think that is a very important point in planning the regulation and operation of your river.

THE CHAIRMAN: May I ask this question: Do those ordinates on that chart show the depletion by evaporation? You have mentioned a 20 or 30 year period; of course that consumes a lot of water.

MR. LARSON: That is right, Mr. Bashore, and the way we do that, we pick out a group of reservoirs and some that we have tentatively selected as the best ones are on that map in circles, Flaming Gorge, Echo Park, Cross Mountain, Curecanti on the Gunnison, and Dark Canyon and Glen Canyon. Now we will have more reservoirs than that but they will be small. Those are the ones that have the least evaporation and have an appreciable amount of storage.

Now if you have a long-time holdover you must of course figure on the enormous evaporation, but you have a lot of capacity and carryover from the high years and evaporation takes its toll, but you arrive at that point where you get the maximum irrigation yield and that of course is the point which we are striving for and that is why we are making a detailed study on the selection of a group of reservoirs that will provide that necessary long-time holdover to get the maximum yield for irrigation, power being secondary,

and to get the power out of the water as it is being handled for irrigation.

I haven't anything further to say because I assume that the report on our main stem studies as we call them, will be made to the States of the Upper Division when we submit our tentative program for the coming year with the expenditure of Colorado River Development Funds, which under the Boulder Canyon Adjustment Act are to be expended on construction and investigation of projects in the four states of the Upper Division.

COM. WATSON: Mr. Larson, do you recall the evaporation statistics on these various reservoir sites you have chosen? Which are the most efficient in the group?

MR. LARSON: I should consult my records to get the best estimates. I believe that at Glen Canyon, the net evaporation is about 15 acre feet per thousand acre feet of capacity per year, and at Echo Park it is very similar. Cross Mountain I believe is a little less, and Curecanti is less. Flaming Gorge is in that neighborhood as well as Dark Canyon. They are all very similar. They average from 7½ to 15 acre feet of evaporation loss per thousand acre feet of capacity per year.

THE CHAIRMAN: Are there any further questions of Mr. Larson? (No response.) If not, thank you very much, Mr. Larson. I think your charts are informative and instructive and any information of that character that can be brought before the Commission is very much in order.

The Chair would like to ask Mr. Larson if his charts can be made available in a form to be included in the record of the Compact Commission.

MR. LARSON: Yes, sir, we will have them prepared.

THE CHAIRMAN: Is there objection to the inclusion of Mr. Larson's charts in the official record of the Commission? (No response.) Apparently that is satisfactory and will you see that they are available for the Commission in a form to be included in the record, Mr. Larson?

MR. LARSON: Yes, sir.

THE CHAIRMAN: Very well.

COM. STONE: I assume copies of the Colorado Statement will be ready in a few minutes for distribution to the Commission.

MR. WEHRLI: Mr. Chairman, before you recess--in the interest of conserving time I wonder if it would be possible for the other states to present during the forenoon session their views on this matter of percentage so that they would be available for study this afternoon. As far as Wyoming is concerned we will be glad to do that.

COM. BISHOP: Mr. Chairman, I would like to present our views on the matter of percentage and in that respect it will not be any revelation because the percentage that we propose will not vary from the one that was proposed by Wyoming many months ago.

The percentage which Wyoming believes ought to be allocated to Wyoming is 16 percent. That is the same figure that was presented, as I say, some considerable time ago.

With reference to the conditions that Colorado has mentioned, I think I perhaps should give our views on those in the order in which they were presented.

First, we do not agree to insertion in the compact of any provision for measurement of depletion in the Upper Basin at Lee Ferry. We would prefer to leave that matter open as we have heretofore said, and I think I need say nothing more about that subject.

Second, as to the inflow-outflow method of measurement of consumptive use in the respective states, we are not in agreement as to the transmountain diversions, which we believe should be measured either at point of diversion from the stream or as nearly as may be to point of departure from the basin.

The next subject that Judge Stone mentioned was reservoir losses in accordance with Attachment "I". I am uncertain what to say about that because Wyoming does not understand the provisions of "I" as they apparently are understood by Colorado and probably by others. At least we cannot at this time agree to Attachment "I". If it means what we believe it does, I think we would probably agree to it. It is a matter we will have to discuss and if possible determine what the meaning is.

The next item that Judge Stone mentioned was the obligation at Lee Ferry, and except for some possible refinement of language I believe Wyoming is fairly well in agreement with Attachment "A". I don't think that we would have any particular disagreement although after having given the article a little thought we are not entirely satisfied with the language. I believe however, from the discussion at Denver that we would be in agreement and it would be merely a matter of perhaps adjusting the language to clarify it to some extent.

I would like to add this further observation, that in making a proposal, or rather, reiterating a previous proposal of 16 percent, we do not believe it safe in our consideration of that percentage to consider it in terms of depletion at Lee Ferry. That may be the appropriate measurement, but if it should turn out at some time in the future to be erroneous, we think it would be unsafe to be making a percentage division upon the thought that depletion at Lee Ferry would necessarily be the controlling principle. Now that has nothing to do with what we put in the Compact. I am merely explaining that we don't want to get into the danger of possibly dividing some water that might not exist.

THE CHAIRMAN: Have you finished, Mr. Bishop?

COM. BISHOP: That is all.

THE CHAIRMAN: Are there further statements to be made at this time?

COM. WILSON: Mr. Chairman, with reference to the proposal made by Colorado and Wyoming as to an allocation of the water, New Mexico prefers to give a statement after I consult with my engineers and after the recess.

COM. WATSON: Mr. Chairman, Utah on the basis of certain facts will consider 28 percent. Those facts are: Present uses estimated by the Engineering Committee, 556,544 acre feet. Future uses as evidenced in the water report issued, 1,441,200 acre feet. One-fourth, the share of the evaporation losses based on 500,000 acre feet makes 125,000, being a total of 2,122,744 acre feet, which is 28 percent.

THE CHAIRMAN: We will recess for ten minutes.

(10:15 a.m. Recess.)

(10:30 a.m. Meeting reconvened.)

THE CHAIRMAN: So far we have heard from Colorado, Wyoming and Utah. The Chair now calls on the Commissioner from Arizona to state his position.

COM. CARSON: Mr. Chairman, I stated Arizona's position at the meeting of this Commission in Santa Fe, New Mexico on September 17, 1946, and it would be to this effect:

"There is hereby apportioned to the State of Arizona for beneficial consumptive use all of the water precipitated on that part of Arizona which is in the Upper Basin as defined in the Colorado River Compact, and in addition thereto, 1,000 acre feet from the Paria River."

Now the situation in that part of Arizona which is in the Upper Basin is this: that our engineers say that it would not be feasible to divert water from either the San Juan River or the Colorado River back up on the high elevations. Therefore Arizona could use only the water that falls and would have to use it before it got into those deep canyons with the exception of a thousand acre feet from the Paria River. There is one dude ranch there now and room for maybe two or three more.

That was stated in the meeting at Santa Fe in 1946 and I think has been at least tentatively agreed to by the other members of the Commission.

THE CHAIRMAN: Would you care to express that in terms of percentage?

COM. CARSON: Well, we will try to see whether we can translate it. I don't know whether we can or not. If we can we will do so. If we can't I thought we could put a special paragraph in the Compact.

MR. RITER: Mr. Chairman, if you will refer to page 8 of the Engineering Report, the virgin flow in the State of Arizona at the state line is 137,200 acre feet. The out of state channel losses are estimated to be a thousand acre feet, indicating virgin contributions at Lee Ferry of 136,200 acre feet. That is just for your information from the Engineering Report.

COM. CARSON: That is what I am talking about. Arizona should have a right to use that which originates there. There is another point too; that part of Arizona that is in the Upper Basin does not share in the obligation to make deliveries at Lee Ferry under the original Colorado River Compact. So we should have the right to use it and it would not be subject to curtailment to make delivery at Lee Ferry.

THE CHAIRMAN: The Chair now calls on the Commissioner from New Mexico. Are you prepared?

COM. WILSON: Mr. Chairman, I am not prepared to make a written statement but I will state orally for the benefit of the record, the position of New Mexico and its conception of its requirements under the terms of the compact we are trying to make.

I will preface what I am about to say with the statement that all members of the Commission are familiar with the situation in New Mexico. You are familiar with the fact that a fair portion of the water that is allotted to New Mexico will be for the use of the Indians, and due to that situation and due to the fact that physically New Mexico must obtain all the water that may be allocated to it from one of the tributaries of the Colorado, that is, the San Juan and its tributaries, we feel that in giving a figure as to a percentage which we feel will be fair it should be considered as definite and not for horse trading purposes.

We have decided after deliberate study on the part of our engineers to get right down to the very minimum that we feel we could possibly justify in view of the situations I have referred to above.

I will state further that heretofore in meetings of this Commission New Mexico has suggested a formula which we thought was fair and which we thought was based upon a principle that is, to eliminate present uses and divide the water four ways after taking care of Arizona's small percentage. I received very little encouragement on that suggested formula but we figured out that would give New Mexico about 20 percent of the beneficial use of the water we are attempting to divide.

Now my engineers have studied the matter and they feel that due to physical limitations that we perhaps could justify accepting 15 percent as New Mexico's allocation. That of course is subject to provisions being inserted in the Compact that will guarantee to New Mexico the right and opportunity to consumptively use that quantity of water.

We are in agreement with the conditions specified in Colorado's offer in paragraphs 1, 2, 3 and 4, in reference to the provisions of the Compact pertaining to measurement of consumptive use, reservoir losses, and other subjects about which I won't go into in detail.

In brief, Mr. Chairman, that is our position and I want to impress upon you that this is not a figure that I am submitting for the purpose of jockeying or having it reduced.

THE CHAIRMAN: Well, gentlemen, the mimeographed statement made by Judge Stone has now been distributed. Are there any questions on this statement which you wish to ask Judge Stone?

COM. WATSON: Mr. Chairman, I will renew my question asked before this written copy was presented. It applies to page 2, item 4, that is whether or not the obligation at Lee Ferry under this statement is considered to be a state or a basin obligation?

COM. STONE: Mr. Chairman, in answer to that question I would direct Mr. Watson's attention to Attachment "A", Report of the Legal Advisory Committee, and I believe that answers the question. In connection with that you should also read the Attachment "I", Report of the Legal Advisory Committee. Mr. Breitenstein suggests particularly the first paragraph of "I". Mr. Tipton can make a further statement that may clear that up in Mr. Watson's mind.

MR. TIPTON: I think, Mr. Watson, I might clear that up. It certainly would be assumed I think by all of the Commission here that there would be provided sufficient reservoir capacity to take care of the Upper Basin obligation at Lee Ferry and those reservoir losses would be apportioned in accordance with the relevant attachment pertaining thereto.

However, as Mr. Larson has indicated in his presentation, we don't know what might happen in the future. We might have more severe drought periods than anybody has ever anticipated, so that it might happen during some periods there would not be sufficient water in the reservoirs to take care of the situation and there would be a deficiency in the flow at Lee Ferry. That deficiency then would be apportioned among the states in accordance with the attachment just referred to.

COM. WATSON: Then will the water in the reservoirs be common property?

MR. TIPTON: Oh, yes.

COM. WATSON: The reservoirs will be common property and the obligation will be common?

MR. TIPTON: That is right.

MR. BREITENSTEIN: No, the obligation is an obligation of the state. The water stored in replacement reservoirs is common water earmarked for no state.

MR. WEHRLI: Mr. Chairman, I would like to be corrected on this if I am wrong: I would assume as far as we have gone at least, each state would have to stand the common reservoir loss apportioned to it from its apportionment of water. Would that be correct?

MR. BREITENSTEIN: That is our theory.

MR. TIPTON: No, reservoir losses that are for the common good of the states. Included within these percentages is the state's share of the reservoir losses which is for the common good of the state.

MR. WEHRLI: In other words, Mr. Tipton, if it should require, for instance, 50,000 acre feet a year from Wyoming that would come out of our 16 percent?

MR. TIPTON: That is our understanding. I say "our understanding"--that is our proposal and the percentage that Colorado submitted to the Commission includes any of the reservoir losses that would be charged to us on those reservoirs that are for the common good of the states. Another important matter, Mr. Watson, that I think might be lost sight of--we are talking about "common". That water which will be flowing in the stream over and above the allocations to the states becomes common property. That goes automatically down to Lee Ferry to take care of that obligation and that becomes common water just the same as the water in the reservoirs.

COM. STONE: Colorado wishes to state that we shall present here a written justification for the offer which Colorado made this morning. We suggest that each of the states make a similar written justification for the study of the Commission, and that any reference to the Engineering Advisory Committee should be deferred until the written justifications by the states are submitted for consideration of the Commission.

COM. WATSON: Mr. Chairman, with Judge Stone's consent I make that as a motion.

COM. STONE: I think your first procedure is agreeable to Colorado. We made a suggestion and as I understand it you make a motion that that suggestion be adopted by the Commission?

COM. WATSON: Yes.

COM. STONE: I will second the motion.

THE CHAIRMAN: The motion is made and seconded. It is open for discussion.

COM. CARSON: Does that mean just the justification for the percentages of water that are requested, or does that go into the whole thing? I think it

should be confined to the justification for the percentage of water.

COM. STONE: That suggestion I made is confined to the justification for the percentages which the various states have offered to accept.

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

MR. CLYDE: Mr. Chairman, as a matter of procedure now that perhaps further discussion of the percentages put forth by each state cannot proceed until this written justification comes in, and since Colorado conditioned her offer upon certain things that appear in the Legal Committee's report I would like to suggest that we turn to the articles of the Engineering Committee report, not so much with the idea of attempting to get tentative approval on them but as a matter of discussiing them so that common understanding can be reached upon what they mean. They have never been read to the Commission other than as being attached to the record, nor appear in the minutes as having been read or set out before the Commission.

THE CHAIRMAN: Mr. Clyde, the Chairman has been hopeful that your suggestion would be carried out by the Commission. And he now asks if there is any objection to taking up the report of the Legal Advisory Committee, article by article.

MR. BREITENSTEIN: That wasn't your proposal, was it?

MR. CLYDE: Mr. Watson said I said Engineering Report. I intended to take up the Legal Committee Report and not take them up for tentative approval but take them up article by article, see if we are in agreement on what they mean.

COM. STONE: Mr. Chairman, as I understand Mr. Clyde's suggestion it is that the article submitted--and I assume he means all the articles?

MR. CLYDE: I do.

COM. STONE: --submitted by the Legal Committee be taken up at this time not for agreement but for the purpose of analysis and determination of what they mean and how they would apply. Am I right on that assumption?

MR. CLYDE: That is what I had in mind. I think Wyoming has already indicated a reluctance to vote on them for tentative approval until discussion and revision proceeds further than it has. I think however that the Commission ought to discuss these and reach a common understanding as to what they mean and after that has been done, then I would think it would be in order to turn to a discussion of them with the idea of tentatively approving or rejecting them but not until after this general discussion is completed and maybe further discussion of this division takes place because I think they are related to the percentage division so closely that many of the states might want to revise the percentage figure depending on what decision is made on such things as depletion and reservoir losses.

MR. WEHRLI: Well, Mr. Chairman, I suppose that this Commission will have to pass upon all of these proposed compact provisions. The only ones that appear to be controversial or upon which we couldn't agree at this time, I think, would be "G", "H", and "I", and perhaps "A" although I think we are in substantial agreement on "A". It might be good use of time to have the Commission pass upon these other provisions, and I think that might well be done.

COM. STONE: May I ask a question? What do you mean by "other provisions", those that are not controversial?

MR. WEHRLI: The provisions that were prepared by the Legal Committee which don't involve any particular question in relation to the matters that we have been unable to agree upon. I think as I said you will find those reflected in "G", "H", and "I". Of course I can conceive that the administrative agency provisions might have to be considered in a different light depending upon what decision might be reached on "G", "H", and "I".

MR. CLYDE: Why don't I modify my suggestion that we proceed with a discussion on those where there appears to be no controversy or disagreement, entertain motions for their approval, and on those that appear to have disagreement, defer tentative action or approval until discussion has been completed both on those and the division.

MR. WEHRLI: That is agreeable.

COM. STONE: Mr. Chairman, if we proceed in that way I think it should be definitely understood that we are approving those articles as to principle and not as to the form in which they now appear because it is very evident that these articles must be carefully considered and in an appropriate manner for the purpose of putting them in precise and the most desirable compact language, so that if any action for approval is taken, it be approval as to principle at this time and not approval of the articles as they are now written.

Mr. Chairman, in connection with the procedure which is now under discussion there arises another matter which might well be brought into the discussion at this time. In order to make progress we might at this time consider the appointment of a Drafting Committee so that in the event we agree upon any particular article as to principle, it could then be referred to a Drafting Committee and perhaps very expeditiously or within a reasonable time be put in final form for approval of the Commission. I offer that in the interest of progress and expediting the work of the Commission.

THE CHAIRMAN: Judge Stone, do you care to present that as a motion? The record shows that--

COM. STONE: No motion has been made.

THE CHAIRMAN: --we have had a motion made and seconded, and passed, to proceed with the consideration?

COM. STONE: I suggest that Mr. Clyde in view of the discussion which has ensued reframe his motion for the consideration of the Commission.

MR. CLYDE: Since I wasn't a commissioner I hadn't stated it in the form of a motion. I will state it and maybe Mr. Watson will care to adopt it: I move that as the next order of business the Commission proceed to discuss article by article Attachment "A" presented by the Legal Committee as a part of its report; that if from the discussion of these articles in principle it appears that there is no controversy, that the Commission then proceed to tentatively approve or reject the principle; on those articles where there is serious disagreement, that the Commission merely discuss the articles so that there is a common understanding of its meaning, and that tentative approval or disapproval be postponed for action at a later time.

COM. WATSON: I adopt that as a motion.

MR. BREITENSTEIN: You referred only to Attachment "A"; there are "A" to "Q".

MR. CLYDE: I am sorry. Attachments "A" to "Q", inclusive. I will add to that motion that the Commission appoint a Drafting Committee to which any item tentatively approved may be referred for further study of the language.

COM. STONE: Mr. Chairman, I second that motion.

THE CHAIRMAN: You have heard the motion as stated by Mr. Clyde and accepted by Com. Watson, and seconded by Judge Stone. Is there any discussion of that motion?

MR. WEHRLI: Mr. Chairman, I am wondering if the situation wouldn't be clarified if we agreed at this time to at least consider first "A" to "F", inclusive, of these proposals, and "J" to "P", inclusive, which are the ones that I think involve no particular controversy.

MR. CLYDE: One might develop, Mr. Wehrli. I think all the Commissioners and certainly I would agree that the ones you excluded are controversial, but others may develop to be so.

MR. WEHRLI: I think my suggestion would be in line with Colorado's suggestion this morning as to method of procedure. That was the only thing I had in mind.

COM. STONE: As the one who seconded Mr. Clyde's motion and with his consent I would be willing that the suggestion of Mr. Wehrli be incorporated in the motion.

MR. CLYDE: It is agreeable to me.

COM. WATSON: I will adopt it.

THE CHAIRMAN: You have heard the motion as amended, the amendment is accepted by the framers of the motion. Is there further discussion of the motion as amended? Ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Watson's motion as amended carried unanimously.)

THE CHAIRMAN: Now does the Commission wish to appoint at this time the Drafting Committee to do the work after you have reached some tentative conclusions on these articles?

COM. STONE: Mr. Chairman, I have a suggestion only to make with respect to that Drafting Committee: that the chairman of the Drafting Committee be J. G. Will, the legal adviser to the Federal Representative and Chairman of this Commission; that the other members of that committee be made up of one representative from each of the five states designated by the Compact Commissioner from each state.

THE CHAIRMAN: Is that a motion?

COM. STONE: I will make that in the form of a motion.

COM. WILSON: I will second that motion.

THE CHAIRMAN: Is there discussion of the motion as made and seconded? (No response.) Are you ready for the question?

COM. STONE: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

MR. CLYDE: May I ask one question on it, Mr. Chairman?

THE CHAIRMAN: Was Utah ready to vote, or what was the situation?

MR. CLYDE: I wanted to ask a question before the vote if I could.

THE CHAIRMAN: Very well.

MR. CLYDE: The suggestion or the motion that there be one representative from each state I think is good and perhaps Utah will have the same person here throughout the negotiations. It is possible it may not in which event I wonder if it would be permissible under that that an alternate be named?

COM. STONE: In my judgment that would be a matter within the discretion of each state.

THE CHAIRMAN: Yes, sir. Certainly.

MR. CLYDE: If that is so explained--I wanted to have that matter cleared up.

THE CHAIRMAN: The motion was carried and as understood by Mr. Clyde. Does the Commission now wish to appoint the Committee?

COM. STONE: Colorado designates Jean S. Breitenstein.

THE CHAIRMAN: New Mexico?

COM. WILSON: New Mexico designates Judge Martin A. Threet.

THE CHAIRMAN: Wyoming?

COM. BISHOP: William J. Wehrli.

THE CHAIRMAN: Arizona?

COM. CARSON: I think I will defer that until I find out how long Judge Udall will be here. If he will be here long enough--I will notify him later.

THE CHAIRMAN: Utah?

COM. WATSON: Judge J. A. Howell.

THE CHAIRMAN: We now have a motion to proceed with the examination of these articles and the appointment of the Committee. I think we are now ready to take them up. Will someone lead off on Attachment "A"?

COM. STONE: Mr. Chairman, would it not be appropriate in this procedure and expedite action if the chairman of the Legal Committee explained what is intended and the meaning of these articles?

THE CHAIRMAN: Yes, I think that is a good suggestion, Judge. Any way to get our teeth into it. Mr. Carson.

MR. CARSON: Attachment "A"--

COM. STONE: Mr. Breitenstein suggests there are those who will not have copies and it might be well if the chairman reads each one before he proceeds with the explanation.

COM. CARSON: Attachment "A". I presume all the members of the Commission and advisers have copies.

THE CHAIRMAN: We will recess until Mr. Clyde returns with the desired copies.

(11:05 a.m. Recess.)

(11:10 a.m. Meeting reconvened.)

THE CHAIRMAN: The meeting will come to order. Is there anyone present who doesn't have his name on this list that was passed around yesterday or the day before? Off the record. (Discussion off the record.)

Now apparently copies of these attachments have been distributed and the chairman of the Legal Committee will proceed with his explanation of the language used.

COM. CARSON: Attachment "A". (Reads Attachment "A").

It seems to me that that principle that is sought to be stated there is understandable without any explanation. It is that the amount of curtailment which might become necessary should be made in proportion to the then consumptive use in that state as compared with the total aggregate consumptive use in all of the states of the Upper Division, but to exclude from the calculation consumptive uses which existed prior to the 24th day of November, 1922. That is the date the original compact was signed and it was thought that the then existing uses should be protected and that any curtailment would be made out of subsequent appropriations and uses; and the further provision that if any state had used more than it was entitled to use during the preceding ten years, that it would have to make up that deficiency, that excess, before any other state would be called upon to curtail its use.

If any member of the Legal Advisory Committee has any different or additional explanation I would be glad if they make it.

MR. CLYDE: Mr. Chairman, I might make a comment on it. It is not at all in disagreement; it is just by way of further explanation.

I think there are four essential parts of this article that everyone ought to understand are present. The first one is that this will only apply after the reservoirs are empty and there is still a shortage at Lee Ferry. If the reservoirs are taking care of it this won't come into operation at all.

Second, if curtailment is necessary because reservoirs are empty, then the curtailment is allocated to the states based upon the use that they are making of the water at the time the shortage occurs or deficiency occurs, rather than on the allocation to the state. If a state is only using half of the water allocated you take the use rather than the percentage allocation.

In taking those uses the uses prior to 1922 are excluded.

And the last thing is the penalty provision that if any state has used more than its allocated share, then it must make it up by returning to

the source, the excess it has used during the previous 10-year period.

I think those are the four essential elements of the article.

COM. STONE: Mr. Chairman, I move the acceptance of the principle set forth in Attachment "A" and that it be referred to the Drafting Committee.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion is made and seconded. Is there further discussion? Are you ready for the question?

MR. BLISS: There is one contingency that should be included in the attachment which may be implied in the attachment and may not be. There might be a condition such that overuses by one or more states would completely make up a deficiency or more than make up a deficiency, in which case presumably the deficiency would be made up in proportion to the overuses of the respective states.

COM. CARSON: We thought that was covered in the latter clause of this article:

"....and provided further that if any state of the Upper Division in the ten years immediately preceding the year in which such curtailment is required to be made shall have consumptively used more water than it was entitled to use under the apportionment made by Article _____ hereof, such state shall be required to supply at Lee Ferry an amount equal to such excess before demand is made on any other state."

MR. BREITENSTEIN: Mr. Carson, it seems that Mr. Bliss has a point there. If there are two states in excess and that excess is more than sufficient to make up the deficiency, the excess should be proportioned between the two states.

MR. TIPTON: In proportion to their use.

THE CHAIRMAN: From the practical aspect of it the Chairman would like a little light on the subject of how a state could exceed its apportionment without having first constructed works in excess of its percentage.

MR. TIPTON: May I suggest to the Chairman that is already happening. We have a compact in existence on the Upper Rio Grande. There is provided in the compact that before certain restrictive measures come into effect there shall be taken care of any excess use by lands below Elephant Butte Reservoir of the water of the Elephant Butte Reservoir. The use specified in the compact is 790,000 acre feet per year. Since that compact went into effect as I remember it the cumulative overuse is 200,000 acre feet.

THE CHAIRMAN: Is that in violation of the state law then?

MR. TIPTON: No, sir.

THE CHAIRMAN: Doesn't the state law limit the diversion and the application?

MR. TIPTON: No, sir; and it isn't in violation of the compact. This would not be in violation of the compact. This merely says before any state is called upon to make up a deficiency a state which has overused shall first be called upon to assist in making up the deficiency to the extent of its overuse.

Exactly the same principle is embodied in the Upper Rio Grande Compact, which states before certain restrictive provisions are placed on New Mexico and Colorado, if there has been released from the Elephant Butte Reservoir more than 790,000 acre feet per year for the purpose of calculation the over-releases shall be brought back into the reservoir. So it can happen. It isn't a remote contingency.

MR. ROLLINS: Mr. Chairman, may I ask a question of Mr. Tipton, if it would be possible for all states then to overuse their allotments?

MR. TIPTON: I think it would be very unlikely because of the lack of water supply.

MR. CLYDE: I would think, Mr. Rollins, if I may make a comment, it would be in any given year. Assume that the Upper Basin had developed on the idea that there would be 6,000,000 acre feet available for use as rather firm water, and the reservoirs were full and then in a given year the amount of water available in the Upper Basin was only 4,000,000 and they didn't cut down and they supplied the water at Lee Ferry from storage and they used 6,000,000 when only 4,000,000 was available for use in the Upper Basin. Every one of them might not cut down sufficiently to get down to the amount that was available for use so on any given year they might use more than was available for use in the Upper Basin.

MR. ROLLINS: That is the purpose of the storage, to regulate that.

MR. CLYDE: Well, but if next year and next year and next year continues the same, why, the reservoirs are going to get empty and the states are going to be above their allocated share.

MR. ROLLINS: My thought is that the Lower Basin will be onto us if a condition of that kind should develop.

COM. STONE: If they did make claims upon us we should have a provision in the compact which would provide adequately for making up that deficiency.

Mr. Chairman, in view of the suggestion made by Mr. Bliss of New Mexico and the discussion which has taken place relative to that suggestion, I amend my motion to contain a directive to the Drafting Committee that the situation suggested by Mr. Bliss, and where two or more states are overusing water, the situation may be taken care of.

MR. RITER: Mr. Chairman--

THE CHAIRMAN: Just a moment. Does the second accept that amendment?

COM. WATSON: Yes, I accept it.

THE CHAIRMAN: The motion has been made and seconded, it is now open for discussion.

MR. RITER: Mr. Chairman, I don't know whether this is a matter of principle or a matter of detail. I notice there about the 12th line of the article the reference to "consumptive use being made". I believe there was discussion of this at the joint meeting of the Legal and Engineering Committees in Denver and as I recall that discussion, we thought that instead of picking out any particular one year that we might use a moving 10-year average on the uses. I notice that the 10-year average was incorporated on the

matter of overdeliveries but was not incorporated on the matter of measurement of consumptive use at the time of the overdraft.

It seems to me that since the overdraft which would occur would be cumulative over successive 10-year periods that it would be fair in measuring each state's obligation to make up the overdraft for the measurement of consumptive uses to be in progressive 10-year periods also rather than on a single year. That is the way I recall the discussion of this particular article at Denver.

MR. BREITENSTEIN: That idea was not incorporated, Mr. Riter. The one you referred to on reservoir losses was "I". I thought your point was that so far as reservoir losses were concerned, consideration was given to a 10-year average rather than the use of the preceding year. The thing I was pointing out was that Attachment "I" does not contain the 10-year average.

MR. RITER: I am discussing "A". The particular article under discussion is Attachment "A". I refer to that particular language. Let's go back and read that whole phrase:

> ".....an amount of water which bears the same relation to the deficiency to be made up as the consumptive use being made by the particular state bears to the aggregate consumptive use of water of the Colorado River System being made at the time by the States of the Upper Division...."

That means then that when the deficiency occurs in any one state, under this article as now written the use being made that year will be the yardstick of measurement of curtailment. Now bearing in mind that the obligation at Lee Ferry, the obligation to refrain from depleting the flow at Lee Ferry, is measured in progressive 10-year series, it seems to me at this particular point in the article, it might be fair instead of referring to the particular year when the deficiency occurs--after all the deficiency is a product of the past 10-years' use--so it seems to me only fair at this particular time we should make it the aggregate of the average of the past 10-years' use.

MR. BREITENSTEIN: I can't agree with that, Mr. Riter. It seems to me that the last project on the stream is the one who should suffer first. This would provide that. Otherwise, if a project irrigating half a million acre feet came on the last year it would prorate with projects that might have been there 20 years.

MR. RITER: As long as that project was not in the class of those that went beyond the allotment aren't they entitled to the use of the water?

MR. BREITENSTEIN: I grant that.

MR. RITER: And according to the article itself, the only thing that affects the priority is the uses prior to the 24th day of November, 1922. So therefore I do not agree with your argument.

MR. BREITENSTEIN: It seems to me that this provision that you just read is there only for the purpose of determining the proportion. Now in determining that proportion I say that you take into consideration facts as they exist at that time and do not determine it on the basis of any moving average. In other words, your last project on the stream is the one which is going to be considered in determining that relationship.

MR. RITER: I fail to see it that way because at the risk of being repetitious let's emphasize it again: Our obligation at Lee Ferry is measured in a 10-year progressive series of years.

MR. BREITENSTEIN: Granting that, that has nothing to do with this because this is determining the proportion. Say Colorado builds an exportation project taking half a million acre feet out of the Basin. That project was on the river when the deficiency occurs. It seems to me that that project should be taken into consideration in determining the proportion.

MR. RITER: Of course the Commission will have to decide it. I merely want to raise the question at this time. In my opinion it would be fair instead of taking the particular uses at the particular year when the deficiency occurs, to go back and look at the average uses during the past 10 years. After all, it is the 10-year uses that measure our obligation at Lee Ferry.

MR. GILES: Wouldn't cumulative use on a 10-year basis be quite a draft on a state if they had to make it up all at once?

MR. RITER: If they are all made on the same basis it would seem to me to be fair.

THE CHAIRMAN: It seems to the Chairman that this article in some way assumes that a state is going to over use its allotment by failing to contribute to the main stem reservoirs. That is the explanation made by Mr. Clyde. Now I can see how that would happen. Is that what you are shooting at in this article?

MR. CLYDE: If that was what I said it isn't what I intended to say.

THE CHAIRMAN: Well, then, the Chairman stands for correction.

MR. CLYDE: I think this article will only come into operation when the reservoirs are empty.

THE CHAIRMAN: Not necessarily, sir. I don't think you are correct.

MR. CLYDE: Or so low that they can't make up the obligation at Lee Ferry.

MR. RITER: Yes, Mr. Clyde is absolutely right. You operate the reservoirs when the flow approaches the minimum; you start releasing water.

THE CHAIRMAN: This assumes then that some state has not been contributing to the main stem reservoirs in accordance with the provisions of the compact?

MR. BREITENSTEIN: All states. I think that the water is going to be owned in the reservoirs in common and you are not going to attempt to keep track of what each state contributes to the reservoir.

MR. TIPTON: There is no obligation to deliver any amount of water except to make up a deficiency. The delivery of water comes about as a result of the limitation of the allocation. There is an allocation made and there is a certain amount of water over and above that and it runs down the stream. That is not an obligation on the part of any state to deliver. The only time a state is obligated to deliver is under this Attachment "A", except in certain cases like New Mexico and Colorado.

MR. CLYDE: I personally favor leaving that point Mr. Riter raises as it is. I think in determining how much curtailment any state is going to make that if you use the total amount of water being used in the basin at the

time you are making the curtailment, the total use of any state being made at that time less uses prior to 1922, you will fix a proportionate curtailment which will be pretty close to fair and much easier to administer than a 10-year average.

MR. BLISS: Mr. Chairman, I would like to know what is meant by over-use. Just as an example I would like to refer to the example Mr. Tipton mentioned, the Elephant Butte Project. The normal project use is 790,000 acre feet but we do know that project uses do not equal 790,000 acre feet each and every year. They vary considerably with the season, rainfall, and a good many other factors. It is especially true that uses increase in dry years and those would be the very years presumably when we would approach the condition envisioned in the Attachment "A", in which deficiencies would have to be made up.

I think that should be made clear for the record so it isn't conceived that the states are going to continually over-appropriate in the hopes that they can get by with it.

COM. STONE: Mr. Chairman, I call for the question on the amendment and then the question on the motion.

THE CHAIRMAN: You have heard the amendment. The question has been called for. (Thereupon a vote was taken and the amendment carried unanimously.)

COM. STONE: Question on the motion.

THE CHAIRMAN: Question on the original motion as amended. I believe that motion was seconded if I am not mistaken. We are ready for the question on that motion. (Thereupon a vote was taken and Com. Stone's motion as amended carried unanimously.)

COM. CARSON: Attachment "B". In the report of the Legal Advisory Committee it is suggested that this be numbered 10 under the powers and duties of the administrative commission which was tentatively approved at a previous meeting. That would change the existing 10 to 11, and the existing 11 to 12. (Reads Attachment "B".)

The purpose of that of course is to be sure that adequate information concerning any extraordinary drought in the Upper Basin is communicated to the United States Section of the International Boundary and Water Commission so that it could invoke the provision of the Mexican Treaty which enables it to reduce deliveries to Mexico in the event of extraordinary drought in the United States. It seems to me that this article is about as far as the Compact Commission could go in calling that to the attention of the United States Section.

COM. WATSON: Mr. Chairman, I move the adoption of this Attachment "B" and that it be referred to the Drafting Committee.

COM. BISHOP: Second the motion.

THE CHAIRMAN: Motion has been made and seconded for the adoption of Attachment "B".

COM. STONE: Should it be in the form of adoption of the principle?

MR. WILL: May I ask whether it was intended to confine such representations as the administrative body might make to the International Boundary and Water Commission, or would this language be wide enough to make representations to such other agencies or officials as might be appropriate?

COM. CARSON: I don't know who that would be but whoever they are it should be broad enough.

MR. WILL: If you name only the Boundary Commission your administrative body may feel bound to go no further whereas it might be appropriate to do so.

COM. STONE: Mr. Chairman, I concur in the suggestion made by Mr. Will that this requirement should be somewhat broadened. I have in mind that it would be well to include delivery of such a finding to all of the states of the Colorado River Basin and such other officials and Federal administrative agencies and others who may be concerned in the matter.

COM. WILSON: Mr. Chairman, I move the Drafting Committee be authorized to insert appropriate language to carry out this idea.

COM. CARSON: I second the motion.

THE CHAIRMAN: We have a motion before the Commission. Are you offering a substitute motion?

COM. WILSON: The motion was to tentatively approve the article as written, I believe, wasn't it?

COM. CARSON: In principle.

THE CHAIRMAN: In principle.

MR. TIPTON: Mr. Will had in mind, of course, highlighting this one agency and then put in the other relevant agencies, because the United States Section of the International Boundary and Water Commission should be highlighted.

MR. WILL: Yes, and then Judge Stone suggested the other states.

COM. WILSON: Who made the original motion to approve?

COM. WATSON: Mr. Chairman--

THE CHAIRMAN: Com. Watson.

COM. WATSON: I will adopt your suggestion in the original motion.

COM. BISHOP: I will accept the change. I seconded it.

THE CHAIRMAN: Now the Chair will ask our very efficient reporter to read the motion.

COM. STONE: I think it would make time, Mr. Chairman, if in line with the suggested language Mr. Watson would reframe his motion to incorporate the suggestions which have been made since the motion was presented.

COM. WATSON: I will withdraw my motion and let Judge Wilson state the motion.

COM. BISHOP: I will withdraw the second.

COM. WILSON: I move that Attachment "B" be tentatively approved and referred to the Drafting Committee with the authority on the part of the

Drafting Committee to incorporate in Attachment "B" appropriate language to carry out the suggestions that have been made by Mr. Will and Judge Stone.

COM. CARSON: I second it.

THE CHAIRMAN: You have heard the motion as made and seconded. It is now open for discussion.

COM. BISHOP: Question.

(Thereupon a vote was taken and Com. Wilson's motion carried unanimously.)

COM. CARSON: Now, Mr. Chairman, if it is possible to go back to the designation of the members of the Drafting Committee I would like to name Judge Jesse A. Udall of Arizona.

THE CHAIRMAN: Yes, that is entirely in order, Mr. Carson.

COM. CARSON: Attachment "C". (Reads Attachment "C".)
That was reported here but it is also contained in a later article. It is referred to here because it was specifically referred to the Legal Committee. I take it it is clear it recognizes the obligations of the United States under the Treaty with Mexico and provides that nothing in the compact shall be deemed to affect those obligations.

MR. BREITENSTEIN: Might I add to what Mr. Carson said? This is the language suggested by the United States Commissioner on the International Boundary and Water Commission, and also is a duplicate of a similar provision of the Rio Grande Compact.

THE CHAIRMAN: Are there further comments on the motion?

COM. CARSON: I move it be accepted in principle and referred to the Drafting Committee.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion is made and seconded. You wish to discuss the motion? (No response. Thereupon a vote was taken and Com.Carson's motion carried unanimously.)

COM. CARSON: Attachment "D". (Reads Attachment "D".)
That was referred to the Legal Committee for appropriate language and to consider whether or not such a clause should be contained in this compact. I think it is self-explanatory and of course it must be clear to us all that the Colorado River Compact to which we are all parties, is in full force and effect, and that what we are apportioning is the quantity of water, the use of water, apportioned to the Upper Basin by that Compact.

I therefore move the adoption in principle and that it be referred to the Drafting Committee.

COM. WATSON: Second the motion.

THE CHAIRMAN: You have heard the motion and the second.

COM. STONE: Mr. Chairman, if that is open for comment, certainly Colorado concurs in the principle but I have some definite recommendations to make to the Drafting Committee. I believe that that should read:

"Each of the signatory states recognizes that the Colorado River Compact is in full force and effect and that all of the provisions of this compact are subject thereto."

I believe it is a little indefinite the way it is written, not well expressed. Of course that is a detail for the Drafting Committee but I should like at this time to make that suggestion.

THE CHAIRMAN: Are there further suggestions on the motion, or discussion? Are you ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

COM. CARSON: Attachment "E". (Reads Attachment "E".)

COM. STONE: Mr. Chairman, I move that in view of the fact that this article includes apportionment and because of the fact that the apportionment matter is subject to further consideration, the Commission pass over Attachment "E" at this time for further consideration at a later time.

COM. CARSON: Second the motion.

THE CHAIRMAN: Is there a discussion of the motion as made and seconded? Are you ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

COM. CARSON: Attachment "F". There was referred to the Legal Committee, appropriate language to recognize the La Plata River Compact. (Reads Attachment "F".)

MR. CLYDE: I have one comment to take there. We perhaps ought to use the word, "consumptive" uses made by either Colorado or New Mexico instead of just "uses"; otherwise it might include power uses.

COM. WILSON: As a matter of fact I don't think there is much opportunity for development of power on the La Plata. I don't know.

COM. CARSON: This language I think was worked out, was it not, by New Mexico and Colorado?

COM. WILSON: Is this satisfactory with you, Mr. Breitenstein?

MR. BREITENSTEIN: The principle is satisfactory. We were just having a discussion of the designation of the compact. Judge Stone questions if the date of signing is the date that should appear. I suggest it should be the citation to the United States Statutes at Large.

COM. CARSON: I move it be adopted in principle and referred to the Drafting Committee.

COM. WILSON: Second the motion.

COM. WILSON: Second the motion.

THE CHAIRMAN: The motion is made and seconded. Is there a further discussion of the motion?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

COM. CARSON: Under the procedure that was outlined I believe we jump to Attachment "J". (Reads Attachment "J".)

Those paragraphs are taken from the original Colorado River Compact and it was the belief of the Legal Advisory Committee that a similar provision should be included in this compact in order to show that the states intend to apportion among themselves the consumptive use of water of the river; and also to provide that the water impounded and used for the generation of electric power should not interfere with the dominant use for agricultural and domestic purposes.

COM. STONE: Mr. Chairman, I move that subparagraph (a) of Attachment "J" be stricken from this article.

In support of that motion I refer to the fact that the states here are all signatories to the original Colorado River Compact. The subject matter of subsection (a) is controlling upon all of the states so far as it is effective under the provisions of the Colorado River Compact.

If we now again raise this question in a compact which is yet to be submitted to the Congress, we may have a good deal of difficulty over it in obtaining the approval of the Congress and Congress may take some action which may not only affect this compact but the original Colorado River Compact. I think it is in the interest of all of these states not to raise that question in this compact but to stand on the situation as it exists, stand on the rights and the relative priority of use as between navigation and beneficial consumptive use purposes as effected by the existing Colorado River Compact. I believe it is a good policy, certainly, that we not include (a) in this compact.

Mr. Breitenstein wishes to add something to that and before he does I should like to call attention to the fact that the same subject was discussed at a previous session by this Commission and it was my understanding--and in that I may be wrong--that we tentatively agreed to eliminate that provision from the Upper Colorado River Basin Compact.

MR. BREITENSTEIN: I wish to remind the Commission of a fact that has been previously brought out and that is, the first Republican River Compact which contained a similar provision to this. The incorporation of that provision in the original Republican River Compact was the basis for the fight on that compact made by the Federal Power Commission and as I recall was specifically referred to by the President in his veto of the Congressional approval of the original Republican River Compact.

COM. STONE: I confirm what Mr. Breitenstein said because it was my job to support that compact before the Committees of Congress, and we not only had one compact vetoed but it required arduous argument and weeks of discussion with the Federal Power Commission when the second compact was negotiated.

COM. BISHOP: I second the motion.

THE CHAIRMAN: The motion is made and seconded. It is now open for discussion.

Is there further discussion of the motion?

COM. STONE: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion carried unanimously.) Now there remains for the Commission to dispose of the remainder of Attachment "J".

COM. CARSON: Mr. Chairman, I would like to suggest to the Drafting Committee that it consider including in subparagraph (b), which then will become (a), "Subject to the provisions of the Colorado River Compact and of this compact" in the first line. And therefore I move that the balance of this article be approved in principle and referred to the Drafting Committee.

COM. WATSON: Second the motion.

COM. STONE: Mr. Chairman, that motion is made and seconded. Before it is acted upon I should like for Mr. Breitenstein to make an observation about subsection (b).

MR. BREITENSTEIN: The question was just asked me by Mr. Silmon Smith of Colorado as to whether or not the phrase, "agricultural and domestic purposes", would include industrial uses. I don't know just what Mr. Smith had in mind there but there might be some future question arise because water can be used for industrial purposes and not be used to generate power or for domestic use, and so on.

COM. CARSON: In the Colorado River Compact it is defined as follows:

> "The term 'domestic use' shall include the use of water for household, stock, municipal, mining, milling, industrial, and other like purposes, but shall exclude the generation of electrical power."

And we thought that term should be included in the definitions later made.

MR. BREITENSTEIN: If that were included it would answer your point, would it not, Mr. Smith?

MR. SMITH: Yes.

MR. HOWELL: That definition will presumably be in this compact finally?

MR. BREITENSTEIN: That is what I assume.

COM. STONE: In passing on that I think that assumption should be clear. That is an important point.

MR. HOWELL: The Legal Committee did not present an article with reference to definitions because the Commission had taken the position that deferred that matter until they had gotten further along so they could determine what definitions should be made in addition to those contained in the compact. But I think it was agreed that practically all the definitions in the original compact should be in this compact.

COM. CARSON: Yes, we reported on it in our report. We reported

as follows on that:

"The Legal Advisory Committee considers that the appropriate definitions contained in Article II of the Colorado River Compact should be incorporated without change in the Upper Basin Compact but concluded that the article containing the definitions should be deferred until it is ascertained whether or not any other terms used in the Upper Basin Compact should be defined in such proposed article."

So it was the Legal Advisory Committee's opinion that all of these definitions contained in Article II of the Colorado River Compact insofar as appropriate should be included here without change.

COM. STONE: Mr. Chairman, in order that there may be no misunderstanding and the record may be clear, I amend the motion to the effect that the approval of this section in principle and reference to the Drafting Committee with the elimination of (a), be with the understanding that the definitions be included in the Upper Colorado River Basin Compact covering the domestic uses as defined in the existing Colorado River Compact.

COM. WATSON: Second the motion.

THE CHAIRMAN: Is there further discussion of the motion as amended by the original maker of the motion that was before the house? Any further discussion of it? Are you ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Stone's motion as amended carried unanimously.)

COM. CARSON: Attachment "K".

MR. HOWELL: What about (c)?

COM. CARSON: The motion covered (c).

MR. HOWELL: I want to raise a question in view of the fact that you have stricken out (a) and limit (b), whether it should be as restrictive as it is where you say: "The provisions of this article shall not apply"--does that imply other articles than (a) will interfere with the regulation and control by any state? In other words, I suggest that the word "article" is too restrictive.

MR. BREITENSTEIN: I agree with you.

MR. HOWELL: Yes, that is what I wanted to suggest. I misunderstood. I thought we were still going to discuss (c). With the understanding that the Drafting Committee may change that word "article" to "compact" I have no objection.

COM. CARSON: Attachment "K". (Reads Attachment "K".)

That article was prepared to make it clear that this compact could not and is not intended to affect the rights of the United States or its obligations to the Indian tribes or to Mexico, or to affect its rights adversely to acquire right to the use of water in the Upper Colorado River Basin. It is my understanding that all of the Federal agencies recognize that any rights they acquire would be acquired in accordance with the state law. Then (d), to subject any

property of the United States to taxation.

All of these matters here have been requested by one or more of the Federal agencies to be included in this compact and we tried to combine them all in this article.

COM. BISHOP: I move Attachment "J" be approved in principle and be referred to the Drafting Committee.

COM. WATSON: Second the motion.

MR. HUMPHERYS: I am not a member of the Commission; therefore I don't know if I have any right to make a statement.

THE CHAIRMAN: We will be glad to hear from you, Mr. Humpherys.

MR. HUMPHERYS: On the morning of the 7th under instructions from the Commissioner of Indian Affairs and the Secretary of the Interior, I read into the record language which had been suggested by the Commissioner of Indian Affairs to cover the rights of the American Indians to use waters from the Colorado River and its tributaries. Conceivably (a) might mean what that suggested language contained, but it doesn't say so.

I think probably before I leave and while I am here and while the Commission has under consideration this article, I ought to say this: that the Indians were here before we were or before our grandparents were, and that they used water and practiced the art of irrigation. That early in this century, even prior thereto, the courts of this land began recognizing the rights of the Indians to use water or waters from streams for the irrigation of their lands, and in Mr. Zimmerman's letter he pointed out what generally is considered the leading case on the matter decided by the Supreme Court of the United States, U.S. vs. Winters, wherein it recognized that the Indians had been placed on areas and confined on areas, in some instances areas not of their own choosing, and that in order for them to make a living it was necessary for them to irrigate their land, and the court held that they did have the right to use water as against others, whether they had used it to the full extent to which they eventually could or would use it, or not.

In other words, the court recognized the fact that the American Indian, having been under the guardianship of the United States, had not progressed in the art of agriculture, had not abandoned their old pursuits as rapidly perhaps as some might have expected them, but nevertheless they had the right to use water for the irrigation of their land.

The court as you undoubtedly all are aware held that the Government had the right to reserve water for their use and that when it created a reservation for their use it impliedly, if not specifically, reserved enough water from the streams arising on, running through, bordering on, or running across their reservation, to meet their irrigation requirements. That doctrine has been enumerated many times by the courts.

The Indian Service, the Secretary of the Interior, nor those of us who have been sent here by the Department of the Interior and the Indian Service, could possibly give any of those rights away. We couldn't possibly shrink those rights whatever they may be even though in some instances they still are inchoate or partially or even largely undeveloped if they need the water to sustain themselves and make a living and eventually be relieved from the burdens of guardianship; then we couldn't possibly do it and I hate even to mention it but I don't think this Commission could either and I don't think it intended to. But in view of some of the other provisions and in view of

the explanation of this article that this compact contemplated that all instrumentalities and agencies of the United States were to require or acquire water rights under and in accordance with state laws--

COM. CARSON: Aside from Indians.

MR. HUMPHERYS: I haven't found that in here. Now if it means that, all right.

COM. CARSON: That is what it means. We took (a) from the Colorado River Compact. It is VII of the original Colorado River Compact. It is almost in the exact words.

MR. HUMPHERYS: I realize it is pretty nearly the same as Article VII.

COM. CARSON: "Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes."

MR. HUMPHERYS: If it said: "Nothing in this compact shall be deemed to affect the obligations of the United States to deliver water from the Colorado River and its tributaries to Indian tribes," then there wouldn't be much doubt about it; but as it stands, I think there may be. I am not an Indian but I hope from the bottom of my heart that the Maker of all of us gives you men the vision and the wisdom to make it so clear and so free from doubt that that is the situation that a lot of prolonged litigation may not result in the future. I hope and as I say I pray that you will not leave that in doubt or leave that possibility open for the future.

COM. CARSON: This first one, Mr. Humpherys:

"Nothing in this compact shall be deemed . . . To affect the obligations of the United States of America to the Indian Tribes."

Doesn't that cover it? It is the same as it was in the original compact.

MR. HUMPHERYS: Has that been in dispute?

COM. CARSON: No, not that I know of.

MR. HUMPHERYS: The reason I mention it, I am afraid it has.

COM. STONE: Mr. Chairman, may I remark that the pattern for covering this subject was set by the Colorado River Compact to which these states are all signatories. It would be dangerous for these states to insert language in this compact on this subject which might not be acceptable to the other signatory states of the Colorado River Compact States. I should like to state that these states in this compact cannot define or settle any questions which may exist relative to the obligation of the United States to the Indian tribes. It is not within the power of this Commission to do so. But we can say and make it clear, as was said in the original Colorado River Compact, that nothing in this compact shall be deemed to affect the obligations of the United States of America to the Indian tribes. We don't attempt either to take away or add to that obligation. That is a question which is beyond the power of this Commission.

It is a subject which involves Federal claims as well as state rights and upon which there may or may not be controversy. By this clause we attempt not to interfere with the law as it is and as it may be held by the Courts to apply on that subject. I think that we should not change the language of this article and make it any different from its wording in the original Colorado River Compact.

MR. THREET: Mr. Chairman, I was wondering if the language used in the Rio Grande Compact might not meet with Mr. Humpherys' objection. That provides:

"Nothing in the compact shall be construed to affect the obligation of the United States to the Indian tribes or impair rights of the Indian tribes."

MR. HOWELL: I don't see that it is necessary to add that and it seems to me that we ought not to depart from the language that is used in the original compact, and in that connection I invite your attention to the fact that Herbert Hoover, who was the Federal Representative and Chairman of the Colorado River Commission at that time, and Secretary of Commerce as I recollect it, after having received communications from the Department of the Interior made this statement--I read from page 36 of "Interstate Compacts, a Compilation of Articles from Various Sources, 1946", provided by the Colorado Water Conservation Board:

"Because of its duties and obligations toward Indians, the United States has a special interest in certain lands within the areas affected by probable developments on the Colorado River. A considerable area of the lands is embraced within Indian reservations. Some progress in the irrigation of these lands has already been made.

"The interest of the United States in this regard is recognized and protected by Article VII of the Compact, which provides that--

"Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes."

So that one Secretary of the Interior thought that language was appropriate and also the special Federal Representative, who happened to be Herbert Hoover at the time the compact was under negotiation.

MR. HUMPHERYS: I am not even questioning but what all the Secretaries have had that thought and, Mr. Chairman, I don't want to be understood as suggesting language other than what you got because I was instructed to present definite language, which you have in your record. I thought if it was appropriate that I should make some comment on it in view of the fact that by the adoption of this, the language which had been suggested I assume would be rejected.

And if the Commission goes on record that it means what Mr. Zimmerman said the Department and the courts had held it to mean, there probably will be no difficulty about it. I make my observations only for that purpose, and thank you very much.

THE CHAIRMAN: Thank you, Mr. Humpherys. I am sure the Commission is pleased to have your comments on the attachment.

COM. STONE: Then I call for the question. I believe the motion was made that this Attachment "K" be adopted in principle and referred to the Drafting Committee. I call for the question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Bishop's motion carried unanimously.)

COM. STONE: Mr. Chairman, before we adjourn I should like to announce that the Colorado group will meet at the same place in this building at two o'clock this afternoon.

THE CHAIRMAN: In accordance with the previous agreement the meeting now stands adjourned until tomorrow morning at 9:30.

(12:25 p.m., Friday, July 9, 1948, recess until 9:30 a.m., Saturday, July 10, 1948.)

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Vernal, Utah
July 10, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order. Mr. Carson, will you continue with your presentation and discussion of the attachments of the Legal Committee's report?

COM. CARSON: I think we had completed Attachment "K" so the next will be Attachment "L":

"The use of water by the United States or any of its agencies, instrumentalities or wards shall be charged to the state in which the use is made."

THE CHAIRMAN: Are there comments or observations on Attachment "L"?

COM. WATSON: Is that matter before the Commission at the present time?

THE CHAIRMAN: Yes, if you wish. Mr. Carson is chairman of the Committee and he is going through these attachments.

COM. WATSON: Mr. Chairman, Utah has about 77,000 acre of Indian land and that has priority over all other water rights in that area. Since the Indians are the wards of the Government and they are in this state, we are very happy that the United States and the State of Utah are giving them a fair deal. But we realize that according to this schedule, the water that they use will be taken out of Utah's portion. We think ourselves that this is an overall basin obligation. If it is charged to Utah's portion, it should be equated properly so that we are allowed credit for that amount of water.

COM. CARSON: I move that this Attachment "L" be approved in principle and referred to the Drafting Committee.

COM. BISHOP: Second the motion.

THE CHAIRMAN: Is there further discussion of the motion? Ready for the question?

COM. WATSON: Question.

COM. STONE: Mr. Chairman, for the record, is it not a fact that this question and the principle of this Attachment "L" was previously discussed by the Commission and this article reflects a position tentatively taken by the Commission at a former session? May I ask that question?

COM. CARSON: Yes, that is right, Judge.

THE CHAIRMAN: That is the understanding of the Chairman also but there is nothing to prevent you from reconsidering your previous tentative commitments. Any further discussion of the motion? (No response. Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

COM. CARSON: Attachment "M":

"The failure of any state to use the water or any part thereof allocated to it for use under the terms of this compact shall not constitute any relinquishment of such water or the right to use the same, to the Lower Basin or to any other state, nor shall it constitute any forfeiture or abandonment of the right to such use."

I think that is clear, the purpose of that and the intent of it. This Commission tentatively decided to make the allocation in perpetuity.

COM. STONE: Mr. Chairman, I move that Attachment "M" be approved in principle and referred to the Drafting Committee.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion is made and seconded. Is there a discussion of the motion?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote is taken and Com. Stone's motion carries unanimously.)

COM. CARSON: That next attachment, "N", is the same as the Attachment "J", the last two paragraphs of Attachment "J", which the Commission has already acted on so I think we can just pass this.

Attachment "O":

"Nothing in this compact shall be construed to limit or prevent any state from instituting or maintaining any action or proceedings, legal or equitable, for the protection of any right under this compact or the enforcement of any of its provisions."

COM. STONE: Mr. Chairman, I move that Attachment "O" be rejected and not included in the compact. If there is a second to my motion--or perhaps I had better state the reason for it.

THE CHAIRMAN: Yes, you can introduce your motion with a statement, Judge.

COM. STONE: My statement in support of the motion is that Attachment "O" is unnecessary. The right to institute legal proceedings is unquestioned whether this provision is put in the compact or not; but by its inclusion we, from a psychological point of view, give comfort and aid and encouragement to litigation. I think the purpose of making a compact on an interstate stream is to avoid interstate litigation. The right exists without expressing it in the compact and I don't believe it is in the spirit of any compact to include a paragraph of this nature and that from the point of view of policy, and also from a legal point of view--from a legal point of view because the right exists anyway--we should reject this article.

COM. WATSON: I second Judge Stone's motion.

THE CHAIRMAN: Is there further discussion of the motion?

MR. WEHRLI: Mr. Chairman, this article is the same as Article IX of the Colorado River Compact. I am wondering if Judge Stone has any information as to the considerations which led to its inclusion in that Compact.

COM. STONE: I am inclined to believe, Mr. Wehrli, that any discussion on this article or a similar article in the existing Colorado River Compact is evidenced by that portion of the minutes of the original Commission which are now missing. I have gone over the minutes that are available for the first 18 sessions of the original Compact Commission and I don't recall, and as a matter of fact I am quite sure that there existed up to the 19th meeting no discussion of this article.

The probabilities are that the original Compact Commission put it in there as a mere recognition of that right. The matter may not have been given very much discussion. But the fact that it is in the original compact in my judgment at this later time, some 20 years later, does not mean that we should include it. We are signatories to the original compact. It does not seem to me that we include such a clause when it is wholly unnecessary from a legal point of view.

MR. WEHRLI: I note that there is something similar to this thought in Article XV of the Rio Grande Compact. I don't know whether a similar provision appears in other compacts or not. What I am trying to find out is if there is some substantial reason for the inclusion of a clause of this kind. I agree with you of course that if a state's rights are violated if would have the right to go to court without this provision.

COM. STONE: Mr. Wehrli, may I ask do you also agree that any violation of the state's rights in the use of the waters of our interstate rivers, whether it is under the compact or otherwise may be presented to the Supreme Court of the United States irrespective of anything that is in the compact?

MR. WEHRLI: Yes, and my thinking about it, Judge, is that I am just wondering if there is some reason for it that you and I as lawyers might be overlooking. I don't know that there is.

COM. STONE: I admit I can't answer why it was put in. I don't see any reason for putting it in any compact. I think there is no valid reason for it. Mr. Tipton tells me that he might have the reason on the Rio Grande. He was very closely identified with that negotiation and I will ask Mr. Tipton to state what he knows about it.

MR. TIPTON: I do not have before me a copy of the Rio Grande Compact. It is my impression, however, that the provision that was placed in the Rio Grande Compact, which was somewhat similar to this, related essentially to the right of any state to institute a suit with respect to the quality of water. The State of Texas had brought suit in the United States Supreme Court against the State of New Mexico concerning certain alleged depletions of water and deterioration of quality. During the course of that suit, quality became a major issue. Prosecution of the suit was held up pending the outcome of compact negotiations.

Finally the compact was negotiated, the suit was dismissed, and there was placed in the compact, you might say more or less as an expedient, this provision, because at that very time there was still pending that bitterly fought Supreme Court case. The affected state insisted for some time that there be placed in the compact some provision with respect to quality. The other

states did not accede. So as I said, there was placed in the compact the provision that does now appear there.

COM. WILSON: Mr. Tipton's analysis of that is correct. As a matter of fact, I wrote Article XI myself, and the idea was that we were settling all differences by the compact, not only the quantity of water but the quality. Texas insisted on a provision that if the quality of the water became worse in the future that we should be liable to be sued for that if Texas thought a suit would be justified. There was a reason for putting that in the Rio Grande Compact.

COM. STONE: I imagine it was an expediency reason rather than a legal reason, was it not, Judge Wilson?

COM. WILSON: I think it was expediency.

THE CHAIRMAN: Are there further comments on the motion? Are you ready for the question?

COM. STONE: I don't believe my motion was seconded.

THE CHAIRMAN: Yes, it was.

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

THE CHAIRMAN: Mr. Carson.

COM. CARSON: Attachment "P":

"This compact may be terminated at any time by the unanimous agreement of the signatory states. In the event of such termination all rights established under it shall continue unimpaired."

COM. WATSON: I move its adoption in principle and reference to Drafting Committee.

COM. WILSON: Second the motion.

THE CHAIRMAN: Motion has been made and seconded for the adoption of the Attachment "P".

COM. STONE: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Watson's motion carried unanimously.) Off the record. (Discussion off the record.) Mr. Carson.

COM. CARSON: Attachment "Q". (Reads Attachment "Q".)

MR. WEHRLI: Mr. Chairman, I believe that was one that it was agreed would be deferred until there would be some general discussion of the subject involved, along with "G" and "H".

THE CHAIRMAN: Without objection, Attachment "Q" is deferred.

COM. STONE: Mr. Chairman, in connection with this article I should

like to call attention to the fact that in all the later compacts more specific provisions were made for the participation of the United States Geological Survey. I recall that on the Republican River Compact, I believe on the Rio Grande and others, the U.S.G.S. submitted the language for such a provision. I know, too, that on the Colorado River U.S.G.S. has had a very definite and it would seem an extensive interest. No article similar to the ones I refer to appears to have been offered or considered for inclusion in this compact. Since that is an engineering matter I wish if it is proper to call on Mr. Tipton to state what he knows about that situation and ask whether or not the Engineering Committee had given consideration to the matter.

MR. TIPTON: The Engineering Committee has not given any consideration to this matter. That which Judge Stone mentions is entirely true. There is a provision in the Republican River Compact which brought the United States Geological Survey squarely into the picture. There is a similar provision in the Costilla Creek Compact. In my opinion there should be that kind of provision in this compact. I don't think it need be further discussed at this time because the decision has been made that consideration of this article be deferred until decision has been reached by the Commission on the method of measurement.

COM. CARSON: There was a little reference to it in the provision for the administrative agency under the powers and duties, which has been tentatively approved by the Commission at a prior meeting. It referred to the maintenance of gaging stations in cooperation with Federal agencies.

Mr. Chairman, that is all except those that were deferred to a later time.

COM. STONE: Mr. Chairman, Colorado moves that those articles not included in this group of articles submitted by the last report of the Legal Committee but which have heretofore been tentatively approved by the Commission at its Denver meetings, be referred to the Drafting Committee.

COM. CARSON: Second the motion.

THE CHAIRMAN: You have heard the motion as made and seconded. Is there a discussion of the motion?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

Gentlemen, the meeting is now open for discussion of any question or problem which any Commissioner or his adviser may wish to discuss at this time.

COM. STONE: Mr. Chairman, Colorado is ready if it is proper and the desire of the Commission, to submit its statement on justification of its offer to accept 56 percent as its apportionment.

THE CHAIRMAN: Judge Stone, the Chairman thinks that would be very interesting and informative, and without objection you may proceed at this time to make your statement.

COM. STONE: The presentation for Colorado on that subject will be made by our engineering adviser, Royce J. Tipton. We will pass out copies of that justification. (Copies distributed.)

MR. TIPTON: Mr. Chairman, I shall read the statement by Colorado in

justification of its proposal made July 9, 1948.

"It is obvious that there is not sufficient water available in the Upper Colorado River Basin from the apportionment made to it by the Colorado River Compact to take care of present uses and all potentialities. The best information on ultimate potential depletion by each of the states of the Upper Basin is contained in the report entitled, "The Colorado River", prepared by the Bureau of Reclamation in 1946. This report indicates on page 151, Table LXXIII, that the total ultimate potential depletion of the Colorado River in the Upper Basin is 9,136,500 acre feet. That quantity includes 831,000 acre feet of estimated reservoir evaporation loss, and 500,000 acre feet of depletion by the irrigation of pasture lands."

Parenthetically I will state that those two latter items are not charged to any of the states by the Bureau in its report.

"The report indicates that the ultimate potential depletion by the State of Colorado, not including any part of the reservoir losses, or the depletion by the irrigation of pasture lands, is 4,260,300 acre feet. Colorado's knowledge of the potentialities with respect to the depletion by irrigation of pasture lands results in the conclusion that that potentiality in Colorado is 400,000 acre feet. The Colorado portion of the total ultimate potential depletion is 56 percent as shown by the following table:

Ultimate potential depletion in the State of Colorado, not including reservoir losses and depletion by pasture lands.	4,260,300 acre feet
Depletion by pasture lands (80 percent of 500,000 acre feet)	400,000 acre feet
Reservoir losses (56 percent of 831,000 acre feet)	465,300 acre feet
Total ultimate potention depletion of Colorado River water in the Upper Basin by Colorado at the point of use	5,125,600 acre feet

"This, in round numbers, is 56 percent of the 9,136,500 acre feet estimated by the Bureau of Reclamation as the ultimate potential depletion in the Upper Basin at the points of use.

"In 1929 and 1930, during Upper Colorado River Basin Compact negotiations, the State of Colorado prepared a report showing its potential uses, not including reservoir evaporation losses to be 4,600,000 acre feet, and at that time made claim to that amount of water. If there is added to the 4,600,000 acre feet 56 percent of the reservoir losses as estimated by the Bureau of Reclamation, there results a total of 5,065,300 acre feet, which is an essential check on the total potentialities for Colorado as indicated above.

"Colorado recognizes there will not be sufficient water available to Colorado for it to make such depletion. By offering to accept 56 percent of that which is apportioned to the Upper Basin by the Colorado River Compact, Colorado is reducing her uses to approximately 4,200,000 acre feet, plus its share of salvage water. This is a substantial reduction in Colorado's former claims.

"In connection with the proposal made by Colorado and this statement, it must be understood that Colorado recognizes the obligation to conform its uses so that the water will be available out of the San Juan River and its tributaries to satisfy the apportionment to New Mexico."

THE CHAIRMAN: Does Colorado have anything further to offer in support of her offer to accept 56 percent?

COM. STONE: At this time, unless there are questions, we have nothing further to offer. We are willing to answer any questions that may be in the mind of any Commissioner.

THE CHAIRMAN: The Chairman is perfectly willing to have questions asked but I think it highly desirable to avoid much argument on the propositions made by the various states just at this time. After all the statements are in it occurs to the Chairman that some of these matters may have to be referred to the Engineering Committee. So if there are no questions of Colorado at this time the Chairman would like to have presented for the benefit of the Commission supporting statements from the other states. Mr. Watson, are you prepared to present a supporting statement for Utah?

COM. WATSON: Yes, sir.

THE CHAIRMAN: Very well, go ahead.

(Statement distributed.)

COM. WATSON: Mr. Chairman, inasmuch as Utah has prepared an economic report and submitted it for the information of this group, our statement is naturally somewhat lengthy, I will not attempt to read all of it, the supporting evidence is there. I shall read the first page.

The existing uses as adduced from the report of the Engineering Advisory Committee amount to 556,400 acre feet.

The potential development as contained in our economic report, which was worked out through the Agricultural College in connection with the Government agencies that know the facts, is as follows:

In the Colorado River Drainage Basin, Schedule A, 216,000 acre feet.

In the Green River Drainage Basin, Schedule B, 265,000 acre feet.

In the Sevier River Drainage Basin, Schedule C, 420,200 acre feet.

In the Weber River-Utah Lake Drainage Basin, Schedule D, 130,000 acre feet.

In the Bear River Drainage Basin, Schedule E, 410,000 acre feet.

Amounting to a total of 1,441,200 acre feet. Adding Utah's estimated share of reservoir losses, 125,000 acre feet, the total is 2,122,744 acre feet.

Now on the last page, skipping the details, the breakdown of the various schedules, I will read the following statement:

"Utah believes:--

"(1) That the water is available at the proposed points of use.

"(2) That the projects listed are economically feasible, especially when considered as part of the overall development of the river and its hydroelectric power.

"(3) Utah is ready to discuss at the proper time what she believes to be controlling factors that should receive consideration in making an equitable apportionment.

"(4) When proper weight is given to the controlling factors, Utah believes she can justify an equitable apportionment of 28 percent of the beneficial consumptive use of the water."

Explanatory of that, we think there are other controlling factors which will come up as the discussion proceeds.

THE CHAIRMAN: Does anyone have a question or observation to make on Com. Watson's statement?

MR. RITER: Mr. Watson, may I ask if the information contained in the Utah statement was taken from the Bureau of Reclamation report on the Colorado River published in 1946?

COM. WATSON: The information was analyzed by the Agricultural College Irrigation Department, contacts were made with the Bureau of Reclamation, the report studied and analyses made and these totals arrived at. The totals are essentially the same.

THE CHAIRMAN: Any further questions of Com. Watson? (No response.) Arizona, you wish to make a statement in support of your request?

COM. CARSON: Yes, Mr. Chairman. (Distributes copies.) Arizona offers the information as to the basis of the Arizona request as follows:

"That part of Arizona which is in the Upper Basin contains no tributaries of dependable flow into either the San Juan River or the Colorado River.

"The San Juan River and the Colorado River are in such deep canyons that it is not feasible to divert water from either stream in the locality according to our engineers.

"That part of Arizona in the Upper Basin does not share the obligation to make deliveries of any water at Lee Ferry.

"There is one guest ranch on the Paria River and room for more guest ranches.

"Therefore, Arizona claims the right to consumptively use all the water precipitated on that part of Arizona which is in the Upper Basin and in addition thereto one thousand acre feet from the Paria River.

"The need for water is great and it is believed all the water that Arizona requests will eventually be used.

"The Engineering Advisory Committee reports that the water reaching the San Juan River and Colorado River from that part of Arizona which is in the Upper Basin under virgin conditions is 137,200 acre feet to which should be added the 1,000 acre feet from the Paria River, making a total of 138,200 acre feet rounded off at 140,000 acre feet.

"Of the 7,500,000 acre feet being apportioned, 140,000 acre feet amounts to 1.81 percent."

THE CHAIRMAN: Does anyone wish to question Com. Carson? (No response.) We will now pass to New Mexico. Com. Wilson, are you now prepared to make a statement supporting your claim for apportionment?

COM. WILSON: Mr. Chairman, we have mimeographed copies of the statement which Mr. Coury will distribute. I would like to call on Mr. John Bliss, the State Engineer, to present it. (Copies distributed.)

MR. BLISS: I will simply read the statement that has been passed out to all of you:

"At the morning session July 9, 1948, New Mexico stated that she could not accept less than 15 percent of the waters allocated to the Upper Basin by the Colorado River Compact. In justification of this claim, New Mexico presents the following, based on depletions at sites of use.

"In New Mexico a large percent of the potential uses are for Indian projects. In a letter from the Office of Indian Affairs, dated November 27, 1946, addressed to Harry W. Bashore, Chairman of the Upper Colorado River Compact Commission, potential uses on Indian lands in the Upper Colorado River Basin were set forth in some detail. In New Mexico these potential depletions involve projects for purely Indian lands and those in which both white and Indian lands are involved. In order to develop the Indian projects, white lands which are incidental to those projects must also be included. In the tabulation submitted with the letter, estimates were made of the depletion resulting from the proposed projects. Potential development of Indian lands as listed by the Indian Commissioner plus consumption on white lands incidental to those projects totals 686,100 acre feet, depletions at sites of use.

"The final report of the Engineering Advisory Committee, shows that 1914-45 depletions at sites of use on white and Indian lands within the state averaged 72,167 acre feet on 39,000 acres of irrigated land. Depletions by 43,000 acres irrigated at the present time, as shown in the report, are estimated to equal 79,500 acre feet.

"One of the principles adopted by the Compact Commission was that each state should participate in water losses incident to operation of the main channel or replacement reservoirs in proportion to its current uses. On the basis of 15 percent allocation to New Mexico, its share of such reservoir losses will approximate 75,000 acre feet annually. In addition to the above uses, depletions may be made by the extension and improvement of existing irrigation systems, by the development of pasture irrigation, by municipal use and by development of small private irrigation enterprises. None of the potential projects mentioned in the preceding paragraphs include any substantial areas of white lands. A balanced development within the state must include a reasonable acreage of such white lands. These developments will deplete the stream system an additional 417,500 acre feet.

"The ultimate use of Colorado River water in the Upper Basin by New Mexico represented by the above items totals 1,258,000 acre feet. This represents a 16.8 percent allocation to New Mexico on the basis of an allowable Upper Basin depletion of 7,500,000 acre feet at sites of use. Assuming that the salvage of water will permit Upper Basin uses of 8,000,000 acre feet, the New Mexico percentage would be reduced to 15.7 percent."

The percentage, therefore, that New Mexico claims is 15 percent as stated by the Commissioner yesterday.

THE CHAIRMAN: Do you wish to question the Commissioner from New Mexico? (No response.) If there are no questions the Chair calls on Wyoming.

COM. BISHOP:

"In compliance with the direction of the Commission at the session yesterday, Wyoming submits herewith a detailed statement of what we believe to be our reasonable needs for the use of water from the Colorado River System. These needs would require about 21 percent of the water allocated to the Upper Basin. We concede at the beginning, however, that we should share in the Lee Ferry obligation and that our equitable share of the water might be as small as 16 percent.

"In the Green River Basin we have approximately 4,000,000 irrigable acres. Nearly 1,000,000 acres of this land is suitable for agricultural use if water can be made available. The Green River Basin Development Company has a filing that has been approved by the State Engineer Office that includes this entire 4,000,000 acres. The priority is 1939 and it is in good standing at this time. We will have a copy of the map filed with this application by Monday for your information and inspection.

"From the beginning of these negotiations it has been conceded by all that there is not sufficient water for irrigation of all the irrigable land in the basin and care for the Lee Ferry obligation. While this itemization shows the need for 90 percent of the water that falls on the Wyoming portion of the watershed, we only ask for 66-2/3 percent of it or 16 percent of the 7,500,000 acre feet of water allocated to the Upper Basin."

MR. WEHRLI: Mr. Chairman, I will hand out copies of this statement. We will have some mimeographed copies so there will be some additional copies. We haven't had time to get them mimeographed at this time.

COM. BISHOP: I now offer Wyoming's statement of present and potential water use:

	Acre feet
"Present Use--Irrigation and Municipal (From Engineering Committee).	234,000
Supplemental Supply for Present Irrigation 106,000 acres @ .5a.f.	53,000
New Lands (Acreage from USBR Report) 291,330 @ 1.5a.f.	437,000
Pasture and Meadow Lands Adjacent to Potential Projects, 337,000 acres @ 1.0 a.f.	337,000
Industrial--(Coal hydrogenization, trona phosphate, wood pulp, etc.)	300,000
Municipal.	10,000
Transmountain Diversions (Green River--South Pass 125,000; Little Snake to North Platte 75,000)	200,000
TOTAL	1,571,000"

That concludes the statement.

COM. STONE: May I ask a question? Will the statement which Mr. Bishop made orally be also included in the copies which will be mimeographed and made available to the Commission?

MR. WEHRLI: They will be, yes, sir.

COM. STONE: Mr. Chairman, these statements in support of offers made by the several states to accept certain percentages as an apportionment of Upper Basin water contain a lot of meat, much material for the study of the various states. It seems to me that in the interest of progress and in order that these statements may be studied, it would be well to recess to enable a study and a discussion by each of the states before the matter is further considered by the Commission as a whole.

For that reason I move that the Commission recess to reconvene at nine-thirty Monday morning.

COM. CARSON: Second the motion.

THE CHAIRMAN: You have heard the motion made and seconded. Is there a discussion of the motion? The Chair understands that to mean then that you will have no meetings of the Commission on Sunday.

Are you ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken on Com. Stone's motion and the motion carried with one dissenting vote.)

THE CHAIRMAN: The Chair will call the roll on that motion. Colorado?

COM. STONE: Yes, and in explanation of that I wish to say that in my judgment the Commission should not meet on Sunday and more progress can be made in writing the compact by taking such an adjournment since all this material is before it and must of necessity be discussed by the various states.

THE CHAIRMAN: Utah?

COM. WATSON: Inasmuch as Wyoming voted "No", why not call on Wyoming and then Utah may want to support them after they explain their vote.

MR. WEHRLI: Mr. Chairman, I think Mr. Bishop might want me to explain his "No" vote. It is ten-thirty at the present time, and these sessions may go on for some considerable time. It would seem to me that this might be an appropriate day, since tomorrow is Sunday, to adopt a different procedure, perhaps adjourn at this time until one-thirty and have an afternoon session, because we are spending very short periods of time in these sessions and I believe that the Wyoming people feel that we could devote a little more time to the sessions of the Commission and still get outside work done.

COM. BISHOP: That is right.

COM. STONE: May I ask a question? If we adjourn until this afternoon, what do you suggest we take up?

MR. WEHRLI: I don't know what the next work of the Commission is. It

may be consideration of some of the Engineering Advisory Committee's report. It might be consideration of these matters. I don't believe there has been any determination as to the next work of the Commission whether it is this afternoon or Monday morning.

COM. STONE: It seems to me if we are going to reconvene this afternoon we ought to have definitely in mind the work that we can take up, that which is before us.

MR. WEHRLI: I am not sure from the record if there was any decision made as to what work would follow the report of the Legal Committee, a consideration of that report. Maybe that is a subject that ought to be determined.

THE CHAIRMAN: Gentlemen, the Chairman yields to nobody in a desire to get this compact done quickly, but it is evident that we have more guests than we have food and between now and next Monday, some state is going to have to modify its requested percentage. I think you are going to have to discuss this among yourselves very carefully so that everybody will understand the situation. I think also that the Drafting Committee can do a lot of work between now and Monday. I don't suggest interfering with your religious obligations, but you know there is a Bible admonition about emergencies. And while I would like to go right ahead and wind it up, I don't see how we can accomplish much by these sessions. In my observation of the work that was done in Denver it seemed to me that very little was accomplished in the open meetings and much was accomplished when you got in groups and thrashed the thing out. You ask a lot of foolish questions; so does the Chairman. And if you would discuss these things you could formulate your questions intelligently and have intelligent answers.

MR. WEHRLI: Well, I was just going to make this observation, Mr. Chairman, that it appeared to me that when this adjournment was proposed there wasn't anything particularly to be done except each state to do their own work. Now if it is proposed that the states or any two states or any three states would have an informal conference of some kind this afternoon or between now and Monday and try to adjust some of these matters I think that would be very helpful. But as I understood the proposal about adjournment, it was simply that we adjourn until Monday morning for the purpose of one state studying what the other state had presented here this morning, and I frankly don't think that amount of time is necessary for that purpose.

COM. WILSON: Mr. Chairman, I think I will support the motion to adjourn until Monday. It seems to me obvious that in an open meeting we can't accomplish anything this afternoon, and I would suggest that the Engineering Committee have a formal or informal meeting to discuss these matters and bring back figures to the Commission---there apparently is an engineering problem involved at present on the facts---which will show whether or not any state can lower its request. I second the motion for adjournment until nine-thirty Monday morning.

COM. WATSON: I vote "yes" with the obligation that we do committee work this afternoon to facilitate getting facts together so we can have a successful meeting Monday morning.

COM. STONE: Mr. Chairman, I want to make an observation. Colorado does want to give serious consideration to the justifications submitted by all of these states. We do have in mind that there is considerable work that the Drafting Committee may wish to do. We do think that it is no time for the Engineering Committee to analyze these proposals. They are not in shape for

reference to the Engineering Committee at this time. There are certain interstate matters where two or more states are involved, such as on the San Juan.

However, if any state such as Wyoming thinks that we can make progress by sitting here and talking, Colorado is willing to sit here. Our suggestion is based upon the belief that more progress will be made by permitting this time for conferences of the states individually and for such conferences as may seem advsiable between two or more states where there are matters such as on the San Juan common to those states.

Colorado would oppose the Engineering Committee trying to do anything on this matter until the states have had a chance to analyze these statements. These statements are not a mere gesture. Each state certainly wants to give consideration in good faith to the proposals and substantiating material submitted by any other state, and that can't be done quickly or easily. We could meet here and quarrel and talk about what some other state had submitted, but unless we study these statements we don't accomplish a great deal. It may be against progress rather than in the interest of progress. Colorado will say to Wyoming that if that state believes that we can make progress by coming back here this afternoon or any other time, we are ready to meet.

COM. BISHOP: Judge, if we could have the Engineering Committee come in with some recommendations based on what they think is equitable and fair, I believe we could save a lot of conversation.

MR. BLISS: I was just going to suggest at the last Denver meeting the conferences between the states, such as Colorado and New Mexico had recently, were called for by the action of the Commission and it seems to me that those interstate conferences could very well work out a great deal of the competition for water which does occur in a good many of these claims.

THE CHAIRMAN: If the Chair remembers correctly also the Commission appointed committees to work out something on these tributaries and so far we have heard very little about that. I don't know whether those committees are ready to report or want to report or what the situation is. I judge that they are not ready to report.

COM. STONE: I may say, Mr. Chairman, that Colorado and New Mexico had such a meeting at Durango, Colorado, and it was very helpful but we could not reach any final conclusions until some of the matters included in the framework of the entire compact were considered by the Commission. The further deliberations of those states were delayed until this meeting here and I assume that New Mexico agrees with Colorado that the time is approaching when we may resume those meetings, probably in this interval between now and Monday. That is a matter we shall discuss with New Mexico.

May I also report that Mr. Bishop met with us in Colorado during the time that the joint meeting of the Engineering and Legal Committees was in session and we had a preliminary discussion with the same conclusion, that no final report or final decisions on the Little Snake could be made until further progress had been made by the entire Commission.

We have not yet had the meeting on some of the interstate tributary matters with Utah, but it was the opinion of Utah and in that Colorado concurred, that those matters could be more easily worked out here.

Now if my statement concerning those matters is not in strict accord

with the understanding of these other states, I trust they will correct me.

THE CHAIRMAN: Com. Stone, is it to be understood then that the time is now ripe for completion of those negotiations during this recess until Monday, or is further action of the Commission necessary?

COM. STONE: You used the word "completion".

THE CHAIRMAN: Well, all right, use any word you want to. You know what I mean.

COM. STONE: I won't say for "completion" but it seems to me progress can be made between now and Monday. That is just my own personal opinion.

THE CHAIRMAN: That answers my question.

The Chairman would like to ask another question: There has been a lot of talk about you can't do this and you can't do that until something else is done. Now can these committees on these two-state matters or interstate tributaries do any productive work between now and Monday in the absence of some instruction by the Commission as a whole? That is the question I am asking. Now I think you can. If the Chair is wrong, please advise us.

COM. STONE: The paramount thing is to analyze these statements and I wish to announce now, the Colorado group if we adjourn over will hold a caucus at two o'clock at the usual place.

COM. BISHOP: Judge Stone, could you find time this afternoon to go into this Little Snake River matter further?

COM. STONE: Mr. Bishop, I think we should find time to have a further meeting on the Little Snake. However, we would prefer, if it is agreeable with you, to have our Colorado meeting this afternoon to carefully consider the justifications made by the various states and defer that until a later time between now and the convening of the Commission on Monday.

COM. BISHOP: In that case the Wyoming group will meet at two o'clock for the same purpose.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: The motion carries. We are now adjourned in accordance with the motion until nine-thirty Monday morning.

(10:50 a.m., Saturday, July 10, 1948, recessed until 9:30 a.m., Monday, July 12, 1948.)

Vernal, Utah
July 12, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order. You have had considerable opportunity since Saturday morning to discuss matters pertaining to the compact among yourselves and certainly there should be some progress indicated, some clarification of thinking or further confusion. The Chair would like to hear from the different Commissioners in regard to any progress or observations or questions they have to present to the meeting.

COM. STONE: Mr. Chairman, as indicated to the Commission on Saturday, the State of Colorado proceeded to carefully analyze the justifications of the claims of the other states. The analysis made by Colorado of those claims indicates that except in the case of one state, there was no relation whatsoever of those justifications, the claims made thereunder, to the potentialities in the states as disclosed by the Colorado River report of the Bureau of Reclamation. Colorado in submitting its justification took as a basis the potentialities in Colorado as indicated by that report.

A summation of these claims indicates that they exceed the amount of water found necessary by the Bureau to meet all potentialities by 1,080,000 acre feet. The Bureau's report itself, as everybody knows, indicated that it would require in excess of 9,000,000 acre feet to meet the potentialities set forth in that report. The summation of all of the offers made here by the various states raised that amount to something over 10,000,000 acre feet of water.

It is very evident that some rational approach must be attempted. We believe that the relation of the available water supply to the potentialities is a rational approach. It is the only one which has been suggested. We also have in mind that the Bureau's report is the only impartial statement of potentialties in the State which is available. We are aware of the fact that the Bureau spent much time and a lot of money to get out this report. It was issued at the insistence of these states. We think that it is a reliable basis of potentialities in the states and the only reliable one available.

Colorado at this time takes the position that until there is some effort on the part of the other states to relate their claims to those potentialities, and on the basis of the relation of the available water supply to potentialities, we have nothing further to offer.

COM. WATSON: Mr. Chairman, the Bureau report ignored state lines and considered the evidence on a basin-wide development. It seems to me hat we haven't any other basis upon which to act excepting the Bureau's report. In fact, it is actually a common denominator. I think it is idle for us to say we want so much water because we want it. That is simply begging the question. Therefore I am distinctly in agreement with Judge Stone in making the Bureau report a common basis for negotiation.

MR. WEHRLI: Mr. Chairman, I believe the Bureau has recognized the fact that its report is not entirely an impartial analysis as to all of the states included within that report. I may be wrong about that but I believe and my opinion is that the Bureau has recognized the fact that the same thoroughness was not employed in New Mexico and Wyoming as was in Utah and Colorado and that there was land in Wyoming that is not included in the Bureau report. I can give a specific instance.

The Seedskadee Project in Wyoming is listed in the Bureau report at 40,000 acres. It has since been gone over and it has been found that 80,000 acres can be irrigated in the Seedskadee Project. So much for that phase of it.

Now Colorado contends that it is standing squarely upon the Bureau report. We don't find that in the Colorado proposal. I don't know, I may have overlocked something in the Bureau report, but I don't find anywhere in the Bureau report that Colorado has 400,000 acres of pasture land. The Bureau report mentions a total of 500,000 acres and we have been given to understand that a major portion of that is in the State of Wyoming. So we can all say that we are standing on the Bureau report but that doesn't prove whether we are or not. Wyoming can just as well claim that it is standing on the Bureau report as Colorado because we have figured up an amount and we are asking only for 16 percent, which we can get very nicely out of the Bureau report if we wish to place some interpretations on it such as Colorado has.

COM. CARSON: Mr. Chairman, it seems to me that our purpose in being here is to reach an agreement, which means to write a compact. If all of us just present our wishes instead of facing the facts, of course we can't write a compact. If any state refuses to meet in a reasonable way, with a reasonable approach so that the result of a compact would be based on equity and fairness in view of the available water supply, of course there would be no compact. Our difficulty seems to be that all of us are presenting what we wish we could use without regard to the effect on any other state or the total supply of water.

So it seems to me that one method of approach that might begin to get down to cases here would be to go back to the Bureau report and figure it out and see how it works. Of course as everything else we are doing here, it would be tentative until the final draft is worked out here; and even if we worked that out at this meeting, it will still be a tentative draft as I understand it. Each state will have to go home and go over it with our people and then meet again in the fall to see whether or not we can sign it. But until we do have some basis of approach that has some offer or promise of being fair and square and equitable, why then we are stymied now and we can't proceed.

Therefore I move that we do go back to the Bureau report on potentialities and as to the available water supply and figure it out and see where we come out.

COM. WATSON: Second the motion.

THE CHAIRMAN: You have heard the motion as made and seconded. It is now open for discussion.

COM. WILSON: Mr. Chairman, I think New Mexico would be willing to acknowledge that the method suggested might be the proper approach in a determination of the percentages that each state should receive. It is the only one I have heard suggested up to this point. However, I think every member of this Commission is familiar with New Mexico's position so far as potentialities are concerned.

Just as an illustration, take the summation on page 151 of the Colorado River Report. The Bureau used the figure 518,400 acre feet for New Mexico's total potentials. Now since that time the Indian demands and claims have been increased by written documents filed with this Commission to the extent of about 115,000 acre feet.

In discussing this--I am not sure whether it was before the Commission as a whole--Mr. Riter has admitted that in this 518,000 acre feet the Shiprock Project was carried for only 70,000 acres, and everybody has acknowledged the increase in the demands that have been made since then as legitimate potentials. Mr. Riter has also acknowledged that in that 518,400 acre feet, he charged the San Juan Project with only 150,000 and it has always been contended by Mr. McClure and Mr. Bliss that that entire 300,000 acre feet would be consumed. And I believe I am right in saying--if I am not Mr. Riter can correct me--that he had concluded that Mr. McClure and Mr. Bliss were probably right and that would just fy another 150,000 acre feet there at least.

Further than that we have claimed that the South San Juan Project and the transmountain diversion are not necessarily competitive. Treated as separate potentials this would be an additional 300,000 acre feet. Nobody can say this is something new brought in here to bolster anything. We made this claim, as the record will disclose, at the meeting in Farmington in November 1946. There at a Commission meeting I discussed with Mr. Riter and the others present, the South San Juan Project as compared to the transmountain diversions, which the Bureau assumed were alternates, that they used the same water and both could not be built. That was always the assumption of the Bureau with which we always disagreed. We have insisted all along that we are entitled to an additional 300,000 acre feet of potential use on the theory that the South San Juan Project could possibly be irrigated by pumping later on.

Now outside of that I am not sure just what the Commission would be willing to do in attempting to reconstruct our potentials. I don't want to ask you to go way out of line and ask you to pick up something that really hasn't been considered and thought of or mentioned before. But if the Bureau can reconstruct our potentials on what is a fair and equitable basis, whether they put in everything I have mentioned or not, I believe we would have a basis then on which the states can begin this procedure and figure out where we stand. I don't know where it would leave us. It does appear to me to be a reasonable procedure and if it gets us down too low, we will have to consider other matters which are equitable and should be considered from a basin-wide standpoint.

That is my position and I don't want anybody to think that we are trying to pad anything. I believe most of you realize the position New Mexico is in on account of their Indians. As pointed out in the justification of our request the other day, I believe we gave you a true picture of our situation down there. The State of New Mexico wants the Indians to be protected, wants them to have water for their land to the full extent available, but inevitably a question is coming up when we take a compact back for ratification. They are going to look at it and try to separate the white potentials from the Indian land potentials. When you do that, if we are limited anything as we are in this original report, there is nothing really to interest New Mexico in such a compact. That is just a situation that exists and I am calling your attention to it.

But outside of those things, I am willing to go along with this procedure if we can get a reasonable, reconstructed potential that is on an equitable basis with the other states.

MR. TIPTON: There are two matters I should like to mention: I don't think it was made plain in the record that in the presentation made by each state, Colorado was the only one that made a claim which is less than its potentialities as shown in the Bureau of Reclamation report. Disregarding pasture lands, Colorado's claim is less than the potentialities shown.

Some of us have been familiar with the San Juan situation for a great

many years. Twenty years ago we were very much concerned about the Indian situation, became a little less concerned when the Bureau of Reclamation started its investigation of the basin by starting its soil surveys. It was disclosed that a project which was being set up for the Indians in an area of some 400 to 600 thousand acres did not have that much irrigable area. The Bureau in its report included certain areas for the Indians. The Bureau of Indian Affairs in only the one state so far as we can determine submitted to this Commission an acreage and a consumptive use of water greater than was considered by the Bureau of Reclamation in its report. That exception was in the State of New Mexico.

On the one Indian project, the Shiprock Project, which was the one we were fearful of twenty years ago--it had a different name at that time--the Indian Service did include 47,000 acres more than was included by the Bureau of Reclamation in its report. As far as the State of Colorado is concerned, we would be unwilling to take the position whereby New Mexico would be penalized by that fact. We will recognize in the compact, I assume, that nothing in the compact shall interfere with the obligations of the United States to the Indians. That additional 47,000 acres percentage-wise so far as New Mexico is concerned means a good deal of water.

For New Mexico there is set up in the Bureau report two projects which the Bureau considered on a competitive basis. I think that Colorado would probably consider those on a competitive basis, the San Juan-Chama transmountain diversion or the diversion of water to what is known as the South San Juan project. Without going outside the Bureau report in any fashion whatsoever, the potentialities for New Mexico could be taken as the transmountain diversion rather than the South San Juan project, which would mean 300,000 acre feet of consumptive use for that project, as opposed to 150,000 acre feet for the South San Juan project. As far as the State of Colorado is concerned, it would consider if this formula being discussed were adopted, New Mexico would be operating within the report of the Bureau of Reclamation so far as potentialities are concerned if there were considered for New Mexico the San Juan-Chama transmountain diversion instead of the South San Juan project.

I am saying that on account of our knowledge of the area and our long familiarity with it. We are relieved that over a period of years soil classifications have reduced in New Mexico the Indian potentialities to the point that they have been reduced. Had they not been reduced the entire basin would have been faced with a very grave problem.

MR. WEHRLI: Mr. Chairman, I don't know what the motion means because it purports to say that we are going to follow the Bureau of Reclamation report. Of course it doesn't purport to say how you are going to interpret that report.

Colorado has made a proposal which Colorado in good faith says is within the Bureau report, but as an illustration, they have included in their demand or in their request, 400,000 acre feet for use on pasture lands. The Bureau report includes only 500,000 acre feet for that purpose and I believe the basis is an acre foot per acre, which makes 500,000 acres. We can say equally with Colorado that our proposal is based on the Bureau report if we interpret the report as we think it should be interpreted.

Let us say that in our opinion 80 percent of that land is in Wyoming. You can take the Bureau figure of 967,000 acre feet and if 400,000 acres of pasture lands are in Wyoming as we believe they are, the total would be 1,367,000 acre feet, which is considerably in excess of what Wyoming is claiming. We are claiming 16 percent and 16 percent of 7,500,000 acre feet is

1,200,000. Even on the basis of our own claim where we put in 337,000 acres or 337,000 acre feet--the two being the same for the pasture lands--our total is 1,314,000 and that is something in excess of what we claim. That is, the total of 967,000 under the report and 337,000 for pasture lands exceeds the 16 percent that we claim.

So that it seems clear to us that whether or not any state has made a request within the Bureau of Reclamation report depends upon how you interpret the report. That is just one instance; I could give others. And passing a motion of this kind will not be very meaningful because you will simply get back to the question of how you are going to interpret the report.

In addition to that, we have never agreed that the full potentialities in Wyoming have been set out in the Bureau report and I think that is more or less an admitted fact. It seems to me that the approach to this problem should be to attempt to eliminate from these proposals some water that can't be used in some of the states making the request, and that if you pass this motion you will not accomplish anything because you will simply get back to the question of whether or not the Bureau report is to be interpreted in a particular way. And let me say that as far as eliminating water that can't be used is concerned or may not be available, Wyoming of course has made a very substantial elimination in its own request in that regard.

COM. CARSON: Mr. Chairman, the difficulty is that it is 117 percent or thereabouts of the water set down in these requests. Now we have got to reach a meeting of the minds in some manner and it seems to me that the best approach to have them on an equal basis is to go back to the Bureau of Reclamation report. The question of how you are going to interpret it will come out when you undertake that.

MR. WEHRLI: May I ask you a question? If this motion passes then you are willing to accept the 49,200 in the Bureau report for the State of Arizona?

COM. CARSON: I am willing to do that in order to try to help make a compact. I might want to round it off at 50,000 acre feet or some such matter as that, depletion at Lee Ferry.

MR. WEHRLI: We would be willing to be a little more generous and give you one percent.

COM. CARSON: That would be very satisfactory.

COM. STONE: May I call for the question. We have had considerable discussion.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken on Com. Carson's motion.) The motion carries four to one, Wyoming voting "No".

MR. WEHRLI: I didn't hear Mr. Wilson's vote.

COM. WILSON: I voted "Yes".

THE CHAIRMAN: Gentlemen, it seems to the Chairman that the claim made by every one of you is vulnerable. I don't except anybody. And you have to get together and find the weaknesses in each other's claims. I think the motion that you have passed provides an avenue of approach at least. It is assumed by the Chairman that you are here to make a compact and that you are going to make a compact.

I believe suggestions are in order as to how you are going to proceed as a result of this motion.

COM. STONE: Mr. Chairman, may I suggest we take a ten-minute recess so we can discuss this?

THE CHAIRMAN: We will recess for ten minutes. The Chairman had just about reached that conclusion.

(10:10 a.m. Recess.)

(10:25 a.m. Meeting resumed.)

THE CHAIRMAN: The meeting will come to order, please.

COM. STONE: Mr. Chairman, in order to carry out the motion as to procedure which has prevailed here, I move that the question of procedure in accordance with this motion be as an initial stage referred to the engineering advisers representing each of the five states with the suggestion that those engineering advisers call upon the Federal engineering adviser to the extent that that committee may see fit; and that the committee approach the formula on the basis of total potentialities for each state and not on the basis of individual projects.

COM. WATSON: Second the motion.

THE CHAIRMAN: The motion is now open for discussion.

COM. WATSON: Question.

THE CHAIRMAN: Are there any comments on the motion? (No response.) The question has been called for. The Chair will call the roll on that. Colorado?

COM. STONE: Yes.

THE CHAIRMAN: Utah?

COM. WATSON: Yes.

THE CHAIRMAN: Arizona?

COM. CARSON: Yes.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Pass.

THE CHAIRMAN: New Mexico?

COM. WILSON: New Mexico votes yes.

THE CHAIRMAN: The motion carries with Wyoming not voting.

COM. STONE: I assume, Mr. Chairman, that the engineering advisers are known to the whole Commission, but for the record, Colorado's engineering adviser who will serve on the committee just approved by the Commission is Royce J. Tipton.

COM. WATSON: Mr. C. O. Roskelley.

THE CHAIRMAN: Com. Watson states Mr. C. O. Roskelley is the engineering adviser for Utah.

COM. CARSON: R. Gail Baker for Arizona.

THE CHAIRMAN: New Mexico?

COM. WILSON: Mr. John Erickson.

COM. BISHOP: Dean Goodrich.

THE CHAIRMAN: The next question to be disposed of is when and where, or is it understood that this is to be handled by each state singly or the states collectively?

COM. CARSON: The states collectively.

COM. STONE: The purport of my motion is that these engineering advisers would meet and it seems to me the sooner the better.

THE CHAIRMAN: Meet as an engineering group and not with the Commissioners?

COM. STONE: The engineer advisers of the participating states.

THE CHAIRMAN: Without the Commissioners?

COM. STONE: Yes, sir. In other words, there is a committee of five that will meet together.

COM. WATSON: Mr. Chairman, I move that we recess at the present time, that the committee meets immediately, considers this matter and reports back to the Commission.

THE CHAIRMAN: As I understand your motion, Mr. Watson, the Chair understands that the Commission will recess, the engineer advisers will meet, and after they have reached some conclusion, they will notify the Chairman of the Commission who will then call the Commission together. Is that the intent of your motion?

COM. WATSON: That's it.

THE CHAIRMAN: It might be today at two o'clock or four o'clock or whenever the Chairman in his wisdom decides that the Commission should get together; and in any event the Commission will meet tomorrow morning at nine-thirty. Was that to be included in your motion?

COM. WATSON: Yes.

THE CHAIRMAN: We hope the Commission will meet earlier than that. Is there a second to that motion?

COM. STONE: Second.

THE CHAIRMAN: Is there discussion of the motion?

COM. WATSON: Question.

THE CHAIRMAN: Is there discussion of the motion? (No response.) The

question has been called for. (Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

THE CHAIRMAN: The motion carries unanimously. We are now in recess.

(10:35 p.m., Monday, July 12, 1948, recess subject to call of Chairman, and in any event not later than 9:30 a.m., Tuesday, July 13, 1948.)

Vernal, Utah
July 13, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will now come to order. It occurs to the Chairman that there are three principal matters to be considered by the Commission today. No. 1 is the report of the engineer advisers. No. 2 is the report of the Drafting Committee. And No. 3 is the decision as to time and place for correcting the minutes of Meeting No. 6. At this time the Chair calls on the chairman of the engineer committee for his report. Mr. Tipton, I believe you are the chairman.

MR. TIPTON: Mr. Chairman, the group did not have a chairman, did not consider itself a committee, merely considered itself as a group of advisers.

The report of the advisers is written and prepared in mimeographed form. I understand copies of the report were distributed to the members of the Commission about five o'clock yesterday afternoon. I shall give only an oral report and submit for the record the formal report.

The engineer advisers conceived its task under the direction of the Commission, to determine the relationship between the potentialities of each state and the total potentialities for the Upper Basin as they were reported by the Bureau of Reclamation in its report entitled, "The Colorado River", dated 1946.

The advisers concluded also that certain adjustments of the potentialities as reported by the Bureau were permissible, the main adjustment being to add to the potentialities as reported by the Bureau any depletions by Indian lands that were reported to the Commission by the Office of Indian Affairs which had not been considered by the Bureau of Reclamation. Those adjustments were made. The two states that were involved were the states of New Mexico and Utah.

In New Mexico the Office of Indian Affairs reported to this Commission 47,000 acres more land on the Shiprock Indian Project than was considered by the Bureau of Reclamation in its report. In the case of Utah, the Office of Indian Affairs reported 22,000 acres of land on what is known as the Uncompahgre Indian Project on the White and Green Rivers that was not reported by the Bureau of Reclamation.

In accounting for those two omissions the depletion rates as assumed by the Office of Indian Affairs in its report to this Commission were assumed.

Adjustment was made for New Mexico where the Bureau reported an alternate project and placed on its summary table one of those projects. New Mexico has

chosen to select the alternate to that project, which was reported by the Bureau of Reclamation as a potentiality.

COM. WILSON: I would like to correct you there for the record, Mr. Tipton. New Mexico has not chosen any project.

MR. TIPTON: I will stand corrected. With respect to New Mexico the advisers added 150,000 acre feet of depletion that was not in the summary table on page 151 and reported by the Bureau of Reclamation. That was for the benefit of New Mexico.

In the case of Utah it was discovered that in the text of the Bureau's report there was reported a potentiality in the Gunnison Valley of 16,000 acre feet which was not carried into the summary table. That omission was inadvertent and admitted by the Bureau.

Those adjustments were made to the depletions as reported on page 151 of the Bureau's report. In that table of the Bureau's report there appears the potential depletions for each state as computed by the Bureau. There appears in the table two items that are not apportioned among the states. One item is 500,000 acre feet of depletion for the irrigation of pasture lands; another item is 831,000 acre feet of reservoir evaporation. The engineer advisers considered that since the Bureau itself did not apportion the depletion by pasture lands among the states it was certainly beyond the function of the engineer advisers to do so. There is no indication in the Bureau's report any place as to where those potentialities are.

The advisers deducted from the total potentialities the 500,000 acre feet, believing that the consideration of that was a Commission matter.

For simplification the advisers deducted the 831,000 acre feet of reservoir evaporation from the total potentialities having in mind that whatever the reservoir evaporation is in the end, the apportionment of it probably will be in about the same proportion as to the uses made by the states. In other words, the states in order to make available their respective shares of the water, including their respective shares of the evaporation of the replacement reservoirs cause reservoir losses which will bear a straight line relation to the amount of water consumed by the respective states.

The base potentiality which was then used by the engineering advisers to determine the relationships of the states' potentialities to that potentiality was a total of 8,115,500 acre feet. The potentialities of each state after making the adjustments I described without including reservoir evaporation or depletions by pasture lands: Arizona, 49,200 acre feet; Colorado, 4,260,300 acre feet; New Mexico, 772,400 acre feet; Utah, 2,066,600 acre feet; Wyoming, 967,000 acre feet, a total of 8,115,500 acre feet.

Let me repeat so it is perfectly clear that these values do not include either pasture land depletion or reservoir evaporation.

The percentages of these potentialities of the total are as follows: Arizona, 0.6 of one percent; Colorado, 52.5 percent; New Mexico, 9.5 percent; Utah, 25.4 percent, Wyoming, 12 percent. Total, 100 percent.

This report, Mr. Chairman, has been signed by Mr. R. G. Baker for Arizona; R. J. Tipton for Colorado, John R. Erickson for New Mexico; C. O. Roskelley for Utah; and R. D. Goodrich for Wyoming.

That completes my report unless any of the advisers have any exception to what I have said or any additions.

THE CHAIRMAN: Does any member of this engineering group have anything further to add? (No response.) Does any member of the Commission or any of the legal advisers have any comments, questions or observations to make on the data submitted by the engineering group?

COM. WILSON: Mr. Chairman, I want to say this, that I think perhaps the report is correct as the engineers interpreted the motion under which it was empowered. However, before adopting that procedure yesterday, I made a statement into the record of the conditions under which New Mexico would agree to this procedure.

Now in that statement I pointed out these two additions and the committee took notice of additional Indian lands that have been submitted since the compilation of the report; the committee however did not see fit to take into consideration what I said about the 300,000 acre feet of additional depletion as a potential project on the theory the South San Juan and Chama are not alternates.

It may be the committee felt it didn't have the power under the assignment to make that decision, but I call the Commission's attention to the fact that on page 148 of the Colorado River Report, Table 64, potential irrigation development in the San Juan Division, there is listed in the San Juan Basin, "South San Juan, New Mexico, 75,000 acres." That project has been entirely omitted from this report. On page 149, "the San Juan-Chama diversion, 300,000 acre feet." Both projects were listed by the Bureau in its original report, but the report shows in small type at the bottom of the page, "Alternative projects excluded from estimates of potential stream depletions in San Juan division."

The Bureau took the position that the water came from the same source and therefore both projects could not be constructed. New Mexico has disagreed with that for the past two years and has made its position known on every occasion when we had an opportunity. And I want to say that if you are going to have paper potentials, both of these projects are just as much paper potentials--and that is all we are dealing with--as any project listed for any of the other states.

It happens that by eliminating this, you eliminate one of the major projects New Mexico is entitled to have considered. And in arriving at this sort of a figure you haven't given New Mexico the benefit of its actual paper potentials; you have gotten right down to the very bottom and considered water supply, the needs of Colorado, and every other detail that you would consider were you going to determine now, once and for all, exactly the quantity of water that can be consumed in that state.

I say these things in order to make my position clear as I tried to do yesterday, and I do believe that this 300,000 acre-foot project should be added as a paper potential for New Mexico. This is the only instance where any state has been called upon to say what projects are going to be selected.

I understood the motion of Judge Stone yesterday to mean, when he said tabulate the potentials by states without going into specific projects, that you would be justified in taking the potentials here as listed without being bound by the conclusion of the Bureau that these two projects are alternates. We take the position they are not alternates. They can both be built and the water is available with which to supply both projects.

COM. STONE: I move that the report of the engineering advisers be

received, referred to the Commission for consideration, and made a part of the official minutes of the Commission.

COM. WATSON: Second the motion.

THE CHAIRMAN: Are there any comments or observations on the motion?

COM. WATSON: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

(The report above referred to is as follows:)

"Report of the Engineering Advisers of the Five States of the Upper Colorado River Basin Under Instructions Given to Them by the Compact Commission on July 12, 1948.

The undersigned Engineering Advisers of the five states of the Upper Colorado River Basin understood that the instructions given to them by the Commission on the morning of July 12, 1948, were to determine the relation between each state's potentiality and the total potentiality in the basin as reported by the United States Bureau of Reclamation in its report entitled, "The Colorado River", dated 1946. The Committee understood, also, that certain adjustments to the potentialities as reported in the Table LXXIII, on Page 151 of the Bureau's report, were permissible to account for any depletion by use of water on Indian lands as submitted to the Commission by the Office of Indian Affairs, which were not included as a part of the potentialities reported by the Bureau.

The Committee also understood that in the case of New Mexico where alternate projects were reported, it was permissible to consider the depletion by that project which the States of New Mexico selects. In accordance with these assumptions, the committee found the total potentialities for the State of New Mexico to be as follows:

	acre feet
Reported in Table LXXIII	518,400
Added 47,000 acres of land in the Shiprock Indian Project at the unit rate of depletion assumed by the Office of Indian Affairs	104,000
Increased depletion by substituting San Juan-Chama Transmountain Diversion for the South San Juan Project	150,000
Total potentiality for New Mexico	772,400

The Committee found an item in respect to the State of Utah, where in the text of the Bureau's report a small project had been included as a potentiality, but inadvertently the potential depletion by that project had not been included in the table of the total potentialities which appears on Page 151 of the report.

The potentiality found for Utah after making adjustments for depletion on Indian lands that was not included in the Bureau report and the addition of the project that inadvertently was omitted by the Bureau is as follows:

	acre feet
Depletion for Utah as reported in Table LXXIII	2,010,600
22,000 acres of land in the Uncompahgre Indian Project on the White and Green Rivers at the unit rate of depletion as assumed by the Bureau of Indian Affairs	40,000
Gunnison Valley lands set up in the Bureau report as a potentiality but inadvertently omitted from the summary table	16,000
Total potential depletion by Utah	2,066,600

In the Table LXXIII on Page 151 in the Bureau's report, the potential depletions by the states are shown, with the exception of two items which the Bureau did not allocate among the states. The first item is 500,000 acre feet of depletion by the irrigation of pasture lands and the second is 831,000 acre feet of reservoir evaporation. In arriving at the relationships, the committee excluded both of these items from the total ultimate potential depletion. It has excluded the 500,000 acre feet of depletion by pasture lands because the Bureau of Reclamation had not distributed this amount among the states and the committee, as a whole, has no knowledge of the manner in which it should be distributed. The distribution of this item is a matter for the consideration of the Commission. The 831,000 acre feet of reservoir evaporation was eliminated because it is assumed that the distribution of the reservoir evaporation in the end would probably be approximately in proportion to the use being made by each state. The depletion value used by the committee in its calculations as a base was derived as follows:

	acre feet
Total depletion as reported in Table LXXIII	9,136,500
Additional depletion for New Mexico	254,000
Additional depletion for the State of Utah	56,000
Total estimated potential depletion	9,446,500
Pasture lands — 500,000 acre feet	
Reservoir evaporation — 831,000 " "	
Deduction	1,331,000
Remaining depletion used as a base	8,115,500

This remaining depletion distributed by states in terms of acre feet and in terms of percentage is shown in the following table:

State	Acre Feet	Percent
Arizona	49,200	0.6
Colorado	4,260,300	52.5
New Mexico	772,400	9.5
Utah	2,066,600	25.4
Wyoming	967,000	12.0
Total	8,115,500	100.0

Respectfully submitted,

(Signed) R. G. Baker
For Arizona

(Signed) R. J. Tipton
For Colorado

(Signed) John R. Erickson
For New Mexico

(Signed) C. O. Roskelley
For Utah

(Signed) R. D. Goodrich
For Wyoming

Vernal, Utah
July 12, 1948."

THE CHAIRMAN: Now as the Chairman understands the situation, this matter of the submission by the engineering group, if you wish to so term that body of engineers, is now before the Commission for further discussion if you so wish.

MR. WEHRLI: Mr. Chairman, yesterday when this motion was proposed Wyoming voted against it. This report fully justifies the position we took at that time. The motion as we understood it was that the Bureau of Reclamation report was to be accepted. What the committee did, and I find no fault with their doing that except that they couldn't and didn't follow the motion, was to make a number of adjustments. They made some adjustments in favor of New Mexico and some adjustments in favor of Utah, and they eliminated 500,000 acre feet of depletion, which probably is divisible between Colorado and Wyoming.

As far as New Mexico is concerned, the adjustments made increase the percentage which they would have under the Bureau of Reclamation report as shown in the table at page 151, about 50 percent. While that was taking place, the lands that Wyoming is particularly interested in, which are not specifically assigned to Wyoming in the report, to the extent of 337,000 acres, were eliminated and that translated into acre feet is 337,000 acre feet. Of course we realize when that elimination was made there was also the elimination of some of those pasture lands which are to be found in Colorado.

Wyoming would be very happy to receive the same consideration and have the figure appearing at page 151 of the Bureau report adjusted upwards 50 percent as was done in the case of New Mexico, and we believe we could show proper justification for it. If that were done our percentage would be 18 percent. We are only claiming 16.

What I wish to point out is that the motion that was passed yesterday as we conceived it then and as now appears to be a fact, can't be made effective. In other words, you can't accept any rigid formula and make it apply. You have got to consider all of the facts. We don't mean by that that we have necessarily got to consider all these various projects, but if we are going to arrive at a compact it seems to us we are going to have to consider the facts that are necessary to be considered as to a particular state. And it can't be reduced to a mathematical formula and neither can any state be compelled to adopt some rigid theory which may be disadvantageous to it and advantageous to someone else.

This report of course has some valuable information in it. I make no

criticism of anyone who worked in its preparation. I am merely trying to point out that you can't fasten some particular formula on this situation and work it out to a mathematical conclusion.

We suggest, Mr. Chairman, that when this meeting adjourns today, and we think it might well be adjourned soon, we arrange a schedule of two-state conferences for the rest of the day and on into the night if that be necessary, giving the states of New Mexico, Wyoming, Utah and Colorado the right to meet two at a time and see if some of these mutually inter-related problems can be worked out by that method. I didn't mean to slight Arizona but it is recognized that the Arizona percentage here on any theory is not very substantial.

I may say too in connection with Arizona, of course we don't have any intention of trying to hold Arizona to any commitment by reason of the question and answer that took place yesterday. The same question might have been properly propounded to New Mexico and of course they couldn't very well answer that in the affirmative, which I think shows the fallacy of trying to follow the kind of formula that was attempted to be set up yesterday.

What we would like to propose is that this series of conferences be arranged. We would like to meet with Colorado and talk over things with Colorado. We would like to meet with Utah. We would like to meet with New Mexico. We believe that if two states at a time would meet and go over some of these things that we might arrive at some conclusions that would be helpful in solving this problem ultimately.

COM. STONE: Mr. Chairman, we of course recognize we are here to make a compact. So far as Colorado is concerned we are desirous of following any suggestion which would appear to be in the interest of arriving at this apportionment of water among the states of the Upper Basin. And we would be willing as a state to follow the suggestion made by Mr. Wehrli. We are willing at any time to meet with Wyoming or any other state.

We recognize, and I think all of the Commissioners must recognize, that in a very peculiar sense, due to the topography of the Basin, particular problems of the Basin are common to certain states on interstate tributaries of the Colorado River. I refer particularly to the common problems on the San Juan which exist between Colorado and New Mexico. We have already had a meeting with New Mexico; we know that we must have a further meeting. The State of Wyoming and the State of Colorado have common problems on the Little Snake River. It is recognized there too that we must have a meeting. It appears to Colorado from discussion in the Commission and outside the Commission that there is another group where there are particular and very important problems. I refer to the State of Utah and the State of Wyoming.

It therefore appears to Colorado that the suggestion made by Mr. Wehrli is a good one. We in Colorado are willing to accept and proceed in accordance with that suggestion.

THE CHAIRMAN: It is the observation of the Chairman that if you haven't been doing that already it would seem difficult to justify your presence here. I think certainly you have been doing that in the last two or three days. About midnight last night I recognized two voices arguing, and they were voices representing two states, about this water question. As I understand Mr. Wehrli's suggestion it is merely to continue that, which seems to be a good thing. Are there further comments?

COM. WATSON: Mr. Chairman, Utah agrees that Mr. Wehrli's suggestion is timely and we agree that there are problems yet to be ironed out between these

respective states although we have been meeting during the last two days.

I therefore make a motion that this body resolve itself into a series of state meetings between the respective states. Utah would like to meet with Colorado and again with Wyoming.

COM. BISHOP: Second the motion.

THE CHAIRMAN: Motion has been made and seconded.

COM. WATSON: I wish also, Mr. Chairman, to state for the record that the pasture lands as set out here in this report be not allocated wholly to Wyoming and Colorado but that they be divided on a percentage basis.

MR. HOWELL: This is just for the record, that Mr. Wehrli's statement that the pasture lands should be allocated to the States of Colorado and Wyoming should not remain unchallenged so as to indicate any acquiescence in that statement by the State of Utah, but has nothing to do with the motion.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Watson's motion carried unanimously.)

MR. WEHRLI: To get a complete round of sessions here we would like to suggest that a schedule be fixed up now before we adjourn. It doesn't make any difference to us how it is, but for instance, supposing that immediately after this meeting, Colorado and Wyoming would meet, and Utah and New Mexico, separately. At two o'clock let's say Colorado and Utah would meet, Wyoming and New Mexico would meet. And at four o'clock, Colorado and New Mexico, and Wyoming and Utah.

We make that suggestion not because we care what sequence is taken but simply to formulate a kind of program so that when the day is over each of these two states will have had a chance to sit down in conference and see what can be accomplished. If you have some other hours or some other schedule we are entirely agreeable to it. We would just like to have some understanding about it so that we will be able to have those two-state meetings.

THE CHAIRMAN: It occurs to the Chairman that that is an excellent suggestion and it is in furtherance of the procedure adopted.

COM. WILSON: It is agreeable with New Mexico to meet at your convenience.

COM. BISHOP: I move that a schedule be followed as suggested by Mr. Wehrli.

COM. WATSON: Second the motion.

COM. STONE: I would like to have that stated so we can write it down Colorado and Wyoming---

THE CHAIRMAN: Will you read it again, Mr. Wehrli, so they can all get it?

MR. WEHRLI: Immediately after adjournment, a meeting between Colora

and Wyoming and one between Utah and New Mexico. At two o'clock, Colorado and Utah, and Wyoming and New Mexico. At four o'clock, Colorado and New Mexico, Wyoming and Utah.

COM. STONE: Call for the question.

THE CHAIRMAN: I was going to do that. Are you ready for the question?

COM. BISHOP: Question.

(Thereupon a vote was taken and Com. Bishop's motion carried unanimously.)

THE CHAIRMAN: The Commission will stand recessed until tomorrow morning at nine-thirty.

(10:30 a.m., Tuesday, July 13, 1948, recess until 9:30 a.m., Wednesday, July 14, 1948.)

Vernal, Utah
July 14, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order. Yesterday afternoon the Chairman took the trouble to move around and observe whether or not these state groups were working. It was the observation of the Chairman that they were working faithfully and industriously in order to reconcile their differences. I believe those meetings should continue and without objection the Commission will now recess until tomorrow morning at nine-thirty or subject to an earlier call of the Chairman when the states have indicated they have reconciled their differences. Is there objection to that procedure?

COM. STONE: Mr. Chairman, if we do adjourn now I should like to call a meeting of the Colorado group at the room where we have been meeting immediately following adjournment.

THE CHAIRMAN: Are there any other observations or announcements in regard to the continuation of the state meetings?

MR. WEHRLI: Judge Stone, if you are going to meet there could we meet with you about ten minutes before you go into your session?

COM. STONE: That will be agreeable, Mr. Wehrli.

MR. WEHRLI: Wouldn't take but just a few minutes.

COM. STONE: That is all right, all the time you want.

THE CHAIRMAN: I believe it should be understood how these meetings are going to be held, the time and the place, and the Chair would like to hear suggestions.

COM. STONE: Couldn't this be on a voluntary arrangement since this thing has gotten started off, with the states calling what meetings they want to have?

THE CHAIRMAN: That is entirely satisfactory provided that is understood.

COM. WATSON: Mr. Chairman, I think that in the case of Utah and Wyoming we should arrange for a meeting soon this morning to go into these projects further that we have discussed on which we lack information, and I would invite several of the Bureau of Reclamation representatives to be there to answer questions that we can't answer ourselves.

MR. WEHRLI: We will be very glad to meet with you as soon as we have a very short session with Colorado. You wish to meet here?

COM. WATSON: Right here with this map in the background.

MR. WEHRLI: That will be fine.

THE CHAIRMAN: Mr. Watson, what Bureau of Reclamation employees do you have in mind for that?

COM. WATSON: We would like to have Mr. Riter, Mr. Jacobson, Mr. Skeen, and Mr. Dugan, those four if we could get them or any group of them.

THE CHAIRMAN: Perhaps the Chairman wasn't understood. I would like to know if you will be satisifed with facts and not with conclusions. You don't expect conclusions from the Bureau of Reclamation employees?

COM. WATSON: We expect to draw our own conclusions.

THE CHAIRMAN: Very good. Are there any further observations or comments?

We now stand adjourned until nine-thirty tomorrow morning unless an earlier meeting is called.

(9:50 a.m., Wednesday, July 14, 1948, recess until 9:30 a.m., Thursday, July 15, 1948, unless an earlier meeting is called by the Chairman.)

Vernal, Utah
July 15, 1948
9:30 o'clock, a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order.

The Chairman is of the opinion that much progress has been made in these state and interstate informal meetings which have been held. The Chairman believes that more progress has been made than would have been made in the regular sessions of the Commission.

Therefore, unless there is serious objection on the part of some member of the Commission this meeting will recess subject to the call of the Chairman for re-assembling not later than nine-thirty tomorrow morning but with the hope that we may re-assemble sometime today or tonight.

Some people who have been attending these meetings are doing so at considerable sacrifice and others have important engagements and commitments which must be met, and it is the hope of the Chairman that by Friday night we will have drawn the loose ends of this negotiation together.

Without objection the meeting is recessed subject to the call of the Chairman but not later than nine-thirty tomorrow morning. We now stand adjourned.

(9:35 a.m., Thursday, July 15, 1948, recessed subject to the call of the Chairman but not later than 9:30 a.m., Friday, July 16, 1948.)

Vernal, Utah
July 16, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order. Does anyone have any comments to make on the progress of the negotiations as to whether or not there is any progress or any nearer agreement? (No response.) Well, does anyone have any observation to offer on any subject what that might properly come before this Commission?

COM. CARSON: Mr. Chairman, it seems to me that more progress could be made by adjourning this until further conferences between these interested states are held.

THE CHAIRMAN: You mean to adjourn here at Vernal?

COM. CARSON: No, to adjourn this open meeting and stay here in Vernal.

MR. WEHRLI: To what time do you suggest that we adjourn or recess, Mr. Carson?

COM. CARSON: Subject to the call of the Chair or until tomorrow morning.

COM. CARSON: Mr. Chairman, I move that we recess subject to the call of the Chair.

THE CHAIRMAN: Is there a second to the motion?

COM. BISHOP: Second the motion.

THE CHAIRMAN: Are you ready for the question? (No response.) Are you ready for the question?

COM. STONE: Question.

(Thereupon a vote was taken and Com. Carson's motion carried.)

THE CHAIRMAN: We are now in recess.

(10:00 a.m., Friday, July 16, 1948, recess subject to the call of the Chairman.)

Vernal, Utah
July 19, 1948
9:30 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will come to order.

This Commission convened here in Vernal, Utah, on July 7th for the express purpose of negotiating a compact. On July 10 each state submitted figures which represented its ideas of the percentage which should be allocated to it. The sum of the percentages thus submitted was 116.8.

On July 12 the engineer advisers of the states prepared a report on the states' potential uses in percentages. The report was submitted to the Commission on July 13. Since that time informal meetings have been had between groups of states and all of the states. It now appears to the Chairman that while considerable progress was made for a while, no progress has been made for several days, and there is still lack of agreement on the percentage of use of water to be allocated to each state. The states are claiming percentages which, in the aggregate, exceed 100 percent. The Chairman has carefully, courteously and patiently listened to the arguments made by each state in support of its position, but in so doing he has refrained from giving comfort to any state in support of its claims.

In consultation with his engineer adviser, Mr. Riter, and after giving full consideration to the claims, needs, potentialities, sources of water supply for each state, and rights of the Indians, the Chairman believes that the percentages which he is about to submit are fair and equitable. No Commissioner for any state nor any adviser has agreed with the Chairman or any of his advisers that the percentages are satisfactory.

These percentages are submitted with the understanding that Arizona will have the use of not to exceed 50,000 acre feet, and that the remaining water available for use in the Upper Colorado River Basin will be divided on the following percentages:

Colorado	51.75
New Mexico	11.25
Utah	23.0
Wyoming	14.0
Total	100.0

In order that you may have the opportunity to consider carefully and in the same spirit of cooperation as they are submitted the percentages which the Chairman and his engineer adviser have agreed upon, with the sole objective of starting the Upper Basin States as a unit in the development of the great water, land, power, and mineral resources of the Upper Colorado River Basin, for the benefit of the nation as a whole, the meeting stands recessed until eight p.m. today when it is hoped that you will indicate approval of the percentages as stated.

We are now adjourned.

(9:38 a.m. Recess.)

(8:00 p.m. Meeting reconvened.)

THE CHAIRMAN: The meeting will come to order, please. Gentlemen, you have had all day to consider the percentages proposed by your Chairman and his engineer adviser for the settlement of the differences between you in regard to the allocation of the consumptive use of water in the Upper Colorado River Basin. In disposing of this question the Chairman believes that the fair way to do it would be in accordance with the accepted traditions of America and that is by secret ballot. The Chairman has prepared ballots which he will hand you and on that ballot the state will indicate "yes" or "no" in regard to the acceptance of the percentages.

Now of course if everybody votes "yes" the Chairman will be most happy to so announce. However, the Chairman promises you that if there is not a unanimous vote that the vote of no Commissioner will be disclosed by the Chairman to anyone and the envelopes containing the ballots will be returned to you. I don't know of any fairer way. You may criticize or suggest in regard to that if you have a better method. What your Chairman is trying to do is protect all of you in your position.

Mr. Riter, will you hand each Commissioner a ballot?

COM. WATSON: Mr. Chairman, part of the members of the Utah Water and Power Board arrived this afternoon and there will be probably two arrive in the morning. And before I express the sentiments of the State of Utah I wish to take this matter up with the Power and Water Board officials, and I therefore ask for a continuation of this meeting until tomorrow morning at ten o'clock. May I add this, however, I am hoping for these two members that I want to have here to be here early. I shall try to meet requirements by ten o'clock.

THE CHAIRMAN: In other words, if the Chair understands your position, you wish to have this meeting postponed until tomorrow morning at ten o'clock when the Commission for Utah will be prepared to vote as outlined by the Chairman?

COM. WATSON: Yes.

THE CHAIRMAN: Mr. Watson, I think we shall have to comply with your

request. However, I do say this, without blaming anyone, that it seems like that the State of Utah has been attending this Commission meeting in relays, and we certainly ought to get down to business one of these days.

COM. STONE: Mr. Chairman, I think we ought to make as much progress as possible; we have had several days of delay. A considerable amount of work remains to be done. It was suggested to me today, if Utah doesn't have to be away from this meeting tonight, we could make progress by consideration of the report of the Drafting Committee and work for an hour and a half or two hours. I am not urging that. If those here feel there are other things more pressing at the moment and Utah has to meet, why, we are not trying to embarrass anybody and I just put that out as a feeler.

THE CHAIRMAN: Well, the Chairman doesn't understand, Judge Stone, how you can consider the report of the Drafting Committee or any other committee or group without the presence of Utah and as I understand Mr. Watson, his presence is required at the meeting of this board, is that correct?

COM. WATSON: Mr. Chairman, we should meet in session here for an hour and then after adjournment our board can meet.

COM. STONE: I wouldn't under that situation, Mr. Chairman, if it is going to delay their meeting. I withdraw my suggestion.

THE CHAIRMAN: I think the withdrawal is in order, Judge Stone, because I don't like to see anything interfere with a meeting of the Utah Board at this time, and I think all the time that remains between now and ten o'clock tomorrow morning should be at its disposal.

COM. CARSON: Mr. Chairman, it might be a good idea to inquire whether all the other states are ready to vote or will be ready at ten o'clock in the morning.

THE CHAIRMAN: Very well, I think that is a good suggestion. Com. Wilson, are you prepared to vote now or tomorrow morning?

COM. WILSON: We are prepared to vote now, Mr. Chairman, or in the morning at ten o'clock.

THE CHAIRMAN: Com. Bishop?

COM. BISHOP: Wyoming is prepared to vote now.

THE CHAIRMAN: Com. Carson?

COM. CARSON: Yes, we are prepared to vote now or in the morning.

THE CHAIRMAN: Com. Stone?

COM. STONE: Colorado is prepared to vote now.

THE CHAIRMAN: Now, gentlemen, of course it would be possible to take a vote on this which wouldn't bind anybody but yourselves, but it occurs to the Chairman that the vote should be deferred until tomorrow morning at ten o'clock.

COM. CARSON: I move we adjourn until tomorrow morning at ten o'clock.

THE CHAIRMAN: You have heard the motion.

COM. WILSON: Second the motion.

THE CHAIRMAN: Any discussion? (Question is called for. Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

We now stand adjourned until tomorrow morning at ten o'clock.

(8:15 p.m., Monday, July 19, 1948, recess until 10:00 a.m., Tuesday, July 20, 1948.)

Vernal, Utah
July 20, 1948
10:00 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: The meeting will please come to order. The Chairman believes that the procedure which he outlined last evening in regard to the balloting should be modified somewhat and he will attempt to state his modified ideas at this time.

The ballots will be submitted to the Chairman in an envelopes and there will be only one ballot. When all ballots are in, the Chairman will then announce how each state has voted. The reason for that is this: to protect the Commissioner of each state from the possible criticism that if he had not led off on this balloting he would probably have gotten a larger allocation of this water.

Gentlemen, are you now ready to ballot?

COM. WATSON: Mr. Chairman, in line with our discussion last night I would like to state Utah's position. We are united. We have seven members of the Water and Power Board here who are advisers and we have gone over this thing carefully. But that is not a quorum. It will take eight for a quorum. Mr. William R. Wallace will be here shortly.

I would like to have the consent of this Commission to defer voting for a short while, say two o'clock.

COM. STONE: Mr. Chairman, may I say in connection with the suggestion made by Com. Watson and in view of our long years of collaboration with Utah and particularly with William R. Wallace, who has been active in the Colorado River for many years, it seems to me that by all means we should cooperate on the suggestion made by Mr. Watson.

THE CHAIRMAN: It appears to the Chairman that there is no object in taking a ballot if the Commissioner for Utah is not ready to vote at this time. There is nothing to do except recess until the Commissioner for Utah has indicated to the Chairman that he is ready to vote, and then please hold yourselves ready to convene here today on call of the Chairman.

Now it occurs to the Chairman that possibly some work may be done during the interim by the Drafting Committee. There are some articles which were passed over and it is the understanding of the Chairman that Utah now has three very able lawyers here and I am in hopes that some work can be done on the articles of the Compact. Does the Chair hear a suggestion?

COM. STONE: May we have a suggestion from a member of the Drafting Committee on that question?

MR. WEHRLI: Mr. Chairman, I see no reason why we can't hold a meeting of that committee immediately following this adjournment. We could hold it here and there is some work that could be done. I believe we could save quite a lot of the time of the sessions of the Commission if such a meeting were held. We would be very glad to do that.

THE CHAIRMAN: May the Chair ask Mr. Clyde if he can participate in that, or do you wish to attend a meeting of the Utah people?

MR. HOWELL: He is not a member of the Board, if I may answer that question. I happen to be. So with the understanding that I may substitute Mr. Clyde for myself, because I want to be at this meeting of course of the Board, then there would be no question about the lawyer from Utah being able.

THE CHAIRMAN: Judge Howell, we include all the lawyers from Utah as being able, but I think that is an excellent suggestion on your part. And is that satisfactory to you, Mr. Clyde?

MR. CLYDE: It is.

THE CHAIRMAN: The Chairman also wants to say that Mr. Skeen, who is a very competent attorney in the employ of the Bureau of Reclamation, is here substituting as legal adviser for the Federal Representative in the place of Mr. Will, who had to leave for Washington on account of very serious illness in his family, and Mr. Skeen will be very glad to work with the Drafting Committee.

MR. HOWELL: May I say, Mr. Chairman, the reason I didn't include Mr. Skeen as being from Utah is that we gave him up to the larger organization, the Reclamation Service. My own opinion is that he is the most able lawyer on irrigation matters in the State of Utah.

THE CHAIRMAN: Mr. Skeen, I hope you won't get swelled up by that very fine compliment paid you by the legal adviser to the Commissioner for Utah. Are there further suggestions?

MR. BREITENSTEIN: I would like to suggest that the legal advisers for the states of Arizona and New Mexico have left town.

COM. CARSON: I named Judge Udall as the member of that Drafting Committee for Arizona. He had to leave so I will substitute myself for him for this meeting today.

THE CHAIRMAN: Thank you, Com. Carson. Are there further observations or suggestions?

MR. WEHRLI: Mr. Chairman, you mentioned the time of reconvening of this Commission as two o'clock. We have no complaint about that time but I am wondering if events transpired making it possible to call us together at one or one-thirty, if it may not be done?

THE CHAIRMAN: Pardon me, Mr. Wehrli. I believe the suggestion of the Chairman was that the present meeting recess subject to the call of the Chairman after the Chairman has been notified by the Commissioner for Utah that he is ready to submit his ballot.

MR. WEHRLI: I didn't understand it that way. I think that is fine.

COM. WILSON: Mr. Chairman, Judge Threet of New Mexico is on this

Drafting Committee. He found it necessary to go home a day or two ago. I will be glad to sit in with the Drafting Committee representing New Mexico.

THE CHAIRMAN: Thank you, Com. Wilson. Are there further matters to be brought up at this time?

MR. GILES: Mr. Chairman, I am not a member of the Commission; however, I am its secretary and early in the negotiations the Chairman said it was perfectly all right for me to make a comment if I saw fit.

The comment I have to make now is that I am sure the Commissioner for Utah and his advisers, and also the members of the Board and others who might be here from Utah, join me in expressing to this group and to the Chairman our deep appreciation for your indulgence on this very important matter and for your further indulgence in awaiting the arrival of Mr. Wallace. We are grateful to you for this attitude.

THE CHAIRMAN: If there are no further comments or observations this meeting stands recessed subject to the call of the Chair.

(10:10 a.m. Recess.)

(8:00 p.m. Meeting reconvened.)

THE CHAIRMAN: The meeting will please come to order. The Chairman observes that some of the members of the Utah Water and Power Board are present this evening and we are delighted that they are here. We are particularly delighted that Mr. Wallace, who has worked on these river problems for longer than most of us, is with us and without whose counsel and guidance it is doubtful if the states could come into agreement within a reasonable time, and the Chair at the proper time will make further remarks to substantiate what he has said.

At this time the Chair will call on Com. Watson to introduce the members of the Utah Board, omitting of course Mr. Wallace whom everybody knows.

COM. WATSON: Mr. Chairman, in addition to Mr. Wallace, who is Chairman of the Board, there is present Judge Howell, who is Vice Chairman. If you gentlemen when called will rise, we can see who you are.

Mr. Wallace Mathis of St. George. Mr. Joseph W. Johnson, Davis County. Mr. Wallace Yardley from Beaver. Dr. P. L. Jones of Nephi. Mr. B. O. Colton from Roosevelt. Mr. Raymond Hammond of Grantsville.

In addition to these gentlemen who are members of the Board, I have contacted three others who are unable to come and who join with us in our decision: Charles Redd, La Sal; L. B. Johnson of Rich County; and Mr. Orson Christensen of Brigham City--also Dr. J. A. Widtsoe.

Mr. Chairman, we would like to have Mr. Thomas Jensen, who does field work, arise. (Applause.)

THE CHAIRMAN: Thank you, Com. Watson, and gentlemen. Certainly Tom Jensen doesn't need any introduction in any meeting where there is something to eat or water to drink and talk about.

Now, gentlemen, are you prepared to cast your ballot on the question of the percentages. Is New Mexico ready?

COM. WILSON: New Mexico is ready.

THE CHAIRMAN: Wyoming?

COM. BISHOP: Ready.

THE CHAIRMAN: Arizona?

COM. CARSON: Ready.

THE CHAIRMAN: Utah?

COM. WATSON: Ready.

THE CHAIRMAN: Colorado?

COM. STONE: Colorado is ready.

THE CHAIRMAN: Now we will cast only one ballot. The decision will be made on the first ballot. Mr. Riter, will you please pass around the ballots so that the Commissioners may examine them as to form and see whether or not they are satisfactory? (Mr. Riter distributes ballots.)

The idea of the ballot is so that any critic of the action which you may take here tonight cannot accuse you of being the first one to lead off. Perhaps some of you would wish the honor, but as long as the Chairman has proceeded on the basis of the ballot, it is requested that you sign your ballots, submit them to the Chairman and the Chairman will announce the result of the balloting.

(Ballots collected.)

THE CHAIRMAN: The Chairman now has five ballots. New Mexico votes "Yes". (Applause.)

Colorado votes "Yes". (Applause.)

Utah votes "Yes". (Applause.)

Wyoming votes "Yes". (Applause.)

Arizona votes "Yes". (Applause.)

MR. BARLOW: Mr. Chairman, how did the Chairman vote?

THE CHAIRMAN: The Chairman will now explain his vote.

To each of the Commissioners, legal advisers, engineer advisers, and common-sense advisers--by the latter I mean such men as my friend Dan Hunter from Dove Creek, Colorado, who has attended faithfully all meetings and whose patience has been a stabilizing influence on your Chairman:

First I want to say to all of you that you have ably and with determination represented your state.

Second, you have stubbornly tried to get all you could get for your state. This refers to every one of you.

Third, no man or group of men could have done better.

Fourth, you have gotten all you could get. No state would have given

up at this meeting or any other meeting another percent.

You have made an extremely important decision. You have rendered a great service to your state, the Upper Colorado River Basin, and to the Nation as a whole. You may now look with satisfaction and an untroubled mind on what you have done and forget about the impossible percent which you had hoped for but which you did not expect to get. (Laughter.) You can now view with great satisfaction the performance of a duty which you have not shirked. (Applause.)

MR. WEHRLI: Mr. Chairman, may we of Wyoming lead in an expression of appreciation to our Chairman, in which expression of appreciation I am sure that every state will join and may we all say together to the Chairman, it is a job well done. (Applause.)

THE CHAIRMAN: Mr. Wehrli, of course the Chairman is very much pleased with the outcome of the balloting and your expression of appreciation. I can't figure that I did much here except to sit around and growl at all of you---I didn't make any exceptions.

COM. CARSON: Mr. Chairman, I would like to add to that the Bureau engineers and lawyers. We all appreciate their service and assistance.

THE CHAIRMAN: Yes, I believe the Bureau of Reclamation people have helped to the limit of their capacity. And the Chairman wants to say this also, that whenever the occasion demands it he will be very glad to defend the action of each and every one of you at any place or at any time.

The Drafting Committee made very good use of its time this morning and this afternoon, and you now have copies of that report before you. The Chairman will now ask Mr. Skeen to read the report, I believe it should be read through before there is any argument or discussion of it, and also to insure that all of you read it. Mr. Skeen.

MR. SKEEN: The Drafting Committee met on July 12 and prepared approximately 14 articles. The Committee met again today and revised some of those articles and I will read the draft of the Upper Colorado River Basin Compact as revised.

"UPPER COLORADO RIVER BASIN COMPACT

The State of Arizona, the State of Colorado, the State of New Mexico, the State of Utah, and the State of Wyoming, acting through their Commissioners,

Charles A. Carson for the State of Arizona,
Clifford H. Stone for the State of Colorado,
Fred E. Wilson for the State of New Mexico,
Ed. H. Watson for the State of Utah, and
L. C. Bishop for the State of Wyoming,

after negotiations participated in by Harry W. Bashore, appointed by the President as the representative of the United States of America, have agreed, subject to the provisions of the Colorado River Compact, to determine the rights and obligations of each State respecting the uses and deliveries of the water of the Upper Basin of the Colorado River, as follows:

ARTICLE I

(a) The major purposes of this Compact are to provide for the equitable division and apportionment of the use of water of the Colorado River System, the use of which was apportioned in perpetuity to the Upper Basin by the Colorado River Compact; to establish the obligations of each State of the Upper Division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River Compact; to promote interstate comity; to remove causes of present and future controversies; and to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of its waters, and the protection of life and property from floods.

(b) It is recognized that the Colorado River Compact is in full force and effect and all of the provisions hereof are subject thereto.

ARTICLE II

As used in this Compact:

(a) The term "Colorado River System" means that portion of the Colorado River and its tributaries within the United States of America.

(b) The term "Colorado River Basin" means all of the drainage area of the Colorado River System and all other territory within the United States of America to which the waters of the Colorado River System shall be beneficially applied.

(c) The term "States of the Upper Division" means the States of Colorado, New Mexico, Utah and Wyoming.

(d) The term "States of the Lower Division" means the States of Arizona, California and Nevada.

(e) The term "Lee Ferry" means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

(f) The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System above Lee Ferry.

(g) The term "Lower Basin" means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System below Lee Ferry.

(h) "Colorado River Compact" means the agreement concerning the apportionment of the use of the waters of the Colorado River System dated November 24, 1922, executed by Commissioners for the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, and by Herbert Hoover, representative of the United States, and proclaimed effective by the President of the United States, June 25, 1929.

(i) The term "Upper Colorado River System" means that portion of the Colorado River System above Lee Ferry.

(j) The term "Commission" means the agency created by this Compact for the administration thereof.

(k) The term "water year" means that period commencing October 1 of any year and ending September 30 of the following year.

(l) The term "acre-foot" is the quantity of water required to cover an acre to the depth of one foot and is equivalent to forty-three thousand five hundred sixty (43,560) cubic feet.

(m) The term "domestic use" shall include the use of water for household, stock, municipal, mining, milling, industrial and other like purposes, but shall exclude the generation of electrical power."

The next article will be the article relating to the division of the water in terms of percentages. That has not been drafted in final form as yet. The articles from here on are unnumbered. I will read them in the order in which they have been gathered.

"ARTICLE_____

In the event curtailment of use by the States of the Upper Division shall at any time become necessary in order that the flow at Lee Ferry shall not be depleted below that flow required by Article III of the Colorado River Compact, the extent of curtailment by each such State of the consumptive use of water, apportioned to it by Article____ of this Compact, shall be such as to result in the delivery at Lee Ferry of an amount of water which bears the same relation to the deficiency to be made up as the consumptive use which was made by each such State during the water year immediately preceding that in which the deficiency occurs bears to the aggregate consumptive use of water which was made pursuant to the apportionment made by Article____ hereof by the States of the Upper Division during the water year immediately preceding that in which the deficiency occurs; provided that, for the purpose of computing the curtailment that must be made by any such State as required by this Article, uses being made prior to November 24, 1922, shall be excluded; provided further, that if any State or States of the Upper Division, in the ten years immediately preceding the water year in which such curtailment is required to be made, shall have consumptively used more water than it was or they were, as the case may be, entitled to use under the apportionment made by Article____ of this Compact, such State or States, as the case may be, shall be required to supply at Lee Ferry an amount equal to its or the aggregate of their overdraft or such proportionate part thereof as may be necessary to supply such deficiency before demand is made on any other State.

ARTICLE_____

(a) No State shall deny the right of the United States and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one State for the purpose of diverting, conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the States of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper State for consumptive use in a lower signatory State when such use is within the apportionment

to such lower State made by this Compact. Such rights shall be subject to the rights in a State in which such reservoir or works are located to receive and use the water, the use of which is apportioned to it by this Compact.

(b) Any signatory State, any person, or any entity of any signatory State shall have the right to acquire property rights necessary to the use of water in conformity with this Compact in any other signatory State by donation, purchase, or through the exercise of the power of eminent domain. Any signatory State, upon the written request of the Governor of any other signatory State for the benefit of whose water users property is to be acquired in the State to which such written request is made, shall proceed expeditiously to acquire the desired property either by purchase at a price satisfactory to the requesting State, or, if such purchase cannot be made, then through the exercise of its power of eminent domain and shall convey such property to the requesting State or such entity as may be designated by the requesting State; provided, that all costs of acquisition and expenses of every kind and nature whatsoever incurred in obtaining of the requested property shall be paid by the requesting State at the time and in the manner prescribed by the State requested to acquire the property.

(c) Should any facility be constructed in a signatory State by and for the benefit of another State or States or the water users thereof, as above provided, the construction, repair, replacement, maintenance and operation of such facility shall be subject to the laws of the State in which the facility is located, except that, in the case of a reservoir constructed in one State for the benefit of another State or States, the water administration officials of the State in which the facility is located shall permit the storage and release of any water which, as determined by finding of the Commission, falls within the apportionment of the State or States for whose benefit the facility is constructed, and, in the case of a regulating reservoir for the joint benefit of all States in making Lee Ferry deliveries, the water administration officials of the State in which the facility is located shall, in permitting the storage and release of water, comply with the findings and orders of the Commission.

(d) In the event property is acquired by a signatory State in another signatory State for the use and benefit of the former, the users of water made available by such facilities shall pay to the political subdivisions of the State in which such works are located, each and every year during which such rights are enjoyed for such purposes, a sum of money equivalent to the average annual amount of taxes levied and assessed against the land and improvements thereon during the ten years preceding the acquisition of such land, in full reimbursement for the loss of taxes in such political subdivisions of the State, said payments to be in lieu of any and all taxes on said property, improvements and rights.

(e) The signatory States recommend to the President and the Congress that, in the event the United States shall acquire property in one of the signatory States for the benefit of another signatory State or its water users, provision be made for like payment in reimbursement of loss of taxes.

ARTICLE _____

(a) The storage capacity of reservoirs and the water stored therein for the purpose of and utilized in making deliveries of water at Lee Ferry in compliance with the provisions of Article III of the Colorado River Compact shall be considered to be for the common benefit of the States of the Upper Division, and water so stored for such purpose shall not be earmarked for nor charged to any individual State.

(b) Reservoir losses resulting from the storage of water for the joint benefit of such States in making deliveries of water at Lee Ferry shall be charged to the States of the Upper Division in proportion to the consumptive use of water in each State of the Upper Division during the year for which the charge is made.

(c) Reservoir losses resulting from the storage of water for purposes other than those covered by paragraphs (a) and (b) of this article by one or more states shall be charged to the State or States for whose benefit the water is so stored in proportion to the benefits received.

ARTICLE _____

The failure of any State to use the water, or any part thereof, the use of which is apportioned to it under the terms of this Compact shall not constitute a relinquishment of the right to such use to the Lower Basin or to any other State, nor shall it constitute a forfeiture or abandonment of the right to such use.

ARTICLE _____

(a) Subject to the provisions of the Colorado River Compact and of this Compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

(b) The provisions of this Compact shall not apply to or interfere with the regulation and control by any State within its boundaries of the appropriation, use, and distribution of water, the consumptive use of which is apportioned to such State by Article _____ hereof.

ARTICLE _____

The signatory States recognize the La Plata River Compact entered into between the States of Colorado and New Mexico, dated the 27th day of November, 1922, approved by the Congress on Juanuary 29, 1925 (43 Stat. 796), and this compact shall not affect the apportionment therein made; provided, that consumptive uses of water made by either Colorado or New Mexico from La Plata River shall be charged as uses under the apportionment made to such State by Article _____ of this Compact.

ARTICLE _____

(a) There is hereby created an interstate administrative agency to be known as "Upper Colorado River Commission." The Commission shall be composed of one representative of each of the States of the Upper Division, namely; Colorado, New Mexico, Utah and Wyoming, designated or appointed in accordance with the laws of each such state and, if designated by the President of the United States, one representative of the United States. The President of the United States is hereby requested to designate a Commissioner for the United States. If a Commissioner is so designated for the United States, he shall be the presiding officer of the Commission and shall be entitled to the same powers and rights as the Commissioner of any State. Any four members of the Commission shall constitute a quorum.

(b) The salaries and personal expenses of each Commissioner shall be paid by the Government which he represents. All other expenses which

are incident to the administration of this compact, and which are not paid by the United States, shall be borne pro rata by the four States according to the percentage of consumptive use apportioned to each. On or before November 1st of each year, the Commission shall adopt and transmit to the governors of the four States and to the President a budget covering an estimate of its expenses for the following year, and of the amount thereof payable by each State. Each State shall pay the amount due by it to the Commission on or before April 1st of the year following. The payment of the expenses of the Commission and of its employees shall not be subject to the audit and accounting procedures of any of the four States.

(c) The Commission shall appoint a Secretary, who shall not be a member of the Commission, and who shall serve for such term and receive such salary and perform such duties as the Commission may direct. The Commission may emply such engineering, legal, clerical and other aid as may, in its judgment be necessary for the performance of its functions under this compact. In the hiring of employees, the Commission shall not be bound by the civil service laws of any State.

(d) The Commission shall have the power to:

(1) Adopt rules and regulations not inconsistent with this compact;

(2) Locate, establish, construct, abandon, operate and maintain water gaging stations;

(3) Make estimates to forecast water run-off on the Colorado River and any of its tributaries;

(4) Engage in cooperative studies of water supplies of the Colorado River and its tributaries;

(5) Collect, analyze, correlate, preserve and report on data as to the stream flows, storage, diversions and use of the waters of the Colorado River, and any of its tributaries;

(6) Make findings as to the quantity of water of the Upper Colorado River System used each water year in the Upper Colorado River Basin and in each State thereof;

(7) Make findings as to the quantity of water deliveries at Lee Ferry during each water year;

(8) Make findings as to the necessity for curtailment of use, if any, pursuant to Article _____ hereof;

(9) Make findings as to the quantity of reservoir losses and as to the share thereof chargeable under Article _____ hereof to each of the States;

(10) Make findings of fact in the event of the occurrence of extraordinary drought or serious accident to the irrigation system in the Upper Basin, whereby deliveries by the Upper Basin of water which it may be required to deliver in order to aid in fulfilling obligations of the United States of America to the United Mexican States arising under the Treaty between the United States of America and the United

Mexican States dated February 3, 1944 (Treaty Series 994) become difficult, and report such findings to the Governors of the Upper Basin States, the President of the United States of America, the United States Section of the International Boundary and Water Commission, and such other Federal officials and agencies as it may deem appropriate to the end that the water allotted to Mexico under Division III of such Treaty may be reduced;

(11) Acquire, hold and dispose of such personal and real property as may be necessary for the performance of its duties hereunder;

(12) Perform all functions required of it by this compact and do all things necessary, proper or convenient in the performance of its duties hereunder;

(13) Make and transmit annually to the Governors of the signatory States and the President of the United States, with the estimated budget, a report covering the activities of the Commission for the preceding year.

(e) The concurrence of four members of the Commission shall be required in any action taken by it.

(f) The Commission and its Secretary shall make available to the Governor of each of the signatory States any information within its possession at any time, and shall always provide free access to its records by the Governors of each of the States, or their representatives, or authorized representatives of the Federal Government.

(g) Findings of fact made by the Commission shall not be conclusive in any court, or before any agency or tribunal, but shall constitute prima facie evidence of the facts found.

ARTICLE ____

(a) The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the Upper Basin and for each State of the Upper Basin by the inflow-outflow method in terms of stream depletion at Lee Ferry and at State lines; unless the Commission, by unanimous action, shall adopt a different method of determination.

(b) The water year shall be used as the basis of computing all annual measurements of stream flows, use and delivery of water.

ARTICLE ____

The use of water by the United States or any of its agencies, instrumentalities or wards shall be charged as a use by the State in which the use is made.

ARTICLE ____

Nothing in this compact shall be construed as:

(a) Affecting the obligations of the United States of America to Indian tribes;

(b) Affecting the obligations of the United States of America under the Treaty with the United Mexican States (Treaty Series 994);

(c) Affecting any rights or powers of the United States of America, its agencies or instrumentalities in or to the waters of the Upper Colorado River System, or its capacity to acquire rights in and to the use of said waters;

(d) Subjecting any property of the United States of America, its agencies or instrumentalities to taxation by any state or subdivision thereof, or creating any obligation on the part of the United States, its agencies or instrumentalities, by reason of the acquisition, construction or operation of any property or works of whatever kind, to make any payment to any State or political subdivision thereof, State agency, municipality or entity whatsoever, in reimbursement for the loss of taxes;

(e) Subjecting any property of the United States, its agencies or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to this Compact.

ARTICLE ____

This Compact may be terminated at any time by the unanimous agreement of the signatory States. In the event of such termination, all rights established under it shall continue unimpaired.

ARTICLE ____

This compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States and approved by the Congress of the United States. Notice of ratification by the legislatures of the signatory States shall be given by the Governor of each signatory States to the Governors of the other signatory States and to the President of the United States, and the President of the United States is hereby requested to give notice to the Governors of the signatory States of approval by the Congress of the United States.

IN WITNESS WHEREOF, the Commissioners have signed this Compact in a single original, which shall be deposited in the archives of the Department of States of the United States of America, and of which a duly certified copy shall be forwarded to the Governor of each of the signatory States.

Done at the City of _____, _____
this _____ day of _____, _____."

THE CHAIRMAN: Thank you, Mr. Skeen, for the reading of the report of the Drafting Committee. It appears to the Chairman that you have performed an excellent job.

(9:50 p.m., Tuesday, July 20, 1948, recess until 9:00 a.m., Wednesday, July 21, 1948.)

Vernal, Utah
July 21, 1948
9:00 o'clock a.m.

(All Commissioners present.)

THE CHAIRMAN: Gentlemen, will you please come to order.

MR. HOWELL: Mr. Chairman, Utah moves that the articles as submitted by the Drafting Committee be accepted and written into the Compact subject to such revision as to language as may be made by the final drafting committee, with the exception of the article relating to curtailment which commences as follows: "In the event of curtailment of use by the States of the Upper Division shall at any time become necessary...." and so forth--- so as to make more clear the language in the last portion thereof--Mr. Wehrli, will you give me the language you wrote in?

MR. WEHRLI: Judge Howell, in the next to the last line in accordance with the suggestion you made, the word "thereof" might be stricken and in lieu of that word, the following words inserted, "of such overdraft".

MR. HOWELL: I shall accept your language then, the article may be amended to read that way. The article relating to storage capacity of reservoirs and at the beginning of the article, insert, "As determined by the Commission:". With those exceptions and the amendments, Utah moves the articles be accepted as amended.

MR. BLISS: Mr. Chairman, I was merely asking about the last correction Judge Howell made.

MR. HOWELL: It is in the article--it isn't numbered of course--but it starts off like this--it has (a), (b), (c) in it: "The storage capacity of reservoirs and the water stored therein. . ." and so forth. Now does that identify it?

MR. BLISS: Yes.

MR. HOWELL: Now my amendment is to insert at the beginning and before the letter (a), "As determined by the Commission:".

COM. STONE: Mr. Chairman, the short article which commences with the words, "The Commission shall determine the quantity of the consumptive use of water. . .", in the fourth line--

Colorado suggests that the word "stream" be stricken and insert the words, "man-made"; and after the word "depletion" insert the words, "of the virgin flow" so that it would read: "in terms of man-made depletion of the virgin flow. . ."

MR. HOWELL: We accept that amendment as part of our motion.

COM. STONE: I have another suggestion which has to do with it but it goes to another article. In line with that then it would be necessary to include in the article covering definitions, a new definition which would read: "The term 'virgin flow' means the flow undepleted by the activities of man."

MR. HOWELL: We will also accept that amendment as part of the motion.

MR. BLISS: Will you repeat that?

COM. STONE: The definition would read: "The term 'virgin flow' means the flow undepleted by the activities of man."

MR. HOWELL: The motion has not been seconded as yet.

THE CHAIRMAN: Are there further additions to the motion?

COM. STONE: Was the motion seconded?

THE CHAIRMAN: No, it was not.

COM. STONE: I will second the motion subject to these corrections and changes that I have suggested.

THE CHAIRMAN: Are you ready for the question?

MR. HOWELL: Question.

MR. WEHRLI: Mr. Chairman, Judge Stone, in your definition of virgin flow, of course we all know what the definition means, but wouldn't it be better to put in that definition after "flow", "of any stream"? "The term 'virgin flow' means the flow of any stream undepleted by the activities of man."

COM. STONE: That would be agreeable.

MR. WEHRLI: There might be some thought that it might relate to Lee Ferry or some particular situation.

COM. STONE: Very well, that may be added.

MR. HOWELL: There is no objection to that either.

THE CHAIRMAN: You have heard the motion and the amendments which have been suggested and accepted by the maker of the motion and the second. Are you ready for the question?

COM. STONE: Question.

(Thereupon a vote was taken and Utah's motion as amended carried unanimously.)

COM. STONE: Mr. Chairman, we agreed yesterday on the apportionment of the water among the states of the Upper Basin. That article has never been referred to the Drafting Committee. Accordingly, I move now that article be referred to the Drafting Committee.

COM. CARSON: Second the motion.

THE CHAIRMAN: You have heard the motion which has been seconded.

COM. BISHOP: Question.

THE CHAIRMAN: Are there comments? Question has been called for.
(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

COM. CARSON: Now, Mr. Chairman, I would like to suggest the consideration of another article to be referred to the Drafting Committee which I have with others outlined as follows:

"The State of Arizona, a signatory to this compact, reserves all of its

rights and interests under the Colorado River Compact as a state of the Lower Division and as a state of the Lower Basin."

I think that is necessary to have in there because we are in that position in Arizona. We have a big interest in the Lower Basin and a relatively small interest in the Upper Basin and I don't want to have anything in here that would give any comfort to anybody that might attack such compact as we might make that we varied its terms, and it is necessary as I see it that we have such a clause.

THE CHAIRMAN: Do you make that as a motion?

COM. CARSON: I therefore move it be approved in principle and referred to the Drafting Committee.

MR. HOWELL: May I ask you a question?

COM. CARSON: Yes.

MR. HOWELL: If you word it that way, may it not be argued that the other states which are also states of the Lower Basin might give up some of their rights? Why can't you make that more inclusive to include all the states of the Lower Basin?

COM. CARSON: That is agreeable.

MR. HOWELL: That would include New Mexico and Utah.

COM. CARSON: Do you approve of that, Fred?

COM. WILSON: I think something like that is very appropriate.

COM. CARSON: I move it be approved in principle and referred to the Drafting Committee with those corrections.

THE CHAIRMAN: Is there a second to the motion?

COM BISHOP: Second.

THE CHAIRMAN: Seconded by Com. Bishop. Ready for the question?

COM. BISHOP: Question.

(Thereupon a vote was taken and the motion of Com. Carson carried unanimously.)

MR. HOWELL: On behalf of the Commissioner of Utah and speaking for him, I move the adoption in principle of an article reading as follows that may be referred to the Drafting Committee to use appropriate language:

"In the event water from another drainage basin is now being or may hereafter be diverted into the Upper Colorado River Basin by the United States or jointly or severally by any of the states signatory hereto, the state having the right to the use of such water shall not be charged therewith in the allocation of the right to the use of water by Article III hereof."

COM. STONE: I second that motion.

THE CHAIRMAN: You have heard the motion and the second. Is there a discussion of the motion? (No response.) Are you ready for the question?

COM. BISHOP: Question.

(Thereupon a vote was taken and Utah's motion carried unanimously.)

THE CHAIRMAN: The Chairman wishes to make this observation at this time. So far as he is aware, the idea of the percentage allocation was first conceived in the mind of one of the men who has attended all of these meetings. I refer to Mr. Wallace. And that idea of a percentage allocation, according to my recollection, was first presented at a meeting called by Governor Hunt of Wyoming about a year ago, and that idea was expressed by Governor Maw of Utah at the suggestion of Mr. Wallace. In the opinion of the Chairman that idea alone has done more than anything else to facilitate the allocation of water in the Upper Basin.

COM. STONE: Colorado moves that two articles, one relating to the delivery of water by Colorado to New Mexico and the other relating to the delivery of water by Colorado to Utah, be referred to the Drafting Committee with the understanding that the articles as submitted express principles and in each instance require engineering studies, and that a note be incorporated in the draft calling attention to that fact, namely, that they express principles and require engineering studies.

COM. WILSON: Second the motion.

MR. HOWELL: Without reading them?

COM. STONE: I will read them. Very well. Here is the first one relating to the San Juan:

"Subject to the provisions of this compact, the consumptive use of the water of the San Juan River and its tributaries are hereby apportioned between Colorado and New Mexico in accordance with the following principles:

(a) Colorado shall deliver to New Mexico during each water year the sum of these quantities set forth in the following tabulations of relationship which correspond to the quantities at the upper index stations.

(b) All consumptive uses of water of the San Juan River and its tributaries made by either Colorado or New Mexico shall be charged as uses under the apportionment to such state by Article ___ of this Compact."

Then this contains the note:

"Here set forth schedules as in the Rio Grande Compact, such schedules to be worked out as to give reasonable assurance to New Mexico that it will receive San Juan water in quantities sufficient to give reasonable anticipation of having available a quantity of water which will make possible the consumptive use apportioned to New Mexico by this Compact. These schedules are to be fair and equitable and are to be so made as to provide for an equitable sharing of unavoidable shortages." That is the note.

The other one reads:

"Subject to the provisions of this Compact, the waters of the Yampa River, a tributary entering the Green River in Colorado, are hereby apportioned between Colorado and Utah in accordance with the following principles and procedures:

(a) Colorado shall deliver at the mouth of the Yampa River during each water year a quantity of water which will assure Utah of a flow of water out of

the Yampa River reasonably adequate for Utah water use projects partly dependent upon the flow of the Yampa River.

(b) All consumptive uses of water of the Yampa River made by either Colorado or Utah shall be charged as uses under the apportionment to such state by Article _____ of this Compact.

Then there is a note here which will be called to the attention of the Drafting Committee by the submission of this tentative draft of the article which reads:

"The details of the formula or procedure to be incorporated into the Compact for the purpose of carrying out the above provisions are to be worked out by the Engineering Advisory Committee for insertion in the Compact before the next meeting and shall be based upon the water requirements as finally determined by the Bureau of Reclamation report on the Central Utah Project." That is the end of the note.

With that explanation we make those proposals and I feel my motion should prevail that they go to the Drafting Committee.

THE CHAIRMAN: Is there a second to the motion?

COM. WILSON: I seconded the motion.

THE CHAIRMAN: Are you ready for the question?

COM. WATSON: Question.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

COM. STONE: I should like to have the draft which this Commission will submit at this time contain a reference to the fact that an article concerning the Little Snake is to be included in this Compact.

MR. WEHRLI: We agree with you on that completely and I have no doubt but that we will be able to prepare that article and have it ready at the next meeting of this Commission.

THE CHAIRMAN: Gentlemen, are you now ready to consider the time and place of the next meeting?

COM. STONE: Mr. Chairman, there is another matter of considerable importance which I believe should take precedence over the consideration of the time and place of the next meeting and that's with reference to certain work that should be done by the Engineering Committee in the interim between this meeting and the next and we hope the final meeting of this Commission. It would seem well at this time the Commission might agree upon those items in order that the Engineering Committee, the members of which are here, could get together and decide the tasks which should be done between now and the next meeting. That will expedite the accomplishment of that work and if there is no objection I should like to have Mr. Tipton explain those items as he understands them as the engineering adviser to the Commissioner for Colorado.

THE CHAIRMAN: Go ahead, Mr. Tipton.

MR. TIPTON: Mr. Chairman, as I have studied these articles as they have tentatively been approved by the Commission it occurs to me that there are several items of importance that must be given consideration by the Engineering

Advisory Committee. Those items will require considerable work.

Take for instance the problems that were outlined in two articles proposed by Judge Stone, the one having to do with the delivery of water by Colorado to New Mexico and the other having to do with the delivery of water by Colorado in the Yampa River to Utah. Those two items must be given study by the Engineering Advisory Committee.

The Commission has adopted in principle that the beneficial consumptive use shall be measured by the man-made depletion of the virgin flow. It has adopted in principle that that measurement shall be made by the inflow-outflow method. In my opinion it is important that the Engineering Advisory Committee between now and the time the Commission meets next, prepare a report to the Commission outlining the gaging stations that should be established and maintained to accomplish that purpose and outlining methods, not having in mind that they would be written in the Compact, but that it would be matters the Commission could consider as means for implementing the methods that the Commission may finally adopt of measurement of beneficial consumptive use. Then if such a report of the Engineering Advisory Committee were adopted, it would provide a connection between the activities of this group and its advisers and the administrative body that is set up. In other words, it would form the foundation for some of the major rules and regulations that such a body would adopt.

I believe those matters are ones that should be considered by the Engineering Advisory Committee. I believe at this session they should be referred to the Committee. The Committee should meet, consider the problems, and should assign tasks to smaller groups and should arrange for further meetings of the Engineering Advisory Committee prior to the time that the Commission holds its next meeting.

COM. STONE: Mr. Chairman, to implement and to carry out the suggestion made by Mr. Tipton, I move that there be referred to the Engineering Advisory Committee for its study and report at the next meeting of the Commission, the matters which were suggested by Mr. Tipton and any other engineering matters which in the judgment of that Committee should be included in its report at the next meeting of the Commission.

COM. BISHOP: Second the motion.

THE CHAIRMAN: Are you ready for the question?

COM. WILSON: Question.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

COM. STONE: Mr. Chairman, I move that the Drafting Committee be authorized to determine the order of the various articles which have been approved by the Commission as they will appear in the completed Compact.

COM. BISHOP: Second the motion.

THE CHAIRMAN: You have heard the motion. Is there discussion of the motion? (No response.) Are you ready for the question?

COM. BISHOP: Question.

(Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

COM. WILSON: There has been something said about another meeting and I would like to know what the ideas of the Commissioners are as to when another meeting should be held and whether we are going to have one or two. New Mexico is very desirous of having the Commission meet in New Mexico. If we are going to have a preliminary meeting, we would prefer to have the final meeting in New Mexico at Santa Fe.

We have been told that the early part of October or the early part of November would be the most desirable dates to get the proper accommodations either in Santa Fe or at Bishop's Lodge. And if it is determined by the Commission to have a final meeting either in October or November, we would very much like to have you there at that time. If there are going to be two meetings or if you are meeting earlier, I am afraid we can't arrange it in New Mexico.

COM. BISHOP: Mr. Chairman, we had in mind inviting the Commission to meet at Jackson beginning on the 11th of September. Of course we would like to have that be the final meeting. If it takes two or three or four days we could take care of it at Jackson just as well as we could at Bishop's Lodge, I believe, if we need another meeting it will be all right to go to New Mexico. We would like to have you consider that suggestion.

COM. WILSON: Mr. Chairman, I move the next meeting be October 4th at Santa Fe.

COM. BISHOP: Second the motion.

(Thereupon a vote was taken and Com. Wilson's motion carried unanimously.)

COM. CARSON: I move that we recess until one-thirty and the Drafting Committee immediately go into session.

MR. WEHRLI: Mr. Carson, maybe I missed something this morning. What were the two new articles which were supposed to be referred to the Drafting Committee?

COM. CARSON: One was this that I suggested that the states of Arizona, New Mexico and Utah, signatories to this compact, reserve all their rights.

MR. HOWELL: The other was the importation of water.

MR. WEHRLI: Is there any essential dispute about those articles?

COM. CARSON: I think when we go home, Mr. Wehrli, we should have assurance that they are tentatively approved by the Commission as drafted by the Drafting Committee.

COM. STONE: Then there are the two articles with the notation regarding the interstate streams.

COM. CARSON: It won't take long to do it and I think it will be very much worthwhile if we go as far as we can while we are in Vernal.

MR. CLYDE: I suggest one-thirty might be later and give the Drafting Committee more time than it needs. I anticipate it won't take very long to re-arrange these articles in proper sequence and the two that have been suggested are practically in the form wanted. We have all worked at least two

or three times before on the article that makes an apportionment. I think we might get back here by eleven-thirty and be through by noon.

MR. WEHRLI: I suggest a half hour because it isn't going to take long.

MR. CLYDE: The Commission can go back in session as soon as the Drafting Committee completes its report.

THE CHAIRMAN: The Commission now stands recessed subject to the call of the Chairman.

(10:15 a.m. Recess.)

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(12:30 p.m. Meeting reconvened.)

THE CHAIRMAN: The meeting will please come to order. At this time the Chairman wishes to express appreciation to Mr. Untermann for making the facilities of this building available at any time of the day or night and keeping up with us in the indefiniteness of time of the meeting. Somebody want to say something now?

THE CHAIRMAN: We will be glad to have a report of the Drafting Committee.

MR. SKEEN: The last revised draft of the Upper Colorado River Basin Compact includes the articles that were approved this morning by the Commission and also articles which were prepared pursuant to the direction of the Commission.

New articles are Article III, Article XI is a blank article, Article XII is a blank to be filled in later, Article XIII is an article relating to the Yampa River which has been prepared in rough. Article XIV relates to the San Juan. Article XVII relates to the importation of water from other drainage basins into the Colorado River Basin. Article XVIII refers to the reservations by Arizona, New Mexico and Utah of rights under the Colorado River Compact.

(Reads Articles III, XIII, XVII, and XVIII as set forth below in the complete draft of the Compact.)

The draft which has been handed out contains the numbered articles and they are tentatively put in the order that the Drafting Committee thought proper.

THE CHAIRMAN: Thank you, Mr. Skeen.

MR. CLYDE: I believe you omitted Article XIV in the reading.

MR. SKEEN: Oh, yes. (Reads Article XIV.)

COM. STONE: Mr. Chairman, I move that the report of the Drafting Committee be approved and that this report of the Drafting Committee be inserted in the record and shall be taken as a draft of the Upper Colorado River Basin Compact subject to the following:

1. Technical revision of language.
2. Final agreement between the affected states as to articles

concerning the Little Snake, Henry's Fork, Yampa, and San Juan Rivers.

COM. CARSON: I second the motion.

THE CHAIRMAN: In making that motion, Judge Stone, I suppose that you understand that the attorneys of the Federal Government will scrutinize this draft for omissions and language so that nothing will be overlooked which might imperil the ratification of the Compact by the Congress of the United States? Is there discussion of the motion?

COM. STONE: Question.

THE CHAIRMAN: Question has been called for. (Thereupon a vote was taken and Com. Stone's motion carried unanimously.)

(The draft of the Upper Colorado River Basin Compact referred to in Judge Stone's motion is as follows:)

"UPPER COLORADO RIVER BASIN
COMPACT

The State of Arizona, the State of Colorado, the State of New Mexico, the State of Utah, and the State of Wyoming, acting through their Commissioners,

Charles A. Carson for the State of Arizona,
Clifford H. Stone for the State of Colorado,
Fred E. Wilson for the State of New Mexico,
Ed. H. Watson for the State of Utah, and
L. C. Bishop for the State of Wyoming.

after negotiations participated in by Harry W. Bashore, appointed by the President as the representative of the United States of America, have agreed, subject to the provisions of the Colorado River Compact, to determine the rights and obligations of each State respecting the uses and deliveries of the water of the Upper Basin of the Colorado River, as follows:

ARTICLE I

(a) The major purposes of this Compact are to provide for the equitable division and apportionment of the use of water of the Colorado River System, the use of which was apportioned in perpetuity to the Upper Basin by the Colorado River Compact; to establish the obligations of each State of the Upper Division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River Compact; to promote interstate comity; to remove causes of present and future controversies; and to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of its waters, and the protection of life and property from floods.

(b) It is recognized that the Colorado River Compact is in full force and effect and all of the provisions hereof are subject thereto.

ARTICLE II

As used in this Compact:

(a) The term "Colorado River System" means that portion of the Colorado River and its tributaries within the United States of America.

(b) The term "Colorado River Basin" means all of the drainage area

of the Colorado River System and all other territory within the United States of America to which the waters of the Colorado River System shall be beneficially applied.

(c) The term "States of the Upper Division" means the States of Colorado, New Mexico, Utah and Wyoming.

(d) The term "States of the Lower Division" means the States of Arizona, California and Nevada.

(e) The term "Lee Ferry" means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

(f) The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System above Lee Ferry.

(g) The term "Lower Basin" means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System below Lee Ferry.

(h) "Colorado River Compact" means the agreement concerning the apportionment of the use of the waters of the Colorado River System dated November 24, 1922, executed by Commissioners for the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, and by Herbert Hoover, representative of the United States, and proclaimed effective by the President of the United States, June 25, 1929.

(i) The term "Upper Colorado River System" means that portion of the Colorado River System above Lee Ferry.

(j) The term "Commission" means the agency created by this Compact for the administration thereof.

(k) The term "water year" means that period commencing October 1 of any year and ending September 30 of the following year.

(l) The term "acre-foot" is the quantity of water required to cover an acre to the depth of one foot and is equivalent to forty-three thousand five hundred sixty (43,560) cubic feet.

(m) The term "domestic use" shall include the use of water for household, stock, municipal, mining, milling, industrial and other like purposes, but shall exclude the generation of electrical power.

(n) The term "virgin flow" means the flow of any stream undepleted by the activities of man.

ARTICLE III

The use of water as such use is apportioned in perpetuity to the Upper Basin and available for use by the States of the Upper Basin under the Colorado River Compact is hereby apportioned among the States of the Upper Basin in perpetuity subject to the provisions and limitations appearing in the

Colorado River Compact and in this Compact, as follows: To the State of Arizona the consumptive use of 50,000 acre feet annually and the remainder to the States of Colorado, New Mexico, Utah and Wyoming in the following proportions:

Colorado	51.75 Per cent
New Mexico	11.25 Per cent
Utah	23.00 Per cent
Wyoming	14.00 Per cent

The apportionment made to each State shall include all water necessary for the supply of any rights which now exist.

No apportionment is hereby made, or intended to be made, of such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact, and any apportionment of such uses shall be made in accordance with the terms of such paragraphs.

ARTICLE IV

In the event curtailment of use by the States of the Upper Division shall, at any time, become necessary in order that the flow at Lee Ferry shall not be depleted below that flow required by Article III of the Colorado River Compact, the extent of curtailment by each such State of the consumptive use of water, apportioned to it by Article III of this Compact, shall be such as to result in the delivery at Lee Ferry of an amount of water which bears the same relation to the deficiency to be made up as the consumptive use which was made by each such State during the water year immediately preceding that in which the deficiency occurs bears to the aggregate consumptive use of water which was made pursuant to the apportionment made by Article III hereof by the States of the Upper Division during the water year immediately preceding that in which the deficiency occurs; provided that, for the purpose of computing the curtailment that must be made by any such State as required by this Article, uses being made prior to November 24, 1922, shall be excluded; provided further, that if any State or States of the Upper Division, in the ten years immediately preceding the water year in which such curtailment is required to be made, shall have consumptively used more water than it was or they were, as the case may be, entitled to use under the apportionment made by Article III of this Compact, such State or States, as the case may be, shall be required to supply at Lee Ferry an amount equal to its, or the aggregate of their overdraft or the proportionate part of such overdraft as may be necessary to supply such deficiency before demand is made on any other State.

ARTICLE V

As determined by the Commission:

(a) The storage capacity of reservoirs and the water stored therein for the purpose of and utilized in making deliveries of water at Lee Ferry in compliance with the provisions of Article III of the Colorado River Compact shall be considered to be for the common benefit of the States of the Upper Division, and water so stored for such purpose shall not be earmarked for nor charged to any individual State.

(b) Reservoir losses resulting from the storage of water for the joint benefit of such States in making deliveries of water at Lee Ferry shall be charged to the States of the Upper Division in proportion to the consumptive use of water in each State of the Upper Division during the year for which the charge is made.

(c) Reservoir losses resulting from the storage of water for purposes other than those covered by paragraphs (a) and (b) of this article by one or more States shall be charged to the State or States for whose benefit the water is so stored in proportion to the benefits received.

ARTICLE VI

(a) The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the Upper Basin and for each State of the Upper Basin by the inflow-outflor method in terms of man-made depletions of the virgin flow at Lee Ferry and at State lines; unless the Commission, by unanimous action, shall adopt a different method of determination.

(b) The water year shall be used as the basis of computing all annual measurements of stream flows, use and delivery of water.

ARTICLE VII

The use of water by the United States or any of its agencies, instrumentalities or wards shall be charged as a use by the State in which the use is made.

ARTICLE VIII

(a) There is hereby created an interstate administrative agency to be known as "Upper Colorado River Commission." The Commission shall be composed of one representative of each of the States of the Upper Division, namely: Colorado, New Mexico, Utah and Wyoming, designated or appointed in accordance with the laws of each such state and, if designated by the President of the United States, one representative of the United States. The President of the United States is hereby requested to designate a Commissioner for the United States. If a Commissioner is so designated for the United States, he shall be the presiding officer of the Commission and shall be entitled to the same power and rights as the Commissioner of any State. Any four members of the Commission shall constitute a quorum.

(b) The salaries and personal expenses of each Commissioner shall be paid by the Government which he represents. All other expenses which are incident to the administration of this compact, and which are not paid by the United States, shall be borne pro rata by the four States according to the percentage of consumptive use apportioned to each. On or before November 1st of each year, the Commission shall adopt and transmit to the Governors of the four States and to the President a budget covering an estimate of its expenses for the following year, and of the amount thereof payable by each State. Each State shall pay the amount due by it to the Commission on or before April 1st of the year following. The payment of the expenses of the Commission and of its employees shall not be subject to the audit and accounting procedures of any of the four States.

(c) The Commission shall appoint a Secretary, who shall not be a member of the Commission, and who shall serve for such term and receive such salary and perform such duties as the Commission may direct. The Commission may employ such engineering, legal, clerical and other aid as may, in its judgment, be necessary for the performance of its functions under this Compact. In the hiring of employees, the Commission shall not be bound by the civil service laws of any State.

(d) The Commission shall have the power to:

(1) Adopt rules and regulations not inconsistent with this Compact;

(2) Locate, establish, construct, abandon, operate and maintain water gaging stations;

(3) Make estimates to forecast water run-off on the Colorado River and any of its tributaries.

(4) Engage in cooperative studies of water supplies of the Colorado River and its tributaries;

(5) Collect, analyze, correlate, preserve and report on data as to the stream flows, storage, diversions and use of the waters of the Colorado River and any of its tributaries;

(6) Make findings as to the quantity of water of the Upper Colorado River System used each water year in the Upper Colorado River Basin and in each State thereof;

(7) Make findings as to the quantity of water deliveries at Lee Ferry during each water year;

(8) Make findings as to the necessity for curtailment of use, if any, pursuant to Article IV hereof;

(9) Make findings as to the quantity of reservoir losses and as to the share thereof chargeable under Article V hereof to each of the States;

(10) Make findings of fact in the event of the occurrence of extraordinary drought or serious accidents to the irrigation system in the Upper Basin, whereby deliveries by the Upper Basin of water which it may be required to deliver in order to aid in fulfilling obligations of the United States of America to the United Mexican States arising under the Treaty between the United States of America and the United Mexican States dated February 3, 1944 (Treaty Series 994) become difficult, and report such findings to the Governors of the Upper Basin States, the President of the United States of America, the United States Section of the International Boundary and Water Commission, and such other Federal officials and agencies as it may deem appropriate to the end that the water allotted to Mexico under Division III of such Treaty may be reduced;

(11) Acquire, hold and dispose of such personal and real property as may be necessary for the performance of its duties hereunder;

(12) Perform all functions required of it by this Compact and do all things necessary, proper or convenient in the performance of its duties hereunder.

(13) Make and transmit annually to the Governors of the signatory States and the President of the United States, with the estimated budget, a report covering the activities of the Commission for the preceding year.

(e) The concurrence of four members of the Commission shall be required in any action taken by it.

(f) The Commission and its Secretary shall make available to the Governor of each of the signatory States any information within its possession at any time, and shall always provide free access to its records by the Governors of each of the signatory States, or their representatives, or authorized representatives of the Federal Government.

(g) Findings of fact made by the Commission shall not be conclusive in any court, or before any agency or tribunal, but shall constitute prima facie evidence of the facts found.

ARTICLE IX

(a) No State shall deny the right of the United States and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one State for the purpose of diverting, conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the States of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an Upper State for consumptive use in a lower signatory State when such use is within the apportionment to such lower State made by this Compact. Such rights shall be subject to the rights in a State in which such reservoir or works are located to receive and use the water, the use of which is apportioned to it by this Compact.

(b) Any signatory State, any person, or any entity of any signatory State shall have the right to acquire property rights necessary to the use of water in conformity with this Compact in any other signatory State by donation, purchase, or through the exercise of the power of eminent domain. Any signatory State, upon the written request of the Governor of any other signatory State for the benefit of whose water users property is to be acquired in the State to which such written request is made, shall proceed expeditiously to acquire the desired property either by purchase at a price satisfactory to the requesting State, or, if such purchase cannot be made, then through the exercise of its power of eminent domain and shall convey such property to the requesting State or such entity as may be designated by the requesting State; provided, that all costs of acquisition and expenses of every kind and nature whatsoever incurred in obtaining the requested property shall be paid by the requesting State at the time and in the manner prescribed by the State requested to acquire the property.

(c) Should any facility be constructed in a signatory State by and for the benefit of another State or States or the water users thereof, as above provided, the construction, repair, replacement, maintenance and operation of such facility shall be subject to the laws of the State in which the facility is located, except that, in the case of a reservoir constructed in one State for the benefit of another State or States, the water administration officials of the State in which the facility is located shall permit the storage and release of any water which, as determined by finding of the Commission, falls within the apportionment of the State or States for whose benefit the facility is constructed, and, in the case of a regulating reservoir for the joint benefit of all States in making Lee Ferry deliveries, the water administration officials of the State in which the facility is located shall, in permitting the storage and release of water, comply with the findings and orders of the Commission.

(d) In the event property is acquired by a signatory State in another signatory State for the use and benefit of the former, the users of water made available by such facilities shall pay to the political subdivisions of the State in which such works are located, each and every year during which such rights are enjoyed for such purposes, a sum of money equivalent to the average annual amount of taxes levied and assessed against the land and improvements thereon during the ten years preceding the acquisition of such land, in full reimbursement for the loss of taxes in such political subdivisions of the State, said payments to be in lieu of any and all taxes on said property, improvements and rights.

(e) The signatory States recommend to the President and the Congress that, in the event the United States shall acquire property in one of the signatory States for the benefit of another signatory State or its water users, provision be made for like payment in reimbursement of loss of taxes.

ARTICLE X

The signatory States recognize the La Plata River Compact entered into between the States of Colorado and New Mexico, dated the 27th day of November, 1944, approved by the Congress on January 29, 1925 (43 Stat. 796), and this Compact shall not affect the apportionment therein made; provided, that consumptive uses of water made by either Colorado or New Mexico from La Plata River shall be charged as uses under the apportionment made to such State by Article III of this Compact.

ARTICLE XI

(Here inset provisions relative to the Little Snake to be agreed upon by Wyoming and Colorado.)

ARTICLE XII

(Here insert provisions relative to Henry's Fork to be agreed upon by Utah and Wyoming).

ARTICLE XIII

Subject to the provisions of this Compact, the right to the use of the waters of the Yampa River, a tributary entering the Green River in Colorado and Utah in accordance with the following principles and procedures:

(a) Colorado shall deliver at the mouth of the Yampa River during each water year a quantity of water which will assure Utah of a flow of water out of the Yampa River reasonably adequate to assure Utah of a water supply for projects partly dependent upon the flow of the Yampa River; the amount of such flow to be based upon the water requirements as finally determined by the Bureau of Reclamation for the Central Utah and allied project and Colorado hereby agrees that Utah may divert water from the Yampa River and the Green River in Colorado for exportation to and use within Utah for the Central Utah and allied projects.

(b) All consumptive uses of water of the Yampa River made either by Colorado or Utah shall be charged as uses under the apportionment to such States made by Article III of this Compact.

(Note: The details of the formula or procedure to be incorporated into the Compact for the purpose of carrying out the above provision are to be worked out by the Engineering Advisory Committee for insertion in the Compact before the next meeting).

ARTICLE XIV

Subject to the provisions of this Compact, the consumptive use of the water of the San Juan River and its tributaries are hereby apportioned between Colorado and New Mexico in accordance with the following principles:

(a) Colorado shall deliver to New Mexico during each water year the sum of those quantities set forth in the following tabulations of relationship which correspond to the quantities at the upper index stations:

(Here set forth schedules as in the Rio Grande Compact, such schedules to be worked out as to give reasonable assurance to New Mexico that it will receive San Juan water in quantities sufficient to give reasonable anticipation of having available a quantity of water which will make possible the consumptive use apportioned to New Mexico by this Compact. These schedules are to be fair and equitable and are to be so made as to provide for an equitable sharing of unavoidable shortages).

(b) All consumptive uses of water of the San Juan River and its tributaries made by either Colorado or New Mexico shall be charged as uses under the apportionment to such State by Article III of this Compact.

ARTICLE XV

(a) Subject to the provisions of the Colorado River Compact and of this Compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

(b) The provisions of this Compact shall not apply to or interfere with the regulation and control by any State within its boundaries of the appropriation, use, and distribution of water, the consumptive use of which is apportioned to such State by Article III hereof.

ARTICLE XVI

The failure of any State to use the water, or any part thereof, the use of which is apportioned to it under the terms of this Compact shall not constitute a relinquishment of the right to such use to the Lower Basin or to any other State, nor shall it constitute a forfeiture or abandonment of the right to such use.

ARTICLE XVII

In the event water from another drainage basin is now being or hereafter shall be imported into the natural basin of the Upper Colorado River System by the United States, or jointly, or severally, by any of the States signatory hereto, the State having the right to use such water shall not be charged therewith in the allocation of the right to the use of water made by Article III hereof.

ARTICLE XVIII

The State of Arizona reserves its rights and interests under the Colorado River Compact as a State of the Lower Division and as a State of the Lower Basin.

The State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River Compact as States of the Lower Basin.

ARTICLE XIX

Nothing in this Compact shall be construed as:

(a) Affecting the obligations of the United States of America to Indian tribes;

(b) Affecting the obligations of the United States of America under the Treaty with the United Mexican States (Treaty Series 994);

(c) Affecting any rights or powers of the United States of America, its agencies or instrumentalities in or to the waters of the Upper Colorado River System, or its capacity to acquire rights in and to the use of said waters;

(d) Subjecting any property of the United States of America, its agencies or instrumentalities to taxation by any state or subdivision thereof, or creating any obligation on the part of the United States, its agencies or instrumentalities, by reason of the acquisition, construction or operation of any property or works of whatever kind, to make any payment to any State or political subdivision thereof, State agency, municipality or entity whatsoever, in reimbursement for the loss of taxes;

(e) Subjecting any property of the United States, its agencies or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to this Compact.

ARTICLE XX

This Compact may be terminated at any time by the unanimous agreement of the signatory States. In the event of such termination, all rights established under it shall continue unimpaired.

ARTICLE XXI

This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States and approved by the Congress of the United States. Notice of ratification by the legislatures of the signatory States shall be given by the Governor of each signatory State to the Governors of the other signatory States and to the President of the United States, and the President of the United States is hereby requested to give notice to the Governors of the signatory States of approval by the Congress of the United States.

IN WITNESS WHEREOF, the Commissioners have signed this Compact in a single original, which shall be deposited in the archives of the Department of State of the United States of America, and of which a duly certified copy shall be forwarded to the Governor of each of the signatory States.

Done at the City of _____, _____, this _____ day of _____, _____.

_____

_____

_____

_____

_____

Approved:

_____

COM. BISHOP: Mr. Chairman, I move that a final drafting committee to be composed of one Federal representative and one representative from each state be created to prepare the final draft of the Compact for submission to the Commission at its next meeting and that such committee meet prior to the next meeting of the Commission.

COM. WATSON: Second the motion.

THE CHAIRMAN: Is there discussion of the motion? Are you ready for the question?

COM. BISHOP: Question.

(Thereupon a vote was taken and Com. Bishop's motion carried unanimously.)

COM. BISHOP: Mr. Chairman, I move we adjourn.

COM. CARSON: Just a minute, Mr. Bishop, before that motion is made.

COM. STONE: We had better appoint that committee.

COM. CARSON: Yes.

COM. STONE: Colorado designates Jean S. Breitenstein.

COM. WATSON: Judge J. A. Howell for Utah.

COM. BISHOP: I will designate Mr. Wehrli for Wyoming.

COM. CARSON: I will serve for Arizona.

COM. WILSON: I will serve on the committee for New Mexico.

THE CHAIRMAN: And Mr. Will will serve for the Federal Representative.

COM. CARSON: Before that motion is made I would like to make a motion that the Commission express its appreciation to the people of Vernal and the Uinta Basin for the many courtesies shown us and the many conveniences furnished us at this meeting.

COM. BISHOP: I second the motion.

THE CHAIRMAN: Is there discussion of the motion?

(Thereupon a vote was taken and Com. Carson's motion carried unanimously.)

COM. BISHOP: I move that we recess to meet at Santa Fe, New Mexico, October 4th, 1948.

COM. WILSON: Second the motion.

THE CHAIRMAN: Are you ready for the question? (Question is called for. Thereupon a vote was taken and Com. Bishop's motion carried unanimously.)

(12:45 p.m., Wednesday, July 21, 1948, recess until October 4, 1948, at Santa Fe, New Mexico.)

- - - - - - - - - - - -

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
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6	I-2_pgs 89-219	22	AE-1_pgs i-60
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8	J, K-1_pgs i-80	**24**	**AF, AG, AH**
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
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16	Y-1_pgs i-81	32	BG, BH, BI

THE UPPER COLORADO RIVER BASIN COMPACT

HEARINGS

BEFORE A

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON PUBLIC LANDS
HOUSE OF REPRESENTATIVES

EIGHTY-FIRST CONGRESS

FIRST SESSION

ON

H. R. 2325, H. R. 2326, H. R. 2327, H. R. 2328
H. R. 2329, H. R. 2330, H. R. 2331, H. R. 2332
H. R. 2333, H. R. 2334

BILLS TO GRANT THE CONSENT OF THE UNITED STATES TO THE UPPER COLORADO RIVER BASIN COMPACT

Serial No. 5

MARCH 14, 15, 16, 17, AND 18, 1949

Printed for the use of the Committee on Public Lands

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THE UPPER COLORADO RIVER BASIN COMPACT

MARCH 14, 1949, 10: 55 a. m.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON PUBLIC LANDS,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

Hon. John R. Murdock, Chairman.

Present: John R. Murdock (presiding), Clair Engle, Toby Morris, Ken Regan, Lloyd M. Bentsen, Jr., Compton I. White, Walter S. Baring, Frank A. Barrett, A. L. Miller, Wesley A. D'Ewart, Norris Poulson, Wayne N. Aspinall, John E. Miles, Richard J. Welch, William Lemke, John Sanborn, Joseph R. Farrington.

The committee had the following bill under consideration:

[H. R. 2325, 81st Cong., 1st sess.]

A BILL To grant the consent of the United States to the Upper Colorado River Basin Compact

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of the Congress is hereby given to the compact, signed (after negotiations in which a representative of the United States, duly appointed by the President, participated and upon which he has reported to the Congress) by the Commissioners for the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, on October 11, 1948, at Santa Fe, N. Mex., and thereafter ratified by the legislatures of each of the States aforesaid, which said compact reads as follows:

"UPPER COLORADO RIVER BASIN COMPACT

"The State of Arizona, the State of Colorado, the State of New Mexico, the State of Utah, and the State of Wyoming, acting through their Commissioners,
"Charles A. Carson for the State of Arizona,
"Clifford H. Stone for the State of Colorado,
"Fred E. Wilson for the State of New Mexico,
"Edward H. Watson for the State of Utah and
"L. C. Bishop for the State of Wyoming,
after negotiations participated in by Harry W. Bashore, appointed by the President as the representative of the United States of America, have agreed, subject to the provisions of the Colorado River Compact, to determine the rights and obligations of each signatory State respecting the uses and deliveries of the water of the Upper Basin of the Colorado River, as follows:

"ARTICLE I

"(a) The major purposes of this Compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River System, the use of which was apportioned in perpetuity to the Upper Basin by the Colorado River Compact; to establish the obligations of each State of the Upper Division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River Compact; to promote interstate comity; to remove causes of present and future controversies; to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of water, and to protect life and property from floods.

"(b) It is recognized that the Colorado River Compact is in full force and effect and all of the provisions hereof are subject thereto.

"ARTICLE II

"As used in this Compact:

"(a) The term 'Colorado River System' means that portion of the Colorado River and its tributaries within the United States of America.

"(b) The term 'Colorado River Basin' means all of the drainage area of the Colorado River System and all other territory within the United States of American to which the waters of the Colorado River System shall be beneficially applied.

"(c) The term 'States of the Upper Division' means the States of Colorado, New Mexico, Utah, and Wyoming.

"(d) The term 'States of the Lower Division' means the States of Arizona, California, and Nevada.

"(e) The term 'Lee Ferry' means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

"(f) The term 'Upper Basin' means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colordo River System which are now or shall hereafter be beneficially served by waters diverted from the Colorado River System above Lee Ferry.

"(g) The term 'Lower Basin' means all those parts of the States of Arizona, California, Nevada, New Mexico and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the Colorado River System below Lee Ferry.

"(h) The term 'Colorado River Compact' means the agreement concerning the apportionment of the use of the waters of the Colorado River System dated November 24, 1922, executed by commissioners for the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, approved by Herbert Hoover, representative of the United States of America, and proclaimed effective by the President of the United States of America, June 25, 1929.

"(i) The term 'Upper Colorado River System' means that portion of the Colorado River System above Lee Ferry.

"(j) The term 'Commission' means the administrative agency created by Article VIII of this Compact.

"(k) The term 'water year' means that period of twelve months ending September 30 of each year.

"(l) The term 'acre-foot' means the quantity of water required to cover an acre to the depth of one foot and is equivalent to 43,560 cubic feet.

"(m) The term 'domestic use' shall include the use of water for household, stock, municipal, mining, milling, industrial and other like purposes, but shall exclude the generation of electrical power.

"(n) The term 'virgin flow' means the flow of any stream undepleted by the activities of man.

"ARTICLE III

(a) Subject to the provisions and limitations contained in the Colorado River Compact and in this Compact, there is hereby apportioned from the Upper Colorado River System in perpetuity to the States of Arizona, Colorado, New Mexico, Utah and Wyoming, respectively, the consumptive use of water as follows:

"(1) To the State of Arizona the consumptive use of 50,000 acre-feet of water per annum.

"(2) To the States of Colorado, New Mexico, Utah and Wyoming, respectively, the consumptive use per annum of the qauntities resulting from the application of the following percentages to the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by Upper Basin under the Colorado River Compact and remaining after the deduction of the use, not to exceed 50,000 acre-feet per annum, made in the State of Arizona.

"State of Colorado, 51.75 per cent; State of New Mexico, 11.25 per cent; State of Utah, 23.00 per cent; State of Wyoming, 14.00 per cent.

"(b) The apportionment made to the respective States by paragraph (a) of this Article is based upon, and shall be applied in conformity with, the following principles and each of them:

"(1) The apportionment is of any and all man-made depletions;

"(2) Beneficial use is the basis, the measure and the limit of the right to use;

"(3) No State shall exceed its apportioned use in any water year when the effect of such excess use, as determined by the Commission, is to deprive another signatory State of its apportioned use during that water year; provided, that this subparagraph (b) (3) shall not be construed as:

"(i) Altering the apportionment of use, or obligations to make deliveries as provided in Article XI, XII, XIII or XIV of this Compact;

"(ii) Purporting to apportion among the signatory States such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact; or

"(iii) Countenancing average uses by any signatory State in excess of its apportionment.

"(4) The apportionment to each State includes all water necessary for the supply of any rights which now exist.

"(c) No apportionment is hereby made, or intended to be made, of such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact.

"(d) The apportionment made by this Article shall not be taken as any basis for the allocation among the signatory States of any benefits resulting from the generation of power.

"ARTICLE IV

"In the event curtailment of use of water by the States of the Upper Division at any time shall become necessary in order that the flow at Lee Ferry shall not be depleted below that required by Article III of the Colorado River Compact, the extent of curtailment by each State of the consumptive use of water apportioned to it by Article III of this Compact shall be in such quantities and at such times as shall be determined by the Commission upon the application of the following principles:

"(a) The extent and times of curtailment shall be such as to assure full compliance with Article III of the Colorado River Compact;

"(b) If any State or States of the Upper Division, in the ten years immediately preceding the water year in which curtailment is necessary, shall have consumptively used more water than it was or they were, as the case may be, entitled to use under the apportionment made by Article III of this Compact, such State or States shall be required to supply at Lee Ferry a quantity of water equal to its, or the aggregate of their, overdraft or the proportionate part of such overdraft, as may be necessary to assure compliance with Article III of the Colorado River Compact, before demand is made on any other State of the Upper Division;

"(c) Except as provided in subparagraph (b) of this Article, the extent of curtailment by each State of the Upper Division of the consumptive use of water apportioned to it by Article III of this Compact shall be such as to result in the delivery at Lee Ferry of a quantity of water which bears the same relation to the total required curtailment of use by the States of the Upper Division as the consumptive use of Upper Colorado River System water which was made by each such State during the water year immediately preceding the year in which the curtailment becomes necessary bears to the total consumptive use of such water in the States of the Upper Division during the same water year; provided, that in determining such relation the uses of water under rights perfected prior to Novemebr 24, 1922, shall be excluded.

"ARTICLE V

"(a) All losses of water occurring from or as the result of the storage of water in reservoirs constructed prior to the signing of this Compact shall be charged to the State in which such reservoir or reservoirs are located. Water stored in reservoirs covered by this paragraph (a) shall be for the exclusive use of and shall be charged to the State in which the reservoir or reservoirs are located.

"(b) All losses of water occurring from or as the result of the storage of water in reservoirs constructed after the signing of this Compact shall be charged as follows:

"(1) If the Commission finds that the reservoir is used, in whole or in part, to assist the States of the Upper Division in meeting their obligations to deliver water at Lee Ferry imposed by Article III of the Colorado River Compact, the Commission shall make findings, which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to

the reservoir capacity allocated for that purpose. The whole or that proportion, as the case may be, of reservoir losses as found by the Commission to be reasonably and properly chargeable to the reservoir or reservoir capacity utilized to assure deliveries at Lee Ferry shall be charged to the States of the Upper Division in the proportion which the consumptive use of water in each State of the Upper Division during the water year in which the charge is made bears to the total consumptive use of water in all States of the Upper Division during the same water year. Water stored in reservoirs or in reservoir capacity covered by this subparagraph (b) (1) shall be for the common benefit of all of the States of the Upper Division.

"(2) If the Commission finds that the reservoir is used, in whole or in part, to supply water for use in a State of the Upper Division, the Commission shall make findings, which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to the reservoir or reservoir capacity utilized to supply water for use and the State in which such water will be used. The whole or that proportion, as the case may be, of reservoir losses as found by the Commission to be reasonably and properly chargeable to the State in which such water will be used shall be borne by that State. As determined by the Commission, water stored in reservoirs covered by this subparagraph (b) (2) shall be earmarked for and charged to the State in which the water will be used.

"(c) In the event the Commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the Upper Division, the storage of water for consumptive use shall be given preference. Any reservoir or reservoir capacity hereafter used to assure deliveries at Lee Ferry shall by order of the Commission be used to store water for consumptive use in a State, provided the Commission finds that such storage is reasonably necessary to permit such State to make the use of the water apportioned to it by this Compact.

"ARTICLE VI

"The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the Upper Basin and for each State of the Upper Basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the Commission, by unanimous action, shall adopt a different method of determination.

"ARTICLE VII

"The consumptive use of water by the United States of America or any of its agencies, instrumentalities or wards shall be charged as a use by the State in which the use is made; provided, that such consumptive use incident to the diversion, impounding, or conveyance of water in one State for use in another shall be charged to such latter State.

"ARTICLE VIII

"(a) There is hereby created an interstate administrative agency to be known as the 'Upper Colorado River Commission.' The Commission shall be composed of one Commissioner representing each of the States of the Upper Division, namely, the States of Colorado, New Mexico, Utah, and Wyoming, designated or appointed in accordance with the laws of each such State and, if designated by the President, one Commissioner representing the United States of America. The President is hereby requested to designate a Commissioner. If so designated the Commissioner representing the United States of America shall be the presiding officer of the Commission and shall be entitled to the same powers and rights as the Commissioner of any State. Any four members of the Commission shall constitute a quorum.

"(b) The salaries and personal expenses of each Commissioner shall be paid by the Government which he represents. All other expenses which are incurred by the Commission incident to the administration of this Compact, and which are not paid by the United States of America, shall be borne by the four States according to the percentage of consumptive use apportioned to each. On or before December 1 of each year, the Commission shall adopt and transmit to the Governors of the four States and to the President a budget covering an estimate of its expenses for the following year, and of the amount payable by each State. Each State shall pay the amount due by it to the Commission on

or before April 1 of the year following. The payment of the expenses of the Commission and of its employees shall not be subject to the audit and accounting procedures of any of the four States; however, all receipts and disbursement of funds handled by the Commission shall be audited yearly by a qualified independent public accountant and the report of the audit shall be included in and become a part of the annual report of the Commission.

"(c) The Commission shall appoint a Secretary, who shall not be a member of the Commission, or an employee of any signatory State or of the United States of America while so acting. He shall serve for such term and receive such salary and perform their duties as the Commission may direct. The Commission may employ such engineering, legal, clerical and other personnel as, in its judgment, may be necessary for the performance of its functions under this Compact. In the hiring of employees, the Commission shall not be bound by the civil service laws of any State.

"(d) The Commission, so far as consistent with this Compact, shall have the power to:

"(1) Adopt rules and regulations;

"(2) Locate, establish, construct, abandon, operate and maintain water gauging stations;

"(3) Make estimates to forecast water run-off on the Colorado River and any of its tributaries;

"(4) Engage in cooperative studies of water supplies of the Colorado River and its tributaries;

"(5) Collect, analyze, correlate, preserve and report on data as to the stream flows, storage, diversions and use of the waters of the Colorado River, and any of its tributaries;

"(6) Make findings as to the quantity of water of the Upper Colorado River System used each year in the Upper Colorado River Basin and in each State thereof;

"(7) Make findings as to the quantity of water deliveries at Lee Ferry during each water year;

"(8) Make findings as to the necessity for and the extent of the curtailment of use, required, if any, pursuant to Article IV hereof;

"(9) Make findings as to the quantity of reservoir losses and as to the share thereof chargeable under Article V, hereof to each of the States;

"(10) Make findings of fact in the event of the occurrence of extraordinary drought or serious accident to the irrigation system in the Upper Basin, whereby deliveries by the Upper Basin of water which it may be required to deliver in order to aid in fulfilling obligations of the United States of America to the United Mexican States arising under the Treaty between the United States of America and the United Mexican States, dated February 3, 1944 (Treaty Series 994) become difficult, and report such findings to the Governors of the Upper Basin States, the President of the United States of America, the United States Section of the International Boundary and Water Commission, and such other Federal officials and agencies as it may deem appropriate to the end that the water allotted to Mexico under Division III of such treaty may be reduced in accordance with the terms of such Treaty;

"(11) Acquire and hold such personal and real property as may be necessary for the performance of its duties hereunder and to dispose of the same when no longer required;

"(12) Perform all functions required of it by this Compact and do all things necessary, proper or convenient in the performance of its duties hereunder, either independently or in cooperation with any state or federal agency;

"(13) Make and transmit annually to the Governors of the signatory States and the President of the United States of America, with the estimated budget, a report covering the activities of the Commission for the preceding water year.

"(e) Except as otherwise provided in this Compact the concurrence of four members of the Commission shall be required in any action taken by it.

"(f) The Commission and its Secretary shall make available to the Governor of each of the signatory States any information within its possession at any time, and shall always provide free access to its records by the Governors of each of the States, or their representatives, or authorized representatives of the United States of America.

"(g) Findings of fact made by the Commission shall not be conclusive in any court, or before any agency or tribunal, but shall constitute prima facie evidence of the facts found.

"(h) The organization meeting of the Commission shall be held within four months from the effective date of this Compact.

"ARTICLE IX

"(a) No State shall deny the right of the United States of America and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity of any signatory State to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals and conduits in one State for the purpose of diverting, conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the States of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing or regulating water in an upper signatory State for consumptive use in a lower signatory State, when such use is within the apportionment to such lower State made by this Compact. Such rights shall be subject to the rights of water users, in a State in which such reservoir or works are located, to receive and use water, the use of which is within the apportionment to such State by this Compact.

"(b) Any signatory State, any person or any entity of any signatory State shall have the right to acquire such property rights as are necessary to the use of water in conformity with this Compact in any other signatory State by donation, purchase or through the exercise of the power of eminent domain. Any signatory State, upon the written request of the Governor of any other signatory State, for the benefit of whose water users property is to be acquired in the State to which such written request is made, shall proceed expeditiously to acquire the desired property either by purchase at a price satisfactory to the requesting State, or, if such purchase cannot be made, then through the exercise of its power of eminent domain and shall convey such property to the requesting State or such entity as may be designated by the requesting State; provided, that all costs of acquisition and expenses of every kind and nature whatsoever incurred in obtaining the requested property shall be paid by the requesting State at the time and in the manner prescribed by the State requested to acquire the property.

"(c) Should any facility be constructed in a signatory State by and for the benefit of another signatory State or States or the water users thereof, as above provided, the construction, repair, replacement, maintenance and operation of such facility shall be subject to the laws of the State in which the facility is located, except that, in the case of a reservoir constructed in one State for the benefit of another State or States, the water administration officials of the State in which the facility is located shall permit the storage and release of any water which, as determined by findings of the Commission, falls within the apportionment of the State or States for whose benefit the facility is constructed. In the case of a regulating reservoir for the joint benefit of all States in making Lee Ferry deliveries, the water administration officials of the State in which the facility is located, in permitting the storage and release of water, shall comply with the findings and orders of the Commission.

"(d) In the event property is acquired by a signatory State in another signatory State for the use and benefit of the former, the users of water made available by such facilities, as a condition precedent to the use thereof, shall pay to the political subdivisions of the State in which such works are located, each and every year during which such rights are enjoyed for such purposes, a sum of money equivalent to the average annual amount of taxes levied and assessed against the land and improvements thereon during the ten years preceding the acquisition of such land. Said payments shall be in full reimbursement for the loss of taxes in such political subdivisions of the State, and in lieu of any and all taxes on said property, improvements and rights. The signatory States recommend to the President and the Congress that, in the event the United States of America shall acquire property in one of the signatory States for the benefit of another signatory State, or its water users, provision be made for like payment in reimbursement of loss of taxes.

"ARTICLE X

"(a) The signatory States recognize La Plata River Compact entered into between the States of Colorado and New Mexico, dated November 27, 1922, approved by the Congress on January 29, 1925 (43 Stat. 796), and this Compact shall not affect the apportionment therein made.

"(b) All consumptive use of water of La Plata River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XI

"Subject to the provisions of this Compact, the consumptive use of the water of the Little Snake River and its tributaries is hereby apportioned between the States of Colorado and Wyoming in such quantities as shall result from the application of the following principles and procedures:

"(a) Water used under right existing prior to the signing of this Compact.

"(1) Water diverted from any tributary of the Little Snake River or from the main stem of the Little Snake River above a point one hundred feet below the confluence of Savery Creek and the Little Snake River shall be administered without regard to rights covering the diversion of water from any down-stream points.

"(2) Water diverted from the main stem of the Little Snake River below a point one hundred feet below the confluence of Savery Creek and the Little Snake River shall be administered on the basis of an interstate priority schedule prepared by the Commission in conformity with priority dates established by the laws of the respective States.

"(b) Water used under rights initiated subsequent to the signing of this Compact.

"(1) Direct flow diversions shall be so administered that, in time of shortage, the curtailment of use on each acre of land irrigated thereunder shall be as nearly equal as may be possible in both of the States.

"(2) The storage of water by projects located in either State, whether of supplemental supply or of water used to irrigate land not irrigated at the date of the signing of this Compact, shall be so administered that in times of water shortage the curtailment of storage of water available for each acre of land irrigated thereunder shall be as nearly equal as may be possible in both States.

"(c) Water uses under the apportionment made by this Article shall be in accordance with the principle that beneficial use shall be the basis, measure and limit of the right to use.

"(d) The States of Colorado and Wyoming each assent to diversions and storage of water in one State for use in the other State, subject to compliance with Article IX of this Compact.

"(e) In the event of the importation of water to the Little Snake River Basin from any other river basin, the State making the importation shall have the exclusive use of such imported water unless by written agreement, made by the representatives of the States of Colorado and Wyoming on the Commission, it is otherwise provided.

"(f) Water use projects initiated after the signing of this Compact, to the greatest extent possible, shall permit the full use within the Basin in the most feasible manner of the waters of the Little Snake River and its tributaries, without regard to the State line; and, so far as is practicable, shall result in an equal division between the States of the use of water not used under rights existing prior to the signing of this Compact.

"(g) All consumptive use of the waters of the Little Snake River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XII

Subject to the provisions of this Compact, the consumptive use of the waters of Henry's Fork, a tributary of Green River originating in the State of Utah and flowing into the State of Wyoming and thence into the Green River in the State of Utah; Beaver Creek, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; Burnt Fork, a tributary of Henry's Fork, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; Birch Creek, a tributary of Henry's Fork, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; and Sheep Creek, a tributary of Green River in the State of Utah, and their tributaries, are hereby apportioned between the States of Utah and Wyoming in such quantities as will result from the application of the following principles and procedures:

"(a) Waters used under rights existing prior to the signing of this Compact.

"Waters diverted from Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek and their tributaries, shall be administered without regard to the state line on the basis of an interstate priority schedule to be prepared by the States affected and approved by the Commission in conformity with the actual priority of right

of use, the water requirements of the land irrigated and the acreage irrigated in connection therewith.

"(b) Waters used under rights from Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek and their tributaries, initiated after the signing of this Compact shall be divided fifty percent to the State of Wyoming and fifty percent to the State of Utah and each State may use said waters as and where it deems advisable.

"(c) The State of Wyoming assents to the exclusive use by the State of Utah of the water of Sheep Creek, except that the lands, if any, presently irirgated in the State of Wyoming from the water of Sheep Creek shall be supplied with water from Sheep Creek in order of priority and in such quantities as are in conformity with the laws of the State of Utah.

"(d) In the event of the importation of water to Henry's Fork, or any of its tributaries, from any other river basin, the State making the importation shall have the exclusive use of such imported water unless by written agreement made by the representatives of the States of Utah and Wyoming on the Commission, it is otherwise provided.

"(e) All consumptive use of waters of Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek, Sheep Creek, and their tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"(f) The States of Utah and Wyoming each assent to the diversion and storage of water in one State for use in the other State, subject to compliance with Article IX of this Compact. It shall be the duty of the water administrative officials of the State where the water is stored to release said stored water to the other State upon demand. If either the State of Utah or the State of Wyoming shall construct a reservoir in the the other State for use in its own State, the water users of the State in which said facilities are constructed may purchase at cost a portion of the capacity of said reservoir sufficient for the irrigation of their lands thereunder.

"(g) In order to measure the flow of water diverted, each State shall cause suitable measuring devices to be constructed, maintained and operated at or near the point of diversion into each ditch.

"(h) The State Engineers of the two States jointly shall appoint a Special Water Commissioner who shall have authority to administer the water in both States in accordance with the terms of this Article. The salary and expenses of such Special Water Commissioner shall be paid, thirty percent by the State of Utah and seventy percent by the State of Wyoming.

"ARTICLE XIII

"Subject to the provisions of this Compact, the rights to the consumptive use of the water of the Yampa River, a tributary entering the Green River in the State of Colorado, are hereby apportioned between the States of Colorado and Utah in accordance with the following principles:

"(a) The State of Colorado will not cause the flow of the Yampa River at the Maybell Gaging Station to be depleted below an aggregate of 5,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification and approval of this Compact. In the event any diversion is made from the Yampa River or from tributaries entering the Yampa River above the Maybell Gaging Station for the benefit of any water use project in the State of Utah, then the gross amount of all such diversions for use in the State of Utah, less any returns from such diversions to the River above Maybell, shall be added to the actual flow at the Maybell Gaging Station to determine the total flow at the Maybell Gaging Station.

"(b) All consumptive use of the waters of the Yampa River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XIV

"Subject to the provisions of this Compact, the consumptive use of the waters of the San Juan River and its tributaries is hereby apportioned between the States of Colorado and New Mexico as follows:

"The State of Colorado agrees to deliver to the State of New Mexico from the San Juan River and its tributaries which rise in the State of Colorado a quantity of water which shall be sufficient, together with water originating in the San Juan Basin in the State of New Mexico, to enable the State of New Mexico to make full use of the water apportioned to the State of New Mexico by Article III of this Compact, subject, however, to the following:

"(a) A first and prior right shall be recognized as to:

"(1) All uses of water made in either State at the time of the signing of this Compact; and

"(2) All uses of water contemplated by projects authorized, at the time of the signing of this Compact, under the laws of the United States of America whether or not such projects are eventually constructed by the United States of America or by some other entity.

"(b) The State of Colorado assents to diversions and storage of water in the State of Colorado for use in the State of New Mexico, subject to compliance with Article IX of this Compact.

"(c) The uses of the waters of the San Juan River and any of its tributaries within either State which are dependent upon a common source of water and which are not covered by (a) hereof, shall in times of water shortages be reduced in such quantity that the resulting consumptive use in each State will bear the same proportionate relation to the consumptive use made in each State during times of average water supply as determined by the Commission; provided, that any preferential uses of water to which Indians are entitled under Article XIX shall be excluded in determining the amount of curtailment to be made under this paragraph.

"(d) The curtailment of water use by either State in order to make deliveries at Lee Ferry as required by Article IV of this Compact shall be independent of any and all conditions imposed by this Article and shall be made by each State, as and when required, without regard to any provision of this Article.

"(e) All consumptive use of the waters of the San Juan River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

"ARTICLE XV

"(a) Subject to the provisions of the Colorado River Compact and of this Compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

"(b) The provisions of this Compact shall not apply to or interfere with the right or power of any signatory State to regulate within its boundaries the appropriation, use and control of water, the consumptive use of which is apportioned and available to such State by this Compact.

"ARTICLE XVI

"The failure of any State to use the water, or any part thereof, the use of which is apportioned to it under the terms of this Compact, shall not constitute a relinquishment of the right to such use to the Lower Basin or to any other State, nor shall it constitute a forfeiture or abandonment of the right to such use.

"ARTICLE XVII

"The use of any water now or hereafter imported into the natural drainage basin of the Upper Colorado River System shall not be charged to any State under the apportionment of consumptive use made by this Compact.

"ARTICLE XVIII

"(a) The State of Arizona reserves its rights and interests under the Colorado River Compact as a State of the Lower Division and as a State of the Lower Basin.

"(b) The State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River Compact as States of the Lower Basin.

"ARTICLE XIX

"Nothing in this Compact shall be construed as:

"(a) Affecting the obligations of the United States of America to Indian tribes;

"(b) Affecting the obligations of the United States of America under the Treaty with the United Mexican States (Treaty Series 994);

"(c) Affecting any rights or powers of the United States of America, its agencies or instrumentalities, in or to the waters of the Upper Colorado River System, or its capacity to acquire rights in and to the use of said waters;

"(d) Subjecting any property of the United States of America, its agencies or instrumentalities, to taxation by any State or subdivision thereof, or creating any obligation on the part of the United States of America, its agencies or instrumentalities, by reason of the acquisition, construction or operation of any property or works of whatever kind, to make any payment to any State or political subdivision thereof, State agency, municipality or entity whatsoever, in reimbursement for the loss of taxes;

"(e) Subjecting any property of the United States of America, its agencies or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to this Compact.

"ARTICLE XX

"This Compact may be terminated at any time by the unanimous agreement of the signatory States. In the event of such termination, all rights established under it shall continue unimpaired.

"ARTICLE XXI

"This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States and approved by the Congress of the United States of America. Notice of ratification by the legislatures of the signatory States shall be given by the Governor of each signatory State to the Governor of each of the other signatory States and to the President of the United Sates of America, and the President is hereby requested to give notice to the Governor of each of the signatory States of approval by the Congress of the United States of America.

"IN WITNESS WHEREOF, the Commissioners have executed six counterparts hereof each of which shall be and constitute an original, one of which shall be deposited in the archives of the Department of State of the United States of America, and one of which shall be forwarded to the Governor of each of the signatory States.

"Done at the City of Santa Fe, State of New Mexico, this 11th day of October, 1948.

[sgd] Charles A. Carson
CHARLES A. CARSON
Commissioner for the State of Arizona
[sgd] Clifford H. Stone
CLIFFORD H. STONE
Commissioner for the State of Colorado
[sgd] Fred E. Wilson
FRED E. WILSON
Commissioner for the State of New Mexico
[sgd] Edward H. Watson
EDWARD H. WATSON
Commissioner for the State of Utah
[sgd] L. C. Bishop
L. C. BISHOP
Commissioner for the State of Wyoming
[sgd] Grover A. Giles
GROVER A. GILES
Secretary

"Approved:
"[sgd] Harry W. Bashore
HARRY W. BASHORE
Representative of the United States of America."

Chairman MURDOCK. The committee will come to order, please.

This is a meeting of the Subcommittee on Irrigation and Reclamation of the Public Lands Committee.

We are running a little behind schedule today. We had hoped to open at 10 o'clock on a measure to get congressional approval of the upper basin compact. We will proceed with that, but if I may have the indulgence of the committee, I would like to make a little statement from the Chair, whether that would be appropriate or not, showing my great interest in the matter, and one that I would like to have the committee consider.

Hearing no objection, the Chair will proceed with this comment:

H. R. 2325, and 10 other identical bills, pertain to a very important subject. Unless you have lived west of the one hundredth meridian, you can scarcely realize how important this subject is. We are called on now to give congressional approval of a compact entered into by five of the States of the Colorado River Basin vitally interested in the upper waters of that great western river. Under the Constitution of the United States, our States may enter into treaties or compacts with each other only with the permission of the Federal Government expressed by Congress. Under previous legislation congressional authorization has been given to these five States, and they have done, in a very short time, what many thought impossible and have come to agreement over the division of their apportioned waters, and now they ask approval of Congress for this compact. It is a simple matter to grant or withhold approval.

As you first glance at the bill, it seems rather lengthy, consisting of 33 pages; however, all but the first page of the bill consists of the text of the compact which the five State legislatures have approved. In my opinion, no changes need be made in this bill, but if any are made, they will have to be on page I, as just stated. I think that all this committee and Congress need to do now is to approve or reject this compact as set forth in the following pages.

Naturally, I am anxious to see congressional approval given without any further delay. All five State legislatures, situated hundreds of miles from each other, acted promptly and unanimously in voting approval—all within a period of 8 days this last January. Already a period of 8 weeks has elapsed without congressional approval in this simple matter. These five great Western States have, in an unbelievable way, come to agreement and have written this compact under authority of previous congressional enactment and subject to the master compact governing the entire basin. I feel that we should, without delay, vote for congressional approval.

As chairman, I would have called this to the attention of the committee weeks ago, but a letter from our colleague, the gentleman from California, Mr. Poulson, led me to believe that there might be some controversy or at least that some of his constituents wanted to be heard on the matter, and I further got the impression that someone might want to offer an amendment to the bill. I heard a remark a few days ago about an innocent amendment that was being proposed and might be offered. I can think of no such innocent or harmless amendment which would be at all necessary for the benefit of anyone. On page 3, lines 5, 6, and 7, it is plainly stated that this new compact is subject to the provisions of the master compact of 1922.

Mr. POULSON. What page was that?

Chairman MURDOCK. On page 3 of the bill, lines 5, 6, and 7, it says in substance: This new compact is subject to the provisions of the master compact. The Colorado River compact is the master compact.

Mr. POULSON. Will you read that fourth part, Mr. Chairman, please?

Mr. D'EWART. It is the wrong page, I think.

Mr. ENGLE. Page 3, lines 5, 6, and 7, read as follows:

It is recognized that the Colorado River compact is in full force and effect and all of the provisions hereof are subject thereto.

Chairman MURDOCK. That was the one to which I had reference. Let us assume that Congress may grant or withhold approval on this compact. We might also assume, in keeping with that assumption, that Congress could approve the compact conditionally, but if that were done the condition imposed would change the compact, and any change in the compact would require its reconsideration by the five State legislatures. Since these State legislatures meet only biennially, a resubmission of this compact to the legislatures might have to wait 2 years or require the calling of special sessions of those legislatures. It is greatly to be hoped that no such delay need or will be occasioned. If an amendment, even though it is unnecessary, should be offered which would change the effect and meaning of the compact, it would certainly delay, if not thwart, this splendid effort.

My own State of Arizona, although situated mostly far down the Colorado River, has a portion of its area in the upper basin and is interested in this division of water in a very minor way so far as the amount of water is concerned, but is interested in this proper settlement far more than Arizona's obtaining less than 1 percent of the divided waters would seem to justify. We in Arizona know, as a matter of enlightened self-interest, if in no other way, that the maximum development of the whole Colorado River Basin cannot be achieved without this upper basin compact, or agreement, being established as a cornerstone.

Mr. WELCH. Mr. Chairman, how many States in the upper and lower Colorado River Basins approved this bill?

Chairman MURDOCK. There are five States involved, Congressman Welch. They are the five States of Wyoming, Colorado, Utah, New Mexico, which are usually called the four upper basin States, and Arizona, because of the fact that a portion of Arizona in the northern corner lies above the dividing line which passes through Arizona, and is entitled to about 1/150th of the water to be divided.

Mr. WELCH. What about the State of California and the State of Nevada?

Mr. ENGLE. Mr. Chairman, if it is appropriate, I would like to be recognized for a statement at this time which I think will indicate the interest and position of some of the people in California. I think it will have a tendency to expedite it.

Chairman MURDOCK. Before you do that, Mr. Engle, I would like to say further there are 11 Members of the House from those 5 States. When the bill was introduced on February 3, every Member sought to introduce the bill to show unanimity, and most of them did introduce bills. A bill was introduced by Governor Miles of New Mexico, a member of our committee. Congressman Aspinall, of Colorado, and his colleagues, Congressmen Carroll, Hill, and Marsalis, of Colorado; Congressman Barrett, of Wyoming; Judge Bosone, of Utah; Congressman Granger, of Utah; Congressman Patten, of Arizona, and myself.

I see most of these Members here with us today. We want to welcome them here. I must say that I do not use my ordinary modesty when I bring up this bill, with the number of 2325 as mine, but I want it distinctly understood that every Member of those five States in the House have identical bills, and many of these Members are far more interested in the matter than I myself.

Mr. Engle.

Mr. ENGLE. Mr. Chairman, I request your permission to make a statement at this time. I do so for the purpose not of implying any opposition to the confirmation of this compact but rather to indicate the position of California with a view to getting certain basic information which we want. We think we ought to have the information in connection with this compact in order to make it possible to put it through without any changes or amendments which would complicate its final acceptance by all the people involved. The compact is obviously the result of a vast amount of work. The ability, perserverance, and forebearance of the negotiators and the representative of the United States in the negotiations, are deserving of high praise. They and the States of the upper basin of the Colorado River are to be congratulated on their success in arriving at a division of the use of water apportioned to the upper basin by the Colorado River compact of 1922. It would be highly desirable if the States of the lower basin were able to arrive at a comparable compact and terminate the long-standing controversy which has existed in that basin.

Speaking for California, we recognize the right of the States of the upper basin to apportion the use of water available to them under the basic compact, in any way that seems right to them. So far as we are concerned, they might use head-gate diversions, acreage limitations, or any other device to divide the use of water among themselves. California's only concern is to protect the lower basin's right under the Colorado River compact of 1922.

We assume that those rights are not intended to be impaired, since we note that by article XVIII of the proposed compact, the State of Arizona has expressly reserved whatever rights it has as a State of the lower basin.

If the upper basin compact does not affect the determination of the quantity of surplus water, as those words appear in the basic Colorado River compact, available for service of the Mexican treaty and available for additional apportionment in 1963, and if the delivery of water at Lee Ferry guaranteed by article III (d) of the basic compact is not affected, California will have no objection to the apportionment of water under the upper basin States compact by any method satisfactory to those States.

It is California's position that nothing agreed upon by the States of the upper Colorado River basin can affect or bind States which are not parties to the agreement.

It is further California's position that the proposed compact cannot modify nor affect the meaning of the Colorado River compact nor the Boulder Canyon Project Act.

It is not my purpose to argue or even suggest the merits of one side or the other of the controversy as to the interpretations of the Colorado River compact or the Boulder Canyon Project Act. Those documents, taken together with the California Limitation Act, are contractual in

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character and mean what the parties meant at the time of their ratification. What the present Congress may do a quarter of a century later can have no bearing upon interpretation of those documents. They will be interpreted according to well recognized principles of contract interpretation, all of which are concerned with ascertaining the intent of the contracting parties at the time the contract involved was made.

To the extent that it is now possible to clarify the meaning of the document, it should be done. To illustrate, I call attention to one of the articles of the pending compact which requires clarification:

Subdivision (g) of the article VIII provides that findings of the administrative commission created by the compact shall constitute prima facie evidence of the facts found.

Subdivisions (6), (7), and (8) of subdivision (d) of the same article provide for findings by the commission as to the quantity of water used each year in the upper basin and in each State of that basin, quantities of water delivered at Lee Ferry during each water year, and the necessity for and extent of curtailments required to satisfy the guarantee to the lower basin. Obviously, the lower basin is much concerned with such facts and, in the event of any difference of opinion, should not be confronted with a prime facie case created by findings of a commission representing conflicting interests. Such findings should not constitute prima facie evidence against the United States nor against any stranger to the compact. Of course, looked at merely as a contract, an interstate compact binds no one but the parties thereto. However, it has been held that, under some circumstances, an interstate compact approved by the Congress, in addition to being a contract, becomes a public law (*Missouri* v. *Illinois*, 200 U. S. 496–519; *Pennsylvania* v. *Wheeling, etc.*, 54 U. S. 518–566).

As a public law it might be held controlling in any Federal court or before any Federal tribunal. I do not believe that the framers of the compact had any intent to arrogate to themselves power to set up findings of fact constituting prima facie evidence against anyone else. However, that might be the result of the language used. On this and other points, we must have more light before acting on the compact.

As has been said, our concern is the protection of existing rights in the lower basin, whatever those rights may be, and to avoid any prejudice one way or the other which might arise under the pending document.

Years ago, when the basic Colorado River compact was under consideration, Senator Carl Hayden of Arizona, who was at that time a member of this body, submitted to the Honorable Herbert Hoover, the Federal representative on the Colorado River Compact Commission of 1922, a series of questions relating to that compact. Mr. Hoover promptly answered the questions, and his answers have been of great value to those who have been called upon to apply the compact.

Following the wise example set by Senator Hayden, and in an effort to expedite early consideration of the pending bill, I have submitted a series of questions addressed to the Honorable Harry W. Bashore, representative of the United States on the Upper Basin Compact Commission, and ask that the answers be made available to me before hearings on the pending bill are closed. I believe that the replies can be made without appreciable loss of time, probably before

completion of testimony of witnesses scheduled to appear before this committee. Mr. Bashore's replies will be of great value to this committee and to all others concerned.

If, Mr. Chairman, we are able to ascertain as a result of Mr. Bashore's answers, that the interests of the lower basin are not impaired, and I anticipate that that will prove to be the case, you may be assured of California's cooperation in securing prompt action upon the pending bill.

Mr. Chairman, I at this point offer for the record the letter which was addressed to the Honorable Harry W. Bashore, representative of the United States, upper Colorado River Basin compact negotiations, sent to him at the Roger Smith Hotel in Washington, D. C.

The letter is somewhat long and I will not undertake to read it at this time, but will submit it for the record, and I have an acknowledgment, Mr. Chairman, from him, in which he indicates that he has received the communication, that the questions submitted will be promptly answered, and will be submitted also to all of the commissioners who entered into this agreement. So I assume that very shortly those answers will be available, and if there is no objection, Mr. Chairman, I would like to submit the letter without reading it.

Chairman MURDOCK. The correspondence will be admitted to the record.

(The letter referred to is as follows:)

MARCH 12, 1949.

Hon. HARRY W. BASHORE,
Representative of the United States, Upper Colorado River Basin Compact Negotiations, Washington, D. C.

DEAR MR. BASHORE: There is pending before the Eighty-first Congress H. R. 2325 which, if adopted, will give congressional approval to the upper Colorado River Basin compact signed at Santa Fe, N. Mex., on the 11th day of October, 1948, by Commissioners of the five States of the upper Colorado River Basin.

In studying the proposal, certain questions have arisen which I assume you can answer. It is my duty and purpose to protect the interests of the lower basin of the Colorado River, particularly in the matter of determination of quantities of surplus water available for service of the Mexican Treaty, and possibly available for additional apportionment in 1963, and to protect the deliveries of water guaranteed by article III (d) of the Colorado River compact. It is not my thought that there has been any deliberate attempt to affect the rights of the lower basin under the Colorado River compact. I feel it necessary, however, to receive assurances on certain points. For that reason, I submit to you the following questions:

Question No. 1. Article I of the proposed compact refers to the apportionment of the "use" of the water of the Colorado River system, the use of which was apportioned in perpetuity to the upper basin by the Colorado River compact.

(*a*) Is the word "use" to be taken as synonymous with the phrase "beneficial consumptive use" as it occurs in the Colorado River compact?

(*b*) In this connection, note that the phrase "consumptive use" occurs frequently in the pending compact. Is there any difference in meaning between the phrase "consumptive use" as used in the pending compact, and "beneficial consumptive use" as the phrase is used in the Colorado River compact?

Question No. 2. In Article II, the term "virgin flow" is defined to mean "the flow of any stream undepleted by the activities of man."

(*a*) Is it proposed to determine "virgin flow" with respect to each year, or to use averages?

(*b*) If on an annual basis, how will "virgin flow" for any particular future water year be determined?

Question No. 3.

(*a*) Will consumptive uses in each of the States, under Article III, be determined with reference to each water year?

(*b*) Or, are these quantities to be determined on long- or short-term averages?

Question No. 4. Article IV speaks of curtailment of use of water in order that flow at Lee Ferry shall not be depleted below that required by article III of the Colorado River compact.

Does the word "use" mean the same thing as the phrase "consumptive use" as determined pursuant to article VI of the compact?

Question No. 5. Article V, subsection (c), provides that: "In the event the Commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the upper division, the storage of water for consumptive use shall be given preference."

Does this mean that the Commission may exonerate any reservoir or reservoir capacity from the obligation of article III (d) of the Colorado River compact? If not, what is meant by the "preference" for consumptive use?

Question No. 6. Article VI provides that the Commission shall determine the quantity of the consumptive use of water for the upper basin and for each State of the upper basin, by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the Commission, by unanimous action, shall adopt a different method of determination.

(*a*) Outflow from the upper basin apparently would be measured at Lee Ferry. Where and how would inflow to the upper basin be measured?

(*b*) It is my understanding that a large part of the use of water in the upper basin will be made possible by over-year and cyclic storage. The impounding of water in storage reservoirs would be reflected by depletion at Lee Ferry during the water year in which water is impounded. Does article VI mean that consumptive use will be measured by water stored, as distinguished from the withdrawals from storage and application to use on land?

(*c*) How is it proposed to account for water stored in one year and applied to use in another and later year? Specifically, would consumptive use be considered as occurring in the year in which water is impounded, or in some later year when it is withdrawn from storage and applied to use?

Question No. 7. Article VIII provides for an "Upper Colorado River Commission." Among other things, the Commission is authorized to (article VIII (d)):

"(6) Make findings as to the quantity of water of the upper Colorado River system used each year in the upper Colorado River Basin and each State thereof;

"(7) Make findings as to the quantity of water deliveries at Lee Ferry during each water year;

"(8) Make findings as to the necessity for and the extent of the curtailment of use, required, if any, pursuant to article IV hereof."

Subdivision (g) of the same article provides that: "Findings of fact made by the Commission shall not be conclusive in any court, or before any agency or tribunal but shall constitute prima facie evidence of the facts found."

It has been held that, in addition to its contractual character, under some circumstances a compact approved by the Congress is a public law (*Missouri* v. *Illinois*, 200 U. S. 496–519; *Pennsylvania* v. *Wheeling, etc.*, 54 U. S. 518–566). Is it intended that subdivision (g) above shall be binding on any State not a party to the upper Colorado River Basin compact, or on the United States?

Question No. 8. Will the ratification by the several States and the approval by the Congress, of the upper Colorado River Basin compact in any way amend or affect the meaning of the Colorado River compact, whatever that document may mean?

Question No. 9. I note that in article XVIII the States of Arizona, New Mexico, and Utah have reserved their respective rights and interests under the Colorado River compact, as States of the lower basin. Will the ratification and approval by the Congress of the upper Colorado River Basin compact impair or in any way affect the rights of States of the lower basin not signatory thereto?

Your early response to the questions submitted herein will be deeply appreciated.

Very truly yours,

CLAIR ENGLE, *Member of Congress.*

Chairman MURDOCK. The letter to Mr. Bashore contains the questions, I suppose?

Mr. ENGLE. That is correct, yes, sir.

Mr. MILLER. Mr. Chairman. the gentleman I believe is a lawyer, and there are other distinguished lawyers on this committee. I know there is a controversy over water. Maybe the question is not

appropriate at this time, but I want to state the question and leave it hanging in the air until we get through with the witnesses, and that is this:

Regardless of the legislative procedure that we, as a committee, or Congress might take, I am wondering if the type of final adjudication of the water rights in this bill as it relates to California would not eventually have to be decided by the Supreme Court, just as it was in the case of Colorado, Wyoming, and Nebraska. That doesn't need to be answered now. I want to leave that question before the committee as you hear the witnesses.

Mr. BARRETT. I can answer you, if the gentleman wants an answer. I will say that the State of Nebraska kept the State of Wyoming in court for nearly a quarter of a century, but in this particular case the upper basin States have very fortunately agreed on the division of the water.

Mr. MILLER. Yes, Mr. Chairman, but the State of California, I believe, has some interest here and some controversy that I say, eventually, will it not have to be adjudicated by the Supreme Court?

Mr. BARRETT. The Supreme Court will not interfere in any way, shape, or form in my humble opinion with the compact arrived at by the upper basin States. Now, the way I see the situation here today, it is a great deal like the colored preacher that was taking over a new church and found they had a very violent dispute in the church, and in his first sermon he did not refer to it. One of the brothers got up and said, "Parson, we all note you said nothing about this here controversy we have been having." He said, "That is true. I just left that in status quo." So the brother got up and said, "I don't understand what that status quo means." He says, "That is a Latin word that means we just left it in the mess it's in," so we are just leaving California and Arizona in the mess that they are in.

Mr. ENGLE. That is all we want to be sure of, Mr. Barrett, that that is precisely what happens.

Mr. MILLER. Mr. Chairman, as we proceed with the witnesses, let's keep the thought in mind, regardless of what this committee or the Congress does "will it not eventually have to be adjudicated by the court, just as California, Wyoming, and Nebraska did adjudicate a long period of controversy in the courts?" It has been settled, and I think satisfactorily.

Mr. ENGLE. Let me comment on what the gentleman from Nebraska says. We think that is true. We think your statement is correct, and the only thing we want to be sure of, as the gentleman from Wyoming indicates, is the status quo, if and when we get into court. In other words, we do not want language in this compact and agreements drawn between States not including California to affect a decision that comes up later. We want the status quo, Mr. Barrett.

Mr. BARRETT. The status quo applies only to the lower basin States. Now, the reason that the Supreme Court took jurisdiction and decided the case between Colorado and Nebraska was that they could not arrive at the compact. Here the compact has been arrived at, and under the Constitution of the United States the sovereign States have a right to agree between themselves, and they have certainly done that here.

Mr. LEMKE. I think the only way they could get in court would be if there would be a misunderstanding between States as to what their language means.

Mr. BARRETT. I don't think there will be any misunderstanding.

Chairman MURDOCK. Before calling the first witness, let us hold in mind, as Congressman Miller said, his question was thrown out for consideration by witnesses as well as members of the committee. I just want to say to Congressman Miller that I was in a hearing before another House committee a few days ago in which one of his colleagues from Nebraska was on the witness stand, and he was asking for appropriations for the development of the Republican River which involved three States. I heard that gentleman from Nebraska say in effect, "We do not want this in litigation. We have had our fill of litigation, and hope that the matter can be settled."

I just say that by way of following up what Congressman Barrett has said. We have this morning Judge Clifford Stone of Colorado, who is one of the leading water authorities in the West, and one well qualified to present this matter to us. He is well qualified to present this matter to us officially in this case as well as otherwise.

Judge Stone, may we have your statement?

STATEMENT OF JUDGE CLIFFORD H. STONE

Mr. STONE. Mr. Chairman, and members of the committee, it might be well at the outset to indicate to the committee the manner in which we propose to submit the upper Colorado River Basin compact under H. R. 2325 for the consideration of this committee.

Chairman MURDOCK. Judge Stone, do you prefer to be seated?

Mr. STONE. Well, I think perhaps I had better stand.

We recognize that if we can present this matter in an orderly fashion, and without repetition, it will save the time of this committee. Accordingly, we plan that I shall make a brief general statement. I shall then be followed by Mr. Royce Tipton, who will explain those provisions of the compact which deal primarily with engineering phases.

Mr. Tipton is an engineer who has participated as one of the engineering advisers in the negotiations of this compact.

Mr. Tipton then will be followed by Mr. Brietenstein who will explain the other provisions of the compact, since they are principally of a legal nature. Mr. Breitenstein served as a legal adviser during the negotiations.

I am director of the Colorado Water Conservation Board, and served as Colorado's commissioner on the commission.

All of the commissioners representing the States who participated in the negotiations are present with the exception of Mr. Watson of Utah. Utah will be represented here by the attorney general, and by Judge Howell of Ogden.

The presentation by the three men whom I have mentioned will then be followed by briefer statements by commissioners and others representing the other signatory States.

Congressman Engle has placed in the record questions which have been submitted to Harry W. Bashore, the Federal representative who served as the chairman of the upper Colorado River Basin compact commission. That letter contains questions which in our judgment California has a right and should present in these hearings in order that the provisions and their intent and purposes may be clearly understood in the consideration of giving congressional consent to this

compact. After reviewing the letter it appeared to us that it would be more appropriate if those answers were given not only by the Federal representative, but by commissioners representing all of the States. After all, a compact negotiated among States represents an agreement among those States and the intent and purpose in the minds of the negotiators, those who represent the States, as distinguished from the Federal Government are very important, and in order to better handle this matter, and before the hearings close, Congressman Engle, we propose to submit for the record and, for further questions, if it is deemed advisable, a letter signed by these commissioners approved by the Federal representative, and those questions will be answered as concisely and accurately as it is possible to do so.

Mr. ENGLE. Thank you very much, Mr. Stone.

Mr. STONE. It is well briefly to review the negotiation of this compact.

On July 22, 1946, the Governors of Arizona, Colorado, New Mexico, Utah, and Wyoming, or their representatives, met at Cheyenne, Wyo., and agreed to initiate negotiations of an upper Colorado River Basin compact. The organization meeting of the commission was held at Salt Lake City, Utah, on July 31, 1946. Harry W. Bashore, who had been previously designated by the President of the United States as the Federal representative, was elected chairman. Grover A. Giles, attorney general of Utah, was made secretary of the commission. The compact was finally signed by the commissioners at Santa Fe, N. Mex., on October 11, 1948.

Before the compact was signed on October 11, 1948, 8 meetings and 50 sessions of the commission were held. At the organization meeting an engineering advisory committee was created, because it was recognized that available information on water supplies, water uses, and other data were not sufficient to serve as a guide to the commission in making the compact. The commission assigned to the engineering committee specific tasks. The committee met on an average of every 2 months over a period of more than 2 years. Its work was not confined to meetings of the committee, but included the time and efforts of the staff of engineers of the Bureau of Reclamation, and of the individual States.

The report of the Bureau of Reclamation, submitted to the President of the United States by the Secretary of the Interior on July 24, 1946, entitled the "Colorado River House Document 149, Eightieth Congress, First Session," was of great value to the Commission in considering the potential development of the basin and important factors in connection therewith.

I should like to suggest to this committee that that report of the engineering advisory committee was of great value to the Commission, and in my judgment will be of great value to anyone interested in the Colorado River in the future. It does not represent the findings of a Federal agency nor of any one State, but it represents the findings of competent engineers from five States collaborating with engineers representing the Bureau of Reclamation.

At this point I wish to pay particular tribute to J. R. Riter, of the Bureau of Reclamation, who served as chairman of that engineering advisory committee.

Following the negotiation of the compact it was considered by the legislatures of the five signatory States. It is interesting to note that in those five legislatures there were only two votes of the total membership of those legislatures against ratification of the compact. In Colorado every member of the house of representatives joined as sponsors in the bill which provided for ratification.

At this time I offer for the record a certified copy of the act passed by the Colorado Legislature ratifying on behalf of the State of Colorado the upper Colorado River Basin compact. This act became effective on the second day of February 1949, when it was signed by Gov. Lee Knous, of Colorado.

In offering this for the record I suggest that in the interest of saving printing that the portion of the report which reproduces the compact be eliminated.

Chairman MURDOCK. Without objection, it will be entered into the record at this point.

(House bill No. 1, State of Colorado, is as follows:)

STATE OF COLORADO

OFFICE OF THE SECRETARY OF STATE

CERTIFICATE

UNITED STATES OF AMERICA,
State of Colorado, ss:

I, George J. Baker, Secretary, of the State of Colorado, do hereby certify that the annexed is a full, true, and complete copy of House Bill No. 1, filed in this office on the 2d day of February A. D. 1949, at 10:30 a. m.

In testimony whereof, I have hereunto set my hand and affixed the great seal of the State of Colorado, at the city of Denver this 2d day of February A. D. 1949.

[SEAL]

GEO. J. BAKER,
Secretary of State.
By JAMES R. MOSIER,
Deputy.

AN ACT

HOUSE BILL NO. 1

By Representatives Bezoff, Steele, Abe, Abernethy, Archambault, Armstrong, Barker, Beede, Beery, Bennett, Bentley, Blackman, Bledsoe, Brown, Clay, Cobb, Crowley, Dameron, Eaton, Foster, Hamburg, Hanson, Herring, Higel, Hill, Hobbs, Holt, Horsman, Houtchens, Johnson (Chey-Lcln), Johnson (Las Animas), Kelley, Kendrick, Kennedy, Kramer, Lamb, Lupton, MacDonald, Nelson, Ogilvie, O'Neill, Owens, Paddock, Parsons, Pellet, Phillips, Pile, Quiat, Radetsky, Roth, Schooley, Smartt, Smith, Stalker, Sullivan, Tinsley, Tyler, Wade, Ward (Crowley & Otero), Ward (Min'l-Rio Grande), Weissenfluh, Wells, Welsh, Yersin, Mr. Speaker.

AN ACT Approving the upper Colorado River compact among the States of Colorado, New Mexico, Utah, Wyoming, and Arizona; affecting the Colorado River, its tributaries, and the waters of said river and its tributaries; and providing for the operation and implementation of said compact

Be It Enacted by the General Assembly of the State of Colorado:

SECTION 1. The General Assembly hereby ratifies the compact among the States of Colorado, New Mexico, Utah, Wyoming, and Arizona, designated as the "Upper Colorado River Basin Compact" and signed in the City of Santa Fe, State of New Mexico, on the 11th day of October, A. D. 1948, by Clifford H. Stone, Commissioner for the State of Colorado, Fred E. Wilson, Commissioner for the State of New Mexico, Edward H. Watson, Commissioner for the State of Utah,

L. C. Bishop, Commissioner for the State of Wyoming, Charles A. Carson, Commissioner for the State of Arizona, and approved by Harry W. Bashore, Representative of the United States of America. Said compact is as follows:

* * * * * * *

EDWARD H. WATSON,
Commissioner for the State of Utah.
L. C. BISHOP,
Commissioner for the State of Wyoming.
GROVER A. GILES,
Secretary.

Approved:

HARRY W. BASHORE,
Representative of the United States of America.

SEC. 2. Said compact shall not become operative unless and until the same shall have been ratified by the legislatures of each of the signatory states and consented to by the Congress of the United States of America. The Governor of the State of Colorado shall give notice of the ratification of said compact by this Act to the Governors of the States of New Mexico, Utah, Wyoming, and Arizona, and to the President of the United States of America.

SEC. 3. It is hereby recognized, found, determined and declared that the compact creates an interstate agency which is known as the Upper Colorado River Commission and which is an independent entity whose members and employees are not officers and employees of any of the states signatory to the compact.

SEC. 4. After the said compact becomes effective, the Colorado member of the Upper Colorado River Commission shall be appointed by the Governor, and shall serve until revocation of his appointment by the Governor, and, on behalf of the Upper Colorado River Commission, the State of Colorado shall pay his necessary expenses and also compensation in an amount which shall be fixed by the Governor, and when so fixed shall be changed only by the Governor.

SEC. 5. The Colorado share of the expenses of the Upper Colorado River Commission and the expenses and the compensation of the Colorado member of that Commission shall be paid out of funds now or hereafter appropriated by the General Assembly to the Colorado Water Conservation Board and warrants shall be drawn against such appropriations upon vouchers signed by the Governor and the Director of the Colorado Water Conservation Board.

SEC. 6. The provisions of the Administrative Code of 1941 (Chapter 2, Colorado Session Laws, 1941) and all acts amendatory or supplementary thereto shall be inapplicable to any acts or proceedings taken to carry out the purposes of said compact.

SEC. 7. If any provision of this act or the application thereof to any person or circumstances is held invalid, such invalidity shall not affect other provisions or applications of the act which can be given effect without the invalid provision or application, and to this end the provisions of this act are declared to be severable.

SEC. 8. The General Assembly hereby finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

SEC. 9. In the opinion of the General Assembly an emergency exists; therefore, this Act shall take effect and be in force from and after its passage.

PAT MAGILL, Jr.,
Speaker of the House of Representatives.
WALTER W. JOHNSON,
President of the Senate.
HENRY CHRISTENSEN,
Chief Clerk of the House of Representatives.
FRED C. FERGUSON,
Secretary of the Senate.

Approved at 10:21 a. m. February 2, 1949:

LEE KNOUS,
Governor of the State of Colorado.

Chairman MURDOCK. May I ask, Judge Stone, will other representatives of the other four States furnish similar evidence of ratification?

Mr. STONE. Yes. It is planned that as each representative from the other States appear here, he will submit for the record evidence of ratification.

At this point, at the suggestion of the Federal representative, Harry W. Bashore, I submit and read into the record a statement of the cost of negotiating this compact. I do that because of the general interest, and in order to indicate to the committee that amicable adjustment of interstate water problems cost much less money than the litigation which has been referred to this morning.

The statement includes direct expenditures and the portion of salaries of regular employees of the States when they devoted their time to the compact negotiations. The statement indicates that Colorado expended $39,850; Arizona, $19,087.86; Wyoming, $18,242.12; New Mexico, $25,443.18; Utah, $28,431; the Federal Government, $90,000. or a total of $221,055.08.

In connection with the submission of that statement, and considering the purpose back of it, when our chairman, Mr. Bashore, made the suggestion, and because of the question asked by Congressman Miller, of Nebraska, may I most sincerely suggest that interstate litigation over water can and should be avoided. It is not necessary to go to the Supreme Court of the United States for the purpose of adjusting controversies over the use of the waters of an interstate stream. There are two methods possible to accomplish this purpose. One of them, of course, is through an original action in the Supreme Court of the United States. The other is the compact method. In recent years, I believe in every case recently before the Supreme Court, it has been suggested by the Court that it is more desirable for the States, and a better result would be obtained, if the involved matters incident to interstate streams were settled through compacts; and may I suggest this, that in the case of the Arkansas River, my own State spent nearly 50 years litigating over the waters of that river, and within the last 2 years, and after we got a Supreme Court decree, we found it necessary to make a compact.

Mr. MILLER. Will the gentleman yield at that point?

Chairman MURDOCK. Will you yield?

Mr. STONE. Yes.

Mr. MILLER. Judge Stone, you are an expert, and I agree with you 100 percent that if you can settle these problems without litigation it is a much better procedure and I hope it can be done, but as an expert on irrigation matters, would you care to look into your crystal ball and suggest an opinion as to whether you think there will be litigation if the Congress passes H. R. 2325?

Mr. STONE. I should like to answer that in a different way. I should like to say that there is much less chance of litigation if this compact is approved. I should like also to suggest that if this compact were not made, so far as the upper Colorado River Basin is concerned, it would be necessary for us to go into court. We do not wish to involve the time and expense to apportion this water by litigation if we can accomplish it through a compact.

Mr. MILLER. I agree with you.

Mr. STONE. Whether in the future there should be some litigation over the interpretation of the compact, none of us can say. We hope we have made a compact that is so plain, so clear and so understandable that such a litigation will not take place.

Mr. MILLER. You think there is a possibility, for instance, that the State of California might challenge some provisions in the compact? You think that is a possibility, don't you?

Mr. STONE. Yes.

Mr. MILLER. And it could be thrown into the Supreme Court?

Mr. STONE. Yes, that is a possibility.

Mr. MILLER. Yes.

Mr. STONE. I think though that we have probably avoided that.

Mr. MILLER. I hope so.

Mr. STONE. In Colorado we have a number of interstate streams. We are the roof tree of the Nation and rivers arising in the State run in all directions. We have had more litigation over interstate waters than any other State in the Union. The Board of which I am director has definitely decided that we are not going to have litigation if we can avoid it by getting along with our neighbors. The basin of the Colorado River, as I shall explain, is made up of the upper and lower basins. It is conceivable there may be questions in the lower basin which may not affect the upper basin; likewise, questions in the upper basin which may not affect the lower basin.

The Supreme Court in the last case over the Arkansas river made this admonition: That the welfare of the water users of Kansas and Colorado would be better served through amicable adjustments of disputes over Arkansas river water than by further litigation. I believe that is true of any interstate streams.

Mr. BARRETT. Judge, in further response to the question from the gentleman from Nebraska, of course, if by any chance the State of California or any other State in the lower basin were to find it possible to get into the Supreme Court on matters agreed upon in this compact, certainly the compact would be conclusive against the signatory States, and any dispute the Court would take jurisdiction of would be between one of the lower States and the entire upper basin group; is that not right?

Mr. STONE. Yes. That may be speculation, but it is probable that, so far as the compact you are now considering is concerned, such a question would involve a matter of whether or not the provisions of the upper basin compact are strictly in accord with the basic document, namely, the Colorado River compact.

As I shall point out later, the upper basin compact was made subject to all of the provisions of the original Colorado River compact which was negotiated in 1922 and finally approved by the Congress in 1928. The five States which negotiated the more recent compact are signatories to the Colorado River compact, and are bound thereby; and the provisions of this recent compact must be carried out in conformity with the provisions of the original compact.

I wish now to go to the matter of the necessity for an upper Colorado River Basin compact. The Colorado River compact of 1922 made no apportionment of water or of the use of water among the States of the Colorado River basin.

The 1922 apportionment was between the upper and lower basin of the river. Besides these five States, the State of California and the State of Nevada negotiated and signed the original Colorado River compact.

Since 1922 water development in the upper Colorado River Basin, and projected plans for ultimate integrated development have precipitated questions of available water supplies in the various States for proposed projects. This is particularly true of the major projects which will utilize large quantities of water.

As authorized by section 15 of the Boulder Canyon Project Act (45 Stat. 1057, 1065), passed in 1928, and section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 774), passed in 1940, the Bureau of Reclamation has been carrying on studies and investigations on the Colorado River for a number of years. These investigations and the formulation of a report were intensified in the years 1944 and 1945, and the forepart of 1946. On July 7, 1946, a departmental report of the Department of the Interior on the Colorado River was issued. This followed and was based upon a report and recommendation, dated March 22, 1946, by the directors of regions 3 and 4, Bureau of Reclamation.

The 1946 report stated:

> There is not enough water available in the Colorado River system for full expansion of existing and authorized projects and for all potential projects outlined in the report, including the new possibilities for exporting water to adjacent watersheds. The need for a determination of the rights of the respective States to deplete the flow of the Colorado River consistent with the Colorado River compact and its associated documents, therefore, is most pressing.

The same report recommended:

> That the States of the Colorado River Basin determine their respective rights to deplete the flow of the Colorado River consistent with the Colorado River compact.

After reviewing the comments of the States and of various Federal agencies on the 1946 report, the Secretary of the Interior on July 19, 1947, submitted his interim report on the status of investigations of potential water-resource development in the Colorado River Basin in Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming. The Secretary in his letter transmitted to the Congress, dated July 24, 1947, explained:

> As stated in the interim report, existing circumstances tend to preclude the formulation of a comprehensive plan of development of the water resources of the Colorado River Basin at this time. Accordingly, although I cannot now recommend authorization of any project, I am transmitting the report to you in order that the Congress may be apprised of this comprehensive inventory of potential water-resource development in the Colorado River Basin and of the present situation regarding water rights in that basin.

The conclusions of the 1947 report on the Colorado River contained this language:

> That a comprehensive plan of development for the Colorado River cannot be formulated at this time.
>
> That further development of the resources of the Colorado River Basin, particularly large-scale development, is seriously handicapped, if not barred, by lack of determination of the rights of individual States to utilize the waters of the Colorado River system. The water supplies for projects to accomplish such development might be assured as a result of compact among the States of the separate basins, appropriated court or congressional action, or otherwise.
>
> That the States of the upper Colorado River Basin and States of the lower Colorado River Basin should be encouraged to proceed expeditiously to determine their respective rights to the waters of the Colorado River consistent with the Colorado River compact.

You will observe, according to that report, that, although plans for comprehensive development are proceeding in other basins in the West, the States of the Colorado River Basin—as I shall now refer particularly to the upper basin—are unable to proceed with any large-scale development in the absence of a compact; and that the Secretary recommended to these States to attempt to consumate a compact.

These five upper basin States accepted that suggestion and, as I have indicated, proceeded almost immediately to negotiate a compact. I wish one could be negotiated in the lower basin, but we shall not touch on that.

So we are here today submitting to you a basic document which is necessary if these five upper basin States are to proceed to develop their water resources.

At this point I wish to suggest to you, contrary to a general view which has been expressed in Congress concerning this compact, that we did not proceed with these negotiations in accordance with any previous statute or authorization by Congress to make a compact. We proceeded under the right of quasi-sovereign States as provided by the Constitution to make a compact, it being understood, of course, that such compact is not binding and effective on the signatories thereto until it had been ratified by their State legislatures, and until Congress had granted its consent to such a compact. It has long been the holding that previous act by Congress is not necessary for States to proceed with the negotiation of a compact. If a compact is made, and later it is consented to by the Congress, such consent implies previous authority to proceed with negotiations. It is under that principle that we proceeded. We did not proceed under any section of the Boulder Canyon Project Act, nor under any provision of the Colorado River compact.

Chairman MURDOCK. I want to thank you for correcting my statement a while ago on that, Judge Stone. I was not quite clear in regard to this first step.

Mr. STONE. That same statement was made over on the Senate side, and I have here a document which I shall not go into, but it is a brief on that subject, and I believe Mr. Breitenstein found 24 compacts where the same procedure was followed as was followed in this case.

Mr. MILLER. And do I understand, Judge Stone, that the upper valley compact involves the area above Lee Ferry, not below?

Mr. STONE. Yes; and I am going to explain that now.

Mr. D'EWART. Could I ask a question on the point Judge Stone just brought out?

Chairman MURDOCK. Yes, sir.

Mr. D'EWART. As you know, I served 4 years on the commission in my State, and I remember the very point you are bringing out was discussed, but as I remember, in order to have a representative of the Federal Government sign the compact, it was necessary for previous authorization, was it not?

Mr. STONE. I do not believe that follows, Congressman D'Ewart, in this particular case, because the Federal Government had designated, through the appointment by the President, a Federal representative. He participated in these negotiations, and upon the signing of the compact approved it, and it was our judgment at that time, and is now our belief, that such previous action by Confress is not necessary to obtain the appointment of a Federal representative, if one is actually appointed.

Now, I should like to refer briefly to the Colorado River compact of 1922 in order to clarify the general relationship, not specific, of this compact now before you, and the original Colorado River compact which was signed at Santa Fe, N. Mex., in November 1922.

The upper Colorado River Basin compact must be in conformity with, and may not violate, the Colorado River compact of 1922. That compact was negotiated and signed by the commissioners representing all seven States of the Colorado River Basin.

It was later ratified by the signatory States and approved by the Congress. The Colorado River compact was signed on November 24, 1922, and more than 6 years passed before it was finally approved by the Congress on December 21, 1928.

The Colorado River compact of 1922 accomplishes these things. I do not mean that this listing is all-inclusive, but it includes these matters which I now mention. They are important to consider in connection with the compact which is now before you.

The compact divides the Colorado River Basin into an upper and lower basin. The dividing point is at Lee Ferry, which is on the river approximately 30 miles (river distance) below the Utah-Arizona boundary line, and 1 mile below the mouth of the Paria River. Colorado and Wyoming are entirely within the upper basin. California and Nevada are entirely within the lower basin. Arizona, Utah, and New Mexico include territories within each of the two basins.

The Colorado River compact of 1922 makes no apportionment of water among the seven States of the Colorado River Basin, but it divides the beneficial consumptive use of water between the upper and lower basins. The beneficial consumptive use of 7,500,000 acre-feet annually is apportioned to the upper basin.

The compact creates two classes of Colorado River Basin States, namely, States of the lower division and States of the upper division. The States of the lower division are Arizona, California, Nevada, and the States of the upper division are Colorado, New Mexico, Utah, and Wyoming.

You will note that there is little distinction between States of the upper basin and States of the upper division. Arizona is a State of the upper basin, but is not a State of the upper division. Apparently the principal purpose of providing for States of the upper division was to include appropriate provisions in the compact for making deliveries of water out of the upper States, the four States of the upper division, for use in the lower division.

The compact provides that the States of the upper division, and I quote:

> * * * will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact.

You will observe from what I have said that under the Colorado River compact the upper five States, that is, States of the upper basin, are apportioned in perpetuity the beneficial consumptive use of 7,500,000 acre-feet of water annually. The four States, not counting Arizona, are also obligated under the compact to make deliveries of water at Lee Ferry in accordance with the quoted provision which I have just read to you, and that that delivery of water shall aggregate 75,000,000 acre-feet for any period of 10 consecutive years, reckoned in continuing progressive series, or you could put it this way, deliver on the average 7,500,000 acre-feet a year.

It will be noted that this obligation to deliver water, on the part of the States of the upper division, constitute a joint and several obligation of the States of the upper division.

Now, having explained those particular provisions of the original Colorado River compact, it immediately indicates the principal job that these five States had in negotiating an upper Colorado River basin compact. I may summarize by saying that it meant:

(1) The apportionment among these five States of the use of the water which was allotted or apportioned to the upper basin by the original Colorado River compact.

(2) That the upper Colorado River basin compact should make appropriate provisions to meet the obligation for the delivery of water, in accordance with the Colorado river compact, at Lee Ferry for use in the lower basin.

(3) It was obvious that it is well enough to divide water, but some appropriate method had to be devised for the measurement of such division or apportionment of the use of water among the States.

(4) It was quite necessary, as in most compacts, to create an administrative commission and define its functions.

Mr. BARRETT. Judge Stone, may I ask you a question, please?

Mr. STONE. Yes.

Mr. BARRETT. I want to get it clear in my own mind the provision made between the four upper division States. As I understand it, article III, the State of Arizona gets 50,000 acre-feet of water per year. And how about the balance?

Mr. STONE. Seven million five hundred thousand.

Mr. BARRETT. How is that, 75,000,000 over a 10-year period?

Mr. STONE. Seven million five hundred thousand each year.

Mr. BARRETT. Seven million five hundred thousand, that is right, and the balance would be 7,450,000 which is divided then according to the percentages set forth?

Mr. STONE. That is correct. May I suggest, Mr. Barrett, Mr. Breitenstein when he appears here will explain those provisions.

Mr. BARRETT. I see.

Mr. STONE. I shall not go into those at this time.

As I stated in the interest of time I am covering it only generally, but that will be explained by Mr. Breitenstein when he appears here as a witness.

Before I conclude my statement there is just one other matter which I wish to cover.

Having explained to you the Colorado River compact, and the fact that these five States which negotiated the Upper Colorado River Basin compact are signatory to that compact, I wish briefly to point out the provisions of the upper basin compact relative to making this compact, the one now before you, subject to the provisions of the original document.

The upper Colorado River Basin compact clearly and expressly recognizes the paramountcy of the Colorado River compact. Attention is directed to the following provisions of the upper basin compact. I shall not specifically refer to all of them, but to some of the most prominent ones. In doing so I suggest to you that this recent compact is made subject to the original compact in twelve different places in the document now before you.

The preamble of the upper Colorado River Basin compact recites that the signatory States:

> have agreed, subject to the provisions of the Colorado River compact, to determine the rights and obligations of each signatory State respecting the uses and deliveries of the water of the upper basin of the Colorado River, * * *

Article I expresses in section (a) the major purposes of the upper basin compact, among which are the equitable division of the use of the waters of the Colorado River system, "the use of which was apportioned in perpetuity to the upper basin by the Colorado River compact," and the establishment of the obligations of each State of the upper division "with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River compact."

Article I, section (b) reads thus—

> It is recognized that the Colorado River compact is in full force and effect and all of the provisions hereof are subject thereto.

Article III, section (a), the one just referred to by Congressman Barrett, which is the apportionment article, states that "subject to the provisions and limitations contained in the Colorado River compact and this compact", there is made an apportionment to the signatory States.

Clause (2) of this same Article III (a) makes the apportionment to the signatory States of the consumptive use per annum—

> apportioned in perpetuity to and available for use each year by the upper basin under the Colorado River compart * * *.

Article IV, section (a), provides:

> The extent and times of curtailment shall be such as to assure full compliance under the Colorado River compact * * *.

That article which deals with curtailment of use of water in upper basin, assures strict compliance with the obligations of the upper States to make deliveries at Lee Ferry in accordance with the provisions of the Colorado River compact.

Gentlemen, that concludes my statement, unless there are questions.

The next witness on behalf of the upper basin compact sponsors will be Mr. Tipton, who will deal primarily with technical phases of certain provisions of the upper Colorado River basin compact.

Chairman MURDOCK. We thank you, Judge Stone.

The House is in session and I think we ought not to continue very long.

Had you a question, Mr. White?

Mr. WHITE. Mr. Chairman, may I address the Chair?

Chairman MURDOCK. Yes.

Mr. WHITE. It has now reached the hour of 5 minutes after 12. The witness just concluded his main statement. Will members of the committee have an opportunity to interrogate the witness?

Chairman MURDOCK. That was the intention.

Will you be here tomorrow, Judge Stone?

Mr. STONE. I will be present, and I will attempt to answer any questions you have, Congressman White.

Mr. WHITE. I have some pertinent questions I am interested in, and I make my apologies to the committee. I had to attend other committee meetings and could not be present all the time.

Mr. STONE. I might suggest this, Mr. Chairman, I anticipate that some questions which may be directed to me may be answered quite specifically by later witnesses, because I have made only a general statement.

Mr. WHITE. As a matter of fact, you have been long connected with the allocation and use of the waters of the Colorado River; is that a matter of fact?

Mr. STONE. I have represented the Colorado for about 12 years.

Mr. WHITE. You have been before this committee on other legislation dealing with the use and utilization of water of the Colorado River. You are very familiar with the subject, is that not a fact?

Mr. STONE. It is a complicated subject, and I would not pretend to know all about it.

Mr. WHITE. Is it the request of the Chair to continue the meeting or to adjourn?

Chairman MURDOCK. I think we had better adjourn, because there are certain matters that Members will want to attend to on the floor. We had better adjourn and call Judge Stone before us the first thing tomorrow morning at 10 o'clock. We will resume the questioning then.

We will adjourn until 10 tomorrow.

(Whereupon, at 12:05 p. m., the subcommittee recessed.)

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THE UPPER COLORADO RIVER BASIN COMPACT

TUESDAY, MARCH 15, 1949

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION,
COMMITTEE ON PUBLIC LANDS,
Washington, D. C.

The subcommittee met at 10 a. m., Hon. John R. Murdock presiding.

Present: Messrs, Murdock, Engle, Morris, Bentsen, White, Baring, Mrs. Bosone, Messrs. Marshall, Aspinall, Miles, Welch, Crawford, Lemke, Barrett, D'Ewart.

Mr. MURDOCK. The committee will come to order, please.

We will take up for further consideration, H. R. 2325.

In view of the fact the House is meeting at 11 today, our hearing will be cut a little short. However, I have just been informed that the Private Calendar is the first order of business. I think under the circumstances we might continue our hearing a little after 11.

Those members who have bills on the Private Calendar, of course, will want to slip away about 11 or soon thereafter.

Judge Stone was our witness at the time of adjournment. I think it well to suggest to the committee, if it meets with your approval, that while you have questions to ask, I have some in my own system, I think it would be well to defer questioning until we have heard the witnesses. There will be a number of witnesses, and no doubt, since they are covering the ground pretty thoroughly, they will have anticipated many of these questions and will conserve time by answering them before we ask them.

Mr. LEMKE. Mr. Chairman, I might also suggest that if you ask them, you ask them all at one time. The one who is familiar with the question can answer it. That will save time.

Mr. MURDOCK. That will save time, too. Besides Judge Stone, we have others that I would like to hear from this morning if time permits. We have Mr. Tipton from the State of Colorado, consulting engineer; Mr. Breitenstein, also of the State of Colorado; we have Judge Fred Wilson from New Mexico, and we have others. I see former Reclamation Commissioner Bashore, and several others whom we hope to hear.

Judge Stone, will you proceed with your statement?

Mr. STONE. Mr. Chairman, I concluded my statement. The next witness appearing in behalf of the compact is Royce J. Tipton, consulting engineer of the Colorado Water Conservation Board, and who is a member of the engineering advisory committee during the compact negotiations.

We would suggest that he be called as the next witness.

Mr. MURDOCK. Thank you, Judge.

STATEMENT OF ROYCE J. TIPTON, CONSULTING ENGINEER, COLORADO WATER CONSERVATION BOARD

Mr. TIPTON. Mr. Chairman, members of the committee, my name is R. J. Tipton, consulting engineer from Denver, Colo. I am appearing in behalf of the State of Colorado in support of the consent by Congress of the Upper Colorado Basin Compact. I am appearing in the capacity of consulting engineer for the Colorado Water Conservation Board.

I was engineering adviser to the Colorado commissioner during the negotiations of the compact, and was a member of the engineering advisory committee to the compact commission.

In my presentation I shall discuss certain articles of the compact which are technical in nature from an engineering standpoint. Those articles are III, IV, V, and VI.

In discussing the articles, I believe it well to have the article appear in the record preceding my discussion of each article, but to conserve the time of the committee, if it is agreeable with the chairman and the committee, I will merely offer for the record each article as I begin to discuss it.

Mr. MURDOCK. It will be included in the record preceding your statement.

Mr. TIPTON. I believe there is before each member of the committee the compact so the committee members can follow my discussion.

I shall first discuss article III and offer for the record article III, which appears on page 28 of the pamphlet which has been distributed.

(Article III referred to is as follows:)

ARTICLE III

(a) Subject to the provisions and limitations contained in the Colorado River compact and in this compact, there is hereby apportioned from the upper Colorado River system in perpetuity to the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, respectively, the consumptive use of water as follows:

(1) To the State of Arizona the consumptive use of 50,000 acre-feet of water per annum.

(2) To the States of Colorado, New Mexico, Utah, and Wyoming, respectively, the consumptive use per annum of the quantities resulting from the application of the following percentages to the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by the upper basin under the Colorado River compact and remaining after the deduction of the use, not to exceed 50,000 acre-feet per annum, made in the State of Arizona.

State of Colorado, 51.75 percent; State of New Mexico, 11.25 percent; State of Utah, 23.00 percent; State of Wyoming, 14.00 percent.

(b) The apportionment made to the respective States by paragraph (a) of this article is based upon, and shall be applied in conformity with, the following principles and each of them:

(1) The apportionment is of any and all man-made depletions;

(2) Beneficial use is the basis, the measure and the limit of the right to use;

(3) No State shall exceed its apportioned use in any water year when the effect of such excess use, as determined by the commission, is to deprive another signatory State of its apportioned use during that water year; provided, that this subparagraph (b) (3) shall not be construed as:

(i) Altering the apportionment of use, or obligations to make deliveries as provided in article XI, XII, or XIV of this compact:

(ii) Purporting to apportion among the signatory States such uses of water as the upper basin may be entitled to under paragraphs (f) and (g) of article III of the Colorado River compact; or

(iii) Purporting to apportion among the signatory State in excess of its apportionment.

(4) The apportionment to each State includes all water necessary for the supply of any rights which now exist.

(c) No apportionment is hereby made, or intended to be made, of such uses of water as the upper basin may be entitled to under paragraphs (f) and (g) of article III of the Colorado River compact.

(d) The apportionment made by this article shall not be taken as any basis for the allocation among the signatory States of any benefits resulting from the generation of power.

Mr. TIPTON. Article III is the apportionment article. Article III (a) of the Colorado River compact apportions to the upper basin, 75,000,000 acre-feet of beneficial consumptive use annually in perpetuity. There are, however, some restrictions.

Article III (d) of the Colorado River compact imposes an obligation on the upper basin to the effect that it will not deplete the flow of the river at Lee Ferry below a 10-year progressive average of 75 million acre-feet. There has been negotiated and made effective a treaty with Mexico, and under article III (c) of the Colorado River compact. The first call on water to take care of the Mexican burden is on surplus water and that is water over and above the 16,000,000 acre-feet which was apportioned by articles III and III (b) of the Colorado River compact. The upper basin has an obligation to make up one-half of any deficiency in the water for delivery to Mexico.

Since the 7,500,000 acre-feet may be reduced at times, the negotiators of the upper Colorado River compact saw fit to make the apportionment among the States of the upper basin in terms of percentages rather than in terms of specific acre-feet, the only exception being the apportionment to Arizona, which is a very small apportionment.

Article III of the upper Colorado River compact, therefore, apportions up to 50,000 acre-feet to Arizona; then of the remainder which was apportioned in perpetuity to the upper basin by the Colorado River compact, there is apportioned to the State of Colorado 51.75 percent, to the State of New Mexico, 11.25 percent, to the State of Utah, 23, to the State of Wyoming, 14 percent.

The commissioners negotiating the compact concluded that the original Colorado River compact apportioned water to the upper basin in terms of virgin flow at Lee Ferry. So the apportionment that was made by the commissioners of the upper basin is in terms of man-made depletion at Lee Ferry; man-made depletion of the virgin flow at Lee Ferry, Lee Ferry being the division point between the upper and the lower basins.

Article III of the upper Colorado River compact makes it plain that no State may use or utilize more than its apportioned share of the water to the detriment of any other State, and provides further that this is not to be construed as altering the obligations to make deliveries at Lee Ferry provided for in articles XI, XII, XIII and XIV of the upper basin compact.

It also makes it very plain that article III does not apportion any of the surplus water that is defined in the original Colorado River compact under article III (f) of that compact, and does not affect in any way the procedure set up by the original compact for apportioning that surplus water after 1963. Article III of the upper Colorado River compact, under subparagraph 3 and subparagraph (iii), indicates also that the subparagraph 3 is not supposed to be construed as countenancing the average use by any signatory State in excess of the opportionment to that State.

Mr. BARRETT. What do you mean by that?

Mr. TIPTON. Subparagraph (3) says:

No State shall exceed its apportioned use in any water year when the effect of such excess use, as determined by the commission, is to deprive another signatory State of its apportioned use during that water year; provided, that this subparagraph (b) (3) shall not be construed as—

and then this subparagraph that I just read is a part of that.

In other words, it is not to be taken that there is implied in the subparagraph (3) any suggestion that any of the upper basin States may use more than its apportioned share on an average. Some years it may exceed its apportioned share, but over a period of years on an average, excess use is not necessarily to be countenanced.

Mr. BARRETT. The upper States may not use more than their apportioned allotment in any given year if it interferes with any of the other States.

Mr. TIPTON. That is right. It is conceivable in some years that States may use more than their apportioned share if it does not affect another State in the upper basin, but over a long period of years the average use should not exceed the apportioned share.

Article III also makes it plain that there is included in the apportionment the water required to take care of the present rights which are extant in each of the States of the upper basin. Article III also makes it plain that there is no apportionment made of any hydroelectric energy which may be generated by works in the upper basin.

Mr. BARRETT. How is that going to be settled?

Mr. TIPTON. I do not know, sir. I am testifying only with respect to the upper Colorado River compact.

Mr. BARRETT. Is it a matter that can be settled by another compact, or will the Bureau of Reclamation have the power to do that?

Mr. TIPTON. I do not know, sir. I think it is entirely in the hands of the States and I do not think it will require a compact to do it. I think it will be a matter of evolution. It will come about step by step. I think that one phase of the problem may at some time be thrown in the hands of the Congress here. This committee may have something to do with it. It may have a direct bearing upon how the situation may be taken care of, not division of the power, but the manner in which revenues derived from the power might be used.

Mr. MURDOCK. While we had agreed at the beginning that we would not ask questions, I would like to ask just one myself. No division was made concerning power in the original compact?

Mr. TIPTON. No; that is correct, sir.

Mr. MURDOCK. So, Congressman Barrett, this goes no further than the original compact. It deals only with water.

Mr. TIPTON. I want to make it plain again that I am testifying only with respect to the compact of the upper Colorado River Basin States and it specifically states the apportionment made by this article III shall not be taken as any basis for the allocation among the signatory States of any benefits resulting from the generation of power.

Mr. BARRETT. Mr. Chairman, I came in after the understanding was arrived at that there would be no questions. I do not care to ask any more questions unless the witness consents to it.

Mr. MURDOCK. These witnesses will be here, with the possible exception of Mr. Tipton. Will you be here for the next few days for questioning?

Mr. TIPTON. I will be here for at least 2 days; yes, sir.

Mr. WHITE. Mr. Chairman——

Mr. MURDOCK. Mr. White.

Mr. WHITE. I think the explanation could be better if we could ask some pertinent questions concerning the existing situation. I can follow the witness and also the outline of the compact in the material before me, but there are some things that are not clear and I do not think are being clarified by the witness in his presentation.

Mr. MURDOCK. It was only a tentative suggestion that we, in the interest of conserving time, do that.

Mr. WHITE. There is one thing I would like to know. We went through this with the other compact. I would like to know what percentage of the water is involved in this transaction of the Colorado River. There are certain agreements and compacts entered into that disposed of about half the water that is permitted to go down and fill the Boulder Dam Reservoir. There was no use to construct a reservoir unless the upper basin States would let enough water come through to fill it. We are talking now about surplus water.

I would like to know if that big storage at Boulder Dam does not take care of all the surplus water and hold it back so it is distributed from that point on and let it down to Parker Dam so the water there is diverted. Then we have transmountain diversion at Colorado-Big Thompson.

I would like to know something about the water that crosses the mountain and comes over this side. I will refrain until the witness completes his statement. It is not very clear.

Mr. TIPTON. I will be glad to answer any question, including that of Congressman White, and any question which is propounded to me which properly should be answered by another witness, I will frankly state should be answered accordingly. If Congressman White's statement is in the form of a question, I will be glad to answer it.

Mr. WHITE. I have to leave here in about 5 minutes to go to a very important meeting.

Mr. TIPTON. I shall construe your statement as a question and proceed to answer it.

That which the upper Colorado River compact deals with is only that which was apportioned to the upper Colorado River Basin by the original compact. It deals with no other water whatsoever. Now, in 1922——

Mr. WHITE. What percentage of the water does this deal with?

Mr. TIPTON. In 1922, there was apportioned 7,500,000 acre-feet for beneficial consumptive use by the upper basin. That is per annum. That is what we are dealing with, except——

Mr. WHITE. How many feet?

Mr. TIPTON. 7,500,000. That is what we are dealing with, except to the extent that that might be modified by some of the restrictive provisions of the compact. Article III (d) which imposes an obligation on the upper basin to deliver——

Mr. WHITE. The measuring point for that water is at Lee Ferry. What portion of 7,500,000 feet is the flow of the Colorado River through those States at Lee Ferry?

Mr. TIPTON. It depends on what periods of years are chosen.

Mr. WHITE. I thought we took an average over 10 years.

Mr. TIPTON. Nature causes the river to fluctuate between rather wide limits. For the period 1914–45, the virgin flow at Lee Ferry is estimated slightly under 16,000,000 acre-feet, so this is less than half of the total flow at Lee Ferry. I am only speaking of the flow at Lee Ferry, not of the total water supply in the basin.

Mr. WHITE. In the case of the diversion upstream and there was a return flow, where does that come in?

Mr. TIPTON. The right of the upper basin is to burn up 7,500,000 acre-feet of the water at Lee Ferry, whether it is burned up on the land or whether it is taken out of the basin—the effect on Lee Ferry flow is the same. The upper basin was given the right in perpetuity to burn up 7,500,000 acre-feet of the virgin flow at Lee Ferry. The manner in which the upper basin burns that water up is only of concern to the upper basin.

Mr. WHITE. In speaking of burning up, which, I assume, is to evaporate and other means of absorbing the water, it is impossible to burn up a full flow of diverted water.

Is there going to be a very large percentage of returned load?

Mr. TIPTON. Yes, Congressman White, in order to permit the upper basin to consume, or using my term to burn up, the 7,500,000 acre-feet, the actual diversion to the land will be several times that amount.

Mr. WHITE. In other words, they get 7,500,000 acre-feet, but in figuring on return flow, they can divert twice as much of that water if the water comes back?

Mr. TIPTON. That is correct.

Mr. WHITE. What happens to this arrangement made to take part of the Colorado waters to the other side of the Continental Divide and divert it to Colorado-Big Thompson? Does that come in on this compact?

Mr. TIPTON. Yes, sir: that is accounted for as the extent to which that reduces the flow at Lee Ferry. To that extent is that charged against the upper basin; to the extent that that depletes the flow at Lee Ferry, to that extent is that charged against Colorado's apportionment of 51.75 percent of the water apportioned to the upper basin by the Colorado River compact.

Mr. WHITE. There can be no return flow from that?

Mr. TIPTON. No, sir. That is a complete removal of the water in the same fashion as there is a complete removal of water from the basin by the transpiration of water by plants in the basin and by reservoir evaporation.

Mr. WHITE. We are dealing here with about 50 percent of the water that flows through the upper basin States. Half of it is pledged to go downstream to fill the Boulder Dam Reservoir. The other half can be diverted and disposed of by the upper-basin States.

Mr. TIPTON. It is slightly less than half, Congressman, and I would like to change your designation that it is pledged to go down and fill Boulder Dam. It is pledged to pass Lee Ferry. What the lower basin does with it is no concern of the upper basin.

Mr. WHITE. We had a $140,000,000 investment in Boulder Dam to create a reservoir. It would be futile to build that dam if the upper-basin States were not pledged in some way to let the water come through to fill the dam. Is that not true?

Mr. TIPTON. That is correct, sir. The upper basin has an obligation under a compact not to deplete the flow of the river at Lee Ferry

below 75,000,000 acre-feet in progressive 10-year series, and this upper-basin compact, as I will point out later, recognizes that obligation and the upper basin intends to comply with that obligation. It is not only bound by the original compact, but it binds itself in this compact to comply with that obligation.

Mr. WHITE. I thank the witness, Mr. Chairman.

Mr. MURDOCK. Proceed, Mr. Tipton.

Mr. TIPTON. I shall next discuss article IV, and I offer at this point article IV of the upper Colorado River compact. It appears on page 29 of the pamphlet that is before you, which I shall now identify: It is a report and submission of the upper Colorado River compact to the Governor and General Assembly of the State of Colorado, by the commissioner for Colorado, dated December 1948.

(Article IV referred to is as follows:)

ARTICLE IV

In the event curtailment of use of water by the States of the upper division at any time shall become necessary in order that the flow at Lee Ferry shall not be depleted below that required by article III of the Colorado River compact, the extent of curtailment by each State of the consumptive use of water apportioned to it by article III of this compact shall be in such quantities and at such times as shall be determined by the commission upon the application of the following principles:

(*a*) The extent and times of curtailment shall be such as to assure full compliance with article III of the Colorado River compact;

(*b*) If any State or States of the upper division, in the 10 years immediately preceding the water year in which curtailment is necessary, shall have consumptively used more water than it was or they were, as the case may be, entitled to use under the apportionment made by article III of this compact, such State or States shall be required to supply at Lee Ferry a quantity of water equal to its, or the aggregate of their, overdraft or the proportionate part of such overdraft, as may be necessary to assure compliance with article III of the Colorado River compact, before demand is made on any other State of the upper division;

(*c*) Except as provided in subparagraph (*b*) of this article, the extent of curtailment by each State of the upper division of the consumptive use of water apportioned to it by article III of this compact shall be such as to result in the delivery at Lee Ferry of a quantity of water which bears the same relation to the total required curtailment of use by the States of the upper division as the consumptive use of upper Colorado River system water which was made by each such State during the water year immediately preceding the year in which the curtailment becomes necessary bears to the total consumptive use of such water in the States of the upper division during the same water year; provided, that in determining such relation, the uses of water under rights perfected prior to November 24, 1922, shall be excluded.

Mr. TIPTON. This goes to one of the matters which Congressman White was discussing. It is anticipated that there, of necessity, will have to be constructed along the main stream of the Colorado River and some of its main tributaries below the major development in the upper basin, a series of reservoirs of substantial capacity, in order to enable the upper basin to make use of its apportioned water. Those reservoirs will be constructed long before they are needed for that purpose for the generation of hydroelectric energy.

It is anticipated the operation of those reservoirs for the generation of hydroelectric energy will so equate the flow of the stream that the upper basin obligation to deliver at Lee Ferry will be taken care of. In other words, the use of those reservoirs to enable the upper basin to take care of its obligation and the use of those reservoirs for the generation of hydroelectric energy is completely compatible.

The maximum amount of firm energy is obtained from a stream when that stream is equated. The upper basin obligation is well taken care of if the stream is equated, so that we hope that there will be no occasion to resort to article IV, which provides the manner in which the States of the upper basin shall curtail uses in the event that that becomes necessary in any year in order that the upper basin be enabled to take care of its obligation at Lee Ferry.

This is a full recognition of the obligation, Congressman White. In the event there shall be curtailment of use, that is, use on the land—the actual ceasing of the use of the water or the closing down of transmountain diversions—it will be up to the individual States as to the particular uses that will be curtailed to take care of the obligation, but if that should come about, article IV provides the manner in which it shall be done and defines the obligation of the respective States.

It provides, first, that if there has been an overuse by any States of water—in other words, the use of water in excess of the apportionment to any State or States for the preceding 10-year period—then that State or those States shall curtail uses in an amount sufficient to deliver at Lee Ferry the amount of the overuse. If that delivery at Lee Ferry is not sufficient to make up the deficiency, then the balance of the deficiency shall be taken care of by curtailment of use in the States in proportion to the amount of water being consumptively used in those States.

For example, if one State is consumptively using 10 percent of the total water being consumptively used at the time that curtailment is necessary, the portion of the remaining deficiency in flow at Lee Ferry to be taken care of by that State will be 10 percent.

Mr. WHITE. Would that be in the nature of a readjustment and not in the nature of paying back water already used? It will just readjust the amount?

Mr. TIPTON. First, if there is an overuse by any State, that State must deliver at Lee Ferry the amount of the overuse first. Then if there is any deficiency remaining, that deficiency is made up by the States in proportion to their consumptive uses being made at the time.

Mr. WHITE. In other words, if one takes a cut, all have to take a proportional cut?

Mr. TIPTON. That is correct, sir, in proportion to the amount they are using, not in proportion to their apportionment, but in proportion to the amount they are actually using.

There is a modification of that. Before determining the relation between the amount of water being used by each State and the total being used in the upper basin, there is deducted the amount of water which was being used by the States and by the upper basin as of the date November 24, 1922. That is the time the Colorado River Compact was signed, and we conceive the obligation to make up any deficiency rests upon rights and uses that came into existence after the Colorado River Compact was negotiated.

That completes my explanation of article IV, Congressman. If there are any questions, I will be glad to answer them.

Mr. WHITE. As to consumptive use, you do not make any provision for return flow. It is water turned out and does not come back.

Mr. TIPTON. I am glad you asked that, Congressman, because there is an important point there. Let us assume a given State must curtail

its uses in a certain amount to make up its part of the deficiency at Lee Ferry. That curtailment, whatever it might be, must be in an amount sufficient to deliver that water at Lee Ferry. In other words, let us assume a hypothetical transmountain diversion.

Let us assume that a State, by its own laws and regulations, has determined the transmountain diversion to be junior to all other uses of Colorado River water in that State and that, in event of curtailment, that transmountain diversion must be the first to curtail its uses. Assume that its share of the deficiency at Lee Ferry is 100,000 acre-feet. The curtailment of diversion by the transmountain diversion must be in excess of 100,000 acre-feet. It must be 100,000 acre-feet plus the amount of water required to carry that 100,000 acre-feet to Lee Ferry.

In other words, if only the 100,000 acre-feet way up at the Continental Divide, were left in the river, all of that water would not get to Lee Ferry. Some of it would be lost in transit.

Mr. WHITE. You call that line loss in electricity?

Mr. TIPTON. That is exactly the same as line loss. So the curtailment at the point of use must be in excess of the deficiency at Lee Ferry in the amount of the channel loss.

Mr. WHITE. When you make your measurement at Lee Ferry, that is, where you want the water delivered, you do not pay attention to what is done upstream.

Mr. TIPTON. That is correct, sir. The measurement is at Lee Ferry.

Mr. MURDOCK. We will now proceed with the questioning. I would like to make just this comment, though, before asking members to propound their questions. We have before us an eminent engineer, and this is largely an engineering question, as well as legal, so that we are mighty anxious to get a full and complete record here. If it seems to some that we are taking more time than we ought to take, I hope you will think again on it.

This record will be carefully thumbed and studied for the next 50 or 100 years. It was true in regard to the other compact and all the laws pertaining thereto, so that Congressman White is exactly right. We do need to get down here in black and white for future study the minute details, both engineering and legal, of this matter.

Mr. Morris, have you a question?

Mr. MORRIS. I believe I do not have a question. I do have this observation to make: While I agree with you, Mr. Chairman, and I assume that is the opinion of most, if not all of the committee, that we should go into all matters thoroughly, yet I feel that on this particular subject matter that if these States which have entered into this compact want it, certainly we ought to let them have it, unless, of course, their agreement by compact should have an adverse effect, or bring about an adverse result on some other State or States.

In other words, the purpose of this provision in the Constitution of the United States was to permit States to contract, and unless their contracting adversely affects somebody else, why should we in any way try to interfere with the matter? We should not go into it and try to minutely determine whether or not some mistakes were made by these States. They have a right to make their own mistakes if they want to. We have no right to again say what they shall do among themselves, in my judgment, unless their doing it does, in fact, adversely affect others.

So I think we should examine it almost entirely, maybe not entirely, but almost entirely from the standpoint of whether or not the compact is going to adversely affect others, and not from the standpoint of whether or not it was good for these States to enter into it. And the record does show that the legislators almost unanimously agreed—I believe there were two of the whole group who failed to agree—so it must be almost the unanimous wish of the States and their people to enter into this compact.

I think that we should not take a large portion of our time and of Congress in going into the proposition and trying to determine whether or not some mistakes were made in this compact. Our main thought should be to determine whether or not another State or States are adversely affected by the compact.

Mr. WHITE. Will the gentleman from Oklahoma yield?

Mr. MORRIS. Yes, sir.

Mr. WHITE. I would like to remind the gentleman from Oklahoma that we are dealing here with an issue that affects not only the upper basin States, but the lower basin States, and goes into an international issue with the great Republic of Mexico south. I would like to further remind the gentleman from Oklahoma that this committee did take on and consider and authorize a compact between Colorado and other States and approved that compact, and the Congress approved it, dealing with the disposition of the waters of the Strawberry River, I believe it was.

The States agreed that that river was not navigable, which took it out from under the jurisdiction of the Federal Government, and while we passed and the States agreed to it, it met with a veto at the White House. We have to be a little careful with what we are doing here because we are dealing with the lower and upper basin States, Mexico; we are dealing with one of the most controversial streams in America, the Colorado River, and we are dealing with probably the only stream in America where the water is taken through a mountain and diverted to a transmountain diversion. We are dealing with a big issue.

I will state to you gentlemen in this committee: use 6, more than 6, weeks to settle this issue in rewriting the contract under which the Boulder Dam and development waters were constructed. It took that much. There was a little impatience in the committee at that time. They wanted to shut off explanation, and Mr. Roberts from the city of Los Angeles had the details at his fingertips and we did not shut him off. We got the whole story of the reasons and we had a complete record.

Mr. MORRIS. Just this one thought—I do not care to carry on with any long argument——

Mr. WHITE. It is not an argument.

Mr. MORRIS. It is not an argument. I think if Mr. White will listen to me—I think your observations are well taken and I agree. I do not have any objection at all. I do not mean to suggest we should rush through this thing. I think you are absolutely right, but on this one particular point I think it would be wise for us, because we are so busy here and these people are all busy, I think it would be wise for us to confine our investigation, at least the major portion of our investigation, to the question of how this compact will affect

others and not so much how it will affect these States that contracted because they have a right to contract if they want to, in my judgment.

Mr. MURDOCK. Mr. Crawford, do you have any questions?

Mr. CRAWFORD. I will let some of the others question the witness.

Mr. MURDOCK. Mr. Engle?

Mr. ENGLE. I have no questions at this time, but in further indication of the position of California, as stated by me yesterday in an opening statement, I would like at an appropriate point in the record (and not in interruption of the gentleman's testimony, because I think it should come after it), to insert in the record the resolution adopted by the California Legislature on March 14, 1949. I am presenting a copy to the clerk for inclusion at the proper place in the record.

The statement of the California Legislature is in line with and conforms to the statement of general principles which I made yesterday at the beginning of the hearings.

Mr. MURDOCK. Without objection, it will be admitted to the record at an appropriate place.

Mr. Lemke?

Mr. LEMKE. I have no questions. I am satisfied this is satisfying California.

Mr. TIPTON. Mr. Chairman, I have two more articles to discuss. I thought maybe you thought I was through.

Mr. MURDOCK. I thought you were through. Go right ahead.

Mr. D'EWART. I have a question, Mr. Chairman.

Mr. MURDOCK. Mr. D'Ewart.

Mr. D'EWART. I wish you would define "consumptive use." You may have done that before I came in.

Mr. TIPTON. The negotiators of the upper Colorado River compact conceived consumptive use when the term is applied to the apportionment made to the upper basin by the Colorado River compact as a certain amount of the virgin flow at Lee Ferry. In other words, the upper basin negotiators consider that the upper basin under the Colorado River compact has the right by man's activities to deplete the virgin flow at Lee Ferry by 7,500,000 acre-feet per year, subject always to the limitations which I have already described.

There are other places in the upper basin compact where the words "use" and "consumptive use" are used, which are not necessarily synonymous with the term "beneficial consumptive use" as used in the original Colorado River compact. They merely apply to relationships among States of the upper basin.

Mr. D'EWART. As I remember, ordinarily consumptive use is used as the amount of water consumed by the practical growth and does not include return flow.

Mr. TIPTON. I wish to repeat, there is used in the Colorado River compact the words "beneficial consumptive use." The negotiators of the upper Colorado River compact interpreted that to mean that the upper basin had the right to withdraw from the river, or withhold from the river at Lee Ferry, 7,500,000 acre-feet, minus any curtailment that might have to be made to make up Lee Ferry's deliveries, and minus any treaty obligations that might be imposed on the upper basin States from time to time.

Mr. ENGLE. Will the gentleman yield to me?

Mr. D'EWART. Yes.

Mr. ENGLE. You say you made an interpretation of the Colorado River compact.

Mr. TIPTON. Yes.

Mr. ENGLE. You have written this interpretation into your own compact?

Mr. TIPTON. It is not written in.

Mr. ENGLE. We are getting right to the point that I think is the meat of this case: and that is to what extent the upper Colorado River compact is an interpretation or presupposes an interpretation or implies an interpretation, by the signators of that compact of the Colorado River compact. Those States which are not signators of the upper Colorado River compact insist they are not bound by such interpretations. That is the meat of this case. That is why I submitted these questions to Mr. Bashore, to make it perfectly clear that five States in the upper basin did not get together, write a compact based upon an interpretation of the Colorado compact, and agree among themselves that everybody in the Colorado Basin would be bound.

Mr. TIPTON. Mr. Chairman——

Mr. ENGLE. I am stating that as the issue. I have submitted these questions to Mr. Bashore and I assume they will be answered in due time, and when they are answered, I assume that they will answer that very specific question; and I am assuming also that it will be answered in accord with our views on the matter.

The question is whether or not you and I can get together and agree what we decided will bind Mr. Baring, for instance. I am stating that as the real issue in this hearing. It is the matter to which Mr. Morris, of Oklahoma, addressed himself, and I am heartily in concurrence with what he says, because I agree as far as the upper basin States are concerned they have a full and proper right to make any contract they want to with regard to the disposition of the water. They can write an agreement that they will throw dice for the water if they want to, and it would not be any of our business.

The only point is, when we get to the proposition of whether or not the upper Colorado River Basin compact embodies interpretations of the main contract, or implies an interpretation of the main contract binding upon those five States, whether or not by implication such interpretation is to be carried into the main compact itself, binding upon those States which are not signators to the upper Colorado River Basin compact.

That is the issue and that is the one we want to get settled before this bill is voted out.

Mr. TIPTON. Mr. Chairman, Congressman Engle's remarks were largely addressed to me. Some of his questions, of course, are legal.

Mr. MURDOCK. Yes.

Mr. TIPTON. I want, however, to compliment the Congressman on his statement of yesterday and the statement he made just now. I thought they were excellent. I can assure the Congressman that the issue, and what he considers to be the only issue, will be satisfactorily resolved, I think, we think, in the letter which already has been prepared in draft form in answer to the Congressman's questions. That letter will be considered by the upper Colorado River group and I am quite sure that it will resolve the issue to his satisfaction and allay all fears of California that they might be bound by some interpretation of

the Colorado River compact which ultimately might be found to be wrong.

We can assure the Congressman there was no intent on the part of the upper basin to bind any State of the lower basin, and I think when the lawyers come on they will indicate that from a legal standpoint that could not be done, and we will state in a position form that we had no intent of doing it and we are not going to do it.

Mr. MURDOCK. I think the main purpose of your testimony thus far is that this compact is entered into by the five States involved and for their own interest and for no other purpose.

Mr. TIPTON. That is correct, sir. We have no intent of binding in any way whatsoever the lower basin. We do not conceive we could. We do not conceive we could impose our interpretations in any manner whatsoever on the lower basin or any State of the lower basin, but I am making that as a general statement. It will be answered more specifically by attorneys and also more specifically by the answers to Congressman Engle's question, sir.

Mr. MURDOCK. Mr. Welch?

Mr. WELCH. In other words, the upper basin States cannot enter into an agreement which would transcend the main contract?

Mr. TIPTON. That is correct, sir. We could not and we did not want to.

Mr. BARING. Mr. Chairman——

Mr. MURDOCK. Mr. Baring.

Mr. BARING. I have a prepared amendment or suggested section which I think if the witness would say whether or not they were favorable, I think would allay the fear of the lower basin States.

Mr. TIPTON. Mr. Chairman, I think that should come with the next witness.

Mr. MURDOCK. Yes; the next witness, please.

Mr. TIPTON. If the Congressman needs the information, Mr. Breitenstein will go into some of these matters and I think it would probably be more appropriate at that time, because I am discussing only engineering and technical matters.

Mr. MURDOCK. Go right ahead, Mr. Tipton.

Mr. TIPTON. I shall now pass to article V of the upper Colorado River Basin compact, which appears on page 29 of the pamphlet which I identified. I offer that article for the record.

(Article V referred to is as follows:)

ARTICLE V

(*a*) All losses of water occurring from or as the result of the storage of water in reservoirs constructed prior to the signing of this compact shall be charged to the State in which such reservoir or reservoirs are located. Water stored in reservoirs covered by such paragraph (*a*) shall be for the exclusive use of and shall be charged to the State in which the reservoir or reservoirs are located.

(*b*) All losses of water occurring from or as the result of the storage of water in reservoirs constructed after the signing of this compact shall be charged as follows:

(1) If the commission finds that the reservoir is used, in whole or in part, to assist the States of the upper division in meeting their obligations to deliver water at Lee Ferry imposed by article III of the Colorado River compact, the commission shall make findings which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to the reservoir capacity allocated for that purpose. The whole or that proportion, as the case may be, of reservoir losses as found by the commission to be

reasonably and properly chargeable to the reservoir or reservoir capacity utilized to assure deliveries at Lee Ferry shall be charged to the States of the upper division in the proportion which the consumptive use of water in each State of the upper division during the water year in which the charge is made bears to the total consumptive use of water in all States of the upper division during the same water year. Water stored in reservoirs or in reservoir capacity covered by this subparagraph (b) (1) shall be for the common benefit of all of the States of the upper division.

(2) If the commission finds that the reservoir is used, in whole or in part, to supply water for use in a State of the upper division, the commission shall make findings, which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to the reservoir or reservoir capacity utilized to supply water for use and the State in which such water will be used. The whole or that proportion, as the case may be, of reservoir losses as found by the commission to be reasonably and properly chargeable to the State in which such water will be used shall be borne by that State. As determined by the commission, water stored in reservoirs covered by this subparagraph (b) (2) shall be earmarked for and charged to the State in which the water will be used.

(c) In the event the commission finds that a reservoir site is available to both assure deliveries at Lee Ferry and to store water for consumptive use in a State of the upper division, the storage of water for consumptive use shall be given preference. Any reservoir or reservoir capacity hereafter used to assure deliveries at Lee Ferry shall by order of the commission be used to store water for consumptive use in a State provided the commission finds that such storage is reasonably necessary to permit such State to make the use of the water apportioned to it by this compact.

Mr. TIPTON. This article has to do with the charging of reservoir losses. There are three types of reservoirs that may be constructed in the upper basin, three general types; and when I say "types," it is not really type of reservoirs, it is reservoirs for three types of use.

There will be reservoirs and there are reservoirs now that are constructed for use by a single State to make water available for irrigation of lands. Some may be constructed for that purpose and some for the generation of energy for the use of a specific State. There is another type of use that will be made by reservoirs constructed in the upper basin, and that will be to enable the upper basin to fulfill its obligation to deliver water at Lee Ferry, spelled out under article III (d) of the Colorado River compact.

The third type of use may be joint. It is conceivable that a reservoir may be used for the supplying of water to a State for consumptive purposes. A part of the capacity may also be used to generate energy and to assist in taking care of the Lee Ferry burden on the upper basin.

Article V, as I have said, provides for the manner in which the reservoir evaporation shall be charged. I want to make it very plain to this committee that the upper basin recognizes reservoir losses as a part of the apportionment made to the upper basin by the Colorado River compact. In other words, the 7,500,000 acre-feet, or whatever it might be that was apportioned the upper basin includes reservoir losses. We charge to the upper basin those losses as against the apportionment made to the upper basin by the main compact.

With respect to the reservoirs that provide for the first kind of use which I described, that is, the use of water by a single State, there are some of those reservoirs in existence at the present time. The compact provides that the water made available by those reservoirs shall be used by the State that is now using that water. The reservoirs' losses shall be charged to the State making use of those reservoirs.

If a reservoir is used in whole or in part to enable the upper basin to comply with its obligation under article III (d) of the Colorado

River compact, the reservoir losses will be charged to the States in proportion to the consumptive use being made by each State, the relation between the consumptive use being made by each State and the total consumptive use being made in the upper basin.

In other words, that is a prorata charging of the losses in proportion to the magnitude of the consumptive uses being made by the States.

This article of the compact provides that in the future, if reservoirs are constructed for the benefit of a single State or a group of States, the reservoir losses, shall be charged to that State or apportioned to two or more States in proportion to the use being made by the States.

Article V of the compact provides also that in the event a reservoir is available for aiding the upper basin in fulfilling its obligation at Lee Ferry, and also available to a State for making water usable for consumptive purposes, the use of that reservoir for consumptive use purposes shall have preference over the use for making delivery at Lee Ferry.

I am going to read a part of an answer to one of Congressman Engle's questions which as yet has not been cleared by the upper Colorado River commissioners. It can be taken at this time as my testimony with respect to this particular item and not as a specific answer to Congressman Engle's question:

> By "preference" is meant that each upper-basin State has a superior right to use a storage site for consumptive purposes within that State, and it may not be deprived of that right by the desire of other upper-division States to utilize the same site for the impoundment of water which will be released to meet the Lee Ferry obligations of the upper-division States.
>
> The exercise of such a preference right must not violate or have the effect of violating the delivery obligations imposed by article III (d) of the Colorado River compact.

In other words, assume in the distant future that the upper basin has reached the limit of its development. Assume the replacement reservoirs are in operation. Assume that one State decides that it can utilize a part of the capacity of one of those reservoirs to make water available for consumptive purposes. The commission can withdraw that capacity which, at that time, is being used to take care of the Lee Ferry operation, but if it does so, and that capacity is actually needed for that purpose, one of two things must happen, or a combination of them: Additional capacity must be provided to take care of the Lee Ferry obligation, or curtailment must be made, if necessary, as provided for under article IV of the upper Colorado River compact.

That completes my explanation, Mr. Chairman, of article V. I will be glad to answer any questions.

Mr. MURDOCK. Mr. Barrett, have you a question? This, I think, bears right on the matter you had in mind.

Mr. BARRETT. I thought we were going to let the witness conclude his whole statement and then go back. When I first started to interrogate the witness, he told me he wanted to complete his statement. I have some questions I would like to clear up in regard to article III. If you prefer to complete your statement, that is satisfactory to me.

Mr. MURDOCK. Would you prefer to do that?

Mr. TIPTON. I have no preference in the matter except if you are going back to article III, I think it would be better if I completed. I have no objection, so far as I am concerned, to answering any questions on article V at this time, or later.

Mr. MURDOCK. The House is now in session. I understand the Private Calendar is being called. I think we may encroach a little bit on the time of the House. Those members having bills on the Private Calendar may want to go, of course. With the understanding, then, that the witness will proceed, we will reserve our questioning.

Mr. TIPTON. I shall now pass to an explanation of article VI. I shall read the article. [Reading:]

ARTICLE VI. The commission shall determine the quantity of the consumptive use of water, which use is apportioned by article III hereof, for the upper basin and for each State of the upper basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the commission, by unanimous action, shall adopt a different method of determination.

The inflow-outflow involves the determination of the correlation between an index of the inflow to a basin as measured at certain gaging stations, and the outflow from the basin. It is obviously impossible to measure all of the inflow. The gaging stations, which are utilized to measure a part of the inflow, are termed "inflow index stations" because the amount of water measured at those stations is an acceptable index of the inflow to the basin.

In the Colorado River Basin at the present time there are in existence, and have been in existence for a considerable period of years, 26 stations which can be considered as inflow index stations. The administrative body provided for by this compact, if this compact is consented to by Congress and becomes effective, undoubtedly will cause to be established more of such stations. Those stations that are now established and those that will be established in the future are above the major developments that have been made in the basin, or that will be made in the future, with the possible exception of transmountain diversions. Some of the index inflow stations of necessity will be below transmountain diversions.

From the plotting by years of the sum of the index inflows against the outflow, there is developed a correlation curve showing the relationship between inflow and outflow. Any changes thereafter in the basin which occur between the points of inflow and the points of outflow, and which affect the water supply of the basin, can be measured by the change in correlation between the inflow and outflow from that indicated by the correlation curve previously developed.

For example, if over a period of years additional depletions occur between the inflow points and the outflow point, the correlation between the inflow and the outflow will change. With a given inflow to the basin, there will be less outflow. The difference between the new correlation curve and the original correlation curve is the measure of the depletion that has occurred between the inflow points and the outflow points.

Mr. MURDOCK. That sounds rather mathematical to me.

Mr. TIPTON. Yes; it is. I tried to keep the mathematics out.

With respect to the upper Colorado River Basin, as we conceive the procedure, the administrative body will determine the relation between the index inflow, which is the sum of the discharge past a selected station around the rim of the basin, and the historic outflow at Lee Ferry. Even with the 26 stations that now exist, there is a good relationship between the sum of the inflow past those stations and the outflow at Lee Ferry.

Then taking the present man-made depletion of the virgin flow at Lee Ferry, there will be developed the relation between the index inflow and the virgin flow at Lee Ferry. That will be the base curve; that is, base relation. It can be in the form of a table or of a curve. As time goes on and when additional depletions are made in the upper basin, with a given inflow past the selected stations, there will be less outflow than the historic outflow has been and, of course, less than the virgin outflow would have been.

That is then a depletion that is being caused or will have been caused by man in the upper basin of the flow past Lee Ferry.

In addition to the rim stations which I have described above all major development—and incidentally, the recorded discharge past those rim stations before that recorded discharge is utilized—it will be corrected for any man-made depletion above the stations in order that that shall be a true representation of the index of the virgin inflow to the basin.

In addition to those rim stations, there will be another important series of stations, some of which now exist, others of which will be established. Such stations will be located below the major irrigation development in the upper basin, but above the major reservoirs that will be constructed on the main stream for the generation of hydroelectric energy, and to enable the upper basin to fulfill its obligation at Lee Ferry.

As I have said, some of those stations now exist: one at Bluff, Utah, on the San Juan; one at Cisco, Utah, on the Colorado River; one on the Green River at Green River, Utah; and there is one up at what we call the Linwood Station on the Green River. Others will be established near the mouths of Utah tributaries. There will be plenty of time to develop the relationship between the flow past those stations and the outflow at Lee Ferry before the major reservoirs are constructed.

A change in the relationship between the flow past those stations and the flow past Lee Ferry will indicate the amount of depletion that is being caused by those large reservoirs. In other words, there will be measured in that fashion the reservoir evaporation, any loss that might be occasioned by deterioration of channel such as that which now is resulting in some parts of the lower basin, and in that fashion there will be integrated everything that happens on the river to change the relation between the inflow coming into the basin and the outflow from the basin.

That second series of stations which I have described, and the relation between the run-off past those stations, and the run-off at Lee Ferry, will be used by the Commission to determine the reservoir losses which are occasioned by reservoirs constructed for the common good of the upper basin. It will be the losses which are to be charged to the upper basin in proportion to their uses as provided for in article V of the compact.

One point should be made clear: the relationships that are derived to indicate the correlation between inflow and outflow for a particular basin cover the full range of historic inflow and outflow.

Ordinarily, during a period of years, there occur years when the inflow is very low with a correspondingly low outflow. There also are years when the inflow of the basin is very high with accordingly

high outflow. Therefore, it is possible to develop a relationship which will fairly accurately cover the entire range of expected water supply so far as such supply is affected by meteorological factors.

Before the upper basin reaches its full development, and before it possibly can, these large main stream reservoirs must be constructed and placed in operation unless there are cheaper means of providing energy devised, those reservoirs will be constructed for the generation of hydroelectric energy long before they will be needed to aid the upper basin in fulfilling its obligation at Lee Ferry. There is considerable pressure at the present time for the authorization of some of those reservoirs for that purpose.

When that time is reached, the water supply of the river, so far as flow past Lee Ferry is concerned, will be largely equated so that this relationship that I have been discussing will have radically changed from present conditions, where under present conditions with a given inflow to the basin, if small, there is a small outflow; if large, there is a large outflow. But under ultimate conditions, the flow past Lee Ferry will be fairly constant from year to year because of the operation of the large reservoirs for the generation of energy. That also will serve the upper basin in meeting its obligation.

Under such equated conditions, the outflow will be about the same under any circumstances. With low inflow, the outflow will be the same as with high inflow, unless in a series of years the inflow is sufficient to cause spills from the reservoir. At that time, then, the matter will become fairly simple so far as determination of the consumption being made by the upper basin in terms of the withdrawal from Lee Ferry, which will be just the difference between the equated flow at Lee Ferry and the long-time average of the virgin flow at Lee Ferry.

That completes my explanation of article VI. That completes my presentation, Congressmen.

Mr. MURDOCK. I shall be able to follow you better when I read this than when I hear you. It is mathematical.

In a spirit of levity, I recall a wise remark made by another gentleman—I think probably he is in this room—meeting with a great group of westerners, engineers and lawyers, on similar problems he said: "When I hear these engineers speak, I cannot understand them, but I can believe them; but when I hear these lawyers speak, I can understand what they say, but I do not believe them."

Mr. TIPTON. Congressman, there is enough conflict between engineers and lawyers without your high lighting it here before this committee.

Mrs. BOSONE. Mr. Chairman, you surely only mean that in the spirit of levity, I hope.

Mr. MURDOCK. Yes, it is in that spirit.

Mr. TIPTON. May I say for the Congressman's information, there is one compact in force, it has been in force for about 10 years, 10 or 11 years, in which the inflow-outflow method is used. There is another one that will be before the Congress here—before your committee—we hope very shortly. That is the Pecos River Compact, in which the same method is used. It is not too complicated, but I can well understand taking it cold, it appears so.

The big advantage of it is, as I say, everything that happens between points is integrated. A lot of theorizing is eliminated as to what reser-

voir losses are, or how much a specific piece of land is burning up by transpiration.

Mr. MURDOCK. In other words, you can figure out these matters as accurately with pertinent statistics as they can in regard to life insurance or other business functions.

Mr. TIPTON. Yes, sir. This is not so uncertain as life, I do not believe. I think it is a little more precise.

Mr. MURDOCK. We are going to have to adjourn in a few minutes. The House is now dealing with private bills, but will soon go to the matter of finishing the rent-control bill under the 5-minute rule, and as assistant whip for the fourteenth zone I would not want to be guilty of keeping the members from the floor at that moment.

Mr. ENGLE. As assistant whip for the fifteenth zone, I concur with the assistant whip for the fourteenth zone.

Mr. MURDOCK. Mr. Tipton, I understand, will be here later. Thanks to the generosity of Mr. Engle, who had the committee room for tomorrow, and has stepped aside for the continuation of this work, we can use this room, and we will adjourn in a moment to meet at 10 o'clock tomorrow morning in this room.

Mr. Tipton, can you return for questioning?

Mr. TIPTON. Yes, sir; I will be here at 10 o'clock tomorrow morning.

Mr. MURDOCK. May I throw out a question or two, not expecting an answer today, but just to put you on notice?

Mr. TIPTON. Yes, sir.

Mr. MURDOCK. I should think these out a little more carefully, but they are pertinent questions to me: As an engineer, are you convinced that by proper engineering the upper basin will ultimately be able to use its apportionment of 7,500,000 acre-feet of water annually, and, at the same time, be able to deliver according to their contract an average of 7,500,000 acre-feet for the lower basin?

Mr. TIPTON. I can answer that question right now. The first part of your question, I can say I am not sure that the upper basin can utilize 7½ million acre-feet. That depends entirely upon the availability of hold-over reservoirs in the upper basin above the points of use. I hate to make that admission, but we are not sure yet.

In order to enable it to do that, there must be substantial hold-over reservoir capacity above the points of use. Now, if those reservoirs are available, and the upper basin can utilize the 7½ million acre-feet, it in turn also can make its required delivery at Lee Ferry. In any event, it will always make its required delivery at Lee Ferry.

Mr. MURDOCK. But it is going to require storage in order to do that.

Mr. TIPTON. Oh, yes. The very development of the basin itself by the construction of the substantial hold-over reservoirs for the direct use of the upper basin above the points of use, the effect of that will be to equate to some extent the flow of the river at Lee Ferry. That always happens, but in addition to those reservoirs, and the effect they will have upon the flow at Lee Ferry there will be required additional reservoirs with an aggregate substantial capacity below our points of use to complete the balance of the equation that is necessary to take care of our obligations.

Mr. MURDOCK. I had two other questions, but I will just hint at them now and word them better overnight: One is with reference to evaporation losses. Evaporation losses, when you have storage, are inevitable, are they not?

Mr. TIPTON. That is correct.

Mr. MURDOCK. Another: You spoke of hydroelectric power being needed and the possibility of its production before the land can be irrigated.

Mr. TIPTON. That is correct.

Mr. MURDOCK. Is it not necessary, since we regard the use of water for irrigation more important than for the use of power, that we safeguard the future uses against the earlier present uses of water for power production?

Mr. TIPTON. That is our conception in the upper basin, sir.

Mr. MURDOCK. We will stand adjourned until 10 o'clock tomorrow morning.

(The resolution previously referred to is as follows:)

RESOLUTION OF THE CALIFORNIA LEGISLATURE, ADOPTED MARCH 14, 1949

Assembly joint resolution No. 24 relative to the upper Colorado River Basin compact.

Whereas by the Colorado River compact of November 24, 1922, the seven States of the Colorado River Basin agreed to an apportionment of water of the Colorado River system as between the upper basin and the lower basin of the river, as therein defined; and

Whereas, the five States of the upper basin of said river on October 11, 1948, signed an "Upper Colorado River Basin compact" apportioning among themselves the water apportioned to the upper basin by the Colorado River compact, and said upper Colorado River Basin compact has been ratified by the legislatures

Whereas there has been introduced in the Congress of the United States S. 790 by which said upper Colorado River Basin compact would be approved; and

Whereas said Colorado River compact makes provision for the apportionment of water as between the upper basin and the lower basin on the basis of beneficial consumptive use; and

Whereas said upper basin compact contains certain provisions for the determination of quantities of water apportioned among the upper basin States "by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry": Now, therefore, be it

Resolved by the Assembly and Senate of the State of California jointly, That the State of California

(1) Approves the action of the upper basin States in reaching and ratifying a compact for apportionment of Colorado River system water among them and heartily congratulates said States for so doing;

(2) Considers that the formula for determination of consumptive use of water set out in said upper basin compact, as above quoted, is indeterminate and is not in consonance with the relevant terms of the Colorado River compact;

(3) Declares that it has no objection to the adoption by the upper basin States, as among themselves, of any formula they may choose for distribution of water among them;

(4) Declares further that the adoption by the upper basin States and said upper basin compact or its approval by the Congress does not and cannot amend nor affect the meaning of the Colorado River compact, nor affect, nor impair the interests of States of the Colorado River Basin which are not a party to said upper Colorado River Basin compact, and for that reason,

(5) Urges the Congress of the United States to provide in any act whereby the Congress consents to said upper basin compact that nothing in said act nor said compact shall be deemed to amend or affect the meaning of the Colorado River compact nor to affect, nor impair the interests of any State which is not a party to said upper Colorado River Basin compact; and be it further,

Resolved, That the chief clerk of the assembly is hereby directed to transmit copies of this resolution to the President and Vice President of the United States, the Speaker of the House of Representatives, and to the Senators and Representatives from the State of California in the Congress of the United States.

(Whereupon, at 11:30 a. m., the committee adjourned, to reconvene at 10 a. m., Wednesday, March 16, 1949.)

UPPER COLORADO RIVER BASIN COMPACT

WEDNESDAY, MARCH 16, 1949

HOUSE OF REPRESENTATIVES,
COMMITTEE ON PUBLIC LANDS,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

The subcommittee met at 10 a. m., Hon. John R. Murdock presiding.

Present: Messrs. Murdock, Engle, White, Baring, Mrs. Bosone, Messrs. Marshall, O'Neill, Aspinall, Miles, Welch, Lemke, Barrett, D'Ewart, Poulson, and Sanborn.

Mr. MURDOCK. We will come to order, please, gentlemen.

We will take up for further consideration at this time, H. R. 2325. We are, as usual, a little short of time today. The House convenes at 11. Possibly we can infringe on the House time a little bit. We will need to hurry along in order to complete our hearings.

We had yesterday at adjournment, Mr. Tipton, consulting engineer, who was giving us the engineering background of the compact. That is a very essential thing, and while I could not follow him too carefully yesterday orally, I promised myself that I would read the transcript very carefully so that I could understand him. We did not have a chance to ask Mr. Tipton yesterday.

Are you ready now, Mr. Tipton, to proceed with your statement?

Mr. TIPTON. Yes, sir; Mr. Chairman.

FURTHER STATEMENT OF ROYCE J. TIPTON, CONSULTING ENGINEER, COLORADO WATER CONSERVATION BOARD

Mr. TIPTON. I completed my statement and I am prepared to answer any questions, or attempt to.

Mr. MURDOCK. There were numerous questions asked. They were submitted for the record. Are you also prepared to answer those questions?

Mr. TIPTON. Yes, sir. I am prepared to answer those I can, and refer those I cannot answer to someone else.

Mr. MURDOCK. Now, gentlemen of the committee, have you questions to ask? Suppose we begin with Mr. Marshall.

Mr. D'EWART. Mr. Chairman, could I ask a question of you? The question is confined to the first six articles of the compact. Is that the schedule?

Mr. MURDOCK. The first six are the ones Mr. Tipton discussed from the engineering standpoint and I think we ought to limit our questions to him on those.

Mr. Marshall?

Mr. MARSHALL. I think I will yield my time to other members of the committee, Mr. Murdock.

Mr. MURDOCK. For the time being, anyhow?

Mr. MARSHALL. Yes.

Mr. MURDOCK. Mr. D'Ewart, had you some questions?

Mr. D'EWART. Mine had to do with article VII and that is not before us at the present time. Perhaps mine should not be directed to Mr. Tipton. I believe I will hold the questions.

Mr. MURDOCK. Mr. Barrett?

Mr. BARRETT. Mr. Tipton, I would like to have you put in rather simple language the effect of article III on the division of water. I will state the way I understand some of the provisions of it.

The purport of that section is first to recognize the rights of Arizona to the maximum of 50,000 acre-feet of water, to recognize the obligations of the upper basin States to the commitment to Mexico on the treaty with that country, and then to divide the water in the percentages outlined on page 6 between the four upper basin States.

Is that right?

Mr. TIPTON. That is correct, sir. When you mention the obligation of the upper basin, if any, to pass water to take care of Mexican obligations, it is not restricted only to that. There is, of course, another restrictive provision in the Colorado River compact and that is an obligation to make certain deliveries.

Mr. BARRETT. I understand that. We have attempted here to protect the lower basin States by several provisions, showing the intent to carry out all of the provisions of the Colorado River compact. You conclude, therefore, the provisions on page 7 have adequately protected the rights of the lower basin States so that any division made will be in conformity with the original compact?

Mr. TIPTON. That is correct, sir. So far as article III is concerned, it apportions only that which was apportioned to the upper basin by the Colorado River compact and does not apportion one drop of water beyond that amount.

Mr. BARRETT. There is one provision in there that is not entirely clear to me, and that is subdivision (d) on page 7. What I would like to know is, you are taking no action on power, and as I remember your testimony, you stated probably the States will have to agree on that.

What I should like to know now is this: Supposing either a comprehensive plan is submitted to the Congress for the development of the upper basin States, or if an omnibus bill were to be presented to the Congress for one or more projects in each of the upper basin States—would the projects in Wyoming be entitled to a contribution from power developed, we will say, in the State of Colorado?

Mr. TIPTON. I cannot answer that question, Congressman. I am not competent to answer it because there has been no agreement made among the States. If an agreement had been made, it might be subject to some sort of statutory action by Congress. I know what is in the Congressman's mind and it is in the minds of a great many of us who are interested in Colorado River development.

I might indicate some of the thinking that exists. It is not conclusive. It will not answer your question, but it goes as far as I can answer it. It is in the minds of some that there might be what is

called, I believe, a power account set-up. That would have to be done by an act of Congress. Any excess revenues from power generated principally for those reservoirs which are for the common good of the States would go into the power account and could be drawn upon to finance projects within the States. That certainly would take some kind of action of Congress, because there is a major matter of policy involved. There is another school of thought.

Mr. BARRETT. Assuming that Congress did take such action, what I would like to know is would that become conclusive on the Upper Basin States without objection from them, or would they have to take some affirmative action in the nature of an additional compact?

Mr. TIPTON. No. In my opinion, Congressman, it would not require by any means a compact. If that were done, projects would be presented from time to time as the investigations progressed to determine the feasibility, and those projects would be presented to Congress.

Mr. BARRETT. Let me ask you this question, Mr. Tipton. Supposing we should bring in a bill authorizing the Seedskadee project in Wyoming and one in Colorado and one in Utah and one in New Mexico, and we would want to assure that the Seedskadee project in Wyoming should get a contribution from a power project in Colorado.

There has been nothing said in this compact with reference to that matter. What would be the procedure?

Mr. TIPTON. I cannot answer you. I presume it would be the same sort of procedure that has been carried on in the past among the States of the upper basin, and for a time among the States of the entire basin. That procedure was a working out of common problems through the means of a committee. We have such a committee in existence at the present time.

The committee would agree upon procedure and then would come to Congress, bringing their recommended procedures as the combined thoughts of the interested States.

Mr. BARRETT. At any rate, your conclusion is that that will not be prohibited by reason of subsection (d)?

Mr. TIPTON. Not by any means. May I complete my statement, Congressman?

I mentioned the one school of thought. There is another school of thought that possibly the development should be by smaller units where projects are more or less interdependent economically. There is another school of thought, which does not exist in the upper basin, that revenues from energy should not be used to assist irrigation projects. I am merely making that statement to indicate the complexity of the problem and to indicate the difficulties that the States would have been in had they attempted in any fashion whatsoever in this compact to make any apportionment of power. It would have been absolutely impossible and it would have been unwise and they could not have done so with propriety.

Mr. BARRETT. I assume you are correct in that statement. The only apprehension I had in the matter was to be certain it was not prohibited in any way from future action.

Mr. TIPTON. No, sir. Making a gratuitous statement on behalf of Colorado, even though Colorado produces 70 percent of the water, and even though Colorado has been apportioned over 50 percent of

the apportionment of the upper basin, Colorado is not going to take the position of the hog as far as the power is concerned.

Mr. BARRETT. It seems to me the purpose of this compact is certainly to expedite the development of the upper Colorado River Basin States. I was very hopeful that we could get the comprehensive plan and get the whole upper basin States developed in an orderly way with a pool of the power to assist in the reclamation of the various States.

Secondly, I certainly hoped we could get some assistance from the power that may be developed, inasmuch as the water is contributed in proportions by the various States as outlined.

I am pleased there is certainly nothing in here that would impede in any way such a program after this compact is ratified.

Mr. TIPTON. That is my opinion, Congressman. The prerequisite at the moment at least of the development you suggest is the making effective of this compact. That has to come first at the moment. Then there will be no doubt considerable pressure to have authorized some of the large reservoir development along the main stream for the generation of energy. There is a need for that energy, a growing need for it.

There will be a market for all of the energy that can be generated by the operation of the reservoirs that will be required by the upper basin to insure it in taking care of its obligation at Lee Ferry.

Mr. BARRETT. That brings me up to the other question that I did want to ask you and that is under article V, in which the various types of reservoirs are enumerated. Take the reservoir that you have just mentioned that is to be constructed for the purpose of fulfilling the obligation of the upper basin States at Lee Ferry. It will also generate power. I assume that the cost of construction of that reservoir would be charged to the entire upper basin area, would it not?

Mr. TIPTON. I think that is a matter that will be before the Congress at the time that is up for authorization and for the appropriation of funds.

Mr. BARRETT. At any rate, any power that would be generated there would be in a pool under some division for the upper basin States.

Mr. TIPTON. That also would require action by Congress to fix policy.

Mr. BARRETT. In other words, the effect of your testimony is that whatever policy the Congress might desire to promulgate under this compact would be entirely right and proper, and all of the States could raise their objections here in the Congress and it would be conclusive on the States whatever action is taken?

Mr. TIPTON. That is correct, sir. In other words, there is not one single provision in this compact which would inhibit the Congress in promulgating any policy Congress in its wisdom desired to promulgate with respect to the generation of hydroelectric energy and the disposition of the revenues from the sale of that energy.

Mr. BARRETT. What I was trying to get at, you certainly must have had something in mind when you designated these three types of reservoirs, one for single use in the State, and you meant that that type of reservoir would be certainly chargeable to the projects in that State. Is that correct?

Mr. TIPTON. Yes. This article which you are discussing, article V, has to do only with the charging of reservoir losses.

Mr. BARRETT. I understand that.

Mr. TIPTON. That is evaporation losses in the reservoirs.

Mr. BARRETT. Did you mean that same theory would go any further than for the evaporation losses?

Mr. TIPTON. No. There is nothing in the article that says it goes to division of power or that it could be implied that the power would be divided up in the same fashion that losses are charged. It does not say that. It does not mean that.

Mr. BARRETT. Thank you very much.

Mr. MURDOCK. I believe it would facilitate matters if we ask Mr. Breitenstein to come to the stand with Mr. Tipton and then direct our questions to both. However, I would like to say to the members of the committee who are from the upper basin States, the former Governor of New Mexico, here on my left, undoubtedly has some questions just as the gentleman from Wyoming had, and I wish we would give preference to those from the upper basin States first. I think we should. The gentleman from Colorado and the gentlewoman from Utah are both present. They are more vitally interested in this than any other members of the comittee.

Mr. WHITE. Might I suggest to the chairman: In previous committees it has been the custom, after the witness completed his testimony, to recognize the gentleman on the Democratic side and alternate on the Republican side and go down through the committee to give them all a chance to participate.

Mr. MURDOCK. We do that as a regular thing. However, we may want to vary a little bit from that on this occasion.

Now, Mr. Breitenstein, you were to answer the questions that Mr. Engle put. Is that it?

STATEMENT OF JEAN S. BREITENSTEIN, ATTORNEY FOR COLORADO WATER CONSERVATION BOARD

Mr. BREITENSTEIN. These are not just my answers.

I might state for the record, my name is Jean S. Breitenstein. I live in Denver, Colo. I am the attorney for the Colorado Water Conservation Board.

During the negotiation of the upper Colorado River Basin compact, I acted as the legal adviser for Clifford H. Stone, the Colorado commissioner, and I was a member of the legal advisory committee.

On Monday of the opening of this hearing, Congressman Engle presented for the record a letter to Harry W. Bashore, the Federal representative in these compact negotiations. That letter has been given consideration by Mr. Bashore and by the representatives of the upper basin States, who are here in Washington. The answer has been approved by Mr. Bashore and the representatives of the upper basin States here in Washington.

However, the original, which I have in my possession, has not yet been signed by Fred E. Wilson, commissioner for the State of New Mexico. It has been approved by him. The original which I have here has been signed by Charles A. Carson, commissioner for the State of Arizona; Clifford H. Stone, commissioner for the State of Colorado; L. C. Bishop, commissioner for the State of Wyoming; Clinton D. Vernon, attorney general of Utah; J. A. Howell, special assistant

attorney general of Utah; and Harry W. Bashore, representative of the United States.

With your permission, Mr. Chairman, I will read the letter.

Mr. MURDOCK. You may proceed.

Mr. BREITENSTEIN. It bears date of March 16, 1949, addressed to Mr. Engle, House of Representatives. [Reading:]

MY DEAR MR. ENGLE: Your letter of March 12, 1949, addressed to Hon. Harry W. Bashore, representative of the United States, upper Colorado River basin compact negotiations, has been given consideration by Mr. Bashore and by the representatives of the upper basin States now assembled in Washington. The answers herein given to your specific questions are the answers of the representatives of the compacting States and of Mr. Bashore.

In this letter the statements made by you in connection with each question and the questions themselves will be italicized. The answers will follow each question.

Question No. 1

Article I of the proposed compact refers to the apportionment of the "use" of the water of the Colorado River system, the use of which was apportioned in perpetuity to the upper basin by the Colorado River compact.

(a) Is the word "use" to be taken as synonymous with the phrase "beneficial consumptive use" as it occurs in the Colorado River compact?

Answer. The word "use" as it occurs in article I of the upper Colorado River Basin compact is synonymous with the phrase "beneficial consumptive use" as it appears in article III (a) and article III (b) of the Colorado River compact.

(b) In this connection, note that the phrase "consumptive use" occurs frequently in the pending compact. Is there any difference in meaning between the phrase "consumptive use" as used in the pending compact, and "beneficial consumptive use" as the phrase is used in the Colorado River compact?

Answer. In all instances where the phrase "consumptive use" occurs with reference to the apportionment made to the upper basin by the Colorado River compact, such phrase is synonymous with the phrase "beneficial consumptive use" as it occurs in article III (a) and article III (b) of the Colorado River compact. This is because of the paramountcy of the Colorado River compact. When such phrase is employed in connection with internal matters relating to the rights of the upper basin States as among themselves to the water available to them under the Colorado River compact, the phrase "consumptive use" is not necessarily synonymous with the phrase "beneficial consumptive use" as used in the Colorado River compact. In this connection it should be pointed out that in each of the compacting States a "beneficial use" is essential to the acquisition of a firm water right. Also attention is directed to article III (b) (2) of the upper basin compact, which provides that "beneficial use is the basis, the measure, and the limit of the right to use."

Question No. 2

In article II, the term "virgin flow" is defined to mean "the flow of any stream undepleted by the activities of man."

(a) Is it proposed to determine "virgin flow" with respect to each year, or to use averages?

Answer: "Virgin flow" will be determined with respect to each water year. In the actual administration of the Upper Colorado River Basin compact, the upper Colorado River commission may make use of averages and necessarily will do so when hold-over reservoirs are constructed and placed in operation.

(b) If on an annual basis, how will "virgin flow" for any particular future water year be determined?

Answer: An index of the virgin inflow will be determined by the summation of the discharge measured at a series of key gaging stations located around the rim of the basin above the major development, the recorded discharge past each station to be corrected for man-made depletions, if any, above that station. The virgin outflow at Lee Ferry will be determined by a correlation curve developed by the historic relationship between recorded inflow at such key gaging stations, corrected for upstream man-made depletions, if any, and recorded Lee Ferry flows, together with the historic man-made depletions above Lee Ferry.

Question No. 3

(a) Will consumptive uses in each of the States, under Article III, be determined with reference to each water year?

Answer: Consumptive uses in each of the upper basin States will be determined with reference to each water year. In making an administrative determination of such consumptive uses the Upper Colorado River Commission will necessarily make use of averages when hold-over reservoirs are constructed and placed in operation. While the compact leaves such determination to the commission, it is considered that the commission may make use of 10-year progressive averages.

(b) Or, are these quantities to be determined on long or short term averages?
Answer: See answer to question No. 3 *(a)* above.

QUESTION *No. 4*

Article IV speaks of curtailment of use of water in order that flow at Lee Ferry shall not be depleted below that required by article III of the Colorado River compact.
Does the word "use" mean the same thing as the phrase "consumptive use" as determined pursuant to article VI of the compact?

Answer: The word "use" as it so occurs includes "consumptive use" as such use is determined pursuant to article VI. "Use" is a broader term than "consumptive use." It is employed in article IV in order that there may be no argument as to the power and obligation of an upper division State to curtail any "use" which it determines should be curtailed in order to assure full compliance with article III (d) of the Colorado River compact.

Question No. 5

Article V, subsection (c), provides that: "In the event the commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the upper division, the storage of water for consumptive use shall be given preference."
Does this mean that the commission may exonerate any reservoir or reservoir capacity from the obligation of article III (d) of the Colorado River compact: If not, what is meant by the "preference" for consumptive use?
Answer: The answer to the first part of this double question is: No. The States and not the commission determine what uses must be curtailed in order to comply with the obligation of article III (d) of the Colorado River compact. By "preference" is meant that each upper division State has a superior right to use a storage site for consumptive uses within that State and it may not be deprived of that right by the desire of other upper division States to utilize the same site for the impoundment of water which will be released to meet the Lee Ferry delivery obligations of the upper division States. The exercise of such a preference right must not violate or have the effect of violating the delivery obligation imposed by article III (d) of the Colorado River compact.

Question No. 6

Article VI provides that the commission shall determine the quantity of the consumptive use of water for the upper basin and for each State of the upper basin, by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the commission, by unanimous action, shall adopt a different method of determination.
(a) Outflow from the upper basin apparently would be measured at Lee Ferry. Where and how would inflow to the upper basin be measured?
Answer: Inflow to the upper basin will be determined by a series of key gaging stations located at strategic points and designed to be an index of the inflow to the upper basin. The recorded discharge past these key gaging stations will be corrected for all man-made depletions, if any, occurring above each station.
(b) It is my understanding that a large part of the use of water in the upper basin will be made possible by overyear and cyclic storage. The impounding of water in storage reservoirs would be reflected by depletion at Lee Ferry during the water year in which water is impounded. Does article VI mean that consumptive use will be measured by water stored, as distinguished from the withdrawals from storage and application to use on land?

Answer: The measurement of use by the inflow-outflow method prescribed by article VI automatically takes into account the storage and release of water from reservoirs. Hence the measurement, in terms of stream depletion at Lee Ferry is by water stored as distinguished from withdrawals from storage and applications to use on land.

(c) *How is it proposed to account for water stored in one year and applied to use in another and later year? Specifically, would consumptive use be considered as occurring in the year in which water is impounded, or in some later year when it is withdrawn and applied to use?*

Answer: The necessity for hold-over storage to enable the upper basin to utilize the apportionment made to it by the Colorado River compact and at the same time to comply with the obligation for Lee Ferry deliveries imposed by article III (d) of the Colorado River compact requires that consumptive use resulting from the storage of water in reservoirs be determined on the basis of progressive averages. While the compact leaves such determination to the commission, it is considered that the commission may make use of progressive averages.

Question No. 7

Article VII provides for an "Upper Colorado River Commission." Among other things, the commission is authorized to (art. VIII (d)):

"(6) Make findings as to the quantity of water of the upper Colorado River system and each year in the upper Colorado River Basin and each State thereof;

"(7) Make findings as to the quantity of water deliveries at Lee Ferry during each water year;

"(8) Make findings as to the necessity for and the extent of the curtailment of use required, if any, pursuant to article IV hereof."

Subdivision (g) of the same article provides that:

"Findings of fact made by the commission shall not be conclusive in any court, or before any agency or tribunal but shall constitute prima facie evidence of the facts found."

It has been held that, in addition to its contractual character, under some circumstances a compact approved by the Congress is a public law (Missouri v. Illinois, 200 U. S. 496–519): Pennsylvania v. Wheeling, etc., 54 U. S. 518–566). Is it intended that subdivision (b) above shall be binding on any State not a party to the upper Colorado River Basin compact, or on the United States?

Answer: Article VIII (g) of the upper Colorado River Basin compact does not bind any State which is not signatory to that compact and does not bind the United States.

Question No. 8

Will the ratification by the several States and the approval by the Congress of the upper Colorado River Basin compact in any way amend or affect the meaning of the Colorado River compact, whatever that document may mean?

Answer: The upper Colorado River Basin compact is an interstate compact between the States of Arizona, Colorado, New Mexico, Utah, and Wyoming. Article I, section 10, of the Constitution of the United States requires that before a compact of agreement between States is effective, the Congress of the United States must consent thereto. The purpose of H. R. 2325 is to give such congressional consent to the upper Colorado River Basin compact. H. R. 2325 does not, nor does the upper Colorado River Basin compact, alter, amend, modify, or repeal the Boulder Canyon Project Act (45 Stat. 1057) or the Colorado River compact signed at Santa Fe, N. Mex., on November 24, 1922. It is recognized that the upper Colorado River Basin compact is binding only upon the States which are signatory thereto, and that the upper Colorado River Basin compact is subject, in all respects, to the provisions and limitations contained in the Colorado River compact.

Question No. 9

I note that in article XVIII the States of Arizona New Mexico, and Utah have reserved their respective rights and interests under the Colorado River compact, as States of the lower basin. Will the ratification and approval by the Congress of the upper Colorado River Basin compact impair or in any way affect the rights of States of the lower basin not signatory thereto?

Answer: All that is sought by H. R. 2325 is the consent of the Congress to the Upper Colorado River Basin compact so that the limitation imposed by

article I, section 10 of the United States Constitution upon the power of any State to "enter into any agreement or compact with another State" may be removed. The lower basin righs of Arizona, New Mexico, and Utah were reserved in order to avoid any questions that might arise if they were not specifically reserved. No implication can be drawn from this reservation with respect to the rights of States not parties to the compact. They are not bound and their legal rights are not and cannot be impaired by a document to which they are not parties.

Mr. BREITENSTEIN. I might suggest that it would seem to me that the answer to question No. 8 clearly states what the situation here is and that it might be well for the committee to give consideration to the inclusion of that in whatever report is made by the committee.

Of course, the committee might wish to make further and greater use of the document, but the answer to No. 8, I submit, is a clear and concise statement of the situation which is before your committee and before the Congress in this bill, to give consent to the upper Colorado River Basin compact.

Mr. MURDOCK. Mr. Engle, these are answers to your questions. Would you like to elaborate in any way, or would you like to make any comment on the last statement that Mr. Breitenstein has made?

Mr. ENGLE. Mr. Chairman, I am of the view that including in the report of the answers set forth in answer to question No. 8, and also the answer to the question set forth as question No. 7, would both be proper subject matter in the report. I am interested, if we may pursue this a little further, in the position of the United States with respect to this compact.

What is your view of the binding effect, if any, of this compact upon the United States Government by Congress giving its consent to the compact?

Mr. BREITENSTEIN. Do you wish me to answer that?

Mr. ENGLE. Yes, if you will.

Mr. BREITENSTEIN. Article I, section 10 of the United States Constitution forbids any State to enter into a treaty, alliance, or confederation. It also forbids any State to enter into a compact or agreement without the consent of the United States.

On the first three—treaty, alliance, or confederation—there is an absolute prohibition. On compact or agreement, you can have such an arrangement between the States, but only if the consent of the United States is secured.

Accordingly, we have to present this matter to the Congress for the consent of the United States. If it were not for that provision of the Constitution, the States could, as they had the right to do before the Constitution, enter into these compacts or agreements.

The Constitution imposes an infirmity, impediment, limitation, whatever you want to call it, which has to be removed. The act of Congress in consenting to the compact does no more than remove that impediment, infirmity, restriction, or whatever you want to call it, and it is binding on Congress only to the extent that that is removed. It is not binding any further upon the Congress. It does not constitute a statute of the United States.

There are decisions which are referred to in your letter. You mention there the two Wheeling and Belmont Bridge cases. As I read those cases, they do not say that an interstate compact is a public law. They do say that it is a law of the Union. The distinction may be unimportant, but, Congressman, as one of the attorneys in the case,

I urged those cases and others to the United States Supreme Court, in the case of Hinderlider against LaPlata, in support of the proposition that a compact was a statute of the United States, and the court disagreed with me and said it was not for the purposes of an appeal under section 237–A of the Judicial Code.

Indeed, Congressman, I say that an act of Congress approving a compact cannot be taken as a statute of the United States because a statute of the United States can be amended, can be modified, can be repealed, and I say that when Congress consents to an interstate compact, it does something which is irrevocable. It cannot later take that back, and when the compact is consented to, it is binding upon the signatory States, but those signatory States cannot change United States law.

I assume that the Congressman is familiar with article XIX of the compact, and in presenting this I would also like to read article XIX in the record, if I may. I would like to read it so everyone will understand it. This is from the upper basin compact. [Reading:]

ARTICLE XIX. Nothing in this compact shall be construed as—

(a) Affecting the obligations of the United States of America to Indian tribes;

(b) Affecting the obligations of the United States of America under the treaty with the United Mexican States (Treaty Series 994);

(c) Affecting any rights or powers of the United States of America, its agencies or instrumentalities, in or to the waters of the upper Colorado River system, or its capacity to acquire rights in and to the use of said waters;

(d) Subjecting any property of the United States of America, its agencies or instrumentalities, to taxation by any State or subdivision thereof, or creating any obligation on the part of the United States of America, its agencies or instrumentalities, by reason of the acquisition, construction, or operation of any property or works of whatever kind, to make any payment to any State or political subdivision thereof, State agency, municipality, or entity whatsoever, in reimbursement for the loss of taxes;

(e) Subjecting any property of the United States of America, its agencies or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to this compact.

Article XIX, may I say, was submitted to the compact commissioners by legal advisers to the agencies of the United States which were interested in this compact. The commissioners accepted the provisions here which were urged by the United States.

Mr. ENGLE. Is it your view, then, that the participation of the United States by officially appointing a commission is solely and only and limited to the purpose and object of satisfying the constitutional requirement of consent and nothing else?

Mr. BREITENSTEIN. Yes, sir.

Mr. ENGLE. And that the participation of the United States in this compact does not abridge or limit, by implication or otherwise, any rights of the United States in the Colorado River?

Mr. BREITENSTEIN. Yes, sir.

Mr. ENGLE. I understand the Supreme Court has held that it is necessary for the United States to be joined as a party in interest in any litigation affecting the Colorado River.

Mr. BREITENSTEIN. I do not agree with you on that statement. I would not give you that premise.

Mr. ENGLE. You do not agree with that?

Mr. BREITENSTEIN. No, sir.

Mr. ENGLE. I understand that is the basis for the bills now pending in this Congress to authorize the litigation of rights in the lower basin. But you do not agree that that legislation is necessary?

Mr. BREITENSTEIN. I would answer that "No." Do not get me wrong. You stated that the United States Supreme Court held that the United States should be a party to any litigation over Colorado River. I do not agree with that statement, Congressman, but by disagreeing with that statement, I am not at the present time taking any position one way or the other on any resolution or bill or what not which may be before the Congress.

Mr. ENGLE. What is your understanding with respect to the requirement of bringing the United States into litigation involving a navigable stream?

Mr. BREITENSTEIN. Well, Congressman, I represented the State of Colorado for a good many years in the North Platte case, which is a navigable stream in Nebraska—at least it is so held by the United States Supreme Court to be navigable in certain stretches. Nebraska sued Wyoming and Wyoming sought to get the case dismissed, among other things holding that the Secretary of the Interior was an indispensable party. The Court refused to dismiss the case. Wyoming then impleaded Colorado and the United States intervened and the litigation went on for many years.

In that case you had a situation where Nebraska claimed, among other things, that Nebraska was being injured by the authorization and construction of a Federal irrigation project in Wyoming. The Court in its decision held that the threat of that project justified the suit by Nebraska. That is one factor in the case.

Now, here, the case to which you are referring is the case of Arizona against California in 298 U. S. In that case, Arizona sought a decree allocating or apportioning to it a share of the unappropriated water of the stream. Among other things, it was alleged in the Arizona bill that the dependable supply of the stream was already overappropriated and for Arizona to get anything it had to get it out of reservoirs, Lake Mead, which has been constructed as a Federal project.

Under those circumstances, the United States Supreme Court held that the United States was a necessary party to that litigation. Any suit which would come up on the same pattern would undoubtedly be controlled by that precedent, but whatever controversy there may exist in the lower basin, so far as I am concerned, I see no necessity of them following that pattern, and if any State thinks it is necessary to conduct litigation because of an injury of serious magnitude which now exists, or which is threatened, they can follow the pattern of the North Platte suit and do not need a consenting act, but by saying that I do not want you to infer that by testifying here I am testifying for or against any resolution which has to do with anything like that, because I am taking no position here.

Mr. ENGLE. Let me ask this question: If it is firmly established in law that the consent given by Congress to a compact serves no purpose other than a bare legal compliance with the necessary constitutional consent, and can by implication or otherwise carry no limitation upon Federal rights in those navigable streams, why was it necessary to put section XIX in the compact?

Mr. BREITENSTEIN. So far as I am concerned, I will say because of the attitude of the legal representatives of certain Federal departments. The use of a clause such as article XIX grew out of the experience in connection with the Republican River compact. That has

been mentioned earlier in these hearings. That is the compact between Colorado, Nebraska, and Kansas. After the first compact was negotiated, the attorneys for a certain Federal bureau raised objections to the compact, saying that the rights of the Federal Government were not adequately saved and protected. They were able to secure a Presidential veto of the compact on that ground.

Later, the compact was renegotiated and the clause upon which article XIX is based was worked out through a series of conferences between representatives of the States and representatives of the Federal Government.

Mr. ENGLE. In other words, there was some doubt, I take it, in some legal minds that a compact of this sort might, in the absence of such a provision, affect the substantial rights of the United States on the stream system involved in the compact. Is that right?

Mr. BREITENSTEIN. There apparently was. The difficulty in the Republican River compact arose from a clause which said the Republican River was not navigable. If there is anyone here from Kansas or Nebraska, I am sure they can appreciate the point, but the compact did say the Republican River was not navigable.

It was thought this might constitute something which would be used to defeat the rights and powers of the United States. I say it could not have been, but that was the argument which was urged.

Mr. ENGLE. In other words, this is a provision giving additional safety or assurances rather than one which you deem to be really necessary,

Mr. BREITENSTEIN. I think it is not necessary, but it does give assurances.

Mr. ENGLE. In view of the fact that in your opinion the consent by Congress is limited to and for the purpose solely of complying with the constitutional requirement of consent, and abridges no rights, by implication or otherwise of the United States, is it a fair statement to say that any interpretation of the Colorado River compact, expressed or implied in the upper Colorado River Basin compact, is binding only and solely upon and affects only the States which are signatory thereto?

Mr. BREITENSTEIN. If you will eliminate two words, I will give you that, Congressman.

Mr. ENGLE. What are they?

Mr. BREITENSTEIN. They are "and affects."

Mr. ENGLE. Why would you want to eliminate those?

Mr. BREITENSTEIN. Because, Congressman, this compact may have an effect which is perfectly proper and perfectly legal. Under this compact, the upper basin States have a most sincere hope to develop the uses of the water of the upper Colorado River basin which are apportioned to them by the old compact and available for use by them, and I say that they have full right to do that under the 1922 compact.

It cannot be denied to them, but that use does affect lower basin States in a perfectly proper, legitimate way under a contract which the lower basin States themselves signed.

Mr. ENGLE. Do you agree that any interpretation of the Colorado compact, express or implied in the upper basin compact is not binding upon the United States Government?

Mr. BREITENSTEIN. Yes, sir.

Mr. ENGLE. You do?

Mr. BREITENSTEIN. Yes, sir.

Mr. ENGLE. Then the Congress of the United States, by giving its consent to this compact, does not bind itself to any interpretations of the Colorado compact express or implied in the upper basin Colorado compact, is that correct?

Mr. BREITENSTEIN. I got a little lost there. I am sorry, Congressman. I will answer it this way——

Mr. ENGLE. I will repeat the question. Is it then true that the consent given by Congress to this compact does not bind the United States Government as to any interpretation, express or implied, of the Colorado compact in the upper basin Colorado compact?

What I am saying is this: In this upper basin Colorado compact is interpretations of the meaning of words, provision and effects of the Colorado River compact, and I am asking whether or not the consent of Congress to this compact will have the effect of congressional approval of those interpretations in a way to be binding upon the United States?

Mr. BREITENSTEIN. I would like to qualify my answer to that in one way, if I may, because I do not think I understood it all clearly, but let me say my position on that: By giving its consent to the upper Colorado River Basin compact, the Congress of the United States, or the United States, let us say, does not place an interpretation or construction upon the Colorado River compact which is binding upon the United States or upon any nonsignatory States.

Now, here is my qualification, and I think you will understand the propriety of it: By this compact, the upper States, the upper basin States, have apportioned their share of the water among themselves and they have apportioned among themselves the obligations imposed upon them by the Colorado River compact.

Now, I say the United States cannot go into the upper basin and develop water uses which are contrary, which would be contrary to such apportionment or such division of obligations. This is a division of water between the States, and I say that it is binding upon those States and that by being binding on those States, it does not bind any other State which is not signatory to it, nor the United States, but the development of your water has to conform to the pattern set by this compact.

I just wanted no misunderstanding on that because I do not believe that the United States, for example, could go into the State of Colorado and put in some projects which would use up 75 percent of the water, which is in excess of the Colorado share. The development by the United States in the upper basin has to conform to the pattern set by the compact.

Mr. ENGLE. I am not interested in the effect of this compact on the States which are signatory to it.

Mr. BREITENSTEIN. Yes.

Mr. ENGLE. What I am interested in is the effect of the compact and the consent of Congress to the compact on the United States Government and on the States which are not signatory to it. I am not concerned over the question of whether or not this compact is fully and by its terms subject to the Colorado River compact, which is the basic compact. What I am concerned about is the fact that this compact,

by interpretation of language, intent, and effect of the Colorado River compact, which are express or implied in it, may bind either the United States or States which are not signatory to it.

Mr. BREITENSTEIN. I will answer your question this way: They bind only the signatory States. I will say it the other way if you want me to, do not bind the nonsignatory States or the United States.

Mr. ENGEL. No; I would prefer to have the proposition stated this way, that any interpretation of the Colorado River compact, express or implied, in the upper Colorado River Basin compact is binding upon and affects only the States which are signatory thereto.

Mr. BREITENSTEIN. If you will eliminate the words "and affects," I will give you that, but I will not with the words "and affects."

Mr. MURDOCK. Will the gentleman yield?

Mr. ENGLE. Yes, sir.

Mr. MURDOCK. I noticed that the two words which you wanted exempted are "and affects." Supposing an amendment should be offered to this bill which would include those two words. Would you not regard that language to mean that the nature of the compact as set forth in the bill would be materially changed?

Mr. BREITENSTEIN. Not only materially changed, Congressman, utterly destroyed.

Mr. MURDOCK. Now, let me see if I get you just right on this: When this compact is approved by Congress, and it is carried out, will not one of the effects be that there will be less water inflowing into the lower basin? Will that not be one of the effects?

Mr. BREITENSTEIN. Yes, certainly that is the effect and it is going to be there and it is perfectly proper under the Colorado River compact.

Mr. MURDOCK. Perfectly proper?

Mr. BREITENSTEIN. Yes.

Mr. MURDOCK. You cannot get away from that?

Mr. BREITENSTEIN. No.

Mr. MURDOCK. The very purpose of this compact is to make it possible for the upper basin to get as much of their 7,500,000 acre-feet annually as they were apportioned by the master compact, or the compact of 1922, so that we would be unreasonable, as I see it—and I am from the lower basin—we would be unreasonable if we demanded any language which would say "the upper basin compact shall have no effect upon the lower basin."

As I understand, that is exactly why you have avoided those two words.

Mr. BREITENSTEIN. That is right.

Mr. POULSON. Would you yield at that point, Mr. Murdock?

Mr. MURDOCK. Yes.

Mr. POULSON. Do you want to imply that this upper basin compact shall have an effect upon the lower basin as to the interpretation of the compact of the over-all compact?

Mr. MURDOCK. Well, now, let us confine ourselves——

Mr. POULSON. Please answer that question.

Mr. MURDOCK. Let us confine ourselves to this one effect. We in the lower basin do not have as much water as we would like in the Colorado River. No State has as much water as it would like to have. If we could only double the precipitation on the basin, we would be glad to do that, or triple it for that matter. But we know

very well that when the proper development occurs in the upper basin there will be less water passing Lee Ferry, and that will be one of the effects of this compact.

It is a legal and proper effect, and I cannot complain about it. I simply do not want to see any amendment adopted to this measure which would nullify the compact or destroy it, as Mr. Breitenstein has stated.

Mr. POULSON. You never answered my question. I will put it to you a little straighter. Do you want to use this upper basin compact and the provision in it and the interpretations, the effect of it as a basis of going down and saying "that is the interpretation that should apply as far as the lower basin is concerned" to the interpretation of the contract? Do you want to use the effect of it that way?

Mr. MURDOCK. I want to see the——

Mr. POULSON. Do you want to use it that way?

Mr. ENGLE. I yielded for a question and I have the floor.

Mr. MURDOCK. Very well. You have the floor.

Mr. ENGLE. I might say in answer to my colleague from California that I think I understand what the witness and Mr. Murdock are talking about. They are saying that the upper basin compact has an effect which is the effect contemplated and implicit in the original basic compact when it was entered into. The basic compact left the matter of distribution of water in each basin to the people in those basins and the States, and that distribution will have an effect.

I do not want to quibble over words, but is it proper to say that any interpretation of the basic compact, the Colorado River compact, which is expressed or implied in the upper basin Colorado River compact, shall be binding only on the States which are signatory thereto?

Mr. BREITENSTEIN. Yes, sir.

Mr. LEMKE. Mr. Chairman, may I ask a question?

Mr. MURDOCK. Yes. We have two witnesses before us. We broke in on the testimony of Mr. Tipton, thinking we could conserve time by uniting them.

Mr. LEMKE. As I understand it, this compact deals only with that which is already yours by the lower basin compact?

Mr. BREITENSTEIN. By the Colorado River compact; yes, sir; that is correct. We claim nothing more than that.

Mr. LEMKE. If the word "effect" may be put in, that may be a surrender of what rights you have under the original compact?

Mr. BREITENSTEIN. That is what I have been trying to say.

Mr. LEMKE. You are objecting, therefore?

Mr. BREITENSTEIN. That is right.

Mr. LEMKE. You do not intend to interfere with the rights of the Colorado River compact, except you are going to claim what is yours already and that is the only thing you are dealing with in this bill.

Mr. BREITENSTEIN. That is exactly right, Congressman.

Mr. WHITE. I wonder if the gentleman from California will yield to me.

Mr. ENGLE. I would like to ask one further question: Do you agree that the Congress, in consenting to the upper Colorado basin compact, is not committing itself to any interpretation, express or implied, in that compact of the language intent or effect of the Colorado River compact?

Mr. BREITENSTEIN. You have the words "or effect" in there again, Congressman. I am not going to agree to those. It does have an effect and it is a proper effect as I think was clearly pointed out by Congressman Lemke's questions. It is bound to, and I am sure that you in California do not disagree with that. You signed the Colorado River compact and said that there was apportioned in perpetuity to the upper basin the beneficial consumptive use of 7,500,000 acre-feet annually.

In turn, we said that the States of the upper division will not deplete the Lee Ferry flows below 75,000,000 acre-feet every 10-year period.

Now, Congressman, as long as we comply with that obligation, I am sure that you and the State of California would say that we in the upper basin have the right to make the use of the apportionment to us by the document which your State signed.

Mr. WHITE. I wonder if I could ask a question.

Mr. MURDOCK. Are you through, Mr. Engle?

Mr. ENGLE. Yes.

Mr. MURDOCK. Mr. White.

Mr. WHITE. I wonder if I can understand the issue. As I understand it, if I might have the attention of the witness, if I understand this issue that is being discussed with the committee at the moment, the water in the original compact was divided between the upper and lower basin States.

Is that a correct statement?

Mr. BREITENSTEIN. That is correct.

Mr. WHITE. The point of measurement would be Lee Ferry?

Mr. BREITENSTEIN. That is correct.

Mr. WHITE. In the water allocated to the upper States, reserved to the upper States, it was not all being utilized, which provided, up until now, surplus water at Lee Ferry, is that right?

Mr. BREITENSTEIN. The flows at Lee Ferry have been in excess of the amount required by article III (d).

Mr. WHITE. Due to the fact the upper basin States, under the original compact, had not as yet utilized water to which they were entitled, is that correct?

Mr. BREITENSTEIN. Yes.

Mr. WHITE. Now, then, the water that was not utilized yet had a surplus at Lee Ferry? It flowed to the Colorado River due to the fact the water of the upper States was not utilized and it created a surplus flow at Lee Ferry?

Mr. BREITENSTEIN. It did not create a surplus flow as that term is used and defined in the Colorado River compact. It creates an excess flow.

Mr. WHITE. Well, excess. You are splitting the hairs between surplus and excess.

Mr. BREITENSTEIN. Because of the definition of the old compact.

Mr. WHITE. Due to that condition, the lower States were getting more water than they were entitled to under the compact because it was being utilized, it was retarded in its flow above Lee Ferry, is that correct?

Mr. BREITENSTEIN. That is correct.

Mr. WHITE. Well then now, what we seek to do here, or are authorizing the States to do, is to divide between themselves the water to which they are entitled in the upper basin.

Mr. BREITENSTEIN. Yes.

Mr. WHITE. Is there any issue that has been raised as to the division between those States and between the lower basin States?

Mr. BREITENSTEIN. None that I know of, and I say that it is the concern of the upper basin States themselves. As I understood the position which Congressman Engle took the other day, we could toss dice or draw straws.

Mr. WHITE. Under existing law, the Congress seeks here to authorize the upper basin States to enter into a compact and then after that compact has been so entered into, to ratify and make it binding on the States.

Mr. BREITENSTEIN. That is correct. That is what we are here for.

Mr. WHITE. Thank you, Mr. Chairman. I thank the witness.

Mr. MURDOCK. Governor Miles, have you a question to ask of either of these witnesses or both of them?

Mr. MILES. Mr. Chairman, I do not believe I have at this time, and in view of the fact that I am not a lawyer or an engineer, sometimes there are technical points that are a little difficult for me to understand, and in view of the fact that it is a little difficult for me to hear where I sit at my official seat at the end of the line, I do appreciate the kindness and courtesy of the chairman in extending to me an invitation to sit where I could better understand and better hear the witnesses, because the problems that are brought out here make the bill more understandable and sometimes more clear to me.

I was particularly interested in the point brought out by Mr. Barrett regarding the power relative to the bill, as I had never heard that discussed before. At this time, I have no questions to ask.

Mr. MURDOCK. Thank you, Governor. There are two or three reasons why I am glad to have you right here beside me. In keeping with my original suggestion that we should hear from those from the States vitally affected, I will now ask Judge Bosone whether she has any questions.

Mrs. BOSONE. I shall reserve my questions.

Mr. MURDOCK. Mr. Aspinall?

Mr. ASPINALL. Mr. Chairman, I will avail myself of one question and reserve the right to talk later.

Mr. Breitenstein, is it not true the purpose of the upper basin Colorado River compact is for the orderly over-all ultimate development of that basin?

Mr. BREITENSTEIN. Exactly right.

Mr. ASPINALL. Then I would simply make this statement in answer to what the gentleman from California has stated, especially Mr. Poulson: Coming from the district where 65 percent of the water of the Colorado River arises, I would suggest that it would be of less adverse effect to the lower basin States if the upper Colorado River Basin States were allowed to develop their water in an over-all orderly program than it would to permit each State to go ahead and fight for as much as it can, because in the ultimate of each State developing its water resources, it means the possibility of a less supply of water being delivered at Lee Ferry in accordance with the terms of the Colorado River compact itself.

Mr. MURDOCK. I think the question is exactly right, if he will permit my asking him to yield at this point. Did we not have it the other day

on another bill? Did we not have the testimony of an expert engineer who said it is possible to add 2 and 2 and get more than 4?

Mr. ASPINALL. That is correct.

Mr. MURDOCK. He was talking about an integrated electric system, where stand-by plants and equipment can be made to produce effectively a greater amount of electric power. Does that same thing not apply to the use of water among so many water users?

Mr. ASPINALL. That is the practical thing.

Mr. ENGLE. Will the gentleman yield to me?

Mr. MURDOCK. Yes, sir.

Mr. ENGLE. Let me say as far as I know California, and as far as I am concerned personally, as I said in the opening of these hearings, I am very glad to see the upper basin States enter into a compact. I think it is an absolute prerequisite to any development of their water. They cannot proceed in an orderly fashion to develop the use of their water without some agreement. I am sorry that we have not been able to work out an agreement in the lower basin. I hope that we will be able to do so. So I have no disagreement at all with the statement made by the gentleman from Colorado.

Mr. POULSON. Mr. Chairman——

Mr. MURDOCK. Mr. Aspinall has the floor.

Mr. ASPINALL. I yield to Mr. Poulson.

Mr. POULSON. I would like to say that you have not served with me in previous Congresses when I have stated here that they thought the upper basin should certainly be getting busy and settling their difficulties so they could begin to develop these projects. Because of the fact they are developing them they are finding there is a lot of water going to waste in the lower basin, which our sister State is using as an argument that there is plenty of water available to put in over a certain fantastic scheme known as the central Arizona project, and that as soon as they use up this water from the upper basin, to which they are legally and justly entitled to and which we would be glad to see them develop then they will find out this so-called surplus of water in the lower basin is not there, and for that reason I am heartily in accord with this idea of getting together and developing the untold possibilities that they have in the upper basin.

Mr. MURDOCK. I would like to say to my friends from California that I appreciate that they take the same stand I do, that the upper basin ought to be developed, and have so indicated by what has just been said. I hope that the interest will prevent any move that would delay or thwart this effort to establish this compact.

Just one word in answer to Mr. Poulson's last comments about the great quantity of water being wasted into the Gulf of California. More than 8,000,000 acre-feet of water is spiling into the Gulf of California. Of course, the gentleman did not mean when he used the word "fantastic" that it is fantastic to take a million or so out of 8 million. I think that is a mathematical proposition, so the word fantastic of course——

Mr. POULSON. Seven and a half million, which they are entitled to in the upper basin, deducted from 8,000,000 leaves 500,000.

Mr. MURDOCK. You need to do a little more careful figuring on that, because the upper basin is already utilizing a third of the amount apportioned to them.

Mr. ASPINALL. May I simply state this: In yielding, I did not desire to have the lower basin States take advantage or get into a discussion of this problem. I appreciate the fact I have not been in Congress very long, but I know some of the problems below, too. We would be very appreciative if you would let us have this compact first; then we will go ahead and listen to the other.

Mr. MURDOCK. Mr. D'Ewart, have you a question?

Mr. D'EWART. I have questions on section VII. Section VII reads:

consumptive use of water of the United States of America or any agencies, instrumentalities, or wards shall be charged.

In other words, you take the position in this compact that you have a right to allocate water that is used by instrumentalities and wards. Now, in the compact commission, on which I served, the Federal Government took the position that the commission had no right to allocate water used by instrumentalities—in that case it meant national parks—or wards, which meant Indians.

Yet in this compact I do take the position you have the right to allocate that water.

Mr. BREITENSTEIN. So far as Indians are concerned, Congressman, I refer you to article XIX, which reads:

Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indians.

So far as uses by such services as the National Park Service, the point is that that use is counted against the share of the State in which the use is made, just like an Indian use is counted against the State in which the use is made. We do not make any allocation of water, except to States. There is no allocation to subdivisions of States to river basins or to particular uses.

Mr. D'EWART. That is correct, but on the commission on which I served, we had to first subtract the water that was owned by the instrumentalities of the National Park—Yellowstone National Park I have in mind—and by the Crow Indian Reservation, as their right to it was prior to the rights of the States.

Mr. BREITENSTEIN. I think you had a vastly different situation up there than exists in the Colorado River.

Mr. D'EWART. That may be true.

Mr. BREITENSTEIN. We are not affecting any Indian rights here, buthe Indian uses are charged against the State in which the use is made.

Mr. D'EWART. There, because of treaty rights, we had to take the water that was due the Indians out of the compact; because the Yellowstone Park was organized before the State was organized, we were not allowed to touch the Yellowstone Park water or have anything to do in the compact with the allocation of that to Wyoming, Montana, or any other State concerned.

In this compact, you allocate the water to the State that is concerned, even though it is in the national park.

Mr. BREITENSTEIN. That is correct. It is charged to that State. I might say, Congressman, that Mr. Bashore, who is here as the Federal representative, took this matter up with all the manifold and multitudinous agencies which are interested, and the language which

was finally agreed upon was acceptable to them, but I am encroaching on his province when I talk about that.

Mr. D'EWART. I wanted the explanation.

Mr. WHITE. Will the gentleman yield to me?

Mr. D'EWART. Yes.

Mr. WHITE. I raised a question here that I did not know about and did not understand. Do you mean to say that entering into a compact on the waters of Montana that you were not permitted to take into consideration the waters that flowed out of the Yellowstone Park?

Mr. D'EWART. That is right. The Yellowstone Park was expressly taken out of the compact.

Mr. WHITE. There is a big outflow from Yellowstone Park?

Mr. D'EWART. That is correct. After it left the Park, then we could deal with it, but we were not allowed to touch anything inside the Yellowstone Park.

Mr. WHITE. At the boundary between the State of Montana and the Yellowstone Park, the authority of the State took, over and the allocation of waters at that point were effected.

Mr. D'EWART. After it left the Yellowstone Park.

Mr. MURDOCK. Mr. Baring?

Mr. BARING. I will reserve my questions.

Mr. MURDOCK. Mr. Sanborn?

Mr. SANBORN. I have no questions.

Mr. MURDOCK. Have I missed anyone?

Mr. ENGLE. I would like to ask one further question. I have been rolling over in my head the effect of the word "effect" in this language which I stated a few minutes ago. I wonder if you would agree that this is right; that the Congress in consenting to the upper basin compact is not committing itself to any interpretation, express of implied, of the Colorado River compact.

Mr. BREITENSTEIN. Is that all?

Mr. ENGLE. Yes.

Mr. BREITENSTEIN. Yes.

Mr. ENGLE. Thank you.

Mr. MURDOCK. The House is in session and there will probably be a roll call in a few moments. When we adjourn, we will adjourn until 10 o'clock tomorrow morning.

Mr. BREITENSTEIN. I had not completed my statement. I had one or two other matters which I would like to include. I can do it very briefly in the morning.

Mr. MURDOCK. Then you will be our first witness in the morning. We have with us some representatives from other States participating, and we have Mr. Bashore, the Federal representative. We want to hear from all of these witnesses.

Mr. ENGLE. Mr. Chairman, I would like to ask whether or not the representatives of the compacting States here have reports of their negotiators to their State legislatures, or governors, and if they have them I wonder whether or not they could be made available to the committee, not for the purpose of the record at this time, but for the file.

Mr. STONE. I may say, Congressman Engle, that Mr. Breitenstein, before he concludes, will place in the record my report as Colorado commissioner to the Governor and general assembly of the State. I

cannot say as to the other commissioners whether they are prepared to do that or not, but they are to appear here and that matter can be brought out at that time. But so far as Colorado is concerned, we are ready and desirous of placing it in the record.

Mr. ENGLE. Mr. Chairman, I very much want to see the reports made by the negotiators for each of the respective States to their State legislatures, and I propose to ask each representative from each State for that report.

Mr. MURDOCK. The commitee stands adjourned until 10 o'clock tomorrow morning.

(Whereupon, at 11:45 a. m., the committee adjourned, to reconvene at 10 a. m., Thursday, March 17, 1949.)

UPPER COLORADO RIVER BASIN COMPACT

THURSDAY, MARCH 17, 1949

HOUSE OF REPRESENTATIVES,
COMMITTEE ON PUBLIC LANDS,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

The subcommittee met at 10 a. m., the Honorable John R. Murdock presiding.

Present: Messrs. Murdock, Peterson, Engle, Regan, Bentsen, White, Baring, Marshall, Mrs. Bosone, Messrs. Aspinall, Miles, Welch, Lemke, Barrett, Miller, Poulson, and Sanborn.

Also present: Hon. Harold A. Patten and Walter K. Granger.

Mr. MURDOCK. The committee will come to order, please.

We are continuing with hearings on the bill to give congressional approval to the upper basin compact.

We have had, during the various sessions, several Members of Congress who have introduced identical bills. I am afraid the Chair has been negligent in noting their presence and calling upon those Members of Congress who are not members of the committee, but who have introduced bills and are sponsoring this legislation.

I note we have with us this morning Congressman Granger, of Utah. We are mighty happy to have him with us. We hope he can remain throughout the hearings. He has been with us before, but we have not had a statement from him. Would you like to say something?

Mr. GRANGER. I will say I am glad to be here this morning and I will, at the proper time, make a statement. I think perhaps this is one of the foremost steps that has ever been taken in the western country. It is very important. I hope the committee will be able to act in due time so this thing will come before the House at the earliest possible moment.

Thank you. I will prepare a statement for the record.

Mr. MURDOCK. Thank you, Mr. Granger.

Mr. ENGLE. I might say, Mr. Chairman, if the record has not previously indicated, your very fine colleague and our new colleague from Arizona, Mr. Patten, has been here. I think the record should show his presence and his interest. If he is not here today, he probably will be shortly. He has been very diligent.

Mr. MURDOCK. Thank you, sir. We shall hear from all in due time.

We had for questioning Mr. Tipton, the engineer, and Mr. Breitenstein, the attorney. Both were on the stand yesterday, trying to save time. We asked one or the other such questions as occurred.

Would you gentlemen take the stand again, please?

Mr. ASPINALL. Mr. Breitenstein has not finished his formal statement yet.

Mr. MURDOCK. I thank you for reminding me. Mr. Breitenstein, would you continue then?

FURTHER STATEMENT OF JEAN S. BREITENSTEIN

Mr. BREITENSTEIN. The only matter I wish to add, Mr. Chairman, is that I wish to offer for the record of this proceeding the report and submission of the upper Colorado River Basin compact by Clifford H. Stone, the compact commissioner for the State of Colorado. This is Commissioner Stone's report to the Governor and General Assembly of the State of Colorado.

In offering this, I suggest that there be omitted from the printed record that portion of the report beginning on page 26, continuing from there to the end, which sets forth the text of the upper Colorado River Basin compact.

Mr. MURDOCK. Without objection, it will be admitted to the record as indicated.

(The information is as follows:)

REPORT AND SUBMISSION OF THE UPPER COLORADO RIVER BASIN COMPACT

NEGOTIATED AND SIGNED BY COMMISSIONERS REPRESENTING THE STATES OF ARIZONA, COLORADO, NEW MEXICO, UTAH, AND WYOMING, AT SANTA FE, N. MEX., OCTOBER 11, 1948, TO THE GOVERNOR AND GENERAL ASSEMBLY, STATE OF COLORADO, BY THE COMMISSIONER FOR COLORADO

THE COMMISSION

Harry W. Bashore, Federal representative and chairman

Charles A. Carson, for Arizona
Clifford H. Stone, for Colorado
Fred E. Wilson, for New Mexico
Edward H. Watson, for Utah
L. C. Bishop, for Wyoming

ENGINEERING ADVISORY COMMITTEE

J. R. Riter, Bureau of Reclamation, chairman

R. Gail Baker and R. I. Meeker, for Arizona.
R. J. Tipton, F. C. Merriell and R. M. Gildersleeve, for Colorado.
J. H. Bliss and J. R. Erickson, for New Mexico.
C. O. Roskelley, for Utah.
R. D. Goodrich and H. T. Person, of Wyoming.
H. P. Dugan, Federal representative.

LEGAL ADVISERS

J. G. Will of Bureau of Reclamation, Federal representative.
Jesse A. Udall, for Arizona.
Jean S. Breitenstein, for Colorado.
Martin A. Threet, for New Mexico.
J. A. Howell and Edward W. Clyde, for Utah.
W. J. Wehrli, for Wyoming.

STATEMENT OF FEDERAL REPRESENTATIVE AT TIME OF SIGNING UPPER COLORADO RIVER BASIN COMPACT

We are gathered here today in the Palace of Governors at Santa Fe, N. Mex., on an occasion which marks a turning point in the history of the Colorado River Basin. There is about to be signed here a document which will forever be an example of fairness, a demonstration of statesmanship of the highest order, and finally, a proof of the ability of States to deal with their mutual problems, no

matter how complex, through the traditional and constitutional compact method.

The upper Colorado River Basin compact which we are now about to execute will be a tower of strength to the States of Arizona, Colorado, New Mexico, Wyoming, and Utah, perhaps for centuries to come. It is a structure for the completion of which we have labored long. It is sound in design. Each part of it has been wrought with great care by men who are notably skilled in their professions and experts in the compact process. It is has been builded by men of good will; and because it has been so builded it will endure.

I have already announced my intention as representative of the United States of America to approve the upper Colorado River Basin compact. I shall approve it because it fully recognizes the interests of the Federal Government; because it creates conditions that will positively foster the conservation and development of the water resources of this vast area for agricultural and domestic purposes; and because it is equitable and sound from every point of view.

It has been an honor to preside over the meetings of the Upper Colorado River Basin Compact Commission. It has been a privilege to participate in the negotiations that have finally culminated in these ceremonies today.

There is honor and glory for each commissioner and his staff. No delegation need leave here with a feeling other than one of high achievement for its State and for the basin as a whole. I congratulate each one of you. I wish you God speed on your trip home; and I trust that you will work just as hard for ratification by your State legislatures and by the Congress of the United States of America as you have during these many months of meeting and negotiation. Your work is not done. You have taken but the first and I believe the most difficult step on the long road toward full development of this upper basin.

DECEMBER 1948.

THE GOVERNOR AND GENERAL ASSEMBLY OF THE STATE OF COLORADO:

There is herewith submitted the upper Colorado River compact which was negotiated and signed by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and approved by the Federal representative, on the 11th day of October A. D. 1948. This compact accomplishes two principal purposes: (a) It apportions the use of the water of the upper Colorado River system among the five signatory States; and (b) it determines the respective obligations of the States of Colorado, New Mexico, Utah, and Wyoming to deliver water, as required by the Colorado River compact of 1922, for use in the lower basin.

The commissioner submits:

1. That this compact is fair and provides an equitable apportionment among the signatory States of the use of the waters of the upper Colorado River Basin.
2. That it provides an equitable and workable determination of the respective obligations of the signatory States to make the deliveries of the water at Lee Ferry required by the Colorado River compact.
3. That the incidental provisions of the compact, including the creation of an administrative agency, are necessary to carry out its principal purposes.
4. That the amount of water made available for consumptive use in Colorado by the compact is all that could reasonably be expected in view of the application of the principles of equitable apportionment to a limited water supply.
5. That the compact will protect existing water rights and present utilization of Colorado River water in the State.
6. That the apportionment made by the compact to Colorado will meet the requirements for reasonable potential water development in the State.
7. That the compact is in conformity with the provisions of the Colorado River compact which apportions water between the upper and lower basins of the Colorado River.
8. That the compact is in the best interests of the State of Colorado and its citizens and is necessary to accomplish development of a major water resource of the State.

Accordingly, the commissioner respectfully recommends and urges that it be ratified by the General Assembly of Colorado.

The compact was executed in six counterparts, each of which constitutes an original. One original has been delivered to the Governor of Colorado. A copy of the compact, together with explanatory material, is attached hereto.

Respectfully submitted.

CLIFFORD H. STONE,
Commissioner for Colorado.

RESOLUTION UNANIMOUSLY ADOPTED BY COLORADO WATER CONSERVATION BOARD ON DECEMBER 10, 1948

Whereas the Colorado Water Conservation Board on September 27, 1948, after a presentation and full discussion of the vernal draft of the proposed upper Colorado River Basin compact, approved that draft of compact and authorized the Colorado Compact Commissioner to execute such compact on behalf of the State of Colorado with such technical and language changes, not affecting the apportionment to or obligations of Colorado, as were acceptable to him and to his engineering and legal advisers; and

Whereas pursuant to such resolution the Colorado Compact Commissioner did, in the city of Santa Fé, N. Mex., on October 11, 1948, execute the upper Colorado River compact on behalf of the State of Colorado; and

Whereas the board has now reviewed and considered the compact so executed at Santa Fe and finds that the compact complies with the resolution of September 27, 1948, and

Whereas the board further finds that the compact is fair and equitable and furnishes an essential basis for the development of the water resource of the upper Colorado River: Now therefore, be it

Resolved, That the Colorado Water Conservation Board approves the upper Colorado River Basin compact signed at Santa Fe, N. Mex., on October 11, 1948, and urges the General Assembly of the State of Colorado to ratify that compact at as early a date as is consistent with orderly legislative procedure.

Further resolved, That upon the ratification of the compact by the signatory States the Congress of the United States should be urged to give its consent and approval to the compact.

Further resolved, That the board commends the Colorado commissioner and his advisers for the work which they have done in negotiating the compact.

Further resolved, That copies of this resolution shall be forwarded by the secretary of the board to each member of the General Assembly of the State of Colorado and to the Senators and Congressmen representing the State of Colorado in the Congress of the United States.

Adopted and approved by unanimous vote this 10th day of December A. D., 1948.

GEORGE J. BAILEY,
Vice Chairman of the Board.

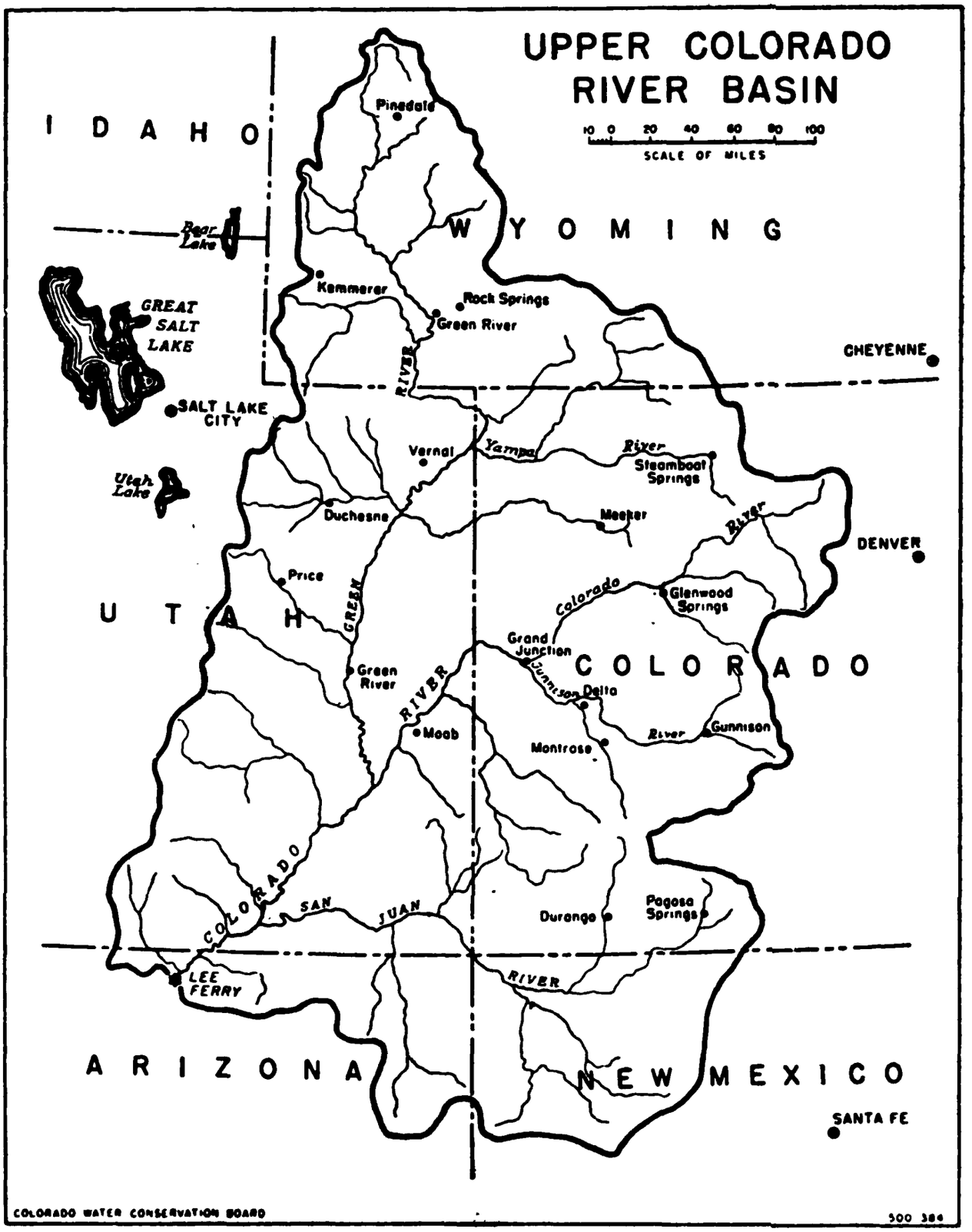
Attest:
CLIFFORD H. STONE,
Director and Secretary of the Board

NECESSITY FOR AN UPPER COLORADO RIVER BASIN COMPACT

The Colorado River compact of 1922 made no apportionment of water, or of the use of water, among the States of the Colorado River Basin. As hereinafter explained, the 1922 apportionment was between the upper and lower basins of the river.

Since 1922 water development in the upper Colorado River Basin and projected plans for ultimate, integrated development have precipitated questions of available water supplies in the various States for proposed projects. This is particularly true of the major projects which will utilize large volumes of water. The Bureau of Reclamation, in making a finding of economic justification and recommending or approving a Federal project, must make a determination of an assured water supply for it. When the Congress acts upon such a project and appropriates money for its construction, it must be shown that the project, together with other water uses, will demand no more water than is available to the State which seeks the project. Then, too, the interested States of the basin cannot assume the risk of promoting any project which, if constructed, will later involve a controversy over its water supply. It is fully realized that a stage of development on the river has been reached when all projects for the maximum and most efficient utilization of a limited water supply must fit into an integrated, basin-wide plan.

As authorized by section 15 of the Boulder Canyon Project Act (45 Stat. 1057, 1065), passed in 1928, and section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 774), passed in 1940, the Bureau of Reclamation has been carrying



on studies and investigations on the Colorado River for a number of years. These investigations and the formulation of a report were intensified in the years 1944, 1945, and the forepart of 1946. On June 7, 1946, a departmental report of the Department of Interior on the Colorado River was issued. This followed and was based upon a report and recommendations, dated March 22, 1946, by the directors of regions III and IV, Bureau of Reclamation.

This 1946 report stated:

"There is not enough water available in the Colorado River system for full expansion of existing and authorized projects and for all potential projects outlined in the report, including the new possibilities for exporting water to adjacent watersheds. The need for a determination of the rights of the respective States to deplete the flow of the Colorado River consistent with the Colorado River compact and its associated documents, therefore, is most pressing."

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And the same report recommended:

"That the States of the Colorado River Basin determine their respective rights to deplete the flow of the Colorado River consistent with the Colorado River compact."

This report of 1946 was submitted to the affected States, pursuant to section 1 of the Flood Control Act of 1944, for their respective views. Colorado submitted its comments and criticisms of the report to the Secretary of the Interior, and concurred in the conclusion that there should be an apportionment of water among the States of the upper basin.

After reviewing the comments of the States and of various Federal agencies on the 1946 report, the Secretary of the Interior on July 19, 1947, submitted his interim report on the status of investigations of potential water resource development in the Colorado River Basin in Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The Secretary in his letter of transmittal to the Congress, dated July 24, 1947, explained:

"As stated in the interim report, existing circumstances tend to preclude the formulation of a comprehensive plan of development of the water resources of the Colorado River Basin at this time. Accordingly, although I cannot now recommend authorization of any project, I am transmitting the report to you in order that the Congress may be apprised of this comprehensive inventory of potential water resource developments in the Colorado River Basin and of the present situation regarding water rights in that basin."

The conclusions of the 1947 report on the Colorado River contained this language:

"That a comprehensive plan of development for the Colorado River Basin cannot be formulated at this time;

"That further development of the resources of the Colorado River Basin, particularly large-scale development, is seriously handicapped, if not barred, by lack of determination of the rights of individual States to utilize the waters of the Colorado River system. The water supplies for projects to accomplish such development might be assured as a result of compact among the States of the separate basins, appropriate court or congressional action, or otherwise;

"That the States of the upper Colorado River Basin and States of the lower Colorado River Basin should be encouraged to proceed expeditiously to determine their respective rights to the waters of the Colorado River consistent with the Colorado River compact."

It is clear from the foregoing that development of Colorado's share of Colorado River water is at a standstill until a compact apportioning the use of such water among the interested States is consummated. Because of the division of the use of water between the upper and lower basins by the 1922 Colorado River compact, the upper basin States may proceed with such apportionment independent of what may be done by the States of the lower basin. In recognition of this situation, the upper Colorado River basin compact was negotiated and signed. It does not become a completed compact binding on the signatory States until ratified by their respective legislatures and approved by the Congress.

NEGOTIATION OF THE COMPACT

On July 22, 1946, the governors of Arizona, Colorado, New Mexico, Utah, and Wyoming, or their representatives, met at Cheyenne, Wyo., and agreed to initiate the negotiation of an upper Colorado River Basin compact. Compact commissioners at that time had been, or later were, appointed in accordance with the laws of the respective participating States. Also the President of the United States had appointed Harry W. Bashore, former Commissioner of the Bureau of Reclamation, as Federal representative on the commission.

The organization meeting of the commission was held at Salt Lake City, Utah, on July 31, 1946. Harry W. Bashore was elected chairman and Grover A. Giles, attorney general of Utah, secretary. Plans of procedure, including the manner of making the official record, were agreed upon, and the commission provided for the creation of an engineering advisory committee.

Before the compact was signed on October 11, 1948, 8 meetings and 50 sessions of the commission were held as follows:

Meeting	Session	Date	Time	Place
No. 1		July 31, 1946		Salt Lake City, Utah.
	No. 1	do	10 a. m	Do.
	No. 2	do	1:30 p. m	Do.
No. 2		Sept. 17-18, 1946		Santa Fe, N. Mex.
	No. 3	Sept. 17, 1946	10 a. m	Do.
	No. 4	do	1:30 p. m	Do.
	No. 5	Sept. 18, 1946	10 a. m	Do.
No. 3		Oct. 28-30-31 and Nov. 2, 1946.		Field meetings.
	No. 6	Oct. 28, 1946	1:45 p. m	Rock Springs, Wyo.
	No. 7	Oct. 30, 1946	10 a. m	Grand Junction, Colo.
	No. 8	Oct. 31, 1946	2 p. m	Price, Utah.
	No. 9	Nov. 2, 1946	8 a. m	Farmington, N. Mex.
	No. 10	do	10 a. m	Do.
No. 4		Sept. 8, 1947		Cheyenne, Wyo.
	No. 11	do	3 p. m	Do.
No. 5		Dec. 1-2-3-4, 1947		Denver, Colo.
	No. 12	Dec. 1, 1947	10 a. m	Do.
	No. 13	do	2 p. m	Do.
	No. 14	Dec. 2, 1947	9 a. m	Do.
	No. 15	do	2 p. m	Do.
	No. 16	Dec. 3, 1947	1:30 p. m	Do.
	No. 17	Dec. 4, 1947	9 a. m	Do.
	No. 18	do	1:30 p. m	Do.
No. 6		Feb. 17-18-19-20-21, 1948.		Do.
	No. 19	Feb. 17, 1948	10 a. m	Do.
	No. 20	Feb. 18, 1948	4 p. m	Do.
	No. 21	Feb. 19, 1948	9:30 a. m	Do.
	No. 22	do	2 p. m	Do.
	No. 23	do	7:30 p. m	Do.
	No. 24	Feb. 20, 1948	10 a. m	Do.
	No. 25	do	1:30 p. m	Do.
	No. 26	Feb. 21, 1948	9:30 a. m	Do.
No. 7		July 7 to 21, 1948		Vernal, Utah.
	No. 27	July 7, 1948	10 a. m	Do.
	No. 28	do	2 p. m	Do.
	No. 29	July 8, 1948	9:30 a. m	Do.
	No. 30	July 9, 1948	9:30 a. m	Do.
	No. 31	July 10, 1948	9:30 a. m	Do.
	No. 32	July 12, 1948	9:30 a. m	Do.
	No. 33	July 13, 1948	9:30 a. m	Do.
	No. 34	July 14, 1948	9:30 a. m	Do.
	No. 35	July 15, 1948	9:30 a. m	Do.
	No. 36	July 16, 1948	9:30 a. m	Do.
	No. 37	July 19, 1948	9:30 a. m	Do.
	No. 38	do	8 p. m	Do.
	No. 39	July 20, 1948	10 a. m	Do.
	No. 40	do	8 p. m	Do.
	No. 41	July 21, 1948	9 a. m	Do.
No. 8		Oct. 4 to 11, 1948		Santa Fe, N. Mex.
	No. 42	Oct. 4, 1948	10 a. m	Do.
	No. 43	do	2:20 p. m	Do.
	No. 44	Oct. 5, 1948	10 a. m	Do.
	No. 45	do	2 p. m	Do.
	No. 46	Oct. 6, 1948	2 p. m	Do.
	No. 47	Oct. 7, 1948	10 a. m	Do.
	No. 48	Oct. 8, 1948	2 p. m	Do.
	No. 49	Oct. 9, 1948	3:30 p. m	Do.
	No. 50	Oct. 11, 1948	2 p. m	Do.

Meeting No. 3, with sessions held in four different States, as shown above, was designed to obtain the views and comments of the people of these States relative to the compact and to enable the commission to explain its proposed procedure and objectives and the need for a compact. These sessions were all well attended and showed the great interest of the water users of the basin in the undertaking.

All sessions during the period of negotiation were open to the people of the participating States. On only one occasion was an executive session held. Representatives of interested water users' organizations and irrigation and conservancy districts of the States were in attendance at all of the sessions. Most of the members of the Colorado Water Conservation Board at one time or another were in attendance and were of assistance to the commissioner. During the negotiations, progress was reported at regular meetings of the water board and various proposed provisions of the compact considered. After the Vernal meeting when an apportionment was made and the major portion of the compact

agreed upon by the commission, the board entered its formal approval of the compact; and after the compact was signed on October 11, 1948, it was approved by the board as shown by the resolution which is made a part of this submission.

The engineering advisory committee was created because it was recognized that available information on water supplies, water uses, and other data were not sufficient to serve as a guide to the commisison in making the compact. The commission assigned to the committee specific tasks. The personnel of the committee is shown at the beginning of this report. The committee met on the average of every 2 months over a period of more than 2 years. Its work was not confined to meetings of members of the committee but included the time and efforts of staff engineers of the Bureau of Reclamation and of the individual States. The committee's final report is available in the office of the Colorado Water Conservation Board to anyone who wishes to study it, and is made a part of the official record of the commission. It is not a fact-finding report of any Federal agency or of any one State but represents united work and agreed conclusions by an agency of the Federal Government and a group of interested States. It not only served well the commission but will be of inestimable worth to the water users of the basin in the future.

The report of the Bureau of Reclamation submitted to the President of the United States by the Secretary of Interior on July 24, 1947, entitled "The Colorado River" (H. Doc. 419, 80th Cong., 1st sess.; 285 pp.), was of great value to the commission in considering potential development of the basin and important factors in connection therewith. It had taken years for the Bureau to make the investigation and prepare this report.

Colorado's commissioner wishes to acknowledge the outstanding services of Jean S. Breitenstein, his legal adviser, and Royce J. Tipton, his principal engineering adviser. Without their help, the results evidenced by the compact could not have been attained. The assistance and engineering studies made by Frank C. Merriell, engineer-secretary of the Colorado River Water Conservation District, made up of seven counties in western Colorado, was of great value not only to the engineering advisory committee, of which he was a member, but also to the commissioner. C. L. Patterson, before his resignation as chief engineer of the Colorado Water Conservation Board, was a capable member of the engineering committee. He was replaced by R. M. Gildersleeve of the engineering staff of the board, who served well in the preparation of the engineering studies.

All of the signatory States owe a debt of gratitude and appreciation to the Bureau of Reclamation in the making of this compact. Services of inestimable value were rendered by the Bureau. Besides the Federal members of the engineering advisory committee, above mentioned, C. B. Jacobson, regional hydrologist of region 4, Bureau of Reclamation, Salt Lake City, Utah, rendered valuable help to the engineering committee. J. G. Will, assistant chief counsel of the Bureau, Washington, D. C., served as chairman of the drafting committee and as a member of the legal committee. His fairness, objective approach to compact problems, and ability won for him the confidence and respect of all members of the commission. J. R. Riter, as chairman of the engineering Advisory committee, displayed a devotion to the task, conscientious endeavor, fairness, and ability which elicited the high commendation of the commission. Harry W. Bashore, Federal representative and chairman of the commission, presided in an impartial manner and guided well the commission over many "rough spots." All of these services by the Bureau were rendered without cost to the States.

The Department of Agriculture, by making available to the commission, without cost to the States except for traveling expenses, the services of Harry F. Blaney, the country's most outstanding expert on the subject of beneficial consumptive use of water, served the commission in an important respect.

The official record of the commission contains approximately 1,900 typewritten pages. It is being put in permanent form so that it will be preserved and made available for future use by the signatory States and the Government. Thus there will be avoided the situation which now exists with respect to the Colorado River compact. An important part of the minutes of the Colorado River Compact Commission of 1922, after careful search, cannot be found in Washington or in the official records of any of the seven signatory States. These lost minutes have a vital bearing on controversies which have arisen on the Colorado River.

The commission has not as yet adjourned sine die. Its members resolved to continue its organization for the purpose of aiding in the consideration of ratification by the States and approval by the Congress of the compact.

EXCERPTS FROM REPORT OF ENGINEERING ADVISORY COMMITTEE

The report of the engineering advisory committee is 202 pages long, including the appendices. No appreciable amount of the information contained in it can be included here, but it seems well to quote certain pertinent data as follows:

"*Average annual historic flows at State line (1914–45, inclusive)*

"Colorado:	*1,000 acre-feet*
Little Snake River (at mouth)	226.9
Yampa River (exclusive of Little Snake River)	1,172.5
White River	576.2
Ungaged area tributary to Green River	27.4
Colorado River including Gunnison River	5,469.9
Dolores River	762.8
San Juan River above Rosa	929.9
Pine River	294.7
Animas River	807.2
La Plata River	30.9
Mancos River	48.2
McElmo Creek	51.1
Ungaged area tributary to San Juan River	13.5
Colorado share of main stem channel losses within State	—2.3
Net flow at State line	[1] 10,408.4

[1] These figures when the 1,000 acre-feet guide at the top of the column is applied mean 10,408,400 acre-feet.

"*Historic contributions at Lee Ferry (1914–45, inclusive)*

State	Historic flow at State lines, acre-feet	Out of State losses, acre-feet	Historic contribution to flow at Lee Ferry	
			Acre-feet	Percent of total
Arizona	133,200	1,000	132,200	0.96
Colorado	10,408,400	455,600	9,952,800	72.18
New Mexico	186,100	7,700	178,400	1.29
Utah	2,022,800	6,000	2,016,800	14.63
Wyoming	1,610,600	102,200	1,508,400	10.94
Total	14,361,100	572,500	13,788,600	100.00

"*Irrigated areas*

"The following tabulation shows the average irrigated areas for the study period, 1914–45, inclusive, and the present irrigated areas adopted by the Engineering Committee.

"*Irrigated areas*

State	Average for 1914–45, inclusive	Present
Arizona	3,770	9,840
Colorado	790,606	[1] 790,600
New Mexico	39,000	43,620
Utah	288,520	303,977
Wyoming	228,700	236,675
Total	1,350,596	1,384,712

[1] Assumed to be same as average for period, 1914–45.

"*Incidental areas*

"The areas of noncropped land adjacent to and consuming irrigation water incidental to the irrigation of the croplands were estimated by inspection of the Bureau of Reclamation land classification sheets, field inspection, available aerial surveys and other detail and general maps of the irrigated areas. The incidental areas adopted by the committee are as follows:

Average for study period, 1914–45, inclusive

	Acres
Arizona	(1)
Colorado	106,812
New Mexico	6,482
Utah	48,625
Wyoming	28,600
Total	190,519

[1] Negligible.

Man-made depletions at State lines and at Lee Ferry—Averages for 1914 to 1945, inclusive

[Acre-feet]

State	At sites of use	At State lines	At Lee Ferry
Arizona	4,000	4,000	4,000
Colorado	1,062,800	1,042,800	1,016,100
New Mexico	72,200	71,300	69,500
Utah	556,500	544,800	544,300
Wyoming	227,700	226,400	216,000
Total	1,923,200	1,889,300	1,849,900

"*Virgin flow at Lee Ferry*

"Virgin stream-flow contributions at State lines and at Lee Ferry were obtained by adding to the historic contributions the man-made stream depletions estimated at these sites. The following tabulation shows the virgin contributions at State lines and Lee Ferry and also the out-of-State channel losses which were estimated for average undepleted flow conditions.

Virgin flow at Lee Ferry

State	Virgin flow of State lines (acre-feet)	Out of State losses (acre-feet)	Contribution to virgin flow at Lee Ferry	
			Acre-feet	Percent of total
Arizona	137,200	1,000	136,200	0.87
Colorado	11,451,200	482,300	10,968,900	70.14
New Mexico	257,400	9,500	247,900	1.58
Utah	2,567,600	6,500	2,561,100	16.38
Wyoming	1,837,000	112,600	1,724,400	11.03
Total	16,250,400	611,900	15,638,500	100.00

"*Main stem reservoir operations*

"The flow of the Colorado River is not uniform but varies from year to year. At Lee Ferry the historic flow has ranged between a minimum of about 4,400,000 acre-feet in 1934 to a maximum of about 21,900,000 acre-feet in 1917. The average historic flow for 1914–45, inclusive, was 13,788,600 acre-feet. In the 10-year period of lowest historic flow, 1931–40, inclusive, the average annual flow at Lee Ferry was 10,151,000 acre-feet.

"Reservoir operation studies were made to determine the extent to which the upper basin can make its apportioned water uses during drought cycles and still meet its compact obligations at Lee Ferry, as it is quite evident that hold-over

reservoirs must be constructed in the upper Colorado River Basin to impound water in years of high run-off, and to release such stored water in critical periods of low run-off, such as 1931–40, to help meet the upper-division obligation at Lee Ferry.

"Such reservoirs will deplete the flow at Lee Ferry by reason of evaporation losses in excess of present stream channel losses. However, such losses, and the hold-over storage capacity required to regulate the stream flow at Lee Ferry can only be approximated at this time until all storage sites have been studied in detail. It is recognized also, that upstream development of future irrigation projects and storage reservoirs will furnish some equation of stream flows, and will to some extent reduce the capacity needed in hold-over reservoirs as herein reported.

"Operation studies were made for the 32-year period, 1914 through 1945. * * * These studies indicate a required live hold-over storage capacity of not to exceed 30,000,000 acre-feet and stream depletions due to reservoir losses of approximately 500,000 acre-feet annually.

"The actual amount of such hold-over storage capacity will be influenced by the extent to which the stream flow will be equated by the operation of upstream hold-over storage capacity needed to regulate stream flows at the sites of diversions and the equating effect of upstream irrigation developments."

COLORADO RIVER COMPACT OF 1922

The upper Colorado River Basin compact must be in conformity with, and may not violate, the Colorado River Basin compact of 1922. That compact was negotiated and signed by commissioners representing all seven States of the Colorado River Basin. It was later ratified by the signatory States and approved by the Congress. For this reason any consideration of the upper Colorado River Basin compact should be approached with the understanding of the salient terms of the first compact.

The Colorado River compact was signed at Santa Fe, N. Mex., on November 24, 1922. More than 6 years passed before it was finally approved by the Congress on December 21, 1928, through provisions contained in the Boulder Canyon Project Act (45 Stat. 1057–1068). During the intervening period much controversy arose over its ratification and congressional approval, resulting to a considerable degree from opposition in Arizona.

Section 4 (a) of the Boulder Canyon Project Act gave consent to the compact if ratified by only six of the signatory States, including the State of California, provided California, by act of its legislature:

"* * * shall agree irrevocably and unconditionally with the United States and for the benefit of the States of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming, as an express covenant and in consideration of the passage of this act, that the aggregate annual consumptive use (diversions less returns to the river) of water to and from the Colorado River for use in the State of California, including all uses under contracts made under the provisions of this act and all water necessary for the supply of any rights which may now exist, shall not exceed 4,400,000 acre-feet of the waters apportioned to the lower-basin States by paragraph (1) of article III of the Colorado River compact, plus not more than one-half of any excess or surplus waters unapportioned by said compact, such uses always to be subject to the terms of said compact."

The California Legislature passed this self-limitation statute and the respective Legislatures of California, Colorado, Nevada, New Mexico, Utah, and Wyoming completed State ratification by March 4, 1929. The President of the United States proclaimed the compact effective on June 25, 1929. Arizona did not ratify until 1944.

The Colorado River compact of 1922 accomplishes these things:

1. It divides the Colorado River Basin into an upper and lower basin. The dividing point is at Lee Ferry which is on the river approximately 30 miles (river distance) below the Utah-Arizona boundary line and 1 mile below the mouth of the Paria River. Colorado and Wyoming are entirely within the upper basin. California and Nevada are entirely within the lower basin. Arizona, Utah, and New Mexico include territory within each of the two basins.

2. It makes no apportionment of water among the seven States of the Colorado River Basin but it divides the beneficial consumptive use of water between the upper and lower basins. The beneficial consumptive use of 8,500,000 acre-feet annually is apportioned to the lower basin and the beneficial consumptive use of 7,500,000 acre-feet annually, to the upper basin.

3. It also creates two classes of Colorado River Basin States, namely, "States of the lower division" and "States of the upper division. The States of the lower division are Arizona, California, and Nevada, and the States of the upper division are Colorado, New Mexico, Utah, and Wyoming. The compact provided that the States of the upper division: "* * * will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years reckoned in continuing progressive series beginning with the 1st day of October next succeeding the ratification of this compact."

It should be noted that this provision constitutes a joint and several obligation of the States of the upper division to deliver at Lee Ferry the 75,000,000 acre-feet of water during each consecutive 10-year period for use of the States of the lower division.

4. It treats any water over and above the total 16,000,000 acre-feet apportionment for beneficial consumptive use in the two basins as "surplus"; and it specifies that if the United States "shall recognize in Mexico any right to the use of any waters of the Colorado River system, such waters shall be supplied first from" such surplus. If such surplus proves insufficient to meet recognized rights to the use of water in Mexico, then "* * * the burden of such deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized * * *."

In 1945 a treaty between the United States and Mexico was consummated. This treaty guarantees to Mexico the right to use annually 1,500,000 acre-feet of water.

5. It provides that the surplus over and above the 16,000,000 acre-feet total beneficial consumptive use apportionment to the two basins and the water required to meet Mexico treaty demands, shall be subject to "further equitable apportionment at any time after October 1, 1963, if and when either basin shall have reached its total beneficial consumptive use" as set out in the compact.

EXPLANATION OF ARTICLES CONTAINED IN THE UPPER COLORADO RIVER BASIN COMPACT

The upper Colorado River Basin compact contains 21 separate articles, each of which must be considered in order to have an understanding of the principles and objects of the proposed compact.

The introductory paragraph of the compact states the official personnel of the compact commission. Colorado's commissioner, Clifford H. Stone, was appointed by the Governor of Colorado under the provisions of the 1937 act creating the Colorado Water Conservation Board. Prior to the appointment, the Governor consulted interested individuals from all sections of the State. As required by law, the appointment was confirmed by the Colorado Water Conservation Board. The action on the part of the board was unanimous.

Since an upper-basin compact must conform to the 1922 compact, the opening paragraph expressly states that the upper-basin compact is subject to the provisions of the Colorado River compact.

No reference is made in the compact as to any congressional authorization for the making of the compact. Under the United States Constitution and the decisions of the United States Supreme Court construing that Constitution, States of the Union have the right to enter into compacts provided only the consent of Congress is obtained. There is no law requiring States to secure antecedent authorization before negotiating a compact. Under their powers as quasi sovereigns, the States may compact and their compacts will be effective if, after the compact is negotiated, the Congress of the United States consents thereto.

Article I

This article is a declaration of intent. Three of the principles of the compact should be specifically mentioned. The compact provides for the equitable apportionment of such use of the water of the Colorado River system as was apportioned in perpetuity to the upper basin by the Colorado River compact. Also the compact establishes the obligations of each State of the upper division with respect to the deliveries of water at Lee Ferry which are required by the Colorado River compact, and it is recognized specifically that all provisions of the upper-basin compact are subject to the Colorado River compact which is and remains in full force and effect.

Article II

This article is made up entirely of definitions of terms appearing in the compact. Among the definitions are included all of the definitions appearing in the 1922 compact. In addition, certain terms not there defined but appearing in the upper basin compact are expressly defined.

Attention is particularly directed to subparagraph (m) which defines the term "domestic use" as including the use of water for household, stock, municipal, mining, milling, industrial, and other like purposes but excluding the generation of electrical power.

Article III

This is the apportionment article. In considering it one must bear in mind two important facts, namely: (1) The 1922 compact does not apportion water but instead the use of water. This resulted from the decision by the makers of the original compact that they should avoid any argument on the question as to whether the United States or the individual States own the unappropriated waters of the river. For this purpose a means of apportioning use rather than apportioning water was devised; (2) while the 1922 compact, by its paragraph III (a), apportions to the upper basin the beneficial consumptive use of 7,500,000 acre-feet of water annually, such use is subject to the availability of water. The States of the upper division are required by the 1922 compact to maintain certain flows at Lee Ferry. The water available for use in the upper basin is that remaining after the Lee Ferry delivery requirements are satisfied. In view of the uncertainty as to the total amount of water which might be available for the upper basin the compact commission determined that so far as the States of the upper division are concerned the apportionment must be in terms of percents of the total amount of water apportioned to, and available for use in, the upper basin.

Accordingly, an apportionment was made upon the following basis: Arizona, which is not a State of the upper division, was granted the right to use a maximum of 50,000 acre-feet annually. The use of the water apportioned to, and available for use in, the upper basin and remaining after the deduction of the use by Arizona of not to exceed 50,000 acre-feet annually, was apportioned on the following basis: to Colorado, 51.75 percent; to New Mexico, 11.25 percent; to Utah, 23 percent; to Wyoming, 14 percent.

It is of interest to consider the analysis made by the Colorado commissioner and his advisers before agreeing to the percentage stated for Colorado. A very careful study was made of existing and potential uses in Colorado both within and without the natural basin of the stream. On the assumption that 7,500,000 acre-feet of water will be available for use in the upper basin, the Colorado percentage is sufficient for a water supply to take care of all existing uses on both the eastern and western slopes, for an expansion of uses on the western slope to an extent that would result in the consumption of double the amount of water now being consumed on the western slope, for taking care of all transmountain diversions constructed or under construction and all planned extensions thereof or additions thereto and for an estimated 1,000,000 acre-feet annually which may be made available for potential transmountain diversion projects. This appraisal was used in considering the apportionment question. It does not constitute a commitment on the manner in which Colorado shall eventually utilize its share of the water.

It is true that Colorado endeavored to secure a larger apportionment. However, it must be realized that each of the States advanced requests for a greater apportionment than that eventually received. In the meeting at Vernal, Utah, when the commissioners for the various States first came forward with their requests, the total amounted to 117 percent of the available water in the upper basin. It was necessary for each State to reduce its request. The final result, while not satisfying the ultimate potentialities of any State, constitutes as fair and equitable an apportionment as is humanly possible. No State can say with any justification that the compart does not treat it fairly.

Particular attention is directed to the apportionment made to the State of New Mexico. It is well known that in northwestern New Mexico there is a large Indian population which in late years has attracted much popular attention. The commissioners wisely determined the water allocation should be such as to satisfy fully the needs of the Indians. Accordingly, New Mexico was allotted a share of water sufficiently large to take care of every water use currently planned for the Indians by the Office of Indian Affairs and in addition to afford New

Mexico an equitable share of water available for use by the whites. Indian uses of water are charged against the share of the State in which the use is made.

It was necessary to specify certain principles upon which the apportionment was made. This is done in subparagraph (b) of article III. It is recognized that the apportionment includes all man-made depletions, that beneficial use is the basis of the right to use, and that the allotment to each State includes all water necessary for the supplying of existing rights. Subparagraph (b) (3) recognizes certain limitations designed to protect each State in securing the use of the water allotted to it.

The compact does not apportion any water which under the terms of the 1922 compact falls within the category of surplus. It is specifically stated that the apportionment made by the compact shall not be taken as any basis for the allocation of benefits resulting from the generation of power.

Article IV

This article relates to curtailment of use if necessary in order to maintain Lee Ferry flows. Under the 1922 compact the States of the upper division may not deplete the Lee Ferry flow below specified quantities. To prevent a violation of that compact it was necessary in the upper basin compact to make provision for the curtailment of uses so as to prevent a depletion of the flow to an extent which would violate the 1922 compact. Article IV gives to the administrative agency created by the compact the authority to determine the extent of curtailment both as to quantity and time. In doing so, however, the commission must follow certain stated principles. The curtailment must be such as to assure full campliance with the Colorado River compact. If any State or States in the 10 years preceding the year in which curtailment is necessary, has used more water than they were entitled to use under the apportionment made in article III, then such State or States must deliver at Lee Ferry a quantity of water equal to the overdraft before demand is made on any other State for curtailment. Except for this requirement the extent of curtailment by each upper division State must be such as to deliver at Lee Ferry the quantity of water which bears the same relation to a total curtailment as the consumptive use of water by that State in the preceding year bears to the total consumptive use in all of the States of the upper division during the same year. It is most important to note that in determining the last-mentioned relationship uses of water under rights perfected prior to November 24, 1922, are excluded. The value of this provision to western slope users should be recognized. A very high proportion of their uses was made under rights antedating 1922.

Article V

This article pertains to the charging of reservoir evaporation losses. One of the weaknesses in the 1922 compact is its failure to provide any method of charging such reservoir evaporation losses. This omission has resulted in a serious dispute among the lower basin States as to their liability for water lost by evaporation from the surfaces of Lake Mead and Lake Havasu.

The negotiators of the upper basin compact deemed it essential to avoid, if possible, such disputes in the upper basin and to that end they have incorporated in article V principles to be followed in charging reservoir evaporation losses. Such losses from reservoirs constructed prior to the signing of the compact are charged to the State in which the reservoirs are located and water stored in such reservoirs is for the use of the State in which the reservoirs are located. Reservoirs constructed after the signing of the compact are divided into two classes. If, as found by the administrative agency, a reservoir is used in whole or in part to assist the upper division States in meeting at Lee Ferry delivery obligations, then the losses, as found by the commission to be chargeable to the reservoir or reservoir capacity so utilized, shall be charged to each State of the upper division in the proportion that the consumptive use of water in that State during the year in which the charge is made bears to the total consumptive use in all of the upper division States during the same year. Water stored in such reservoir or reservoir capacity is to be for the common benefit of all the States of the upper division and is not to be earmarked for any particular State.

As to reservoir or reservoir capacity found by the commission to be used to supply water for use in an upper division State, the commission shall make a finding in regard thereto and all the reservoir losses properly allocable to such reservoir or reservoir capacity shall be charged to the State which has the use of the water and the water shall be earmarked for and charged to that State.

The commissioners thought that there might be some controversy as to whether a reservoir site should preferably be used for the benefit of a particular State or for the benefit of all the States of the upper division in making Lee Ferry deliveries. Accordingly, paragraph (c) provides that the storage of water for consumptive use in a State of the upper division shall have preference.

Article VI

The purpose of this article is to establish the method of measuring consumptive use of water. There is no purpose in making an apportionment of consumptive use unless the procedure for measurement is defined. There have been in the Colorado River Basin two conflicting theories as to the measurement of consumptive use. Without entering upon a technical discussion of the details, it is sufficient to say that under one of these theories the use is measured by totaling the diversions from the river and subtracting therefrom the return flows. Under the second theory the quantity of consumptive use is determined by computing the extent to which the man-made uses have depleted the stream flows at designated points. The first theory is utterly unworkable in Colorado. On the western slope there are thousands of ditch diversions. To apply the principle of diversions less returns it would theoretically be necessary to install automatic measuring devices at the headgate of each ditch. By such procedure the diversions could be measured. The measuring of returns to the river from this multitude of individual diversions would present a complex problem for which no easy solution has ever been indicated. The situation in Colorado is comparable to that existing in other upper basin States.

The negotiators of the upper basin compact also gave consideration to the intent of the makers of the 1922 compact. It was concluded that such intent was to measure uses in terms of stream depletions at Lee Ferry so far as the upper basin is concerned.

After full consideration, it was determined that consumptive use should be measured "by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry." The "inflow-outflow" method is an engineering procedure whereby the amount of water occurring in the upper basin is measured by series of rim stations. The outflow is, of course, determined by the flow at Lee Ferry. The amount of consumptive use represents the change in the relationship between the index stations from that existing under virgin conditions and that existing at any particular time after the stream has been depleted by man's activities.

"Man-made depletions" means the reduction in river flow caused by the activities of man. "Virgin flow," sometimes called "reconstructed flow," means the amount of water flowing in the river before any of it is put to use by man's activities.

The actual determination of the consumptive use by the procedure indicated is made a responsibility of the administrative agency. The commissioners recognized that in the future some other or different method of measurement might become necessary; hence the commission is given the right to adopt a different method of determination, but in taking such action the commission must act unanimously.

Article VII

Article VII is designed to make clear that uses of water by agencies, instrumentalities, or wards of the United States shall be charged against the State in which the use occurs. Among other things, this means that Indian uses are a charge against the share of the State in which the use is made.

Another point made clear by this article is that where water is diverted, stored, or conveyed in one State for use in another State, the charge is against the State which receives the beneficial use of the water.

Article VIII

This very important article creates an interstate agency to administer the compact. It was obvious to all the commissioners that the multitude of problems which may develop in connection with the use of upper basin water could neither be foreseen nor solved at this time. A desirable feature of any compact is flexibility. Under the circumstances, it was deemed essential to set up an agency authorized to administer the compact.

Article VIII creates the Upper Colorado River Commission. Arizona, because of its slight interest in the upper basin, was not given a place on the commission. The other four States each have a commissioner designated or appointed in accordance with the laws of the particular State. The President of the United States is requested to designate a commissioner for the United States who shall be the presiding officer and shall have the same powers and rights as the commissioner of any State. A quorum consists of any four members of the commission. Expenses of the commission, except the salaries and expenses of each commissioner and the expenses paid by the United States, are borne by the four States according to the percentage of consumptive use apportioned to each. This means that Colorado, which has an apportionment of 51.75 percent must bear 51.75 percent of the expense of the commission.

The commission is required to appoint a secretary who shall not be a member of the commission or an employee of any signatory State or of the United States. Engineering, legal, clerical or other personnel may be employed without regard to the civil-service laws of any State.

The commission is given numerous specific powers. Among the more important are the following: To adopt rules and regulations, to establish gaging stations, to forecast water run-off, to report on water supplies and uses, to make findings on matters covered by the compact, to acquire and hold personal and real property, and to make annual reports. All of these powers must be exercised in a manner consistent with the compact. Concurrence of four members of the commission is necessary on any matter except where the compact requires unanimous action. The records of the commission shall be readily available to the official representatives of the States and of the United States. The organization meeting of the commission must be held within 4 months from the effective date of the compact.

Consideration was given to the question as to whether or not the commission should have judicial powers. It was finally agreed that it would be improper to delegate any judicial authority to the commission. However, it seemed very desirable to give some standing to findings of facts made by the commission. Accordingly, paragraph (g) provides that findings of fact made by the commission while not conclusive in any court shall constitute prima facie evidence of the facts found.

Article IX

In order to utilize fully the waters of the upper basin it will be necessary to have facilities in one State to divert, store, convey, and regulate water both for use in another State and for use in satisfying the Lee Ferry delivery obligations. Article IX has as its purpose the provision of machinery necessary for the establishment of facilities in one State for the benefit of another State or States.

It should be recognized that Colorado more than any other State is affected by this article. Plans for future development encompass facilities located in Colorado for the use of Wyoming, Utah, and New Mexico. It will be recalled that Colorado has a statute forbidding diversions in this State for use in another State. In the negotiation of the Republican River compact, Colorado was confronted with the same situation as is presented on the upper Colorado. In fairness to our neighbors we must permit the construction and use of facilities in Colorado for the benefit of States lower on the stream. To do this it is necessary to supersede the statute above-mentioned.

Another problem relates to the use of the power of eminent domain. There are decisions to the effect that one State may not come within the boundaries of another State and there exercise the power of eminent domain. To get around this difficulty it was necessary to provide that an upper State would in its own sovereign capacity exercise the power of eminent domain upon the proper request from another State.

The principles set forth in article IX follow very closely those contained in the Republican River compact, which was made by Colorado, Nebraska, and Kansas. Because of particular conditions existing on the upper Colorado it was necessary to go into more detail than is found in the Republican River compact.

In connection with the facilities in an upper State for use in a lower State, the lower State must bear the expense and, in acquiring the property and constructing the facilities, must comply with the laws of the upper State. The storage and release of water is made by the upper State upon the order of the State for whose benefit the facility is constructed or, if the facility is constructed for the benefit of all States, upon the order of the commission. The rights of the lower State are subject to the rights of the water users in the State where the

facilities are located to receive and use the water apportioned to the State in which the facility is constructed.

As a condition precedent to the use of facilities, it is required that, except in the case of the United States, those for whose benefit the facilities are constructed must pay to the State in which the facilities are located, in lieu of taxes lost, a sum equivalent to the average amount of taxes levied and assessed against the land and improvements thereon during the 10 years preceding the acquisition of the land for use and benefit of the lower State.

Article X

This article recognizes the continued validity of the La Plata River compact which was entered into in 1922 between Colorado and New Mexico for the apportionment of the waters of that stream which is a tributary of the San Juan arising in southwestern Colorado and flowing into New Mexico. Comsumptive uses of La Plata River water are charged under the apportionment made in article III to Colorado and New Mexico.

This article is the first of several dealing with specific interstate tributaries. The commission deemed it wise to settle the rights of the States on interstate tributaries of the upper Colorado rather than to have those tributaries the subject matter of individual compacts.

Article XI

This article determines the rights of Colorado and Wyoming to the use of the waters of the Little Snake River which arises in Colorado and flows back and forth across the Colorado-Wyoming line 19 times before finally joining the Yampa River in Colorado. The existing rights on the main stream below the confluence of Savery Creek and Little Snake are required to be administered on the basis of an interstate priority schedule. Rights initiated subsequent to the signing of the compact, both direct flow and storage, are required to be so administered that in times of water shortage the curtailment of use in each State shall be as nearly equal as is possible. Future water use projects shall to the greatest extent possible result in an equal division between the two States of water not used under rights existing prior to the signing of this compact.

Water uses along the Little Snake and along all other tributaries which are individually treated by the compact, are chargeable against the apportionment made in article III to the State in which the consumptive use occurs.

Article XII

This relates to Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek, and Sheep Creek, all of which originate in Utah and join the Green River in Wyoming. Water uses under rights existing prior to the signing of the compact are required to be administered on the basis of a priority schedule. On certain of these creeks water uses under rights initiated in the future are divided equally between the two States. Measuring devices are required to be maintained at ditch diversion points. Provision is made for the appointment by the two State engineers of a special water commissioner with authority to administer the water in both States in accordance with this article. The salary and expenses of this commissioner are paid 30 percent by Utah and 70 percent by Wyoming.

Article XIII

This article pertains to the Yampa River, a tributary of the Green River. A compelling reason for the apportionment between Utah and Colorado of the use of the Yampa River water was the fact that Utah desired assurance of a water supply for its central Utah project.

By this article Colorado agrees not to deplete the flow of the Yampa at the Maybell station below 5,000,000 acre-feet in any period of 10 consecutive years. The Colorado engineers are of the opinion that the water supply of the Yampa River is adequate to take care of all existing and potential uses made from that stream in Colorado and still meet the required delivery at Maybell.

Article XIV

By this article the use of the waters of the San Juan River are apportioned between Colorado and New Mexico. The San Juan River and its principal tributaries arise in Colorado and then flow into New Mexico. Reference has heretofore been made to the fact that the apportionment made by article III to New Mexico is adequate to care for all projects planned by the Office of Indian Affairs.

Colorado agrees to deliver to New Mexico a quantity of water which shall be sufficient, together with water originating in the basin in New Mexico, to enable New Mexico to make full use of water apportioned to it, subject to certain conditions. A prior right is recognized in all uses of water existing at the time of the signing of the compact and in all uses contemplated by projects authorized for construction at such time. It is provided that uses of water dependent upon a common water supply and not existing or authorized at the time of the signing of the compact shall in times of water shortage be so reduced that the resulting consumptive use in each State is proportionate to the use made during times of average supply, with the exception that if any preferential uses are recognized in the Indians such uses shall be excluded at the time of determining the amount of curtailment. The overriding obligation of each State to contribute to Lee Ferry deliveries is recognized.

Article XV

Paragraph (a) of this article provides that the use of water for the generation of electrical power shall be subservient to the dominant use of such water for agricultural and domestic purposes.

Paragraph (b) assures each State the right to regulate within its boundaries the appropriations, use, and control of water apportioned and available to it under the compact.

Article XVI

This is a savings clause protecting the States against any abandonment or forfeiture of water because of failure to use.

Article XVII

This is a usual compact provision concerning water imported to the natural basin of the stream from some other basin. The use of such water is not charged to the State making the importation as water apportioned by article III of this compact.

Article XVIII

By this article Arizona reserves its rights under the 1922 compact as a lower division State, and Arizona, New Mexico, and Utah reserve their rights under that compact as lower basin States.

Article XIX

The intent of this article is to recognize the rights of the United States.

It is stated that nothing in the compact affects the obligations of the United States to Indian tribes or under the treaty with the United Mexican States. Likewise, the compact does not disturb the rights or powers of the United States in the waters of the upper Colorado River system or its capacity to acquire rights in and to the use of such waters.

It is expressly stated that the compact does not subject any property of the United States to taxation or to any payments whatsoever in reimbursement for loss of taxes.

Paragraph (e) expressly provides that the compact does not subject any property of the United States to the laws of any State "to an extent other than the extent to which such laws would apply without regard to this compact."

In connection with this article XIX it must be recognized that without the provisions contained therein it would be impossible to secure the necessary congressional consent to this compact.

Article XX

This provides for the termination of the compact by unanimous agreement of the signatory States. In this connection it should be pointed out that such termination cannot result from Executive action. The compact to be effective must be ratified by the legislature of each State. Termination can only result from similar action.

As a necessary protective measure it is provided that in the event of termination all rights established under the compact shall continue unimpaired.

Article XXI

This relates to the procedure for ratification and approval of the compact. The legislature of each signatory State must ratify the compact and the Congress must consent thereto. The machinery for giving the necessary notices is provided for in this article.

The concluding paragraph provides for execution of the compact in six original counterparts, one of which shall be deposited with the Department of State of the United States and one of which shall be forwarded to the Governor of each signatory State.

Mr. BREITENSTEIN. That is the only matter which I had not covered in my statement of yesterday.

Mr. MURDOCK. The witnesses are ready to answer questions from the committee.

Mr. Engle, do you have questions?

Mr. ENGLE. Yes, Mr. Chairman. As I said at the close of the hearing yesterday, I have been turning over in my head the effect of the word "effect" and refer to the colloquy which occurred between Mr. Breitenstein and myself in the record of yesterday, in which be agreed, I believe, that Congress in consenting to this compact is not consenting to any interpretation, expressed or implied, of the basic Colorado compact in the upper Colorado compact, but I asked the gentleman whether he would agree that it was not binding the Congress as to the language, intent or effect of the basic compact, and if I am correct, he would go along with that statement save and except the use of the word "effect." Is that correct, Mr. Breitenstein?

Mr. BREITENSTEIN. I believe that is correct. The wording of the question is a little hazy in my mind, but I do remember I questioned those words.

Mr. ENGLE. I am sorry Mr. Lemke is not here because I am referring to the questions asked by Mr. Lemke and the answers given by the witness to his questions. Mr. Lemke said:

As I understand it, this compact deals only with that which is already yours by the lower basin compact.

Mr. BREITENSTEIN. Yes, sir, that is correct. We claim nothing more than that.

Mr. LEMKE. If the word "effect" may be put in, that may be a surrender of what rights you have under the original compact?

Mr. BREITENSTEIN. That is what I have been trying to say.

Mr. LEMKE. You are objecting, therefore?

Mr. BREITENSTEIN. That is right.

Mr. LEMKE. You do not intend to interfere with the rights of the Colorado River compact, except you are going to claim what is yours already, and that is the only thing you are dealing with in this bill?

Mr. BREITENSTEIN. That is exactly right, Congressman.

Now, I can understand how it was implicit in the original Colorado compact, the basic compact, that a compact should be arrived at in the upper basin and one should be arrived at in the lower basin, and

within the framework of those compacts and the legal and proper framework of those compacts, one would have an effect upon the other, and that is the legitimate effect which I assume the witness is referring to. Is that correct, Mr. Breitenstein?

Mr. BREITENSTEIN. That is correct, yes sir.

Mr. ENGLE. I want to go a little further, because I think there are some other effects which may be had, and I would like a clear definition of what is intended with reference to those, so I would like to ask the witness whether or not the basic Colorado River compact specifically defines the phrase "beneficial consumptive use."

Mr. BREITENSTEIN. In my opinion, it does not.

Mr. ENGLE. Is it true that there is a difference of opinion as to the definition of and how beneficial consumptive use would be measured under article III (a) of the Colorado River compact?

Mr. BREITENSTEIN. There are differences of opinion, yes, sir.

Mr. ENGLE. Is it true that some States interpret this phrase to mean "the amount of water consumed at the site of use," a definition sometimes referred to as "diversions less return to the river?"

Mr. BREITENSTEIN. Yes, sir.

Mr. ENGLE. Is it also true that in the other interpretation commonly called the "depletion theory," and the one relied upon by the framers of the upper Colorado River compact, that this phrase, "beneficial consumptive use," means the amount of man-made depletions of virgin flow at specific points on the main river, so far as the upper basin is concerned, the point being Lee Ferry.

Mr. BREITENSTEIN. That is my opinion, yes, sir.

Mr. ENGLE. Is it also true that under the depletion theory if man-made works have the effect of salvaging certain natural losses of war, such as evaporation and transpiration, the use of water so salvaged would not be charged as a beneficial consumptive use under article III (a) of the basic Colorado River compact?

Mr. BREITENSTEIN. I would like to have you repeat that one, if you do not mind.

Mr. ENGLE. Is it true that under the depletion theory, if man-made works have the effect of salvaging certain natural losses of water, such as evaporation and transpiration, the use of water so salvaged would not be charged as a beneficial consumptive use under article III (a) of the basic Colorado River compact?

Mr. MURDOCK. Is the witness ready to answer?

Mr. BREITENSTEIN. I will answer that "yes."

Mr. ENGLE. Now, to continue——

Mr. BREITENSTEIN. Congressman, we are still a little confused about that last question to which I answered "Yes." I do not mean to be insistent, but if you would read it again, I think perhaps we would all be sure as to whether or not I have answered that in accordance with our position.

Mr. ENGLE. I will repeat it very slowly: Is it also true that under the depletion theory, if man-made works have the effect of salvaging certain natural losses of water, such as evaporation and transpiration, the use of water so salvaged would not be charged as a beneficial consumptive use under article III (a) of the basic Colorado River compact?

Mr. BREITENSTEIN. My answer to that is still "Yes," Congressman, but I think that I should amplify my answer to this extent: by that answer I do not mean to imply that it is the intent of the upper basin States to violate the Colorado River compact. It is our intent to live up to the Colorado River compact, and in our opinion, the depletion theory is a correct interpretation of the Colorado River compact.

So far as the upper basin States are concerned, we have adopted that theory as the method of measurement of the allotments to each of the upper basin States. I have conceded that there are differences of opinion in regard to the definition and measurement of beneficial consumptive use. You have raised the question of salvage water.

I would like to just throw out for consideration by the committee here that evaporation losses from reservoirs are a large factor in consumption of water, depletion of stream, and I suggest that consideration be given as to whether or not under the diversions-less-returns theory, some accounting, some charge should not be imposed for reservoir evaporation losses.

Mr. ENGLE. That is a proper consideration, but I want to pursue this particlar line of thought for just a little longer. In the upper basin, the additional salvaged water available for use under the depletion theory, without being charged as a beneficial consumptive use under article III (a) of the basin compact would be quite substantial, would it not?

Mr. BREITENSTEIN. I would prefer you ask that question of Mr. Tipton. I am just a lawyer. Mr. Tipton is here.

Mr. ENGLE. Mr. Tipton?

Mr. TIPTON. I cannot answer that, Congressman. There would be some salvage of water. There is a difference of opinion among engineers as to what the magnitude might be. No one knows; no one ever will know until the full development takes place.

Mr. ENGLE. If the upper basin consumptively uses 7,500,000 acre-feet of water per annum measured out on the depletion theory, the amount of water passing Lee Ferry would be less, would it not, than would be the case if the upper basin consumptively uses 7,500,000 acre-feet per annum, measured at the site of the use on the diversions less returns to the river theory?

Mr. BREITENSTEIN. So far as I am concerned, I do not know. Maybe Mr. Tipton does.

Mr. TIPTON. Congressman, I should like to have an amplification of the theory "diversions minus return to the stream." Does that theory also carry with it the proposition that there shall be charged as beneficial consumptive use under article III (a) of the Colorado River compact, reservoir losses?

Do you consider reservoir losses a diversion minus return to the stream?

Mr. ENGLE. I am referring to the diversions less returns to the river.

Mr. TIPTON. Congressman, I cannot answer the question unless I know whether the proponents of the theory that beneficial consumptive use under article III (a) shall be measured as diversions minus returns to the stream include, as a part of the beneficial consumptive use, reservoir losses.

Mr. ENGLE. It is my opinion that reservoir losses are charged against the basin in which they occur.

Mr. TIPTON. In other words, reservoir losses also would be considered in the category of diversion minus return to the stream.

Mr. ENGLE. You are getting in a very technical field. What I have in mind is the diversions less return to the river theory, which is embodied in the California Limitation Act, and which was written into the Mexican Treaty.

Mr. TIPTON. Now we are getting right down squarely, I think, to the difference in theory. I have heard the California theory discussed many times before committees of Congress. I have never heard in any of those discussions any of the California proponents of that theory suggest that reservoir losses from Lake Mead, any reservoir losses from Lake Mead, should be charged to California. The only place, Congressman, that there is mention of diversion minus return to the stream is in the Boulder Canyon Project Act, which provides that before the compact be consented to by the Congress, California shall irrevocably, for the benefit of Arizona and the other States of the basin, reciting them, limit her beneficial consumptive use—diversion minus return to the stream—to 4,400,000 acre-feet of water apportioned by article III (a) of the compact.

California's position from that time on has been that that has been an interpretation of beneficial consumptive use under article III (a) of the compact. It has been further California's position, as I understand it, that that is net use by California and that there shall not be charged to California any reservoir losses. Now, I will answer your question.

Assuming that that is the interpretation of beneficial consumptive use as set forth in article III (a) of the compact by those who are proponents of that theory, diversion minus return to the stream, if that same theory that was proposed by California had been adopted by the upper basin States when it wrote its compact, there would be less water passing Lee Ferry than there will be under the theory that is set forth in the upper basin compact.

The reservoir losses in the upper basin will amount to much more than any salvage of water that ever can be made, so that if we said that our uses shall be measured as diversions minus return at the site of use, and we take the same position as California, that there shall be charged no reservoir losses against us, there would be less water at Lee Ferry than there would be under the other theory.

Mr. ENGLE. Mr. Tipton, I did not intend to get into a discussion of the lower-basin concept, except as the upper Colorado compact may bear upon it.

Mr. TIPTON. You understand I could not answer the question unless I knew the complete theory.

Mr. ENGLE. The question so far developed this: That the words "beneficial consumptive use" as used in the basic compact have not been defined and are not defined in that compact; that there is a disagreement as to the definition of beneficial consumptive use; that the upper basin, in its compact which is now before this committee, has accepted the depletion theory of beneficial consumptive use.

It is my impression, and I am proceeding on the assumption, that the upper States would not accept a definition of beneficial consumptive use which would give them less water, but would adopt the theory giving them more, which brings me to this question: If it is true,

and assuming that it is true for the purpose of this question, that the definition given to beneficial consumptive use in the basic compact will affect the total amount of water delivered at Lee Ferry, or the measurement of water delivered at Lee Ferry, then is it not a fact that the lower basin States are interested in the manner in which that measurement is made?

Mr. BREITENSTEIN. May I at least start the answer to that, Congressman?

Mr. ENGLE. Yes.

Mr. BREITENSTEIN. So far as the measurement of water between the two basins is concerned, if at times of ultimate development when we are up to near the maximum of our use, or when the question is whether or not we are meeting our delivery obligations, there is disagreement between the two basins as to how beneficial consumptive use is to be measured and it cannot be settled amicably, I assume that at that time, some uncertain date in the future, there may have to be a decision of the United States Supreme Court determining as between these two basins, which method is discussed here, or perhaps some other method that one of us have thought of yet, is the correct method of measuring beneficial consumptive use.

Mr. ENGLE. That is precisely the point I am getting to.

Mr. BREITENSTEIN. May I continue for just a moment?

Mr. ENGLE. Yes, proceed.

Mr. BREITENSTEIN. I would like, if I may, Congressman, to just give a brief statement on these two theories, because perhaps some of the members of the committee here do not understand them and I would like to give at least one very logical reason as to why the upper basin States in this compact, I say, were forced to adopt the depletion theory.

Diversions minus returns, the theory advocated by California, as I understand it, would measure consumptive use by adding up the total of all the diversions. I assume that that contemplates the recording by automatic devices of all head gate diversions. As to how the return flows will be measured, I do not know.

I have sat through many hours of hearings with the California lawyers and California engineers, and none of them have yet said how you were going to measure the return flows; but be that as it may, consider for a moment the difference between California and Colorado. In California, you have very few diversions, most of which are extremely large, and they take the water almost immediately out of the basin of the Colorado River, so there is probably a minimum of return flows. In Colorado, Congressman, we have between four and five thousand diversions on the west slope of Colorado. For us to require the installation of automatic measuring devices on each of those ditches would be to impose a burden which would never be accepted by the people of Colorado; and secondly, if any engineer can devise a method of measuring the return flow from these four or five thousand individual ditches, I have never heard it and I do not know how it can be done.

Mr. MILLER. Will the gentleman yield at that point?

Mr. ENGLE. Let me pursue this just a little further, Mr. Breitenstein. I am not trying to get into a discussion of the relative merits of the depletion theory or definition of beneficial consumptive use

and the theory of diversions less returns to the river. What I am trying to establish is that the upper basin Colorado compact does, in effect, accept one theory and does, in effect, write that theory into its compact, and I am trying to determine the effect, and I use the word "effect" purposely of writing that interpretation into the other upper Colorado River compact on the basic Colorado compact.

Mr. BREITENSTEIN. I will continue with what I had to say, because I believe it goes to that point.

(Discussion off the record.)

Mr. ENGLE. May I get back on the record and ask one or two further questions?

If it is true that the method of measurement of the 7,500,000 acre-feet of beneficial consumptive use, which the upper basin States are entitled to, is affected by the method in which that measurement is made, and the definition of that measurement is set up in this upper Colorado Basin compact, are the upper basin States now requesting that the United States, in consenting to the pending compact, accept or concur in any interpretations of the Colorado River compact, expressed or implied, in the upper basin compact?

Mr. BREITENSTEIN. The method of measurement set up in the upper Colorado River Basin compact is binding upon the States signatory thereto. That method of measurement is not binding upon the non-signatory States nor upon the United States.

Mr. ENGLE. In your opinion, does the Congress have the authority or the power to interpret an interstate compact?

Mr. BREITENSTEIN. No, sir.

Mr. ENGLE. And as a consequence, any consent given by Congress to this compact is not an acceptance or a concurrence in any interpretation of the basic compact which might be expressed or implied in the upper basin compact, is that correct?

Mr. BREITENSTEIN. Yes, sir, and also Congress, in the Boulder Canyon Project Act, did not interpret the beneficial consumptive use phrase as meaning diversions less returns to the river. It works both ways.

Mr. ENGLE. Let me go one step further: Inasmuch as it is conceded that the consent of Congress to this compact does not mean an acceptance or a concurrence by Congress in any interpretation, express or implied, of the basic compact by the upper basin compact, do you have any objection to writing a proviso in the first section of this bill which explicitly says that the consent of Congress to this compact is not a consent to any interpretation, expressed or implied, of the basic compact in the upper Colorado River compact?

Mr. BREITENSTEIN. Yes, sir; I do.

Mr. ENGLE. And why?

Mr. BREITENSTEIN. Because if you do that, you recognize by implication that Congress might so interpret and construe it and would be saying that in the Boulder Canyon Project Act they had interpreted the old compact to mean diversions less returns to the river, and I say that Congress cannot do it now and it could not have done it then.

Mr. ENGLE. Mr. Breitenstein, if I say that I do not intend to kick your dog, does that mean that I do so intend and in the absence of such a declaration I will kick your dog?

Mr. BREITENSTEIN. No; but also if you adopt that analogy, in the 1928 Boulder Canyon Project Act, you did kick my dog.

Mr. ENGLE. How can you say that consistently with section XIX, which you have written in the upper basin Colorado compact? Whose dog are you kicking there, when you set up a special section of the upper Colorado compact to indicate that you are not abridging or curtailing any of the rights of the United States Government as set forth in section XIX?

Mr. BREITENSTEIN. Congressman, we went into that yesterday, and I told you the best knowledge that I had of the background of article XIX.

Mr. ENGLE. Let us just put the shoe on the other foot now. Does the express waiving and denial of any intent to abridge the rights of the United States Government in section XIX or article XIX of this compact imply that in the absence of such a declaration those rights would be abridged?

Mr. BREITENSTEIN. All I can say on that is that the representatives of the United States Government, going back through these compacts since the Republican River compact was up, have thought it necessary to put in those provisions, or provisions similar to that.

As to the reasons for them, I would prefer that you ask the Federal representative or his legal adviser. I think they were not necessary.

Mr. ENGLE. But were they positively and affirmatively damaging in that they implied the existence of something which in the absence of those provisions would exist, to wit, an operation of this compact to affirmatively affect the rights of the United States Government?

Mr. BREITENSTEIN. I do not think it was necessary to have that. But I have given you my objection to that language, and my objection, I will say it again, is that if you put that in, you have an implication that Congress could interpret and could construe; and then I rather fear, and I think it is a well-founded fear, that your State would urge in any possible litigation that by the Boulder Canyon Project Act, Congress did interpret and construe the phrase "beneficial consumptive use" and I say that Congress could not do it and it is not doing it now. You want the advantage and you want us to have all the disadvantage.

Mr. ENGLE. No; do not attribute that to me. I am just trying to find out, Mr. Breitenstein, where we stand.

Mr. BREITENSTEIN. That is the effect of it, Congressman.

Mr. ENGLE. And inasmuch as there has been written into article XIX of this compact an express disclaimer as far as the United States Government is concerned, all I am asking is that so far as the lower basin States are concerned, not signators to this compact, that we write in a statement plainly putting into the law the proposition which you have admitted to be the fact, and that is that the consent of Congress is the bare legal requirement, satisfying the Constitution of the United State, and that it is not a consent to any interpretation, express or implied, of the basic compact, either by the United States or the States. What is unfair and wrong about that?

Mr. BREITENSTEIN. It is all right if you will also do one other thing: Put in a provision here to the effect that the Boulder Canyon Project Act did not interpret or construe the Colorado River compact.

Mr. ENGLE. May we pursue that a little bit? What makes you think the Boulder Canyon Act interpreted the basic compact?

Mr. BREITENSTEIN. I say it did not.

Mr. ENGLE. What are you worrying about?

Mr. BREITENSTEIN. Because you want us to say here that Congress, by consenting to this legislation, does not interpret or construe our compact, and I say it does not, but when you put that in here, it carries with it the implication that Congress could interpret and construe a compact. Hence, the argument will be made that in the Boulder Canyon Project Act, Congress interpreted and construed the Colorado River compact, and said that "beneficial consumptive use" means "diversions less returns." I say you could not do it then and you cannot do it now.

Mr. ENGLE. You mean because California is bound by the diversions minus returns to the river under its Limitations Act? Is that what you are saying?

Mr. BREITENSTEIN. I am talking about the Boulder Canyon Project Act.

Mr. ENGLE. What language in it might be used in this unconscionable way to imply an interpretation by Congress?

Mr. BREITSTEIN. That language in parentheses. I have a copy of the act. It says: "(diversions less returns to the rivers)," in section IV of the Boulder Canyon Project Act.

Mr. ENGLE. I would want to think about that. It is not my intention to prejudice the position of the parties in this matter or the respective basins in any way. I am for what the gentleman from Wyoming referred to the other day as the status quo, and all I am trying to be sure of is this: That when and if this question ever has to be settled, that we have not by a consent of Congress to this act given leverage either to one side or the other. I want to reserve those points. That is the objective I have in mind and it is just a question of how we arrive at it.

I do not believe that the witness has any desire to have this compact, by implication or otherwise, bind anyone else as to interpretation of the basic compact. Am I correct in that?

Mr. BREITENSTEIN. It only binds the five compacting States so far as the upper basin is concerned. We have said in our statement and I have said many times here, we are not binding the nonsignatory States nor the United States. All the United States is doing is removing a constitutional limitation upon the rights of these States to compact. That is all it is doing.

Now, so far as these States are concerned, in dividing up this water we are bound by the theory we have adopted, but it does not bind your State and it does not bind the United States. If we can get along in the future, Congressman, and may I say I most sincerely hope we can, then in the days of ultimate development there will be no argument on this thing. It would be ridiculous, in my opinion, to go through a lawsuit like the North Platte case.

Now, I had, among my other jobs, the representation of the State of Colorado in the North Platte case, and I know just what it is, and in my opinion, Mr. Congressman, the lawsuit was absolutely unnecessary.

Mr. ENGLE. I think that completes my questioning, Mr. Chairman. Thank you.

Mr. MURDOCK. Contrary to my usual practice, I think I would like to ask a few questions right at this point.

Did I understand you, Mr. Breitenstein, to say the theory or method of measurement adopted in the writing of the upper basin compact is the so-called depletion theory or method?

Mr. BREITENSTEIN. Yes; that is the method of measurement used.

Mr. MURDOCK. The method of measurement?

Mr. BREITENSTEIN. Yes.

Mr. MURDOCK. I think it is not quite clear to all the committee—it certainly is not quite clear to me—the fundamental difference between these two theories or methods of measurement. Do we not need to know that fundamental difference and consider their application so far as the upper basin problem solely is concerned, as well as in any dispute that might be occurring in the lower basin?

Mr. BREITENSTEIN. Congressman, that is a technical engineering matter. I would prefer to have a qualified engineer, Mr. Tipton, answer that rather than give you a lawyer's version of it.

Mr. MURDOCK. I think you are right on that. One more question, though: Did I understand you to say that under the theory that was adopted and incorporated in the upper basin compact that after full development, there will be more water passing Lee River than there would under the other theory?

Mr. BREITENSTEIN. That is Mr. Tipton's problem.

Mr. MURDOCK. Please, Mr. Tipton.

Mr. TIPTON. I am speaking, Congressman, only with respect to the upper basin. You mentioned the controversy in the lower basin which we have heard about from time to time. I am not speaking at all with respect to that controversy. I am speaking only with respect to the upper basin. I also want to state for the record to Congressman Engle that the negotiators of the upper basin compact did not use the method which would give the upper basin the most water, because that method would do that. It chose the method which it conceived to be the proper one as evidenced by the intent of the negotiators of the original compact.

Now, going specifically to your question, the negotiators of the upper basin interpret article III (a) of the Colorado River compact as apportioning the virgin flow at Lee Ferry and apportioning to the upper basin the use of 7,500,000 acre-feet of that virgin flow. Said in another way, the upper basin conceives that article III (a) gives it the right to deplete the virgin flow at Lee Ferry, the division point between the two basins, 7,500,000 acre-feet per annum. That is the depletion theory, that whatever the virgin flow might be, whatever it might be over a series of years, the upper basin has the right to remove from that virgin flow and consume, burn up, if you will, 7,500,000 acre-feet. That is the interpretation.

The negotiators of the Colorado River compact did raise their eyes above Lee Ferry. Lee Ferry was a point of measurement.

Mr. STONE. You mean below.

Mr. TIPTON. They did not raise their eyes above Lee Ferry.

That was the point of measurement so far as the upper basin is concerned. The only water that was being considered when the apportionment was made to the upper basin was the virgin flow at Lee Ferry, at that time called the reconstructed flow. The negotiators were not considering the original source of the water.

There are 75,000,000 acre-feet of water on an average that falls on the watershed of the upper Colorado River Basin. There are some-

thing over 15,000,000 acre-feet in the virgin state that reaches Lee Ferry. In other words, only about 20 percent of the total water that falls on the watershed of the upper basin ever did reach Lee Ferry in the state of nature.

The compact commission was not apportioning 75,000,000 acre-feet, it was apportioning the virgin flow at Lee Ferry or the so-called "reconstructed flow" at that time. That is our position.

Mr. MURDOCK. May I ask you this question, Mr. Tipton? Supposing we had used the other measuring stick. Supposing in your council you had decided that you ought to consider every possible diversion and take the sum total of those diversions. How much would that probably have amounted to after full development?

Mr. TIPTON. You mean the diversion, sir, or diversions minus return?

Mr. MURDOCK. Of course, I mean diversion minus return; but how much would you have applied in the irrigation or in consumptive use—beneficial consumptive use?

Incidentally, I regard that phrase "beneficial consumptive use" a mighty important concept in western water law, but I regard it as a measure of right of use more than a measure of quantity.

This is what I am trying to get at: Under the so-called California doctrine, or beneficial consumptive use measurement system, how much would you probably apply to the land in irrigation?

Mr. TIPTON. I think there are two prongs to the question, Congressman. As far as the application of water to the land, that means diversion.

Mr. MURDOCK. That is right.

Mr. TIPTON. Upper basin will apply to the land by use and reuse in order to burn up 7½ million acre-feet. That is the application of the land. There is some of that that returns.

Mr. MURDOCK. You must not apply so much to the land, however, that there is not a return flow which will cause no greater depletion than 7,500,000 acre-feet at Lee Ferry.

Mr. TIPTON. That is right. The return flow happens anyway. There must be a certain amount of return flow. I think, going further, the question probably is what would be the difference on the effect of the flow at Lee Ferry by the application of one theory as opposed to the application of the other theory. That is the same question Congressman Engle asked. I will have to qualify the question because I am not completely clear on the theory of the proponents of the diversion minus return proposition.

If that carries with it also the charging of reservoir evaporation as a part of beneficial consumptive use, then under the depletion theory there, of course, would not be charged to the upper basin any water that was salvaged in the process of the use of water, the salvaged water being the water that never did reach Lee Ferry.

Now I will have to give the indefinite answer that I gave to Congressman Engle: Engineers cannot estimate that and it will never be known until we reach ultimate development. It would be a significant quantity; 200,000 acre-feet, 400,000 acre-feet. We do not know. On the other hand, if the proponents of the diversion minus return theory maintain that the storage of water in a reservoir does not constitute a diversion, and that there shall not be charged against

the beneficial consumptive use apportioned to that proponent, any reservoir losses as a part of the beneficial consumptive use, then under the depletion theory, as far as the upper basin is concerned, there would be delivered to Lee Ferry several hundred thousand acre-feet more water than there would be delivered under the diversion minus return theory. Reservoir evaporation from the main stream reservoirs about which I testified the other day, which will be used for enabling the upper basin to fulfill its obligation at Lee Ferry probably will be in the order of four or five hundred thousand acre-feet per year.

In addition to those reservoirs, there will be many that must be constructed above the points of use to make water available and for use.

The loss from those reservoirs will be substantial. If under the theory of diversion minus returns, those losses are not charged against the upper basin, those losses would exceed any estimate that has ever been made of the salvage water in the upper basin.

Let me point out clearly, as I did the other day, that by the means of measurement which has been adopted by the upper basin compact, unless by unanimous action of the commission another means is adopted, all of the reservoir losses will be accounted for in terms of their effect on below Lee Ferry.

Mr. MURDOCK. I have one more very serious question, but before propounding it, I am reminded now of the lectures which the great philosopher Plato held out under the trees near Athens, and to that lecture came his disciples, of course, but also a cynic by the name of Diogenes, and Diogenes said to the great philosopher, "Plato, I can understand table, but I cannot understand tableness; I can understand chair, but I cannot understand chairness," and Plato said, "Diogenes, that is because you have eyes with which you can see a table or a chair, but you lack a mind with which to contemplate tableness and chairness."

Sometimes I feel that I am in the class with Diogenes in some of these basic concepts and puzzling matters, but it does seem to me, contrasting these two theories of measurements, these systems of accounting, that the depletion method is the sensible method. This is a serious question I wanted to ask you, if you will pardon my levity.

If we use the other method and penalize every State that uses salvage water by totaling the sum total of their applications, is that not contrary to public policy where we must use every drop of water in the West?

Mr. TIPTON. Congressman, I did not know we were going to get into the merits of the two methods. If it is the desire of the committee to go to the merits——

Mr. MURDOCK. I would be glad to have them.

Mr. ENGLE. I will say, if the gentleman will permit, I had no intention of raising the issue of the merits. The question I am raising is what effect does the upper Colorado compact adopting one method have upon the basic compact?

Mr. TIPTON. May I complete? That is what I understood exactly. Should the committee consider that it is necessary to have before it a discussion of the merits, I would be only too happy to discuss the merits insofar as I am capable of doing so. That would be up to the

committee, but as I understood Congressman Engle's position, he was not desirous of going into the merits.

Mr. ENGLE. Not in view of the answers which have been given. The only thing I am interested in now is nailing the thing down so that it is perfectly plain, so that as Mr. Barrett said, at some future time, if the issue arises, we have the status quo.

Mr. TIPTON. I can go this far. Congressman Murdock: Under either theory we can assume that all of the water of the Colorado River Basin will be utilized for the good of mankind so we will not be violating any of our ideas that there should not be a wasteful use of the water or the water shall not be unnecessarily wasted into the ocean.

Under either theory, ultimately there will be full use of the water of the Colorado River Basin.

Mr. MURDOCK. That river is our "water bank." It is highly important that we know what system of accounting should be used, and that is why I think the discussion here is quite pertinent, even if we are thinking only of the upper basin, because I want to know what system of accounting is being used so that each State, when it takes water from this water bank, will be properly charged and not overcharged.

Mr. BREITENSTEIN. May I add one thing in response to what Congressman Engle said a few minutes ago?

Mr. MURDOCK. Yes, sir.

Mr. BREITENSTEIN. We tried to make it as clear as we could in the statement which is signed by the representatives of the upper basin States and by the Federal representative, that this upper basin compact binds the signatory States, not the nonsignatory States nor the United States, and I suggested yesterday and I again suggest today that the pertinent parts of that statement might well be included in the committee report to show the intent. We have tried to make it as clear as our presentation here could, that the intent is in conformity with the expressions contained in the answers to those questions.

Mr. ENGLE. Let me say to you that I am not impressed at all with the answers to the questions. I can visualize these answers being written into the report and meaning nothing whatever, because it is entirely possible to approach this matter from a legal standpoint and to say that the upper basin compact does not modify, amend, or change the terms of the basic Colorado River compact. From the standpoint of some people that is perfectly correct, because they interpreted the words "beneficial consumptive use" in the basic Colorado compact by the same definition which is now embodied in the upper basin Colorado compact.

Therefore, no language in the upper basin Colorado compact would amend, modify, or alter, according to their view, the provisions of the basic Colorado compact.

What I am concerned with is the fact that the upper Colorado compact interprets language which is used but not defined in the basic Colorado compact, and I am concerned lest congressional consent to this compact will operate in some way as giving congressional blessing, acceptance, or concurrence in an interpretation, express or implied, in the upper basin Colorado compact, of those terms in the basic Colorado compact.

Let me ask this question, then: Would you be willing for the record to state that Congress does not, by its consent to this compact, concur

in or accept any interpretations, express or implied, in the upper basin Colorado compact of the language of the basic Colorado compact?

Mr. BREITENSTEIN. Certainly, so far as Colorado is concerned, we would have no objection to such a statement in the record, and if the committee desires to make it, we would have no objection, because that is our position.

Mr. ENGLE. But you object to writing it in the bill?

Mr. BREITENSTEIN. I do, and I have expressed my reason for it and I think it is a very sound reason.

Mr. ENGLE. Because you think if I hand you a statement to the effect I do not intend to kick your dog, that in the absence of such a statement I do so intend or that that statement implies I have such an intent and am disclaiming it.

Mr. BREITENSTEIN. Well, as I say, under those circumstances we get back to who kicked the dog first, and if it had not been for that provision in the Boulder Canyon Project Act, I would feel differently about it, but it is there. I do not want us to get an advantage or disadvantage, and I do not want you to.

So far as the upper basin is concerned, Congressman, we perceive that there were two, at least two sources of controversy existing under the old compact: One, the method of measuring, and, second, the matter of charging reservoir losses, reservoir evaporation losses. That is not covered in the old compact at all. We most sincerely, in the upper basin, desired to settle those matters as between ourselves so that differences of opinion which now exist in the lower basin would not exist in the upper basin, but Congressman, while we took care of those two matters in our own little family, we did not bind anybody who is not in our family to the solution which we accepted, and we do not intend to bind them.

Mr. ENGLE. I think, Mr. Breitenstein, we are in agreement on objective, and that is to write a bill here which will not prejudice the position of either the United States or any States not signatory to this compact. The question is whether or not we have done it.

Mr. MURDOCK. Governor Miles, have you some questions? We have kept these witnesses quite a little while, but we have not gotten around to some of the members.

Mr. MILES. Mr. Chairman, I thought for a moment they were getting this discussion down on a basis which I could understand. When they began to talk about measuring a haystack or kicking a dog, I could understand it. Then they brought out another thought that I thought cleared the matter in my mind as to whether of the two theories of engineering, in arriving at the amount of water we delivered at Lee Ferry, they were arguing about whether one theory delivered more water or less water than the other. Then I thought I understood when it was answered, that that was the point. But evidently that is not the point.

It is getting back on a basis which I am afraid I do not understand. There was a question asked by Congressman Miller off the record, I believe, as to whether or not it would not in the end be necessary to take the case to the Supreme Court for a decision as to the division of water, and I think that the witness started to answer that question, but was stopped for some reason.

Either off the record or on the record at some time I would like to hear his opinion regarding the matter, and I also believe Congress-

man Barrett said he did not think it would be necessary to take it to the courts.

Mr. BREITENSTEIN. You never have to have a lawsuit, Congressman, unless you cannot agree on something. We in Colorado have had more interstate lawsuits in the United States Supreme Court over water than any State in the Union. We have also had more interstate compacts apportioning the waters of the interstate streams than any State in the Union, and it is our considered judgment that of those two constitutional methods of settlement, the one greatly to be preferred is that of interstate compact.

I do not want to get into any discussion of the legal points which are involved in any interstate litigation of the United States Supreme Court, but we have a compact here which represents the best efforts of these States to solve these matters. We hope that it is clear, we hope that it settles controversial matters as between them, so I say as between these upper basin States, the possibilities of Supreme Court litigation are minimized insofar as is humanly possible to do at this time.

Now, so far as possible differences between the upper basin and the lower basin are concerned, that is a matter for the future. Some 10, 20, 50 years from now we will probably have different methods of measuring and determining beneficial consumptive use than had been suggested here. I do not know, but when you get to a state of ultimate development on this river, the Colorado River Basin States, all seven of them, should make—and I assume they will because it is their duty, in my opinion, to do so—should make an honest and sincere effort to amicably settle those differences, and only if that effort fails, will it be necessary to have Supreme Court litigation.

There is no need for it now, Congressman; right now there are some seven, eight, or nine million acre-feet of water going down to the Gulf of Mexico unused. There is plenty of water for everybody. Until you get down to the place where the water is being in very large measure all used up, you do not have the basis of a dispute between the two basins.

Mr. MILLER. Of course, I understand there are some interests in California who feel they are not getting sufficient water for their needs now.

Mr. BREITENSTEIN. Let me say one thing there, Mr. Congressman. I have attended quite a few controversial hearings on these matters. I have never heard it denied that California is entitled to 4,400,000 acre-feet of Colorado River water as a firm right. The California uses up to the present time are, according to my information, around 3,200,000 acre-feet.

In other words, she has 1,200,000 acre-feet yet to go before she is up to the amount that everyone concedes she is entitled to; and, in conclusion, Congressman, let me say this: I most sincerely ask that you and the committee and the Congress do not, by withholding consent, condemn these States to litigation.

Mr. MILLER. I am thoroughly agreed and want to go along with your statements here, but I am looking at the possibility of the lower States not being satisfied. The gentleman from California, who has been asking you questions this morning, indicates he is not clear the compact would protect the water at Lees Ferry and some of those

provisions of the bill would be subject to interpretations that might get into a lawsuit.

I was interested in the litigation between Colorado, Wyoming, and Nebraska. I think it was unfortunate and dragged out too long. I thought it settled things. You said in the next 10 years we will have another matter, which I presume can always be started by interests in either State. I do not know what there would be at this time, whether that was a threat or whether that was a suggestion.

Mr. BREITENSTEIN. It was a prophecy and not a threat at all.

Mr. MILLER. Is it in the making? I wondered.

Mr. BREITENSTEIN. Along that line, we have had a little litigation in Colorado, on the Laramie River. We were in litigation from 1911 to 1940. There were three different proceedings in the United States Supreme Court. The Court first entered a decree in 1922 and within 6 months it changed it, and then there were three later decisions on that decree.

Mr. MILLER. Would you say at the present time there was some difference of opinion between Colorado, Wyoming, and Nebraska relative to division of waters, that there might be litigation in the next 10 years?

Mr. BREITENSTEIN. I do not care to express an opinion on that, but I call attention to the fact that the United States Supreme Court in its decree affirmatively recognized that there might be changes of situation which would require the parties to go back.

In that connection, Congressman, that case was reported on by the master upon the basis that Pathfinder Reservoir would never again fill. The Supreme Court in large part affirmed his report. Within the month that that decision came down, the storage of water in the Pathfinder area was more than enough to fill the Pathfinder Reservoir. The Court could not foresee natural conditions.

Mr. MILLER. As a member of this committee, let me say I will be happy if we can get this upper State compact through and no litigation occurs. I think it is a great step forward and should be done. I think it must be done before too long in the lower States, Arizona, New Mexico, and California. I think it must be done if we are going to make progress in the use of our beneficial use of water.

I have simply asked the question. Are we not getting the basis or groundwork laid here for some difficulties in the future? I hope not. I hope it can be settled as we are trying to do here.

Mr. MURDOCK. Mr. Regan, do you have any questions?

Mr. REGAN. No question.

Mr. MURDOCK. Mr. Barrett, do you have questions?

Mr. BARRETT. I am very hopeful that the gentleman from California is satisfied with the abundant testimony here, that certainly the people from the upper basin States are united in the objective with them and they do not want to disturb any rights the lower basin States may have under the original compact.

I would like to get this clear in my mind. Assuming that these different theories would bring about a different result. On the one hand, there is the theory that you take the diversion less the return flow, which, as I understand, does not necessarily take into account the evaporation in the dams; and the other, the depletion theory, and at the future date when the maximum development has taken place in the

upper basin States, all of the States of the basin by a new compact or agreement between themselves, or the Court by a decision says that the upper basin States had a perfect right to enter into any agreement they so desired, which was binding on themselves alone, not on the lower basin States nor on the United States.

Consequently, you got to use this other theory insofar as the lower basin States are concerned. Would it not then be just a matter of the obligation of the upper basin States at Lee Ferry?

Mr. BREITENSTEIN. No; it would be a little broader than that, Congressman. There are two things: There are two limitations upon the upper division States. First, it is limited to the beneficial consumptive use of 7,500,000 acre-feet annually, and second, there is the obligation upon the upper division States to deliver 75,000,000 acre-feet every 10-year period. Those two matters define and limit the rights in the upper basin.

Mr. BARRETT. But the result of all that is that the upper basin States are required to deliver a certain amount of water at Lee Ferry, and if the gentleman from California is correct in his contention, then the Court might say you deliver more water down there at Lee Ferry rather than consume it up above. Is that not right?

Mr. BREITENSTEIN. No, Congressman. Omitting from the discussion here any reference to the Mexican water treaty, a difference in measurement would go only to the extent of the firm right of the upper basin States. That is the right to 7,500,000 acre-feet. It would not increase their delivery obligation, but might limit their firm right to the use of water.

Mr. BARRETT. It seems to me that it could be stated the other way. Before the lower basin States could object, they would have to show that they had been injured in some way by the methods above under the original compact.

Mr. BREITENSTEIN. You understand, Congressman, that under articles III (a) and III (b) of the 1922 compact, certain amounts of water are apportioned to each basin. Then there is another provision of the compact that surplus water—that is, water over and above that—may be the subject of future allocation in 1963 when and if either basin is using total amount apportioned to it.

Mr. BARRETT. I understand that. That is why it seemed to me if under any interpretation as to the surplus water there in 1963, if the lower basin States got any and all waters they were entitled to under 3 (a) and also their fair division of the surplus waters, that certainly they have not harmed anyone in any way.

Mr. BREITENSTEIN. That is possible, Congressman, but I think the division of the surplus will have to wait until 1963.

Mr. BARRETT. That is quite true, but we certainly are not going to have this basin developed by 1963, and if the method whereby the diversion less return flows is binding, we will say, for the purpose of arriving at the waters that should be delivered at Lee Ferry, the excess waters at Lee Ferry, then it seems to me that the only requirement would be for the upper basin States to deliver more water there.

Mr. BREITENSTEIN. As I tried to point out, Congressman, it really goes to the question of the surplus. Our Lee Ferry delivery obligation is fixed. Our right to use is fixed. The adoption of one method of measurement or the other might mean the difference whether we are below or above the quantity apportioned to us.

Mr. BARRETT. If the court would say you are above, then they are getting more water than they would get under the other method, is that not right?

Mr. BREITENSTEIN. If we exceed 7,500,000 acre-feet of use as measured by method fixed by the Supreme Court, we do not thereby get a firm right to the use of that water.

Mr. BARRETT. That is what I had in mind. That is all. Thank you.

Mr. MURDOCK. Mr. Bentsen, had you questions?

Mr. BENTSEN. No questions.

Mr. MURDOCK. Mr. Poulson?

Mr. POULSON. Is this the last speaker? I think our able Representative, Mr. Engle, brought out the main thing we are concerned with, and that is the fact we do not want this to be taken in any way as an interpretation of the over-all compact. Our main concern is definitely to see that by the Congress ratifying such a compact, that the Congress has not implied they are accepting that interpretation placed on the various means of division, that interpretation as being the correct interpretation.

You have stated that in your opinion this interpretation, the fact that Congress is ratifying the compact, is not evidence of the fact that Congress is ratifying that type of division or interpretation as it would apply to the over-all contract or to the lower-basin contract.

Mr. BREITENSTEIN. In the first place, Congressman, Congress does not ratify the compact. We are not asking Congress to ratify the compact. We are asking Congress to give its consent to this compact, and that is all, and Congress, by giving its consent, removes a constitutional limitation imposed upon these States, and the compact which thereby becomes effective is binding upon those States and only upon those States.

Mr. POULSON. Would you be willing that such an interpretation be placed in a report?

Mr. BREITENSTEIN. I have indicated that and I have suggested that answers to these questions and the statement contained therein be made a part of the report.

Mr. POULSON. That is all.

Mr. MURDOCK. Mr. Baring, have you questions?

Mr. BARING. Not at this time.

Mr. MURDOCK. Mr. Sanborn, do you have any questions?

Mr. SANBORN. I believe not at this time.

Mr. MURDOCK. Judge Bosone?

Mrs. BOSONE. I tried to hang on to every word I heard in the discussion of this bill and from what I can gather, I would certainly hate to see any more spelled out than is spelled out, or any further limitations put on it. What elasticity there probably is in the bill at this time, or in the act before the Congress at this time, I think it will lend itself to a healthy situation later on.

I think that is one of the troubles with one of the important bills that was passed by the Eightieth Congress. Everything was spelled out in it, and as a result, the people who were affected, trampled on each other's toes. There was no room for people to get together on something that might come up in the future. I could be wrong, of course, because this is new to me, but it seems to me the very fact there still are some points upon which we can differ but later get together

on, would lend itself to making pretty good law. After all, we cannot write a perfect law because we are not perfect people.

Mr. MURDOCK. Thank you. Mr. Marshall?

Mr. MARSHALL. I would like to compliment the witnesses on the manner in which they have answered the questions. I think they have not only made it interesting but have made every attempt to make the problem clear.

There was just one question that came to my mind that I was wondering about, in these methods which you talked about for measuring water. Are there other States besides California that measure water in the method which Mr. Engle was discussing?

Mr. TIPTON. Congressman, because of the fact that there is a large quantity of water going to the Gulf of Lower California unused, there has not come up as a direct issue the method of measurements of water. It merely applies to the future, what shall be the method in the future.

Now, in more direct answer to your question, I will repeat what Mr. Breitenstein has said. The large uses by California are essentially transbasin diversions. The water is taken out of the basin. The All-American Canal, which uses two and a half million acre-feet or a little more, most of that water is diverted completely out of the basin, and the return flow gets to Salton Sea.

In other words, the consumptive use under the diversion minus return theory is essentially the diversion itself. The other large use by California is by the Los Angeles aqueduct, which is taking about 175,000 acre-feet per year since San Diego came into the picture, and it will have an ultimate capacity of 1,100,000 acre-feet. The water diverted by the aqueduct is taken out of the basin into the coastal area, so there is no return to the river from that.

I may state further also that so far as California is concerned itself, the adoption of either theory, and applied direct to California, not the relation of California to other States, but directly at California, the adoption of either theory would have little effect on the amount of water that California would get. This is—assuming the difference between California and other States are resolved—because the diversion points are relatively near the international boundary.

Salvage of water by uses of California would be small. Actually, by man-made activity, instead of salvage in that reach of river, there is an increased use of it because of deterioration of channel.

Under either theory, taking the magnitude of the use, there would be little difference. That is a rather long answer to your question. The short answer is that at the present time it really has not been necessary to measure the use of the water by any State under any theory, because there is a large surplus of water going to the Gulf.

Mr. ENGLE. Will the gentleman yield to me?

Mr. MARSHALL. Yes.

Mr. ENGLE. I call the gentleman's attention in regard to the question as to whether or not the theory of outflow-inflow has been accepted in other instances, to article I of the Mexican Treaty, which provides as follows, in subdivision J:

Consumptive use means use of water by evaporation, plant transpiration or other manner whereby the water is consumed and does not return to its source of supply. In general, it is measured by the amount of water diverted less the part thereof which returns to the stream.

That is the theory of diversions less returns to the river which I have been referring to, which was adopted in the Mexican treaty.

Mr. Tipton testified as follows, and I am reading from the hearings at pages 1224, 1225, and 1226:

> Water is measured at the head of the irrigation area for administrative purposes in Colorado. The water commissioner of the given water district every single day during the irrigation season phones the proper official of each canal system and tells him how much water he can take from the stream in the order of priority of the water rights of his system, so we have good stream-gaging stations to measure the inflow to the area. We know how much water goes out. It is simply a matter of deducting one from the other to determine the consumptive use.

Mr. MARSHALL. May I ask my colleague a question in order to help clear my mind, as these things are all so vague to me?

Mr. MURDOCK. Yes.

Mr. MARSHALL. Is the gentleman satisfied under the terms of the Colorado River compact, as written at the present time, that it is returning a certain flow of water that must be delivered at Lee Ferry?

Mr. ENGLE. I am satisfied with the compact, provided that I am assured by these hearings and by action taken in these hearings, that the consent of Congress to this compact is not an acceptance or concurrence in any interpretation of the basic compact made in the upper Colorado River compact.

To put it another way, I have no objection at all to these five States making any division of the water they want to make, but when they undertake in their compact to interpret language in the basic compact, then I think it should be made perfectly clear that the action of this Congress in consenting to that compact does not give the blessing of Congress, its approbation or its agreement to those interpretations.

In other words, if those interpretations do not hurt us, then we are very, very happy indeed to go along. That is the proposition I have been trying to determine in my questions to Mr. Breitenstein. That is why I asked if he would be willing to have put in the report the disclaimer to which I referred or in the language of the bill in section I.

He agreed to one, as far as Colorado is concerned, as I understand, and disagreed to the other on the ground it carried an implication or might be construed as carrying an implication which would be adverse to their interests. I hope we can work out something on language for the bill.

Mr. MARSHALL. Mr. Breitenstein, as I followed the report back here some time ago, you said it would be rather impossible to use that measure of water in Colorado because of requiring four or five thousand stations.

Mr. BREITENSTEIN. Yes. You see, the only way you can measure your total diversions is by adding up all the head gate diversions. In western Colorado, Congressman Aspinall's district, we have a great multitude of small ditches that irrigate small areas, and the only way you can get the diversions is to put an automatic measuring device which, may I say, is costly, upon each one of those ditches, and if we were trying to do that on the four or five thousand ditches in western Colorado, the people of Colorado would not stand for it. It is utterly impractical. They have a few big diversions down in California, so it is practical.

Mr. MARSHALL. As far as I am concerned, you appreciate that being from Minnesota, it is not a problem of getting water, it is a problem sometimes of getting rid of water.

Mr. BREITENSTEIN. Yes.

Mr. MARSHALL. The reason I asked the question, we might be asking you to do something relatively impossible if we were to ask you to use the method of measuring water as proposed by my colleague from California.

Mr. BREITENSTEIN. It would not be impossible, it would be impractical.

Mr. ENGLE. If the gentleman will yield, I want to say I am not suggesting they accept that method. What I am suggesting is their acceptance of a different method, not be binding on us.

Mr. BREITENSTEIN. I say it is not binding on you, Congressman, as I have said before. I am still of that position. We are binding ourselves, but we are not binding you.

Mr. MARSHALL. I think that is all.

Mr. MURDOCK. Mr. Aspinall?

Mr. ASPINALL. I have no questions.

Mr. MURDOCK. I note that my colleague from Arizona, Mr. Patten, has been with us right along during the session. We have not given him an opportunity to express himself. I would be glad to do so now, Congressman Patten.

Mr. PATTEN. I have no questions, but I do ask the chairman and the committee for consent to file a statement at the conclusion of the hearings, if I might.

Mr. MURDOCK. We would be very happy to give that permission to all Congressmen who are sponsors of this legislation and interested in it.

If there are no further questions, Judge Stone——

Mr. STONE. No. These two witnesses came back this morning for questions, and the next witnesses will appear for other States.

Mr. MURDOCK. Yes. We thank you, gentlemen, for being so patient with us and attempting to answer our questions, and doing so quite well.

Mr. BREITENSTEIN. Thank you.

Mr. STONE. I may suggest, if you are proceeding with other witnesses, Mr. Chairman, that the next State which appears here is New Mexico, to be followed by Wyoming; then Arizona and presentations by the States, concluded by Utah. Then presentation to be followed by the appearance of the Federal representative and his engineering and legal advisers, possibly his legal adviser.

Mr. MURDOCK. Thank, you, Judge Stone.

Is Judge Fred Wilson here, representing the State of New Mexico?

STATEMENT OF JUDGE FRED WILSON, REPRESENTING THE STATE OF NEW MEXICO

Mr. WILSON. Mr. Chairman and gentlemen of the committee, the chairman has suggested he would like to finish these hearings today, and I will be very glad to cooperate with you and make my statement just as brief as possible. The fact that my statement will be brief should not be taken as any indication that New Mexico or myself

are not vitally interested and concerned with the measure now before the Congress.

I was one of the commissioners who negotiated this compact, representing New Mexico, and we are here now simply asking the congressional consent to the compact which we have made.

I desire to introduce in the record a certified copy of the Senate bill No. 30, which was the act of the New Mexico Legislature ratifying the compact, and I will state that the ratification by the Legislature of New Mexico was unanimous in both houses.

I should also like to offer for the record, if the chairman will permit, my letter of transmittal of the compact to the Governor of New Mexico and to the State legislature, accompanied by a resolution adopted by the Interstate Stream Commission of New Mexico, authorizing the signing of the compact by the commissioner and urging its ratification and urging Congress to consent to the ratification; also accompanied by a memorandum which I submitted to the Governor and to the New Mexico Legislature, which in general terms explains my conception of the compact.

Mr. MURDOCK. The Chair regards both of these documents as pertinent and vitally important. Without objection, they will be admitted to the record.

(The documents referred to are as follows:)

JANUARY 11, 1949.

To the Governor, and Members of the Legislature of the State of New Mexico:

There is herewith submitted the upper Colorado River basin compact, which was negotiated and signed at Santa Fe, N. Mex., on the 11th day of October 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and the representative of the United States of America. This compact has been approved by the New Mexico Interstate Stream Commission by resolution adopted January 10, 1949, copy of which resolution is attached hereto.

I feel that this compact is fair and equitable, and is in the best interests of the State of New Mexico and its citizens, and is necessary to accomplish the development of the water resources of the State. I have prepared a memorandum explaining in greater detail the various provisions of the compact, and will make it available to the members of the legislature and other interested parties.

The compact was executed in six counterparts, each of which constitutes an original. One original has been delivered to the governor of the State of New Mexico. A copy of the compact, together with memorandum explaining its various provisions is attached hereto.

As commissioner, I respectfully recommend and urge that the compact be ratified by the Legislature of the State of New Mexico.

Respectfully submitted.

FRED E. WILSON,
Commissioner for New Mexico.

RESOLUTION UNANIMOUSLY ADOPTED BY THE INTERSTATE STREAM COMMISSION ON JANUARY 10, 1949

Whereas the Interstate Stream Commission on August 18, 1948, after presentation and full discussion of a draft of the proposed upper Colorado River basin compact, agreed to at Vernal, Utah, July 21, 1948, tentatively approved that draft of the compact, and authorized the compact commissioner for New Mexico to execute the compact, subject to certain changes in article –IV thereof relating to the use of the waters of the San Juan River and its tributaries; and

Whereas at a meeting of the Interstate Stream Commission held at Santa Fe, N. Mex., at Bishop's Lodge, on October 10, 1948, the complete draft of the compact as tentatively agreed to at Vernal, and as finally agreed to at Bishop's Lodge, Santa Fe, N. Mex., prior to October 10, 1948, by the commissioners of the respective States, was submitted to the New Mexico Interstate Stream Commission, and after full discussion and consideration the commission approved said compact and authorized the commissioner for New Mexico to sign the same; and

Whereas pursuant to said authorization, the commissioner for New Mexico did in the city of Santa Fe, N. Mex., on October 11, 1948, execute the upper Colorado River Basin compact on behalf of the State of New Mexico; and

Whereas the commission has now reviewed and considered the compact so executed at Santa Fe, and finds that it is fair and equitable, and fully protects New Mexico's rights in the use of the water of the Colorado River system: Now, therefore, be it

Resolved, That the New Mexico Interstate Stream Commission approves the upper Colorado River Basin compact signed at Santa Fee, N. Mex., on October 11, 1948, and urges the Legislature of the State of New Mexico to ratify the compact as soon as can be done in conformity with orderly legislative procedure; be it further

Resolved, That upon ratification of the compact by the legislatures of the signatory States, the Congress of the United States be urged to give its consent and approval to the compact; be it further

Resolved, That the commission commends the New Mexico commissioner and his legal and engineering advisers, for the work they have done in the negotiation of the compact; be it further

Resolved, That copies of this resolution be forwarded by the secretary of the commission to the Governor and the members of the Legislature of the State of New Mexico, and to the Senators and Congressmen representing the State of New Mexico in the Congress of the United States.

Adopted and approved by unanimous vote this 10th day of January 1949.

(Signed) J. D. ATWOOD,
Chairman of the Commission.

Attest:

JOHN H. BLISS, *Secretary.*

MEMORANDUM RE UPPER COLORADO RIVER BASIN COMPACT

The upper Colorado River Basin compact, entered into by the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, at Santa Fee, N. Mex., October 11, 1948, contains 21 articles, each of which should be considered in order to have an understanding of the principles and objects of the compact.

The introductory paragraph states the names of the official representatives of the signatory States, and the representative of the United States of America. On the 9th day of August 1946, the Interstate Stream Commission duly appointed Hon. Thomas M. McClure to act as commissioner for New Mexico, and to enter into negotiations for a compact with representatives of the States of Arizona, Colorado, Utah, and Wyoming. Mr. McClure acted as commissioner until his death, which occurred on the 5th day of November 1946. Thereafter, on the 19th day of November 1946, the Interstate Stream Commission, by resolution, duly appointed Fred E. Wilson to represent the State of New Mexico to succeed Thomas M. McClure, deceased. These appointments were made by the Interstate Stream Commission pursuant to an act of the Legislature of the State of New Mexico, approved February 14, 1935, which authorized the commission created by the act to negotiate compacts with other States, to settle interstate controversies, and for other purposes.

In the introductory paragraph it is stated that the negotiations of the official representatives of the States, participated in by a representative of the United States of America, were all subject to the provisions of the Colorado River compact. This has reference to the Colorado River compact of 1922, also signed at Santa Fe, N. Mex., which is still in full force and effect, and it was intended that the upper Colorado River Basin compact should conform in all respects to the provisions of the compact of 1922.

Article I sets forth the major purposes of the compact, and article II is made up entirely of definitions of terms appearing in the compact.

ARTICLE III

This is the article making the apportionment among the five States involved, on a percentage basis. It is the most vital part of the compact, and presented a question upon which it was most difficult to reach an agreement. In order to determine whether the apportionment is an equitable one, many details of an engineering nature must be considered, as well as the history and background of the original Colorado River compact. In order to understand article III, it is necessary to understand that which was apportioned to each of the States.

The language indicates that it was the use of water "available for use by the States of the upper basin under the Colorado River compact." In order to reduce the percentages apportioned to each State in article III to quantities of usable water it is necessary to consider article III of the original Colorado River compact dated November 24, 1922, signed at Santa Fe. Article III (a) reads as follows:

"There is hereby apportioned from the Colorado River system in perpetuity to the upper basin * * * the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist."

In this connection, it is also important to keep in mind the provisions of article III (d), which reads as follows:

"The States of the upper basin will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years reckoned in continuing progressive series, beginning with the 1st day of October next succeeding the ratification of the compact."

Thus, there was an apportionment made by article III of the upper Colorado River Basin compact of the use of a quantity of water "available for use by the States of the upper basin under the Colorado River compact." The actual quantity of water, the beneficial use of which was apportioned by the original Colorado River compact, is variable and is difficult to determine accurately in terms of acre-feet. It may be more or less than the specified 7,500,000 acre-feet. Accordingly, an apportionment was made upon the following basis:

Arizona, which is not a State of the upper basin but does have a comparatively small drainage area therein, was granted the right to use a maximum of 50,000 acre-feet annually. The use of water apportioned to, and available for use in the upper basin remaining after deduction of the use by Arizona of not to exceed 50,000 acre-feet annually was apportioned on the following basis:

	Percent		*Percent*
Colorado	51.75	Utah	23.00
New Mexico	11.25	Wyoming	14.00

The method of measuring consumptive use adopted by the Upper Colorado River Basin Compact Commission is set out in article VI, and is described as "the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry." According to the engineers, this method of determining the quantity of consumptive use of the water will enable the upper basin States to have the benefit of what might be called salvage water, and they estimate that the quanity available under this method of measurement will probably be closer to 8,000,000 acre-feet than 7,500,000 acre-feet.

However, for the purpose of applying the precentages in article III, in order to arrive at a quantity of water the consumptive use of which was apportioned to each State, either the figure 7,500,000 or 8,000,000 may be used. After deducting 50,000 acre-feet, the use of which was apportioned to Arizona, the percentage allocated to New Mexico would be approximately 800,000 acre-feet. It would be more if the amount available for use in the upper basin should be 8,000,000 acre-feet. This means that under the apportionment New Mexico has the right to consume that quantity of water annually, or in other words, to deplete the virgin flow at Lee Ferry to that extent.

It should be stated here that the use of this quantity of water was not apportioned to any particular project. It may be used any place in the State of New Mexico, as New Mexico may determine. It is believed, however, that New Mexico's percentage is sufficient for a water supply to take care of all present and future needs of both Indians and whites in the San Juan Basin in New Mexico, and the possible exportation of not to exceed 300,000 acre-feet for use outside of the Basin.

In an analysis of the compact made by the commissioner for Colorado, it is said:

"Particular attention is directed to the apportionment made to the State of New Mexico. It is well known that in northwestern New Mexico there is a large Indian population which in late years has attracted much popular attention. The commissioners wisely determined the water allocation should be such as to satisfy fully the needs of the Indians. Accordingly, New Mexico was allotted a share of water sufficiently large to take care of every water use currently planned for the Indians by the Office of Indian Affairs, and in addition to afford New Mexico an equitable share of water available for use by the whites. Indian uses of water are charged against the share of the State in which the use is made."

It is true that New Mexico endeavored to secure a larger proportion than that fixed by the compact. However, it must be realized that each of the States advanced requests for a greater apportionment than they eventually received. When consideration is given to the topography and physical conditions existing in the San Juan Basin, the fact that New Mexico's entire apportionment must be made available through the San Juan River and its tributaries, and that Coloradio's equitable uses in the basin must be recognized, it would seem apparent that the apportionment to New Mexico is fair and equitable.

ARTICLE IV

This article relates to curtailment of use, if necessary, in order to maintain Lee Ferry flows. Under the terms of article III (d) of the Colorado River compact, the States of the upper basin agreed that they would not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet, for any period of 10 consecutive years reckoned in continuing progressive series beginning with the 1st day of October next succeeding the ratification of the compact. To prevent a violation of that provision, article IV of the upper Colorado River Basin compact provided a method of reducing or curtailing use of water in the upper basin to make up possible deficiencies. The language of the article shows that the commission created by the compact to administer it is authorized to determine how such deficiencies, if any, at Lee Ferry shall be made good. However, the commission is required by paragraph (b) of article IV

"(1) If reduction is necessary on the part of any State in the upper basin, that State, or those States, which have exceeded their allotment shall first be required to reduce their consumptive use of the water;

"(2) Otherwise, the deficiency, if any, shall be made up by each State in proportion to the consumptive use being made by each State, compared to the consumptive use being made by all the States in the upper basin."

In passing, it might be stated that this situation, which would require curtailment of use by any State, will not likely occur. If it does occur, it will be when full consumptive use is being made by all the States of the upper basin, which is not likely to happen for many years. It is to be noted also that in determining such necessity for curtailment, no reduction can be made as to water rights in existence November 24, 1922. This has the effect of preserving intact present water rights or uses. Also by subparagraph (c) of article XIV, any curtailment of use which might be necessary in the future "shall not affect uses being made on Indian lands, if it is determined that the Indians have any preferential rights to the use of water of the San Juan River."

ARTICLE V

Under powers of the commission created by article VIII of the compact, the commission is authorized to make findings as to quantity of reservoir losses, and as to the share thereof chargeable under article V to each of the States. Article V sets up the method by which the commission will ascertain the manner in which reservoir losses shall be charged, dependent upon whether the reservoir is (1) for the benefit of all the States, or (2) for the benefit of any individual State. These provisions look to the future when it is contemplated reservoirs will be constructed in order to enable each State to make beneficial use of its allotment. This matter of reservoir losses will be determined by the commission some time in the future when and as it becomes important.

ARTICLE VI

By subparagraph (6) of article VIII, the upper Colorado River Commission is empowered to make findings as to the qauntity of water of the upper Colorado River system used each year in the upper Colorado River Basin, and in each State thereof.

Article VI directs the commission in making this determination to use the so-called inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry. By this article, the commission, by unanimous action, may adopt a different method of determination. Without entering into a technical discussion, it is sufficient to say here that under the theory of measurement of consumptive use adopted in the compact, the quantity of consumptive use is determined by computing the extent in which the man-made uses have depleted the flows at designated points, and so far as the upper basin is concerned, how

much the stream flow has been depleted at Lee Ferry. Another theory which might be contended for by some would require that the consumptive use be measured at the points of use. This would require a procedure whereby it would be necessary to measure all the diversions from the river at the points of use and subtract therefrom the return flows. The method adopted in the compact seems the most practical and plausible, and can, we believe, be defended by the best engineering experience and technical knowledge.

ARTICLE VII

The language of article VII is clear. It provides that the consumptive use of water by the Indians, as wards of the United States, is chargeable to the State in which the use is made.

ARTICLE VIII

Article VIII is important, as it creates the upper Colorado River Commission, which will be the agency to administer the compact in the future. New Mexico will have a member on this commission, as well as Colorado, Utah, and Wyoming. Arizona will not be represented on the commission, as its slight interest in the upper basin, compared to its larger interest in the lower basin, did not seem to justify equal representation on the commission which will administer the compact. If the President of the United States designates a commissioner to represent the United States, such representative will also be a member of the commission, and the presiding officer thereof. The powers of the commission and other matters connected with its administration of the provision of the compact are fully set forth in article VIII. It is not believed necessary to attempt to explain them in detail in this memorandum.

ARTICLE IX

Article IX provides the machinery necessary for the establishment of facilities in one State for the benefit of another State, or States, in order that the allocations of the use of water made by the compact to each State may be realized. New Mexico, being one of the lower States in the upper basin, is not likely to have any reservoirs constructed within its boundaries for the benefit of one of the other States.

However, it is possible that a reservoir might be desirable in New Mexico for the benefit of all the States of the upper basin, in order to make deliveries at Lee Ferry. It is very likely that New Mexico will need, and necessary that it have the power, to go into the State of Colorado and construct reservoirs and impound water in that State in order to obtain its alloted share of the water. This article sets up the machinery by which that may be accomplished.

ARTICLE X

This article is of special interest to New Mexico. It recognizes the La Plata River compact entered into between Colorado and New Mexico on November 27, 1922, and provides that it shall not be affected by the apportionment made in article III. In other words, the La Plata compact will remain in full force and effect in accordance with the unanimous desire of users of water on the La Plata in both Colorado and New Mexico. All consumptive uses of La Plata River water made in Colorado will, of course, be chargeable to Colorado's allotment, and uses made in New Mexico of La Plata River water will be chargeable to New Mexico's allotment.

ARTICLES XI, XII, AND XIII

Articles XI, XII, and XIII deal with tributaries in which Colorado, Wyoming and Utah are concerned.

ARTICLE XIV

Article XIV is of special interest to New Mexico. As heretofore stated, New Mexico can obtain its apportioned share of the use of the water of the entire Colorado River system only from the San Juan River and its tributaries. The San Juan and most of its tributaries rise in Colorado and flow through New Mexico on into Utah and the Colorado River above Lee Ferry. The allotment to New Mexico of 11.25 percent of all the water available for consumptive use in the upper basin (excluding the slight interest of Arizona) cannot be consumed unless the State of Colorado permits that quantity of water to flow

into New Mexico, or else permits New Mexico to go into Colorado and construct reservoirs to impound water in that State for use in New Mexico, and that is what article XIV is intended to accomplish. The language seems clear, as it states:

"The State of Colorado agrees to deliver to the State of New Mexico from the San Juan River and its tributaries which rise in the State of Colorado a quantity of water which shall be sufficient, together with water originating in the San Juan Basin in the State of New Mexico, to enable the State of New Mexico to make full use of the water apportioned to the State of New Mexico by article III of this compact."

This broad agreement by Colorado was made subject to the following:

(*a*) (1) Rights existing in both States at the time of the signing of the compact are recognized as prior and will not be interfered with but protected;

(2) Priority is recognized to all uses of water contemplated by projects authorized at the time of the signing of this compact. The only project authorized at the time of the signing of the compact, affecting in any way uses of San Juan River water, is a small transmountain diversion in Colorado, which contemplates the use of not to exceed 21,000 acre-feet of water.

Thus, New Mexico recognizes the priority of this project, should it ever be constructed, and also recognizes all present uses being made in Colorado and New Mexico at the time of the compact.

However, there is a provision, subparagraph (c) of article XIV, that in times of water shortages on the San Juan and its tributaries in either State, where the uses being made are dependent upon a common source of water supply, and which do not affect present uses or projects authorized at the time of the signing of the compact, each State shall reduce its consumptive use proportionately.

It is to be noted that paragraph (b) provides that the State of Colorado assents to diversions and storage of water in the State of Colorado for use in the State of New Mexico, subject to compliance with article IX of the compact. This makes it possible for New Mexico to construct reservoirs and facilities in Colorado for the storage and transportation of water for use in New Mexico, within the apportionment made to New Mexico by article III of the compact.

ARTICLE XV ET SEQ.

Articles XV, XVI, XVII, XVIII, XIX, XX, and XXI are important, but seem to require no detailed explanation. It might be noted that by the terms of article XVIII the State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River compact as States of the lower basin. This has reference to the provisions of the Colorado River compact of 1922, article II, subparagraph (g), whereby the term "lower basin" is defined as "those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now, or shall hereafter be beneficially served by waters diverted from the Colorado River system below Lee Ferry." This recognizes the interest of New Mexico in the Gila and Little Colorado Rivers and their tributaries which rise in New Mexico. These rights are not affected by the terms of the upper Colorado River Basin compact. They are governed entirely by the terms of the original Colorado River compact of 1922. The portion of the waters of these rivers which New Mexico may be entitled to use consumptively has not been determined. This will have to be done by compact with the other States of the lower division, or in the case of the Gila River by the authorization by Congress of the construction of the Central Arizona project, and congressional provisions binding on Arizona, California, and Nevada, apportioning certain quantity of consumptive use to New Mexico, or by agreement with Arizona alone after Arizona and California settle their controversies over the waters of the lower Colorado and its tributaries.

John H. Bliss, State engineer, and John R. Erickson, engineer for the Interstate Stream Commission, both of whom were members of the Engineer Advisory Committee, and who advised the commissioner in all engineering phases of the compact, are ready and willing as is the commissioner to appear before the legislature, or any committee thereof, and explain in more detail any of the provisions of the compact.

FRED E. WILSON,
Commissioner for New Mexico.

SENATE BILL No. 30

Introduced by Committee of the Whole Senate, Approved February 2, 1949

AN ACT To ratify the upper Colorado River Basin compact entered into at Santa Fe, N. Mex., October 11, 1948, by the State of Arizona, Colorado, New Mexico, Utah, and Wyoming; and declaring an emergency

Whereas the Legislature of the State of New Mexico, by an act approved February 14, 1935, entitled "An Act Creating the Interstate Stream Commission, Defining its Rights, Duties, and Powers, Providing for its Appointment and Compensation, and Making an Appropriation Therefor," appearing as chapter 25 of the Session Laws of 1935, and as sections 77-3301, 77-3303, New Mexico Statutes Annotated, 1941 compilation, created the Interstate Stream Commission, which was authorized to negotiate compacts with other States, to settle interstate controversies and for other purposes; and

Whereas on the 9th day of August 1946, the Interstate Stream Commission authorized and empowered the Honorable Thomas M. McClure to act as commissioner for New Mexico, and to enter into negotiations with the representatives of the States of Arizona, Colorado, Utah, and Wyoming, for the purpose of negotiating and entering into a compact or agreement respecting the uses and the deliveries of the water of the upper basin of the Colorado River; and

Whereas on the 19th day of November 1946, the Honorable Fred E. Wilson was duly appointed as commissioner by said Interstate Stream Commission to represent the State of New Mexico, to succeed Thomas M. McClure, deceased; and

Whereas on the 11th day of October 1948, at the city of Santa Fe, N. Mex., the commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and the representatives of the United States of America signed a compact comformable to the provisions of the act of the New Mexico Legislature approved February 14, 1935, an original of which compact as so signed and entered into by the commissioners aforesaid, is now on file with the Secretary of this State; and

Whereas on the 10th day of January 1949, the Interstate Stream Commission approved said compact and authorized its submission to the State legislature for ratification thereof: therefore,

Be it enacted, by the Legislature of the State of New Mexico, Section 1:

That the State of New Mexico does hereby ratify, approve, and adopt the compact aforesaid, which is as follows:

UPPER COLORADO RIVER BASIN COMPACT

The State of Arizona, the State of New Mexico, the State of Utah, and the State of Wyoming, acting through their commissioners:

Charles A. Carson for the State of Arizona,
Clifford H. Stone for the State of Colorado,
Fred E. Wilson for the State of New Mexico,
Edward H. Watson for the State of Utah and
L. C. Bishop for the State of Wyoming,

after negotiations participated in by Harry W. Bashore, appointed by the President as the representative of the United States of America, have agreed, subject to the provisions of the Colorado River compact, to determine the rights and obligations of each signatory state respecting the uses and deliveries of the water of the Upper Basin of the Colorado River, as follows: * * *

(Text of the compact is set forth in full in H. R. 2325.)

SEC. 2. Notice of approval of said Compact shall be given by the Governor of New Mexico to the Governors of Arizona, Colorado, Utah, and Wyoming, and to the President of the United States of America, as provided in Article XXI of said Compact.

SEC. 3. The ratification and approval of said Compact by this state shall not be binding or obligatory until it shall have been likewise approved by the Legislatures of the States of Arizona, Colorado, Utah, and Wyoming, and approved by the Congress of the United States of America.

SEC. 4. It is necessary for the preservation of the public health, peace, and safety of the inhabitants of the State of New Mexico, that the provisions of this Act shall become effective at the earliest possible time and therefore an emergency is hereby declared to exist, and this Act shall be in full force and effect from and after its passage and approval.

Mr. ENGLE. May I request, but not for the record, but only for the use of the committee, whether or not there is available a copy of the report?

Mr. WILSON. You mean a copy of my memorandum?

Mr. ENGLE. The report of the negotiator to the Governor or to the State legislature.

Mr. WILSON. I have only two or three copies. Outside of that, I do not desire to go into any of these various questions that have been discussed, unless you desire to ask some questions, but I do want to volunteer just one thing. That is along the line that you have been discussing all morning. That is whether or not the method that we used in measuring consumptive use of water is binding on some other State.

I just want to call your attention to one thing I have not heard brought out yet, and direct your attention to article VI of the compact itself, which we negotiated, and if you will permit me, I would like to read that.

It is just five or six lines:

> The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof for the Upper Basin and for each state of the Upper Basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the Commission by unanimous action shall adopt a different method of determination.

In other words, this method is not even binding upon the States that made it, and certainly could not be binding on some other State. The administrative body that will be set up to administer the compact is told to use this method of measurement, but by unanimous consent they can use some other method.

I wanted to bring that out because I do not think it was emphasized this morning. Outside of that, I have nothing further unless you have some questions.

Mr. MURDOCK. Have you any questions, Governor Miles?

Mr. MILES. No.

Mr. MURDOCK. Has anyone on the committee any questions to ask?

Mr. ENGLE. May I ask the judge a question?

Mr. MURDOCK. Yes, sir.

Mr. ENGEL. Judge, would you have any objection to including in the report of this committee a statement to the effect that the consent of Congress to this compact does not carry an agreement to or concurrence in any definition or interpretation, by implication or otherwise, of the terms of the basic Colorado River compact in the upper basin Colorado compact?

Mr. WILSON. That is rather a long question, Mr. Congressman. I will say this, that all of the States have agreed on the language that we would be willing to see go into the report of this committee. I do not know where that report is, but in substance, I have no objection to any report the committee makes, if the committee deems it necessary to clarify the matter in any manner by language in your report.

I agree with the questions that were asked. All of the States agreed on those, and I agree with them. I think it has language to that effect in the answers.

Mr. ENGLE. I have seen some language discussed which embodies more or less the statements in the letter which was sent to me by Mr.

Bashore in answer to specific questions. I do not regard that language as covering the situation at all, because as I pointed out to Mr. Breitenstein, it is perfectly possible on the concept of the basic Colorado compact, which is held by some people in the upper basin, to say in all sincerity that the upper basin does not amend, alter, or modify the basic compact, and yet if the consent given by Congress to that compact is to be regarded at some future time as an agreement to or a concurrence in the interpretations of the language of the basic compact as set forth in the upper Colorado River Basin compact, then such interpretations might be prejudicial to either the United States Government or States not signatory to the compact.

I would want to see included in that language a plain and unequivocal statement to the effect that such consent does not carry any concurrence or agreement in those interpretations.

Mr. WILSON. I would answer that this way, Mr. Congressman, that as far as I am concerned, I have no objection to the committee expressing any opinion it may have as to the effect of the consent which I hope you will grant to this bill. Personally, I feel that you are overemphasizing the importance of any interpretation that may have been put on the old Colorado River compact. If we have interpreted it one way, if that is wrong, it is not going to bind anybody. If we interpret it in a way that is the right interpretation, it might be binding on everybody when that question becomes important.

Mr. ENGLE. In such event, it would not be binding because it was in the compact. It would be binding because that was the original intent of the parties at the time they executed the basic compact in 1922.

Mr. WILSON. That is right.

Mr. ENGLE. In other words, it is your view that a compact is a contract and is to be construed by the usual rules of construction applied to contracts.

Mr. WILSON. Yes, and it might have some weight if it ever gets before a court as to the interpretation of other language to which it refers, if that other language is ambiguous and needs interpretation. I do not think the fact we interpret the language of the old compact in one particular manner would be taken by a court as having some weight, but even a court would not be bound to give it any consideration at all.

Mr. ENGLE. We do not care how much weight the court gives the views of the Upper Basin. We think their views in the matter should be given weight. Our concern is whether or not Congress adds any weight by giving consent to this compact, and we want to insist that Congress does not.

Mr. MURDOCK. Are there other questions to Judge Wilson?

If not, we thank you, Judge.

Mr. WILSON. Thank you, Mr. Chairman.

Mr. MURDOCK. The House is convening today for a short session. I am sure I am bringing none of you news when I say this is the 17th day of March. It is evidenced by several present, but this matter is so important that it ought to be disposed of, it seems to me, with the greatest possible dispatch. We have yet to hear from the representatives of three States and the representatives of the Federal Government.

What is the pleasure of the committee? The committee will stand adjourned until 2 o'clock this afternoon.

(Whereupon, at 12:05 p. m., the committee recessed, to reconvene at 2 p. m., the same day.)

AFTERNOON SESSION

Mr. MURDOCK. The committee will come to order, please.

We would like now to present and have a statement from the commissioners of the compacting States. We have already heard, of course, from two.

We have with us Mr. Bishop, the commissioner for the State of Wyoming who is negotiating the compact. Mr. Bishop, we would be pleased to have you come forward.

STATEMENT OF L. C. BISHOP, STATE ENGINEER AND INTERSTATE STREAMS COMMISSIONER FOR THE STATE OF WYOMING

Mr. BISHOP. Mr. Chairman and gentlemen of the committee, I have prepared a short statement on behalf of the State of Wyoming.

My name is L. C. Bishop, and I hold the position as State engineer and interstate streams commissioner for the State of Wyoming. I was the commissioner for the State of Wyoming on the recently negotiated Upper Colorado River compact.

Of the 97,913 square miles of the area of the State of Wyoming, about 17.50 percent is located in the Colorado River Basin.

The Wyoming portion of the Colorado River watershed is located on the headwaters of two major tributaries, the Green and Little Snake Rivers. Much of our irrigated area is located at elevations in excess of 7,000 feet above sea level where development is necessarily slow and where a compact is desirable for protection of our right to the use of a reasonable amount of the water of this interstate and international stream.

The presently irrigated area of the Colorado River watershed in Wyoming is 236,675 acres. There are more than 800,000 additional acres of irrigable land in the basin in Wyoming, of which we will have water from our allocation to irrigate about one-half.

The Colorado River compact of 1922 signed by Frank C. Emerson as commissioner for Wyoming at Santa Fe, N. Mex., allocated to the upper basin States in perpetuity the beneficial consumptive use of 7,500,000 acre-feet of water per annum with the proviso that they not deplete the flow of the stream at Lee Ferry below 85,000,000 acre-feet in continuing 10-year periods. It did not divide this allocation among the individual States.

In 1946 commissioners were appointed by all the upper basin States for the purpose of negotiating a compact for division of the 7,500,000 acre-feet of water allocated to them by the Colorado River compact. The upper basin States are Arizona, Colorado, New Mexico, Utah, and Wyoming.

The preliminary organization meeting was held at Cheyenne, Wyo., July 22, 1946, at the urgent request of Gov. L. C. Hunt, of Wyoming. Official meeting No. 1 was held at Salt Lake City, Utah, July 31, 1946. At this meeting an engineering committee consisting of one or more engineers from each State, and one from the United States Bureau of

Reclamation was appointed. This committee assisted materially in the negotiations by compiling and correlating engineering information, including water-supply studies on the main stream and of the principal tributaries of the Colorado River. A legal committee was appointed later.

Nine meetings were held in all before the final compact was agreed upon and signed at Santa Fe, N. Mex., on the 11th of October 1948: Two at Cheyenne, Wyo.; two at Santa Fe, N. Mex.; two at Denver, Colo.; one at Vernal, Utah; and a series of hearings were held respectively at Rock Springs, Wyo.; Grand Junction, Colo.; Price, Utah; and Farmington, N. Mex., where the public was invited and did attend. These hearings were held for the purpose of informing the people with reference to the compact negotiations, and to hear what the water users of the basin had to say concerning the proposed compact. The compact passed both houses of the Wyoming Legislature promptly and without dissenting vote and was signed by Gov. A. G. Crane, January 25, 1949.

Under the terms of this compact, Arizona will receive 50,000 acre-feet of water, and of the remaining 7,450,000 acre-feet Colorado will receive 51.75 percent; New Mexico 11.25 percent; Utah, 23 percent, and Wyoming, 14 percent.

The virgin contribution of the flow of water at Lee Ferry, by States, according to the latest information furnished by the engineering committee is: For Arizona, 0.87 percent; Colorado, 70.14 percent; New Mexico, 1.58 percent; Utah, 16.38 percent; and Wyoming, 11.03 percent.

Wyoming has three projects that have been investigated by the United States Bureau of Reclamation which we hope to see authorized for construction in the immediate future. They are Seedskadee, Eden and Lyman. Also, we hope to see Kendall and Savery Reservoirs constructed at an early date as they are the key projects of the entire development in Wyoming. We hope to see the entire development program as proposed by the United States Bureau of Reclamation carried to completion in an orderly manner.

As we see it, the upper Colorado River compact has removed all obstacles that have held up this program for so many years, and we believe that in all fairness, the reasonable needs of our State should receive immediate and favorable consideration by the Congress at this time.

With five States and the United States involved in the negotiations, it was indeed a complex problem, which has been solved in a most democratic manner to the satisfaction of all the States concerned.

In my judgment, the compact will accomplish what it purports to do, and I consider that its terms are fair and that the division of the water between the upper basin States is equitable to the end that the waters of the upper Colorado River Basin will be applied to the most beneficial and economical use.

That is all I have, gentlemen.

Mr. MURDOCK. We appreciate that statement, Mr. Bishop. I want to say to you of all the delegations in the House, the delegation from Wyoming shows the greatest unanimity. It is also very effective.

Mr. BISHOP. Thank you.

Mr. MURDOCK. I think due to that attitude we ought to recognize Congressman Barrett for the first questions, if there be any.

Mr. LEMKE. Before you do that I would like to make an observation. I wonder if the reason why they stick together is because they all sing, "Why, oh, why, did I leave Wyoming?"

Mr. BISHOP. Mr. Chairman, I would like to add to my prepared statement a further statement to the effect that I have here a copy of the enrolled act, certified to by the secretary of state. I do not know whether you would like to put that in the record or not. It is a matter for you to decide. I have it here for any use you care to make of it.

Mr. MURDOCK. Thank you, sir. It will be admitted in the record.

(The material referred to is as follows:)

THE STATE OF WYOMING

OFFICE OF THE SECRETARY OF STATE

UNITED STATES OF AMERICA,
State of Wyoming, ss:

I, A. G. Crane, Secretary of the State of Wyoming, do hereby certify that the annexed is a full, true, and correct copy of Enrolled Act No. 6, Senate, being Original Senate File No. 3, as passed by the Thirtieth Legislature of the State of Wyoming, and approved by the Governor on 25th day of January, A. D., 1949, at 3:35 o'clock P. M.

In testimony whereof, I have hereunto set my hand and affixed the Great Seal of the State of Wyoming.

Done at Cheyenne, the Capital, this 14th day of March, A. D., 1949.

[SEAL]

A. G. CRANE,
Secretary of State.
T. C. THOMPSON,
Deputy.

ENROLLED ACT NO. 6, SENATE

THIRTIETH STATE LEGISLATURE OF THE STATE OF WYOMING

Chapter 6

AN ACT To provide for the ratification and approval of the Upper Colorado River Basin Compact

Whereas the Twenty-sixth Wyoming Legislature passed an act entitled "An act relating to the appointment of Interstate Streams Commissioner and assistant Commissioners to negotiate agreements relative to interstate streams and providing for the Governor of Wyoming to notify the Governors of other States as to the appointment of said Commissioner, detailing the authority of said Commissioner," which said act was approved on the 24th day of February 1941, by the Governor (now section 71-2601, Wyoming Compiled Statutes, 1945), and

Whereas under the authority of said act, the State Engineer, L. C. Bishop, acted as Commissioner, who, together with the duly appointed Commissioners of the States of Arizona, Colorado, New Mexico, and Utah and the representative of the United States of America, negotiated a compact or agreement now called the "Upper Colorado River Basin Compact" and which was signed on the 11th day of October, A. D. 1948, at the city of Santa Fe, State of New Mexico; and

Whereas the said Act of the Twenty-sixth Wyoming Legislature further contained the following provision: "that any such compact or compacts, agreement or agreements so entered into by such States and the United States shall not be binding or obligatory upon any of the contracting parties thereto unless or until the same shall have been ratified and approved by the legislature of each of such States and the Congress of the United States." Therefore

Be it enacted by the legislature of the State of Wyoming:

SECTION 1. That ratification and approval is hereby given to the Upper Colorado River Basin Compact as signed at the City of Santa Fe, in the State of New Mexico, on the 11th day of October, A. D. 1948, by L. C. Bishop, the State Engineer of the State of Wyoming, under and in accordance with the authority of the Act of the Twenty-sixth Wyoming Legislature approved the 24th day of February, 1941, entitled "An Act relating to the appointment of Interstate Streams Commissioner and assistant Commissioners to negotiate agreements relative to interstate

streams and providing for the Governor of Wyoming to notify the Governors of other States as to the appointment of said Commissioner, detailing the authority of said Commissioner" (now Section 71-2601, Wyoming Compiled Statutes, 1945), which Compact was also signed by the duly authorized Commissioners of the States of Arizona, Colorado, New Mexico, and Utah and approved by the representative of the United States, which Upper Colorado River Basin Compact is in full as follows:

* * * * * * *

States of America. Notice of ratification by the legislatures of the signatory States shall be given by the Governor of each signatory State to the Governor of each of the other signatory States and to the President of the United States of America, and the President is hereby requested to give notice to the Governor of each of the signatory States of approval by the Congress of the United States of America.

In witness whereof, the Commissioners have executed six counterparts hereof each of which shall be and constitute an original, one of which shall be deposited in the archives of the Department of State of the United States of America, and one of which shall be forwarded to the Governor of each of the signatory States.

Done at the City of Santa Fe, State of New Mexico, this 11th day of October, 1948.

(S) Charles A. Carson,
CHARLES A. CARSON,
Commissioner for the State of Arizona.
(S) Clifford H. Stone,
CLIFFORD H. STONE,
Commissioner for the State of Colorado.
(S) Fred E. Wilson,
FRED E. WILSON,
Commissioner for the State of New Mexico.
(S) Edward H. Watson,
EDWARD H. WATSON,
Commissioner for the State of Utah.
(S) L. C. Bishop,
L. C. BISHOP,
Commissioner for the State of Wyoming.
(S) Grover A. Giles,
GROVER A. GILES,
Secretary.

Approved:

(S) Harry W. Bashore,
HARRY W. BASHORE,
Representative of the United States of America.

SECTION 2. That said Compact shall not be binding or obligatory upon any of the high contracting parties thereto unless and until the same shall have been ratified by the Legislature of each of the said States and approved by the Congress of the United States. The Governor of Wyoming shall give notice of the ratification and approval of said Compact by the Thirtieth Wyoming Legislature to the governors of the States of Arizona, Colorado, New Mexico, and Utah, and to the President of the United States.

SECTION 3. This Act shall take effect and be in force from and after its passage.

HERMAN D. MAYLAND,
Speaker of the House.
GEORGE BURKE,
President of the Senate.

Approved, January 25, 1949.

A. G. CRANE, *Governor.*

I hereby certify that this Act originated in the Senate.

WILLIAM A. RIVER, Jr.,
Chief Clerk.

Mr. BARRETT. Mr. Chairman, I want to commend our distinguished State engineer for his statement. He has worked diligently on the matters involved in this compact and on the development of our Green River Basin in Wyoming for more than a quarter of a century. I know he is happy that we can look forward to the time in the not too far dis-

tant future when we will be able to get some actual development work going on that section of our State as well as in the other States in the upper basin.

I want to ask Mr. Bishop one question.

Of course, you have heard the discussion here between my colleagues from California and the witnesses this morning. I should like to ask you if some language in the report that is generally along the line suggested this morning would meet with your approval.

Mr. BISHOP. Yes, sir.

Mrs. BOSONE. Mr. Chairman, may I make this suggestion, that Congressman Engle write out the question he has been asking the gentlemen who have appeared at the hearing. What is the language? Let us have it actually before us.

Mr. ENGLE. I will read it. Here is the language.

Mrs. BOSONE. Is it very long?

Mr. ENGLE. No, I will give the gentlewoman from Utah a copy.

This is the language I propose for the report, which is in addition to the language on which there has been discussion over on the Senate side. If there is no objection I will read the whole statement and indicate what I have added. It is very short.

Mr. MURDOCK. I think that would be better, Mr. Engle.

Mr. ENGLE. The whole statement is as follows:

The upper Colorado River Basin compact is an interstate compact between the States of Arizona, Colorado, New Mexico, Utah, and Wyoming. Article 1, section 10, of the Constitution of the United States requires that before a compact or agreement between States is effective, the Congress of the United States must consent thereto. The purpose of S. 790 (H. R. 2325) is to give such congressional consent to the upper Colorado River Basin compact. S. 790 (H. R. 2325) does not, nor does the upper Colorado River Basin compact alter, amend, modify, or repeal the Boulder Canyon Project Act (45 Stat. 1057) or the Colorado River compact signed at Santa Fe, N. Mex., on November 24, 1922. It is recognized that the upper Colorado River Basin compact is binding only upon the States which are signatory thereto and does not impair any rights of any State not signatory thereto, and that the upper Colorado River Basin compact is subject, in all respects, to the provisions and limitations contained in the Colorado River compact.

That is the language that was discussed over on the Senate side. I propose adding this:

It is further recognized that Congress, by giving its consent to the upper Colorado River Basin compact, does not accept, adopt, concur in, nor commit the United States to any interpretation of the Colorado River compact expressed in or implied from the upper Colorado River Basin compact.

That sentence that I have just read is substantially the question which I asked Mr. Breitenstein yesterday. It appears in the record. It is at page 39 of the reporter's transcript. It is as follows:

Mr. ENGLE. I would like to ask one further question. I have been rolling over in my head the effect of the word "effect" in this language which I stated a few minutes ago. *I wonder if you agree that this is right: That the Congress in* consenting to the upper-basin compact is not committing itself to any interpretation, expressed or implied, of the Colorado River compact.

Mr. BREITENSTEIN. Is that all?

Mr. ENGLE. Yes.

Mr. BREITENSTEIN. Yes.

Mr. BARRETT. Will the gentlemen yield?

Mr. ENGLE. Yes.

Mr. BARRETT. I wonder if that language should not be changed a trifle to conform with the other statements that will follow. I wonder

if we could change it by inserting this language, so that your sentence would read as follows:

It is further recognized that Congress by giving its consent to the upper Colorado River Basin compact does not either accept or reject, adopt, concur in or, on the other hand, disapprove or commit the United States to any interpretation of the Colorado River compact expressed in or implied from the upper Colorado River Basin compact.

Mr. STONE. May I interpose for a moment?

Mr. MURDOCK. Yes.

Mr. STONE. Those of us representing the upper basin States have given this language suggested by Congressman Engle some consideration. We understand that this is to be appended to the language which is incorporated in the answer to question No. 8 of his letter submitted to Harry W. Bashore, the Federal representative.

We have the same thought expressed by Congressman Barrett, that this added language should be so drafted as to be reciprocal in its nature, that is, that it neither approves nor disapproves or agrees or disagrees with the interpretation. We do not wish that any implication be left here that this language could be implied to mean disapproval.

Congressman ENGLE. We were trying our hand at the same thing that Congressman Barrett was. We wondered if this would accomplish the purpose and leave the matter in status quo.

It is further recognized that Congress, by giving its consent to the upper Colorado River Basin compact does not commit the United States to any interpretation of the Colorado River compact expressed in or implied from the upper Colorado River Basin compact, and expresses neither agreement nor disagreement with any such interpretation.

Mr. ENGLE. Offhand, I can see no objection to that. In other words, as I understand your objective, which is similar to that of the gentleman from Wyoming, you want to state the proposition in such a manner as not to imply a disapproval of the interpretation placed, for instance, on the words, "beneficial consumptive use" in the upper Colorado River compact as applied in the basic Colorado River compact?

Mr. STONE. That is correct, sir, to express neither approval nor disapproval.

Mr. ENGLE. That is precisely what I am trying to do.

In making it clear that the upper basin compact does not give a consent or concurrence, I do not want to write language which implies a disapproval. If your language meets that purpose—and so far as I can determine at this point it does—it would be agreeable.

Mr. STONE. May I show you this so that you can read it?

Mr. ENGLE. I will be glad to have a copy of it.

Mr. MURDOCK. Will the gentleman yield?

Mr. ENGLE. Yes.

Mr. MURDOCK. It will be pretty difficult to write the language in on the floor of the House or with witnesses before the committee. It is understood, I believe, that some language will need to be written into the report to be satisfactory all around.

Who, Judge Stone, would constitute the judgment of the proponents of the legislation? Would it be those of you who are here representing the States?

Mr. STONE. That is correct. As a matter of fact, except for Mr. Watson from Utah, the commissioners who negotiated this compact are all here. Judge J. A. Howell and the attorney general, Mr. Vernon, are both here from Utah. That group is in a position to express judgment on these matters.

Mr. MURDOCK. May I ask then, Mr. Engle, who, representing the opposite view, would be competent to decide on the language for the report to be submitted to the committee?

Mr. ENGLE. I will take the responsibility, Mr. Chairman.

Mr. MURDOCK. That brings us together then.

Would it not be a good idea to come as near together as we can here in open discussion, and then leave this matter for the final determination outside the committee?

Mr. ENGLE. I am only speaking with reference to California, Mr. Chairman. Nevada is represented here by Mr. Baring.

Mr. MURDOCK. That is a suggestion to the Chair. Perhaps we can work it out that way.

Mr. ENGLE. I think if we can agree on our objectives the writing of the language will be only a matter of draftsmanship and if the witnesses here agree that there is no objection to the language to accomplish what we have stated to be our objective, then I am confident that I can sit down with the people here who are the proponents of this legislation and get the language which will be entirely agreeable.

Mr. STONE. Mr. Chairman, I have canvassed the States' representatives and the language I have suggested here would meet with the approval of the sponsors of the compact.

Mr. MURDOCK. Thank you for that, Judge Stone.

Mr. STONE. If there is anyone here that I have not canvassed and he has a contrary view, I trust he will speak up.

Mr. BARRETT. Perhaps we have come to an agreement already.

Mr. MURDOCK. It appears that that might be the agreement. Are there any further questions of Mr. Bishop?

Mr. ENGLE. There is one further question.

Mr. Bishop, do you have with you the report which you submitted as the negotiator of this agreement which is binding to your State government, binding either to the State government or the legislature, or both?

Mr. BISHOP. I did not make a report to the Governor and the legislature at the time the compact was introduced.

We had three Senators that were members of our compact commission. Senator Barlow here, is the one who presented the compact to the Senate and explained it to the Governor. He is here to speak for himself, and I would like to have him make a statement on behalf of the people of the Green River Basin in the matter.

Mr. ENGLE. I did not intend to burden the record with further testimony. If such a report is in existence, I wanted to see it; but if it is not in existence, that disposes of the matter.

Mr. MURDOCK. You mentioned Senator Barlow.

Mr. BISHOP. Norman W. Barlow, of Cora, Wyo.

Mr. MURDOCK. Will you introduce him, please?

Mr. BISHOP. Mr. Barlow?

Mr. MURDOCK. Mr. Barlow, we would be glad to have a statement from you for the record.

STATEMENT OF NORMAN W. BARLOW, MEMBER, COMPACT COMMISSION, STATE OF WYOMING

Mr. BARLOW. Mr. Chairman, and members of the committee, my statement to this committee is merely to bring you up to date as a committee in the capacity that I am representing Wyoming.

I am president of the Green River Development Co., which is a basin company taking in the Green River Basin of the Colorado River in Wyoming. This nonprofit organization is represented by directors of each of the counties contained within the basin and is an organization that has been instrumental in bringing about this compact for Wyoming.

I am also a compact commissioner for Wyoming and a State senator in the Wyoming State Senate. In that capacity I introduced Senate file 3 in the Wyoming Senate.

We did not have any opposition in the Wyoming Legislature. There was not one dissenting vote, Mr. Chairman, and Wyoming as far as the legislature and the people who are contained within the basin are concerned, are 100 percent behind this consent legislation and the upper Colorado River Basin compact.

We are particularly anxious to see this consent given at this time because we have numerous projects that will be effectuated when this compact becomes operative.

We are particularly anxious to have these projects started under the terms of the upper Colorado River Basin compact and we, in the Green River Basin, consider this a fair and just and an equitable division of the water of the upper division.

We are also recognizing the fact that without some sort of an agreement, a compact or a contract, the development in the upper division of the Colorado River would have been impeded.

I hope this committee will recognize that by giving consent legislation the various facilities and various agencies that will be operating under this compact will know what each State's rights are and we will cooperatively develop our water resources in the upper division of the Colorado River Basin.

That is the extent of my statement concerning my area as represented in this compact.

Mr. MURDOCK. We thank you for your statement, Senator. I want to congratulate you as well as Mr. Bishop and the others for bringing us thus far along.

Mr. ENGLE. May I ask the Senator one question?

Mr. MURDOCK. Yes.

Mr. ENGLE. Did you submit a formal report to the State legislature?

Mr. BARLOW. I did not, Congressman, I was on the lands and irrigation committee in the senate. In explaining the compact to the senate I did not in any way preface the introduction by any statement that was introduced other than an oral statement.

Mr. MURDOCK. We have next Mr. Charles Carson, of Arizona, commissioner for the State of Arizona and the compact.

STATEMENT OF CHARLES A. CARSON, COMMISSIONER, STATE OF ARIZONA

Mr. CARSON. Mr. Chairman, and members of the committee I was the compact commissioner on this compact for the State of Arizona. I have brought here and will hand to the clerk a certified copy of the act of Arizona Legislature ratifying the upper basin compact. We did not make a formal report to the legislature in Arizona.

I did make a report to the Arizona Interstate Stream Commission and they sent a copy of my report to them with a copy of the compact by mail to each member of the legislature before the legislature convened. I would like to leave with the committee two copies of this report of mine to the stream commission.

Mr. MURDOCK. The two documents will be admitted to the record, along with the others.

Mr. CARSON. I would like to explain Arizona's position with relation to the upper Colorado River Basin compact.

Part of Arizona is in the upper basin and part is in the lower basin. In the upper basin Arizona has approximately 6,900 square miles of land. There is not much possibility of using water on that land except as it may be developed by the Indian service on the Navajo Reservation. All of their engineers and our engineers reported that they could not ultimately use more than 30,000 acre-feet. But for safety the compact allows a maximum of 50,000 acre-feet of water to Arizona.

Arizona's greatest interest, however, is in the lower basin.

Now, on that lower basin interest, I have shown it, on the bottom of page 3 and the top of page 4 of my report. The rest of the report is more or less just a recitation of the various meetings and I do not think you would be concerned with that and with the people who attended them from Arizona as advisers and as engineers.

During the course of the negotiations every member of the Arizona Interstate Streams Commission was participating to some degree, and we had other engineers and lawyers.

Mr. MILLER. Could you give us, from the maetrial at the bottom of page 3, the reaction to the Colorado River Basin project?

Mr. CARSON. I will read that to you, if I may.

> Arizona's interest, of course, was to see that that portion of Arizona which is in the upper basin secured an apportionment to it of sufficient water to meet its ultimate possible uses.
>
> The Arizona engineering advisers and the engineers of the United States Indian service reported that the ultimate probable use of water in that portion of Arizona which is in the upper basin would not exceed 30,000 acre-feet per annum.
>
> The compact allocates Arizona 50,000 acre-feet as a measure of safety. The reason for that small possible use in Arizona is that by that time the San Juan River and the Colorado River are in very deep canyons and it is not possible to get water out of those streams back up onto the high plateaus and mesas which are along its banks.

Proceeding with this report, then—

> Arizona's interests further require that the upper-basin compact be consistent with Arizona's contention that the beneficial consumptive use of water of the Gila River should be measured by the resulting depletion of the Gila at its confluence with the Colorado River and further that reservoir losses be shared by the States benefiting from the storage of water in reservoirs in proportion to the benefits received from such storage.

While Arizona's interests further required that machinery be set up whereby the States of the upper division would make deliveries of water at Lee Ferry for use in the lower basin such interest is because Arizona is a lower-basin State. That portion of Arizona which is in the upper basin does not share in the obligation to make deliveries at Lee Ferry.

Accordingly, it was felt that Arizona should not be represented on the administrative commission which is set up by the upper-basin compact to administer water rights as between Colorado, New Mexico, Utah, and Wyoming, so that those States will make the deliveries at Lee Ferry which they agreed to make under the provisions of the Colorado River compact.

Our interests in that are identical with the interest expressed by the Congressman from California.

Then there follows just a brief analysis of each article of this compact that I made as a report to the Arizona Interstate Streams Commission.

I think none of those would be of interest to the gentleman from California, except under article VI on page 6, after quoting the article, I had this to say:

This, of course, is in complete accord with Arizona's construction of the Colorado River compact and it is believed to be helpful to Arizona in opposing California's arguments on the Gila River.

Then it just proceeds with the analysis of the articles. I think there is nothing in there which the gentleman would be particularly interested in.

He might be, however, in the conclusion, which I would like to read. It is on the last page:

I deem it a great honor and privilege to have been called upon to represent Arizona in the negotiation of this upper Colorado River Basin compact. I believe it to be fair, just, and equitable to all of the States, and particularly valuable to Arizona in that it supports Arizona's position in opposition to the arguments made by certain California interests.

Of course, I recognize that this compact, as stated in the letter that I signed to this committee, is binding only upon the signatory States who are parties thereto and is not binding on the United States or the States of California and Nevada. However, I do believe it has evidentiary value in that, wherever the question of the construction of the original Colorado River compact may arise, here is evidence that five States construe that compact to mean that beneficial consumptive use should be measured by depletion. They also agree reservoir losses should be shared.

That is not binding on California or Nevada. They can contend otherwise if they see fit. It does have evidentiary value as to the construction placed upon the main Colorado River compact by five States who are parties to it in dealing among themselves. And, of course, no upper Colorado River compact could have been negotiated without an understanding among the negotiators of what the original Colorado River compact meant. Our compact states in 12 places that it is subject to the Colorado River compact and states:

It is recognized that the Colorado River compact is in full force and effect and all the provisions hereof are subject thereto.

So we have contracted among ourselves, five States, that our compact is subject to and controlled by the provisions of the Colorado River compact.

There is no attempt to prejudice or harm California or Nevada or that part of Arizona which is in the lower basin, or that part of New Mexico which is in the lower basin, or that part of Utah which is in the lower basin.

To make that definitely clear we put in article 18 which provides:

The State of Arizona reserves its rights and interests under the Colorado River compact as a State of the lower division and as a State of the lower basin.

It further provides that—

The State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River compact as States of the lower basin.

These three States are partially in both basins. None of California and none of Nevada is in the upper basin. They are wholly within the lower basin.

So that, so far as the lower basin rights are concerned, I consider that this compact would be valuable to Arizona only as evidence of the construction placed upon the original compact by the five States who negotiated this compact who are also bound by the original compact.

I think in that connection it does have some evidentiary value.

That is all I have to say, unless there are some questions.

Mr. MURDOCK. Without objection the report as read in part will be placed in full in the record.

(The material referred to is as follows:)

To: The Arizona Interstate Stream Commission.
Report from Charles A. Carson on the upper Colorado River Basin compact.

At a conference of the Governors of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, on July 22, 1946, at which I had the honor of representing Governor Osborn and at which the Governors of the other States were present in person, it was agreed that the negotiation of an upper Colorado River basin compact to allocate among the named States the use of the water apportioned to the upper basin by the Colorado River compact, signed November 4, 1922, should be immediately undertaken.

On July 31, 1946, the compact commissioners appointed by the governors of the various States at a meeting held in Salt Lake City, Utah, organized as a commission, with the Honorable Harry W. Bashore, Federal representative, and formerly Commissioner of the Bureau of Reclamation, elected chairman, and Grover E. Giles, attorney general of Utah, elected secretary.

Thereafter meetings were held in Santa Fe, N. Mex. September 18, 1946, and on October 28, 30, 31, and November 2, 1946, meetings were held at Rock Springs, Wyo.; Grand Junction, Colo.; Price, Utah; and Farmington, N. Mex. On September 8, 1947, a meeting was held at Cheyenne, Wyo., and on December 1, 2, 3, and 4, 1947, meetings were held at Denver, Colo. On February 17, 18, 19, 20, and 21, 1948, meetings were held at Denver, Colo. On July 7 to 23, inclusive, 1948, meetings were held at Vernal, Utah, and on October 4 to 11, inclusive, 1948, meetings were held at Santa Fe, N. Mex., where the upper Colorado River basin compact was signed by the commissioner of each of the five States, on October 11, 1948.

I was requested by Governor Osborn in July of 1946 to serve as the commissioner for Arizona in the negotiation of this compact. I was assisted throughout by R. Gail Baker and Ralph I. Meeker as engineering advisers, who, in addition to the compact commission meetings, attended many meetings and did a great deal of research work as engineering advisers to the Arizona commissioner, and as members of the engineering advisory committee of the upper Colorado River Basin compact commission.

In addition to Mr. Baker and Mr. Meeker, many people from Arizona attended one or more meetings and were very helpful to the Arizona commissioner in the negotiations of this compact.

Those attending one or more meetings were:

Donald C. Scott, former member of the Colorado River commission of the State of Arizona and an engineer, has studied the Colorado River for many years.

Nellie T. Bush and J. E. Bush, of Parker, Ariz. Mrs. Bush was formerly a member and secretary of the Colorado River Commission and has been a student of Colorado River matters for many years.

Jesse A. Udall, member of the Arizona Interstate Stream Commission, who at the request of the commissioner for Arizona, served as a member of the drafting committee for the upper Colorado River Compact Commission.

Wayne M. Akin, chairman of the Arizona Interstate Stream Commission;

R. H. McElhaney, vice chairman of the Arizona Interstate Stream Commission;

Dr. Alfred Atkinson, member of the Arizona Interstate Stream Commission;

Jay M. Gates, member of the Arizona Interstate Stream Commission;

Barry M. Goldwater, member of the Arizona Interstate Stream Commission:

John A. Roberts, member of the Arizona Interstate Stream Commission;

Ray Killian, executive secretary of the Arizona Interstate Stream Commission; and

O. C. Williams, land and water commissioner of the State of Arizona.

The commission appointed an engineering advisory committee at an early meeting, of which committee John R. Riter, Chief of the Hydrology Division of the Bureau of Reclamation, was chairman, and upon which engineers of the various States selected by the various commissioners served as members.

The Bureau of Reclamation and its engineers and attorneys were of very great aid to the commission, particularly Mr. Riter and Mr. J. G. Will, assistant chief counsel of the Bureau. Mr. Will served from the beginning upon the legal advisory committee, of which the Arizona commissioner was chairman, and later served as chairman of the final drafting committee which prepared the final draft of the upper Colorado River Basin compact.

UPPER COLORADO RIVER BASIN COMPACT SUBJECT TO COLORADO RIVER COMPACT

The Colorado River compact apportioned to the upper basin the exclusive beneficial consumptive use in perpetuity of 7,500,000 acre-feet of water per annum. This basin is definied as those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which water naturally drains into the Colorado River system above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now, or shall hereafter be, beneficially served by water diverted from the system above Lee Ferry. Approximately 6,900 square miles of Arizona is in the upper basin, of which approximately 450 square miles is north of the main stream of the Colorado River and the remainder of which is on the Navajo Indian Reservation.

The "States of the upper division" is defined as meaning the States of Colorado, New Mexico, Utah, and Wyoming, so that while Arizona is a State of the upper basin, it is not a State of the upper division.

The Colorado River compact provides that the States of the upper division, meaning the States of Colorado, New Mexico, Utah, and Wyoming, will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years reckoned in continuing progressive series, beginning with the 1st day of October of each year.

The purpose and authority of the Upper Colorado River Basin Compact Commission were, therefore, to apportion among the five States the use of the water which was apportioned to them jointly by the Colorado River compact, and at the same time to provide the machinery by which the States of the upper division, Colorado, New Mexico, Utah, and Wyoming, would meet the obligation of making deliveries at Lee Ferry under the Colorado River compact.

ARIZONA'S INTEREST

Arizona's interest, of course, was to see that that portion of Arizona which is in the upper basin secured an apportionment to it of sufficient water to meet its ultimate possible uses.

The Arizona engineering advisors and the engineers of the United States Indian Service reported that the ultimate probable use of water in that portion of Arizona which is in the upper basin would not exceed 30,000 acre-feet per annum.

Arizona's interests further required that the upper basin compact be consistent with Arizona's contention that the beneficial consumptive use of water of the Gila River should be measured by the resulting depletion of the Gila at its confluence with the Colorado River, and further that reservoir losses be shared by the States benefiting from the storage of water in reservoirs in proportion to the benefits received from such storage.

While Arizona's interests further required that machinery be set up whereby the States of the upper division would make deliveries of water at Lee Ferry for use in the lower basin, such interest is because Arizona is a lower basin State. That portion of Arizona which is in the upper basin does not share in the obligation to make deliveries at Lee Ferry.

Accordingly, it was felt that Arizona should not be represented on the administrative commission which is set up by the upper basin compact to administer water rights as between Colorado, New Mexico, Utah, and Wyoming, so that those States will make the deliveries at Lee Ferry which they agreed to make under the provisions of the Colorado River compact.

THE UPPER COLORADO RIVER COMPACT

Each of you has been furnished with a copy of the upper Colorado River Basin compact signed at Santa Fe, N. Mex., October 11, 1948, by the commissioners of the respective States and by Grover E. Giles, secretary of the commission, and approved by Harry W. Bashore, chairman of the commission and the representative of the United States of America.

It is believed that the upper basin compact is clear and concise.

ANALYSIS OF THE UPPER BASIN COMPACT

The preamble merely gives the names of the States and the commissioners and recites that they have agreed, subject to the provisions of the Colorado River compact, to determine the rights and obligations of each signatory State respecting the uses and deliveries of the water of the upper basin of the Colorado River as is set forth in later articles of the upper basin compact.

Article I

Article I sets forth the purposes of the compact and recognizes that the Colorado River compact is in full force and effect and that the provisions of the Upper Colorado River Basin compact are subject thereto.

Article II

Article II contains definitions which are believed to be clear and need no further explanation.

Article III

Article III apportions to the State of Arizona in perpetuity the consumptive use of 50,000 acre-feet of water per annum. (This is believed to be ample for any ultimate possible uses in that portion of Arizona which is in the upper basin.)

The consumptive use of the balance of the water apportioned to the upper basin by the Colorado River compact is apportioned as follows:

	Percent		*Percent*
State of Colorado	51.75	State of Utah	23.00
State of New Mexico	11.25	State of Wyoming	14.00

The apportionment is of any and all man-made depletions. The beneficial use is the basis, the measure and the limit of the right to use.

Article III further provides that no State shall exceed its apportioned use in any water-year when the effect of such excess use as determined by the Upper Colorado River Commission set up as the administrative agency is to deprive another signatory State of its apportioned use during that water-year. The apportionment to each State includes all water necessary for the supply of any rights which may now exist.

No apportionment is made of the use of any surplus water and the apportionments of water shall not be taken as any basis for the allocation among the signatory States of any benefits resulting from the generation of power.

Article IV

Article IV provides for the curtailment of the use of water in the States of the upper division (Colorado, New Mexico, Utah, and Wyoming) in the event such curtailment is necessary in order that the flow at Lee Ferry shall not be depleted below that required by article III of the Colorado River compact, and empowers the Upper Colorado River Commission, the administrative agency set up by the compact, to determine the curtailment necessary to be made in each State.

Article V

Article V provides that reservoir losses shall be shared in proportion to the benefits received from the storage of water in each reservoir.

Article VI

Article VI provides that the consumptive use of water for the upper basin and for each State shall be determined by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the commission by unanimous action shall adopt a different method of determination.

This of course is in complete accord with Arizona's construction of the Colorado River compact and it is believed will be helpful to Arizona in opposing California's arguments on the Gila River.

Article VII

Article VII provides that consumptive use of water by the United States or any agency, instrumentality or wards shall be charged as a use by the State in which the use is made.

Article VIII

Article VIII provides for the creation of an interstate administrative agency to be known as the Upper Colorado River Commission. It provides that it shall be composed of one commissioner representing each of the States of the upper division, namely; Colorado, New Mexico, Utah, and Wyoming, and by a Federal representative appointed by the President.

The article sets forth the powers and duties of the commission. It was believed by the Arizona commissioner that Arizona should not be represented on such commission for the reason that it concerns the States of the upper division and not the States of the upper basin, and sets up the machinery by which the States of the upper division will meet their obligations for deliveries of water at Lee Ferry for use in the lower basin, and Arizona desires to retain unimpaired her rights as a State of the lower basin against the States of the upper division jointly and severally to require deliveries at Lee Ferry. And again, it was thought by the Arizona commissioner that it would be embarrassing to Arizona to be represented on the commission and would likewise entail some needless expense.

Article IX

Article IX contains provisions respecting the acquisition, construction, and use of facilities in one State for the benefit of another State. On account of the geography of the basin, this article does not directly concern Arizona.

Article X

Article X recognizes the La Plata River compact between Colorado and New Mexico, and does not directly concern Arizona.

Article XI

Article XI constitutes an agreement between Colorado and Wyoming as to the use of water of the Little Snake River, an interstate tributary, but does not directly concern Arizona.

Article XII

Article XII constitutes an agreement between Utah and Wyoming concerning the use of water of Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek, and Sheep Creek, interstate tributaries of the Green River, and does not directly concern Arizona.

Article XIII

Article XIII constitutes an agreement between Colorado and Utah concerning the use of the water of the Yampa River, an interstate tributary, and does not directly concern Arizona.

Article XIV

Article XIV constitutes an agreement between Colorado and New Mexico concerning the use of the water of the San Juan River and its tributaries, and does not directly concern Arizona.

Article XV

Article XV provides that water may be impounded and used for the generation of electrical power, but that such use shall be subservient to and shall not interfere with or prevent use of water for agricultural and domestic purposes, and further provides that the provisions of the compact shall not interfere with the right or power of any State to regulate within its boundaries the appropriation, use, and control of water, the consumptive use of which is apportioned and available to such State by this compact.

Article XVI

Article XVI provides that the failure of any State to use the water apportioned to it by the compact shall not constitute a relinquishment of the right to such use to the lower basin, or to any other State, nor shall it constitute a forfeiture or abandonment of the right to such use. In other words, the apportionment is in perpetuity.

Article XVII

Article XVII provides that the use of any water imported into the natural drainage basin of the upper Colorado River Basin shall not be charged to any State under the apportionment of consumptive use made by the compact.

Article XVIII

Article XVIII provides that the State of Arizona reserves its rights and interests under the Colorado River compact as a State of the lower division and as a State of the lower basin. It further provides that the State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River compact as States of the lower basin.

Article XIX

Article XIX provides that nothing in the compact shall be construed as:

(a) Affecting the obligations of the United States of America to Indian tribes;

(b) Affecting the obligations of the United States of America under the treaty with the United Mexican States (Treaty Series 994);

(c) Affecting any rights or powers of the United States of America, its agencies or instrumentalities, in or to the waters of the upper Colorado River system, or its capacity to acquire rights in and to the use of said waters;

(d) Subjecting any property of the United States of America, its agencies or instrumentalities, to taxation by any State or subdivision thereof, or creating any obligation on the part of the United States of America, its agencies or instrumentalities, by reason of the acquisition, construction or operation of any property, or works of whatever kind, to make any payment to any State or political subdivision thereof, State agency, municipality, or entity whatsoever, in reimbursement for the loss of taxes;

(e) Subjecting any property of the United States of America, its agencies or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to this compact.

The provisions of this article were considered necessary by the members of the commission and were specifically requested by Federal agencies.

Article XX

Article XX provides that the compact may be terminated by unanimous agreement and that in the event of such termination all rights established under it shall continue unimpaired.

Article XXI

Article XXI provides that the compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States and approved by the Congress of the United States of America, and provides for notifications of such ratification and approval.

The concluding clause sets forth that the compact is executed in six counterparts, each of which shall be and constitute an original, one of which shall be deposited in the archives of the Department of State of the United States of America, and one of which shall be forwarded to the governor of each of the signatory States.

The commissioner for the State of Arizona has delivered Arizona's signed counterpart of Acting Governor Dan E. Garvey.

CONCLUSION

I deem it a great honor and privilege to have been called upon to represent Arizona in the negotiation of this upper Colorado River Basin compact. I believe it to be fair, just, and equitable to all of the States, and particularly valuable to Arizona in that it supports Arizona's position in opposition to the arguments made by certain California interests.

Respectfully submitted.

CHARLES A. CARSON.

STATE OF ARIZONA

OFFICE OF THE SECRETARY

UNITED STATES OF AMERICA,
State of Arizona, ss:

J. Wesley Bolin, secretary of state, do hereby certify that the attached document is a true, correct, and complete copy of chapter 4, house bill No. 13, nineteenth legislature, regular session; that I am the official of the State of Arizona having custody and control of the original of said copy and the legal keeper thereof.

In witness whereof, I have hereunto set my hand and affixed the great seal of the State of Arizona. Done at Phoenix, the capital, this 2d day of March A. D. 1949.

[SEAL]

WESLEY BOLIN,
Secretary of State.

STATE OF ARIZONA

HOUSE OF REPRESENTATIVES, NINETEENTH LEGISLATURE, REGULAR SESSION

CHAPTER 4

HOUSE BILL NO. 13

AN ACT Ratifying the upper Colorado River Basin compact, and declaring an emergency

Be it enacted by the Legislature of the State of Arizona:

SECTION 1. *Ratification.*—The upper Colorado River Basin compact executed in Santa Fe, N. Mex. on October 11, 1948, by representatives of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, is unconditionally ratified, approved, and confirmed.

SEC. 2. *Emergency.*—To preserve the public peace, health, and safety it is necessary that this act become immediately operative. It is therefore declared to be an emergency measure, to take effect as provided by law.

Approved by the Governor, January 21, 1949.

Filed in the office of the secretary of state, January 21, 1949.

Mr. MURDOCK. Are there any questions?

Mr. CARSON. I might add that I went over this language here as read by Judge Stone and I am in accord with that and I think it is proper.

If you put anything like that in there you would want to be sure it goes both ways. Because otherwise we would be faced sometime, somewhere with an argument that by putting in that it did not agree to our interpretation that there was an implication that Congress had disagreed, and I do not think you have to either agree or disagree. All you have to do here is to give the consent to our compact to make it binding only upon us, not the United States and not California or Nevada.

Mr. MURDOCK. Mr. Engle.

Mr. ENGLE. I was going to ask one or two questions.

Mr. Carson, are you an attorney?

Mr. CARSON. Yes.

Mr. ENGLE. Is it your view that a declaration of intent with reference to a contract, made 26 years after the contract was entered into, in whatever form, will be accepted by a court as having evidentiary value as to what the parties meant 26 years ago when they entered into the contract?

Mr. CARSON. I think it will, Mr. Congressman. I think again, too—I do not want to be misunderstood here as saying that the original compact and the California Limitation Act and the Boulder Canyon Project Act need any interpretation. In my judgment they are clear

in their terms and in their language, and if properly read they mean the same thing that this upper basin compact construed them to mean.

Mr. ENGLE. That is precisely why, Mr. Carson, I think the answer Mr. Bashore submitted to question 8 of the letter I sent him, as I have told my good friend, the distinguished chairman today, not only misses the target, but is a blank.

Mr. CARSON. I am agreeable to this language that Judge Stone read, and I think you can then have no more kick coming.

But if you put it in there without the reciprocal language, then I am sure that some day sooner or later we would be faced with the argument that Congress in consenting to this upper basin contract expressly disagreed with the constructions that were placed on the original compact by this upper Colorado River Basin compact. This would remove that possibility and it would remove our possibility which we never intended to do anyway, because we know that, in consenting, you do not either agree or disagree with the interpretation.

Mr. ENGLE. As I said previously, Mr. Carson, the protection which has been suggested from the language is perfectly appropriate and it has not been my intention——

Mr. CARSON. I understand that.

Mr. ENGLE. To imply anything different.

I will have to say also that as an attorney I disagree with your view that a statement made 26 years after a contract, in the nature of a declaration of intention in regard to the contract, will be accepted as having any evidentiary value. I think a court——

Mr. CARSON. I think that will be up to the Court, would it not?

Mr. ENGLE. I think the Court would look with a good deal of misgiving on a self-serving and self-benefiting declaration of that type 26 years later.

But I am compelled to ask you this question with regard to article VI. Article VI provides that the depletion theory shall be adopted, but it hangs on a significant proviso when it says, "Unless the Commission, by unanimous action, shall adopt a different method of determination." In other words, is it to be implied from that that at some future time their minds can be changed about what was intended in the basic act?

Mr. CARSON. Yes, sir; that was the purpose of putting it in there. There may be developed better methods, or the Supreme Court or somebody might hold that we had adopted here the wrong method. If that were done then this commission would have to determine another method, but it would not destroy this compact.

Mr. ENGLE. I cannot agree with you that the discovery of any better method would vary the terms of the contract entered into by the parties in 1922. If the compact of 1922 is so clear and unequivocal in its terms that it requires no interpretation, as you have previously indicated, it would seem to me you are stuck with the depletion theory—if that is the correct theory—and I doubt it—unanimous action by the commission or not. That section 6 wobbles a bit.

There is one other question I would like to ask you. Is it your view that Arizona is a party to the Colorado River compact?

Mr. CARSON. Yes; of course we are. We have ratified it fully and completely and we are a party to it and as firmly bound by it as the State of California, in my judgment.

Mr. ENGLE. Which compact are you a party to, the seven States or the six States compact?

Mr. CARSON. The seven States compact.

Mr. ENGLE. What are you going to do with the Boulder Canyon pact and the California Limitation Act?

Mr. CARSON. We are going to try to hold you to it if we can.

Mr. ENGLE. It is not relevant to this inquiry, Mr. Carson.

Mr. CARSON. No.

Mr. ENGLE. But I think there is a very grave question as to whether or not Arizona can come along 26 years after the contract is entered into and after intervening acts have occurred, predicated upon the refusal of Arizona to participate in the original seven-State compact, and claim the benefits of the seven-State compact and not disown, and disgorge I might say, the benefits which have accrued by subsequent legislation and action.

As I say, it is not a relevant inquiry here.

Mr. CARSON. It is not relevant, but let me say this to you, Mr. Congressman. Would you prefer that Arizona not be a member of the compact?

Mr. ENGLE. I am not expressing a preference. I am just wondering what the law is. I am wondering if California gets status quo under those circumstances.

Mr. CARSON. Yes, of course. By this concept your position is not changed. You are just where you were before this compact was negotiated and this consent given which is my definition of "status quo."

Mr. ENGLE. It is a fine definition, but to use Mr. Breitenstein's expression, I think in that connection it was our dog that got kicked first.

Mr. CARSON. I am sorry for these other points to come in, gentlemen of the committee, but we will be back here on some other legislation which will involve these things, and I will be glad to discuss them with you very thoroughly and fully.

Mr. ENGLE. Mr. Carson, I am glad that we are in agreement on the language that can go into this report. I think it will eliminate any necessity of controversy among us and will facilitate an early and successful consideration of this compact.

Mr. CARSON. Yes, I think that is right.

Mr. MURDOCK. Are there any other questions?

Mr. POULSON. Out of this 7,500,000 acre-feet of water per annum for the upper basin only 30,000 feet is for Arizona.

Mr. CARSON. 50,000.

Mr. POULSON. It is less than 1 percent?

Mr. CARSON. Yes.

Mr. POULSON. Then having less than 1 percent in that, would you as Arizona's representative, have signed this compact if they had made a different interpretation of the term "beneficial consumptive use"?

Mr. CARSON. No, sir, I would not. I will tell you why, because that is an argument between California and Arizona in the lower basin. Arizona is bound by this compact; California is not. If we had agreed to any other interpretation here, of course, it would have been used against us in the lower basin.

So we could not consistently agree to any other definition.

But let me make this clear to you: This depletion theory was the considered judgment of all of the negotiators of this compact and their

advisers as to the proper method of measuring beneficial consumptive use under the original Colorado River compact. It was not because of my insistence or the Arizona position that this conclusion was reached. We reached it before this compact was negotiated. We reached it in the old Colorado River Basin States Committee, which was then a committee of 14 and 16 and from which California withdrew and Nevada withdrew and have broken off relations with that committee. That was settled policy and the interpretation of all of the interstate committees, of which I have any knowledge on the river, with the exception of California and Nevada.

Mr. POULSON. However, it still states in here, as Mr. Engle points out, that there is still the chance for the commission by unanimous action to adopt a different method?

Mr. CARSON. Yes.

Mr. POULSON. On that same basis, since you have stated that you would not have signed it had it not had this interpretation, then can it not be taken that your main interest in having this consent granted by Congress is to try to establish a basis for determining that your interpretation is correct? Is that your main interest in the contract?

Mr. CARSON. I would not say that it was the main interest. I would say it was the main benefit. Of course, we were interested and are, in Arizona, in trying to aid sister States develop their water resources and irrigate land and make homes for people. So we wanted to join in for that purpose and protect our own people who were there. But the comparative water supply that Arizona could use there is limited. We do believe it would be valuable to Arizona in this lower-basin question to know how "beneficial consumptive use" shall be employed and we think that is one of the greatest values to us.

Mr. POULSON. You are still supporting the proposed wording in the report to the effect that it is not to be interpreted as either for or against? You are not consistent in the statement you are making now and in the statement of the report, are you?

Mr. CARSON. Yes; they are consistent but you are misquoting the statement. The statement says that Congress, by consenting, does not do so. It does not say that you would not do so if it became material or that a court could not consider it. That is one thing that I want to be sure about, that in whatever language you put in this report, we are not foreclosed from the right, which is a legitimate right, to present this to whoever has to consider the question as an agreement among five parties to the original compact as to how it should be done.

With the aid of that we should try to have the compact construed, if we can, in the way we contend.

Mr. MURDOCK. Are there any further questions of Mr. Carson?

Mr. Carson, there are other members here from Arizona, are there not? Would you introduce them?

Mr. CARSON. Yes; Mr. Aiken and Mr. Killian.

Mr. MURDOCK. What are their positions?

Mr. CARSON. Mr. Aiken is chairman of the Arizona Interstate Streams Commission and Mr. Killian is the executive secretary.

Mr. MURDOCK. Have you gentlemen any statement that you would like to make to the committee or insert in the record in the hearing?

Mr. AIKEN. No.

Mr. KILLIAN. No.

Mr. MURDOCK. We have also with us Judge Howell, of Utah.

STATEMENT OF J. A. HOWELL, ASSISTANT TO THE ATTORNEY GENERAL, STATE OF UTAH

Mr. HOWELL. My name is J. A. Howell. I reside in Ogden, Utah, where I practice law. I appear in this proceeding as assistant to the attorney general of Utah. The attorney general of the State of Utah, Clinton D. Vernon, is also here representing the State of Utah.

I may say to you by way of explanation of Utah's position at this time that in these proceedings that under the statute of the State of Utah the State engineer, with the consent of the government, is authorized to negotiate compacts with one or more of Utah's sister States and as you will have observed this compact was negotiated by and signed by the then State engineer of the State of Utah, Ed H. Watson. His term of office expired upon March 1, and owing to a change of Governors he was not reappointed, and the new State engineer, of course, is totally unfamiliar with the negotiation of this compact or its terms and so it was deemed wise that instead of his coming on here, the attorney general should come and I should accompany him by reason of the fact that I was legal adviser to the State engineer in negotiating the compact and I am familiar with its terms.

I say that particularly for the benefit of Mr. Engle, to assure him that we have the authority to speak for the State of Utah, and if he has any doubt about it as we say in the law, we will be glad to give you any further assurance that you may require.

I would like to present for the record the bill which was introduced in the legislature ratifying this compact which was senate bill No. 1. I am sorry that I have not a certified copy of it, although the attorney general has sent for one. I know of my own knowledge that it is the bill that was introduced as Senate bill No. 1 because I drew it. It was passed without amendment and signed by the Governor.

I am sorry that I have not here the report, which I also drafted, of the State engineer to the Governor and the legislature, but the attorney general has wired for that also. As soon as it comes we will ask that it be made a part of the record.

Mr. MURDOCK. This act of the legislature of the State of Utah contains the text of the compact, does it not?

Mr. HOWELL. It does.

Mr. MURDOCK. I will ask in this case, as in one or two other cases, that the portion of the document which is pertinent be included in the record, with the omission of the text of the compact. Is there any objection? It is so ordered.

(The material referred to is as follows:)

STATE OF UTAH

EXECUTIVE DEPARTMENT—SECRETARY OF STATE'S OFFICE

I, Heber Bennion, Jr., secretary of state of the State of Utah, do hereby certify that the attached is a full, true, and correct copy of Senate bill No. 1 passed by the Utah Legislature on January 25, 1949, and approved by the Governor of the State of Utah on January 31, 1949, as appears of record in my office.

In witness whereof, I have hereunto set my hand and affixed the great seal of the State of Utah at Salt Lake City, this 16th day of March 1949.

HEBER BENNION, Jr.,
Secretary of State.

SENATE BILL NO. 1

By Merrs. Hopkin and Melich

AN ACT Ratifying the Upper Colorado River Basin Compact entered into at Santa Fe, New Mexico, on October 11, 1948, by those States of the Upper Colorado River Basin; namely, Arizona, Colorado, New Mexico, Utah, and Wyoming, by the representatives of those States, with the approval of the representative of the United States of America

Be it enacted by the Legislature of the State of Utah:

SECTION 1. The Upper Colorado River Basin Compact entered into at Santa Fe, New Mexico, on October 11, 1948, by the Upper Colorado River Basin States, namely, Arizona, Colorado, New Mexico, Utah, and Wyoming, by the representatives of those States, with the approval of the representative of the United States of America, is hereby unconditionally ratified, approved, and confirmed for and by the State of Utah.

SEC. 2. The text of said Compact is as follows: * * *

SEC. 3. The Compact ratified by this Act is the original signed by the Commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and the Secretary of the Commission, and approved by the representative of the United States of America, and deposited in the archives of the Department of State of the United States of America, and in the office of the secretary of state of the State of Utah.

SEC. 4. Any error made, if any, in copying the original Compact in Section 2 hereof, shall be held not to invalidate the ratification of the Compact in any way:

SEC. 5. This act shall not take effect until said Upper Colorado River Basin Compact has been ratified by the States of Arizona, Colorado, New Mexico, and Wyoming, and until the Congress of the United States of America has consented thereto, but upon such ratification and such consent, shall at once take effect.

Mr. HOWELL. So far as there is any testimony in behalf of Utah, I am sure that any testimony I might give would be purely cumulative, and with the consent of the chairman and the members of the committee, Utah would like to submit this matter as Utah's presentation of the case, that is, the testimony that has already been given here and the answers thereto, as far as they are pertinent to any matter that is before the committee at this time.

With that, I have nothing further to present except that I would be glad to answer any questions that I may be able to answer.

Mr. MURDOCK. Mr. Engle?

Mr. ENGLE. Did you mention any official report made by your negotiator to your State?

Mr. HOWELL. I did. I said that I regretted that we did not have it with us, but we had sent for it and that as soon as it came in we would furnish it to you and ask that it be made a part of the record.

Mr. ENGLE. I would suggest that it be made a part of the file, because I do not know how voluminous it is.

Mr. HOWELL. I do not care.

Mr. ENGLE. I take it that you have already considered this language which has been under discussion here.

Mr. HOWELL. Yes; I have. I agreed to it.

Mr. MILLER. Utah is in the upper or lower basin or both?

Mr. HOWELL. In both.

Mr. MILLER. What percentage and what division?

Mr. HOWELL. A very small percentage is in the lower basin. The greater part is in the upper basin.

Mr. MILLER. How much water under the compact would be your share?

Mr. HOWELL. Twenty-three percent in accordance with the compact.

Mr. MURDOCK. Judge Howell, are there others here from Utah? Are there members of your streams commission here?

Mr. HOWELL. Only the attorney general, Clinton D. Vernon, is here.

Mr. MURDOCK. Will you introduce him?

Mr. HOWELL. This is Mr. Vernon, the attorney general.

Mr. MURDOCK. Mr. Vernon, would you like to make a statement to the committee?

Mr. VERNON. I have no further statement than that which was made by Judge Howell.

Mr. MURDOCK. We congratulate you and Judge Howell both.

Mrs. BOSONE. Mr. Chairman, I hope that you believe everything that Judge Howell said. He is from Utah which makes him doubly creditable.

Mr. MURDOCK. I do believe him.

Mr. BARRETT. I have known Judge Howell for quite some time, and I know the attorney general. They are both fine men.

Mr. MURDOCK. This concludes the statements of the representatives of the five States participating in the compact. However, we have not yet heard from the Federal representative.

Before we do that, we have two gentlemen here from New Mexico, the Governor informs me. Governor Miles, will you introduce them?

Mr. MILES. We have with us Mr. Bliss, the State engineer, and Mr. Curry, who is a member of the interstate streams commission.

Mr. MURDOCK. We are glad to have you here, gentlemen. We have with us John R. Riter, engineer adviser to the Federal representative of the upper Colorado River Basin compact. Mr. Riter should be able to speak on this matter before we call on the former Commissioner, Mr. Bashore. Go right ahead, Mr. Riter.

STATEMENT OF JOHN R. RITER, ENGINEER ADVISER TO FEDERAL REPRESENTATIVE, UPPER COLORADO RIVER BASIN COMPACT

Mr. RITER. I have a brief statement that I would like to read, with your permission.

Mr. MURDOCK. Go right ahead.

Mr. RITER. Mr. Chairman, I deem it a privilege to appear before this committee in connection with the proposed upper Colorado River Basin compact.

My name is John R. Riter. I am employed as an engineer by the Bureau of Reclamation; my present position is Chief, Hydrology Division, Branch of Project Planning. In July 1946 I was asked to serve as engineer adviser to the Federal representative in connection with the upper Colorado River Basin compact negotiations. I also served as chairman of the engineering advisory committee to the Upper Colorado River Basin Compact Commission.

Other engineers served on the engineering advisory committee, as follows:

Arizona: R. Gail Baker and R. I. Meeker.

Colorado: R. J. Tipton, R. M. Gildersleeve, F. C. Meriell, and C. L. Patterson, who served until January 1948.

New Mexico: J. H. Bliss and J. R. Erickson.

Utah: C. O. Roskelley; F. W. Cottress, served intermittently; C. S. Jarvis, served until January 1948.

Wyoming: R. D. Goodrich and H. T. Person.

Federal: H. P. Dugan.

The committee also secured the services of Harry F. Blaney and Wayne D. Griddle of the Department of Agriculture to advise on consumptive use rates in the upper Colorado River Basin.

Pursuant to instructions from the Upper Colorado River Basin Compact Commission, the engineering advisory committee studied and reported on factual data useful to the commission in negotiating the upper Colorado River Basin compact. Progress reports were submitted to the commission in September 1946, December 1947, July 1948, and October 1948. A final report summarizing the various progress reports was prepared and submitted November 29, 1948.

I wish to state that all of the conclusions of the engineering studies were available and submitted to the commission before the compact was completed.

The November 1948 report was merely a compilation of the conclusion of the various progress reports of the engineering committee.

The various factors studied by the committee and the conclusions are briefly discussed herein.

Potential uses of water constitute important factors in dividing the available water supplies among the individual States, and are considered to be involved up to the 7,500,000 acre-feet heretofore allocated to the upper basin by the Colorado River compact.

The report by the Bureau of Reclamation, The Colorado River, House Document No. 419, Eightieth Congress, first session, describes present developments and lists potential irrigation and power projects within the Colorado River Basin. According to the Bureau of Reclamation estimates, if all of the listed potential project possibilities in the upper Colorado River Basin were constructed, the flow of the Colorado River at Lee Ferry would be depleted by about 9,100,000 acre-feet.

In addition to the project potentialities presented in the Bureau of Reclamation report, in each State used, data from its own files pertaining to water use potentialities, particularly on water required for irrigation of potential pasture land and for industrial and municipal purposes. Use was made also of data submitted to the commission by the Office of Indian Affairs on potential uses of water by Indian irrigation projects.

To assist in the water analysis, base maps were prepared to show the locations of stream gaging stations on the Colorado River and tributaries, drainage areas above the gaging stations, sites where climatological data have been secured, and locations of present and potential irrigation developments within the upper Colorado River Basin.

Water contributions by States were determined by the committee for the 32-year period 1914–45, inclusive. This period was chosen for study because it was found to be most reliable from the standpoint of available stream-flow records which could be used to determine the water contributions by States. To complete this portion of the assignment, it was necessary to—

(*a*) Tabulate historic stream flows at key gaging stations on the Colorado River at Lee Ferry and on tributaries near the State lines.

(*b*) Extend the available discharge records, where necessary, by estimates based on correlations with available records at other stations to secure a complete record for the study period 1914–45, inclusive.

(*c*) Estimate run-off from ungaged drainage areas between State lines and key gaging stations. This involved a more refined determi-

nation of drainage areas above the gaging stations and estimates of unit rates of run-off on the basis of records from similar drainage areas and from precipitation data.

(*d*) Estimate past average annual stream-flow depletions due to man-made developments at the sites of use, at State lines, and at Lee Ferry. To assist in solving this particular problem, data on irrigated acreages compiled by the Bureau of Reclamation, State and other agencies were reviewed; climatological data in the water use areas were compiled and analyzed; a field inspection trip was made through the upper Colorado River Basin and the services were secured of two experts from the Department of Agriculture—Harry F. Blaney, senior irrigation engineer, and Wayne D. Criddle, irrigation engineer. Under the direction of George D. Clyde, Chief, Division of Irrigation and Water Conservation, Soil Conservation Service Research, these two experts prepared for the committee a special report, entitled "Consumptive Use of Water Rates in the Upper Colorado River Basin," June 15, 1948.

(*e*) Estimate channel losses between the sites of use, State lines, and Lee Ferry and the relationship between annual channel loss and annual discharge. This study involved consideration of concurrent inflows and outflows to various river sections, channel areas, and rates of evaporation and transpiration losses by water areas and native vegetation adjacent to stream channels.

There is presented on page 6 the water uses and water contributions by States, the average for the period 1914–45, inclusive.

With the permission of the chairman, I will have it inserted without reading it.

Mr. MURDOCK. Yes, if you wish. We will insert it in the record at this point.

(The information requested is as follows:)

Water uses and water contributions by States, averages for period 1914–45, inclusive

[Units 1,000 acre-feet]

State	Arizona	Colorado	New Mexico	Utah	Wyoming	Total
Past annual depletions: [1]						
At sites of use	4.0	1,062.8	72.2	556.5	227.7	1,923.2
At State lines	4.0	1,042.8	71.3	544.8	226.4	1,889.3
At Lee Ferry	4.0	1,016.1	69.5	544.3	216.0	1,849.9
Historic stream flows:						
At State lines	133.2	10,408.4	186.1	2,022.8	1,610.6	14,361.1
Out-of-State channel losses	1.0	455.6	7.7	6.0	102.2	572.5
Contribution at Lee Ferry	132.2	9,952.8	178.4	2,016.8	1,508.4	13,788.6
Virgin stream flows. [2]						
At State lines	137.2	11,451.2	257.4	2,567.6	1,837.0	16,250.4
Out-of-State channel losses	1.0	482.3	9.5	6.5	112.6	611.9
Contribution at Lee Ferry	136.2	10,968.9	247.9	2,561.1	1,724.4	15,638.5
Percent of total	0.87	70.14	1.58	16.38	11.03	100.00

[1] Differences between indicated depletions at sites of use, State lines, and Lee Ferry, represent salvaged channel losses.

[2] Reconstructed flows to represent conditions as they would be prior to any man-made developments within the upper Colorado River Basin.

Mr. RITER. The flow of the Colorado River is not uniform but varies from year to year. At Lee Ferry the historic flow has ranged between a minimum of about 4,400,000 acre-feet in 1934 to a maximum of about 21,900,000 acre-feet in 1917. The average historic flow for 1914–45, inclusive, was 13,788,600 acre-feet. In the 10-year period of lowest historic flow, 1931–40 inclusive, the average annual flow at Lee Ferry was 10,151,000 acre-feet.

To permit full use in the upper basin of its apportioned water during drought cycles and still meet its compact obligation for delivery of 75,000,000 acre-feet at Lee Ferry in any period of 10 consecutive years, it is evident that hold-over reservoirs must be constructed in the upper Colorado River Basin to impound water in years of high run-off and to release such stored water in critical periods of low run-off, such as 1931–40 to help meet the upper-division obligation at Lee Ferry.

The effects of the operations of irrigation projects and of storage reservoirs which will be constructed in connection with such projects will be to partially regulate the stream flow. Rough studies made by the Engineering Advisory Committee indicate a required live-storage capacity of not to exceed 30,000,000 acre-feet of river regulation. As developments and additional studies proceed, the amount of storage capacity needed for regulatory purposes will be more precisely determined in the future. There are known storage sites in the upper Colorado River Basin which have potential combined capacities greatly in excess of the indicated live-storage requirements for river regulation.

Special studies were made of the potential uses and residual stream flows in the Green, Yampa, and San Juan Rivers to assist the Commission in preparing articles XII, XIII, and XIV of the proposed compact.

That concludes my statement.

Mr. MURDOCK. May I ask a question with respect to (*d*) at the bottom of page 4, please, which gives the basis of your estimate of stream flow.

Did your committee make any use of the tree-ring studies conducted by Dr. Douglas?

Mr. RITER. No, sir. We did not. We confined ourselves to the period of record on the river from 1914 to 1945, inclusive. That period included the most severe drought for which we have stream-flow records on the Colorado River.

Mr. MURDOCK. Do you know how that period of drought compares with other periods of drought as indicated by the tree-ring records?

Mr. RITER. No, sir; we have not considered tree rings. We did have an indication by comparing the fluctuations of the level of the Great Salt Lake where records have been available for about 100 years. Now, of course, it is presumptive evidence.

There is no direct mathematical correlation, but it did indicate that recent droughts—the one that we hope has been broken by this year's run-off—were as severe as any other droughts for which we have records for, comparing it with the Great Salt Lake records.

Mr. MURDOCK. Are there other questions?

Mr. WHITE. What is the amount of water—it has been stated over and over again, but I did not get it—that is permitted to flow down

the Colorado River in the original compact for the States at Lee Ferry? What is the volume?

Mr. RITER. You mean the amount that was permitted to go down?

Mr. WHITE. The first compact permitted about 50 percent of the water of the Colorado River to go over to the States. What is that item?

Mr. RITER. The upper basin is committed to leave 75,000,000 acre-feet in any 10-year period. That means an average of 7,500,000 acre-feet in any 10-year period.

Mr. WHITE. 7,500,000 acre-feet?

Mr. RITER. Yes.

Mr. ENGLE. And you say the flow there was about 4,400,000 acre-feet in 1934, and it swelled to a maximum of about 21,000,000 acre-feet. Then, there is quite an excess of over half the water that is now going by Lee ferry?

Mr. RITER. Yes, sir.

Mr. WHITE. Is it contemplated to use all the water except the amount that is embraced in the first compact?

Mr. RITER. The upper basin contemplates the use of the 7,000,000 feet per year on the average if such water is available after meeting the commitment of the lower basin and meeting the commitment of the Mexican treaty to which all the basin States are bound.

Mr. WHITE. According to you statement on page 7, during the year 1934, the minimum period, there would not be enough water in the whole river to supply the needs of the lower-basin States from Lee Ferry. You were short about 3,000,000; right?

Mr. RITER. That is true, with the unregulated river. But, sir, it is planned that large reservoirs will be built in the upper Colorado River Basin which will store water in years of high run-off and release that water in years of low run-off.

Mr. WHITE. Is is contemplated to hold the water over from year to year or to regulate the flow?

Mr. RITER. It is planned to hold the water over from year to year.

Mr. WHITE. When you had the peak in 1917, you had three times as much water going by Lee Ferry?

Mr. RITER. That is right.

Mr. WHITE. Was it contemplated in making this first pact that it would be possible to carry out the terms of the agreement that there would be storage places built upstream?

Mr. RITER. You are asking me questions that I cannot answer. I was not present at the first pact. It is the concept of the States of the upper Colorado River Basin that reservoirs will be built on the main stream to generate hydroelectric power and also furnish regulation.

Mr. WHITE. It appears from your statement there would not be any water left for the upper-basin States if they were bound to permit 7,500,000 to go down the stream when there is only 4,400,000 now. What would the upper-basin States get out of it?

Mr. RITER. Remember that that 7,500,000 is an average obligation in any 10-year period. The lowest 10-year period of record was 1931 to 1940.

Mr. WHITE. You have 1 year when it was only 4,400,000?

Mr. RITER. That is right.

Mr. WHITE. What do those people do? They cannot wait for averages. They have to have the water when they need it each year.

Mr. RITER. You understand there is a large reservoir on the lower basin that will help in that. The original compact provided 75,000,000 acre-feet in a 10-year period.

That did not necessarily mean, sir, that there has or had to be 7,500,000 in any year. It means a 10-year period. If you want to get a yardstick, let us look at the average for 1931 to 1940, where it averaged about 10,000,000 acre-feet.

So, even without stream-flow regulation, there would be some water left for the upper basin to develop. Does that answer your question, Mr. White?

Mr. WHITE. I cannot contemplate that the men representing those States would go into an agreement where the water would fluctuate like that. They have to have a steady supply.

Mr. REGAN. Do you yield?

Mr. WHITE. Yes.

Mr. REGAN. In 1 year they had 4,000,000, and in the next year they had 21,000,000. That is 25,000,000. They have a reservoir down below that stores the water: so that, over a 10-year period, they get 7,500,000 each year.

The people irrigating the land below will have sufficient water.

Mr. WHITE. It will not do any good to set up an irrigation project with the water fluctuating.

Mr. MURDOCK. Will the gentleman yield?

Mr. WHITE. I do not want to delay the proceedings. I just want some information.

Mr. MURDOCK. I hope, from what has just been said by the two gentlemen and the witness, that it is clear to everyone that this plan will not work unless we have a storage in order to enable the upper basin to deliver its average of 7,500,000 feet.

Mr. ENGLE. Let me add this one point. I think it should be clear. If I am wrong I hope the witness will straighten me out. My understanding is that the 75,000,000 acre-feet which has to be delivered at Lee Ferry over an average of 10-year period is the minimum, not the maximum.

Mr. RITER. Congressman, if there is more water available, it will be delivered. Of course, the upper basin—in fact, the whole basin—is bound by the Mexican treaty which guarantees to Mexico certain quantities of water; and under the basin compact there is a provision which indicates that, if there is no surplus water to meet the demands of the treaty in the upper basin and the lower basin, they will have to share equally in any deficiency. Which means, if that condition should arise, in addition to the 75,000,000 acre-feet, the upper basin would also have to deliver its share of the Mexican-treaty burden. Then, if there is water left over, in addition to the Mexican-treaty water and in addition to the 75,000,000 acre-feet in every 10-year period, if there is any water left over after the upper basin has used its share, such excess would go to the lower basin. Does that answer your question?

Mr. ENGLE. It does. And it brings me to the point I wanted to get around to, and that is the table on page 6 of your statement.

In the first bracket, you have indicated the past annual depletions in units of 1,000 acre-feet, and note 1 says that the differences between

indicated depletions at sites of use, State lines, and Lee Ferry represent salvaged channel losses.

Mr. RITER. Yes, sir.

Mr. ENGLE. I notice over here in the total the difference between the first figure, which is at the sites of use, is 1,923.2, and at Lee Ferry it is 1,849.9.

Now, subtracting those two, I get 83.3. How much water would that be?

Mr. RITER. 73,300 acre-feet.

Mr. ENGLE. 73,000?

Mr. RITER. And 300 acre-feet.

Mr. ENGLE. I subtracted wrong. It is 73.3. That is the salvage?

Mr. RITER. Yes, sir.

Mr. ENGLE. If the right of the upper States to 7,500,000 acre-feet of water is measured by the depletion theory at Lee Ferry, the difference between the amount measured at Lee Ferry and at the site use would be the salvage water which is to be used to raise corn and to raise crops and would not be chargeable against their beneficial consumptive use of 7,500,000 acre-feet; is not that correct?

Mr. RITER. Under that interpretation; yes, sir. You understand, of course, that I am not an attorney. I am not trying to place any construction on this. My connection with the compact negotiations was merely that of an engineer to secure factual information.

These calculations that you have referred to are the result of our calculations of these eminent engineers from each State. They are matters of factual information. Now, the compact commission has decided as a matter of policy, or for other reasons which are beyond a mere engineer, that the depletion theory is the correct theory.

Mr. ENGLE. If they do not change their minds.

Mr. RITER. And I think that is a highly significant statement in article 6, incidentally, which leaves flexibility.

Mr. ENGLE. I did not intend to put you in the position of construing the compact.

Mr. RITER. I understand that.

Mr. ENGLE. I have been trying all day to bring out the fact that some water could be used to raise corn and grow vegetables which, under one construction of this agreement, would be available to the upper-basin States, and under another theory would not be. I want to ask this further question as an engineering matter: As improvements are made on the stream, then your salvaged channel losses will increase; will they not?

Mr. RITER. That is something we do not know exactly. We discussed that in our engineering committee and we could not come to a uniform agreement on it. There were some members of the committee who felt that this salvage would continue indefinitely.

My view is this, sir: These reservoirs will occupy stream channels so the opportunity for salvage will be reduced by virtue of the fact that a large part of the channel will be covered up by the reservoir and will increase the losses on it. That is one thought. There is some possibility, sir, that, as we further reduce the amount of water carried in the stream, the stream channels will tend to deteriorate.

In other words, these streams are not clear streams. They carry quantities of sediment; and, as the discharge of the streams decreases,

some of that sediment will tend to become deposited in the channels and it may cause them to deteriorate and actually cause loss of water rather than a salvage.

We were unable to agree on that in our engineering committee. That was the reason Mr. Tipton was unable to give you a direct answer to your question this morning. We did discuss it, and there were those two conflicting viewpoints brought out.

Mr. ENGLE. Thank you very much.

Mr. WHITE. You speak of this depletion. What do you attribute that to, seepage, evaporation, or diversion?

Mr. RITER. The largest share of this, sir, is consumptive use within the basin.

Mr. WHITE. That would be diversion?

Mr. RITER. Yes.

Mr. WHITE. What about seepage?

Mr. RITER. We have found some areas that have seeped.

Mr. WHITE. Do you think seepage is one of the factors in the depletion?

Mr. RITER. Yes, sir.

Mr. WHITE. What about evaporation?

Mr. RITER. It is definitely a factor, sir.

Mr. WHITE. You speak of this silt. Isn't the tendency of silt to seal the bottom and the channel so that the water cannot seep out?

Mr. RITER. Yes; but this seepage that I refer to, sir, is seepage adjacent to the irrigated land.

Mr. WHITE. What part would you attribute to seepage?

Mr. RITER. That is difficult to say precisely.

Mr. WHITE. What percentage do you attribute to diversion?

Mr. RITER. Approximately 90 percent.

Mr. WHITE. Would not evaporation easily account for 10 percent?

Mr. RITER. Yes: evaporation would and diversion out of the basin.

Mr. MURDOCK. Unless there are further questions we will excuse you, Mr. Riter.

Thank you.

Now we come to the conclusion. We would be glad to have a statement from Mr. Bashore, former Commissioner of Reclamation and Presidential appointee as chairman of this conference who drew the compact.

Mr. Bashore.

STATEMENT OF HARRY W. BASHORE, REPRESENTATIVE OF THE UNITED STATES, CHAIRMAN OF UPPER COLORADO RIVER BASIN COMPACT COMMISSION

Mr. BASHORE. Mr. Chairman, I appreciate having this opportunity to appear before this distinguished committee of the House of Representatives. Some years have elapsed since I have testified before a committee of the Congress. I have always felt that our congressional committees have evidenced great interest in the Federal reclamation program of the West. I have noted that, in recent years as in the past, the congressional committees have continued to exhibit keen interest in all matters affecting the 17 western States and, of course, particularly in the water problems there arising.

The entire delegations from the States of Arizona, Colorado, New Mexico, Utah, and Wyoming are supporting legislation to grant the consent of the Congress to the compact entered into by those States on October 11, 1948. You have heard the witnesses from the upper basin States. The compact has been before the Congress officially since January 31, of this year. Many members of this committee, however, have been familiar with its terms prior to that date. My report on the negotiation of the compact was forwarded 2 months ago both to the President of the Senate and to the Speaker of the House. It is contained in Senate Document 8 of the first session of this Eighty-first Congress and has been made widely available. In the circumstances, I consider that it is unnecessary for me to dwell at length upon the negotiations which took place over a fairly extended period and which, finally, culminated in that document called the upper Colorado River Basin compact. It would be inappropriate for me to do so in any event for preceding witnesses here have discussed the details of that compact with you.

Let me, then, just point out some of the high spots of the compact itself. The purpose of the compact and the effect of the compact are principally to apportion among the States directly concerned the use of waters of the Colorado River system which was apportioned to those States as a group under the Colorado River compact. Fifty thousand acre-feet have been apportioned to Arizona; 51.75 percent of whatever remaining use is available to the upper basin under the Colorado River compact has been apportioned to Colorado; 11.25 percent of that use has been apportioned to New Mexico; 23 percent of that use has been apportioned to Utah; and 14 percent of that use has been apportioned to Wyoming.

There, gentlemen, is the nub of the compact. Necessarily, some rather elaborate provisions had to be written, and were written, to define and to protect the rights of the States that are parties to the upper Colorado River Basin compact.

Furthermore, an agreement among the States necessarily required some administrative provisions. Those were and are provided. Finally, no compact would be complete or could be satisfactory unless it took cognizance of the prerogatives, powers, and rights of the Federal Government in all respects. Many provisions of the upper Colorado River Basin compact have been written to that end. I am satisfied with them and I have so advised the President and the Congress.

The commissioners from the respective States that are parties to the compact are men of learning and experience. They were well aware, for instance, of the expectation that major water development works in the Colorado River Basin must, in the future, as they have in the past, be undertaken largely by Federal agencies carrying out constitutional and statutory purposes of the Federal Government. We were all concerned that this compact should be so written as to foster such development with due regard of course for the best interests of the several affected States and of all States in the basin as a whole.

I am happy to be able to advise this committee that this compact is so written as to foster development by Federal agencies as well as by agencies of the several States; as to promote the fulfillment by the States of the Upper Basin States of their part of the obligations entered into by the United States in its treaty with Mexico.

There is nothing in this compact that in any sense or in the remotest degree adversely affects the rights and privileges of any States that are parties to the Colorado River Basin compact. Nothing in this compact affects the obligations of the United States to the Indian tribes or circumscribes the United States in caring for and in promoting the welfare of its Indian wards, or affects the rights of those wards.

I do not want to express myself at any length, at all, but I must deal before this committee with one or two matters that I have heard discussed since the upper Colorado River Basin compact was entered into.

I have heard it suggested that the upper Colorado River compact prematurely adopts a theory affecting the measurement of the consumptive use of water and that consent by the Congress to the compact would constitute adoption by the Congress of the self-same theory as being legally proper. It is then said that, since consent by the Congress would constitute congressional adoption of that theory, the rights of lower basin States might be impaired should those States, at some time or another, become engaged, let us say, in litigation wherein, among other things, the propriety of that theory might be brought into question.

I have been advised by my counsel that the mere consent by the United States to this compact would not of itself constitute implicit adoption by the Congress of one theory of measurement of consumptive use as against another. I hereby solemnly advise this committee, therefore, that congressional consent to this compact would not have, and is not intended to have, such effect.

I have heard it suggested that the provisions in the upper Colorado River Basin compact—to the effect that the consumptive use of water by the United States of America or of any of its agencies, instrumentalities, or wards shall be charged as a use by the State in which such use is made—adversely affects the rights of the Indians. Nothing could be further from the truth. The provision in question is obviously intended only as a practical guide to the respective States. It does not, and cannot have the effect of limting the rights of the United States of America, whether exercised in behalf of its wards or in any other behalf or the rights of Indian tribes or wards. The compact specifically disclaims any intent whatsoever to affect the obligations of the United States, its agencies, or instrumentalities in or to the waters of the upper Colorado River system. Obviously, such rights and powers include rights and powers to create developments in behalf of its Indian wards as well as in fulfillment of its obligations to Indian tribes.

On October 11, 1948, at the ceremonies incident to the formal signature of the upper Colorado River Basin compact, which were held in the historic Palace of the Governors at Santa Fe, N. Mex., I was privileged to say a few words.

On that occasion I described the upper Colorado River Basin compact as it then seemed to me. I have not changed my mind about it and I think, therefore, that it may be appropriate for me on this occasion to quote a portion of my address on that date. I then referred to the upper Colorado River Basin compact as "a document which will forever be an example of fairness, a demonstration of statesmanship of the highest order, and finally, a proof of the ability

of States to deal with their mutual problems no matter how complex, through the traditional and constitutional compact method."

Mr. Chairman, in concluding the presentation of matters relating to the upper Colorado River Basin compact, may I be permitted to make a few remarks concerning the work of those with whom it has been my honor to be associated and, also, a few comments on these hearings.

It has been a great satisfaction to me to work with men of the fairness and ability of the commissioners and their legal and engineering advisers of the five upper Basin States. As the State of Colorado supplies the major portion of the water to the Colorado River and as the Colorado commissioner and his advisers have had much experience in the negotiation of compacts, the major burden of our work fell naturally on Judge Stone—a lawyer who has earned and deserves a high reputation throughout the West for integrity, ability, and fairness. In my opinion, he is to be highly commended for the leadership he has taken among the State commissioners.

In appearing before this distinguished committee, it has been our plan to make our presentation as brief as possible in order to conserve your time. There has been no attempt to evade answers nor to avoid furnishing any information which this committee, in its wisdom, felt necessary. I believe that you will agree that the States have ably and fairly presented the facts relating to the negotiation of the compact and its intent.

Mr. Chairman, I have attended many hearings here in Washington, but I want to say that you personally have conducted these hearings in an orderly and courteous manner and have been very patient with all of our witnesses. The members of the committee have with promptness in attendance and great patience listened to our presentation and the questions have been direct and to the point. I desire to express my appreciation to Mr. Engle and Mr. Poulson of California—particularly to Mr. Engle, whose questions served to develop facts in the most direct manner. His questions have been incisive and clear.

I would also like to have inserted in the record my appreciation of the work of my legal adviser, Mr. J. G. Will, and my engineering adviser, Mr. John R. Riter. They have been of great assistance to the Federal representative and, I believe, to the commission as a whole, and have attempted at all times to be fair and cooperative.

To you, Mr. Chairman, and to all members of this distinguished committee, I express my deep appreciation for your patience and courtesy.

That concludes my statement, Mr. Chairman.

Mr. MURDOCK. Since you, Mr. Commissioner, and I grew up within "hog-calling" distance of each other in our boyhood days there are many things I would like to say to you, and about you, but I am going to yield now to Congressman Miller, in whose district I believe you are a resident and his constituent. Mr. Miller.

Mr. MILLER. Thank you, Mr. Chairman.

I want the record to show that Harry Bashore—I do not know how many years he has served in the Reclamation Service, but it goes back, I guess, nearly a third of a century—thought he was going to retire from the Reclamation Service. He did retire, and moved out to a little farm in western Nebraska, an irrigated farm in an irri-

gation district, I think Harry Bashore was instrumental in setting up in 1903.

Mr. BASHORE. Congressman Miller, please do not give me credit for all the mistakes that might have been made.

Mr. MILLER. He was in on the ground floor. It is one of the oldest irrigation districts in the United States.

When I first came to Congress 6 years ago Harry Bashore was Commissioner of Reclamation, and many members on this committee know the great service that he rendered at that time to me and to the committee.

It was a great service.

I want the record to show that the service of Harry Bashore as rendered to the 17 western States in matters of irrigation and their problems has been invaluable.

While he thought he was going to retire, like a good soldier, when the President asked him if he would not sit in on this upper basin State compact he responded.

I hope that now if he is to lay down his duties, he will get out again in western Nebraska where men live a little closer to the soil and sun. He has been a useful and faithful citizen to western Nebraska and the Nation. I want the record to show he is my constituent and we are proud of him.

Mr. MURDOCK. This compact is a fitting monument to a life well spent in the cause of reclamation.

Mrs. BOSONE. It seems to me the only mistake that the gentleman has made concerning Mr. Bashore is that he did not settle in Utah where we have the lowest death rate in the country.

Mr. ENGLE. We think that Mr. Bashore will eventually wind up where so many other thousands of American people are spending their final happy days of retirement, in the great State of California. We will welcome you when you are ready to come.

Mr. BASHORE. That is a possibility, of course.

Mr. ENGLE. I have one or two questions I would like to ask Mr. Bashore.

Mr. MURDOCK. Very well, Mr. Engle.

Mr. ENGLE. In undertaking your responsibilities representing the Federal Government on this commission, what did you regard as your obligations to the Federal Government and to the States in carrying out your duties?

Mr. BASHORE. Well, to see that all of the United States was properly protected and to give whatever assistance I could in helping the States to reach an agreement on the apportionment of water that would be provided for them in the Colorado River compact.

Mr. ENGLE. Referring to the provision of the Constitution requiring the consent of Congress to interstate compacts, do you know the purpose of putting that in the Constitution?

Mr. BASHORE. Congressman Engle, I am not a lawyer and all I know about law is the association that I have had with it. I refer that to my legal adviser.

Mr. ENGLE. The reason I ask is that I have been a little bit puzzled about the status of a Federal representative on this commission. If it is true that the consent of Congress is asked for no other purpose than the bare legal requirement of consent under the Constitution, what is his function? Is he a referee?

STATEMENT OF J. G. WILL, BUREAU OF RECLAMATION

Mr. WILL. There are certain classes of agreements which, under the Constitution, States may not enter into.

I believe that one of the primary purposes of a Federal representative to participate in negotiations is so that he may aside from lending assistance to the negotiating parties report back to the Congress on the negotiations so that the Congress through his report may, among other things, ascertain that the agreement does not belong in that class of inhibited or prohibited agreements.

Mr. ENGLE. It may be necessary to determine that the compact was not within the range of those which are not proper for a State to enter into. Secondly, it would seem to me that he would have as his obligation the duty of protecting the interest of the Federal Government.

Beyond that he would be a presiding officer, if he is so designated.

Mr. WILL. By courtesy of the Commission, Mr. Bashore was unanimously elected chairman of the Upper Colorado River Basin Compact Commission.

Mr. ENGLE. You have heard, Mr. Bashore, the discussion in regard to the language which has been suggested as a part of the report of this committee. From listening to your statement I take it that that language is in accord with your views?

Mr. BASHORE. That language is in accord with my views. If you put it in the report of the committee, I do not think it would be objectionable whatever.

Mr. ENGLE. I have one further question. You have filed, have you not, a report?

Mr. BASHORE. Yes.

Mr. ENGLE. Is there any objection to his report being made a part of the record in this proceeding?

Mr. MURDOCK. The Chair hears none.

Mr. WILL. That report is Senate Document No. 8.

(The document referred to is as follows:)

[S. Doc. No. 8, 81st Cong., 1st sess.]

UPPER COLORADO RIVER BASIN COMPACT

Compact Entered into by the States of Arizona, Colorado, New Mexico, Utah, and Wyoming on the 11th day of October 1948, To Determine the Rights and Obligations of Those States Respecting Uses and Deliveries of the Water of the Upper Basin of the Colorado River

LETTER OF SUBMITTAL

MITCHELL, NEBR., *January 31, 1949.*

HON. ALBEN W. BARKLEY,
President of the Senate.

MY DEAR MR. PRESIDENT: I have the honor to enclose a conformed copy of a compact entered into on the 11th day of October 1948, among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, to determine the rights and obligations of those States respecting uses and deliveries of the water of the upper basin of the Colorado River.

By virtue of my appointment by the President as the representative of the United States, I participated in the negotiations which led to the compact. My report thereon is enclosed.

Sincerely yours,

HARRY W. BASHORE,
Representative of the United States,
Upper Colorado River Basin Compact Negotiations.

Upper Colorado River Basin Compact

(Report and recommendation by Harry W. Bashore, representative of the United States)

I. APPOINTMENT OF THE REPRESENTATIVE OF THE UNITED STATES

On the 17th day of July 1946 I was appointed by the President to participate, as representative of the United States of America, in the negotiation of a compact proposed to be entered into among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming to the end of determining the rights and obligations of those States respecting the uses and deliveries of the water of the upper basin of the Colorado River.

II. PURPOSES OF THE COMPACT

The major purposes sought to be accomplished by the compact in question are more particularly and best stated in paragraph (a) of article I of the compact itself, which reads as follows:

"(a) The major purposes of this compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River System, the use of which was apportioned in perpetuity to the Upper Basin by the Colorado River Compact; to establish the obligations of each State of the Upper Division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River Compact; to promote interstate comity; to remove causes of present and future controversies; to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of water and to protect life and property from floods."

III. RECOMMENDATION

I recommend that the Congress of the United States grant its consent to this compact as promptly as possibly after the compact shall have been ratified by the legislature of each of the signatory States.

IV. BACKGROUND OF THE COMPACT

The report entitled "The Colorado River" (H. Doc. 419, 80th Cong.) contains, among other things, the following recommendation jointly made by Messrs E. A. Moritz and E. O. Larson, regional directors, respectively, for regions 3 and 4 of the Bureau of Reclamation, Department of the Interior;

"* * * That the States of the Colorado River Basin determine their respective rights to deplete the flow of the Colorado River consistent with the Colorado River compact * * *."

The upper Colorado River Basin is defined in the Colorado River compact as "those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry." It is, as pointed out in the Interior Department's report, an area "larger than New York, Pennsylvania, and New Jersey combined." It is the source of the greater part of the water reaching the Colorado River.

By the Colorado River compact there was apportioned in perpetuity to the upper basin "the exclusive fieneficial consumptive use of 7,500,000 acre-feet of water per annum * * *." That compact does not apportion such use among the States concerned. Under the terms of that compact the upper-basin States are obligated also, among other things, not to "cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years reckoned in continuing progressive series beginning with the 1st day of October net succeeding" its ratification.

V. HISTORY OF THE COMPACT NEGOTIATIONS

The task of reaching agreement upon an apportionment, among the States concerned, was begun officially on July 31, 1946, at Salt Lake City, Utah, the date upon which the group, consisting of one commissioner from each of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and their engineering and legal advisers first met formally. On that date I was honored by being elected to preside over those and subsequent negotiations and deliberations. Seven additional sessions followed: Two at Santa Fe, N. Mex.; two at Denver, Colo.; one at Cheyenne, Wyo.; one at Vernal, Utah; and the series of hearings

held, respectively, at Rock Springs, Wyo.; Grand Junction, Colo.; Price, Utah; and Farmington, N. Mex.

Meetings of the Upper Colorado River Compact Commission were open to the public. The public was invited at all times to express opinion and helpful advice. At the hearings, to which I have referred, the Commission was successful in eliciting much testimony that served greatly to assist in its subsequent deliberations.

Agencies of the Federal Government contributed much to the successful negotiation of the compact. Regional Directors Larson and Batson, of the Bureau of Reclamation, attended most of the sessions. They made their engineering and legal aides available at all times. The Commission was greatly assisted by Mr. J. R. Riter, Chief, Division of Hydrology, Branch of Project Planning, Bureau of Reclamation, who served as chairman of the Commission's engineering committee and who, together with other distinguished engineers from each of the signatory States, performed a monumental task in the collation and the interpretation of basic data. All agencies and departments of the Federal Government having an interest in the outcome of the negotiations were invited to inform the Commission, through me, of their views on the solution of the problems with which the Commission was faced. They were invited to confer with me at any time. So that no agency or department should be overlooked, I invited the Director of the Bureau of the Budget, after having informed him that I had requested views from the Secretaries of War, Agriculture, and Interior, and from the Federal Power Commission, to apprise all other agencies or departments of my interest in receiving their views. This general inquiry was followed, some months later, by a specific request to each of such agencies to advise, first, what right, if any, to the use of upper Colorado River water the agency had or claimed on behalf of the United States, and, second, what particular provision and what particular language should be incorporated in the compact to protect the right, if any, to the use of upper Colorado River water held or claimed by such agency on behalf of the United States. All information and suggestions received were given careful consideration by the Commission.

VI. TREATMENT OF FEDERAL INTERESTS

All specific suggestions made by Federal agencies for incorporation in the compact of language to protect the interests of the United States or of its wards were adopted.

Outstanding provisions in which these interests are protected under the terms of the compact are, in the order in which they appear:

(1) The provision in article VIII of the compact for representation of the United States on the Upper Colorado River Commission.

(2) The provision of paragraph (a) of article IX whereby no State may—"deny the right of the United States of America * * * to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one State for the purpose of diverting, conveying, storing, regulating, and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the States of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper signatory State for consumptive use in a lower signatory State when such use is within the apportionment to such lower State made by this Compact;".

(3) The provisions of paragraph (c) of article XIV, whereby "any preferential uses of water to which Indians are entitled under Article XIX" are required to be "excluded in determining the amount of curtailment to be made" under such paragraph; and

(4) Article XIX, which provides that nothing in the compact shall be construed as—

"(*a*) Affecting the obligations of the United States of America to Indian tribes;

"(*b*) Affecting the obligations of the United States of America under its treaty with Mexico;

"(*c*) Affecting any rights or powers of the United States of America, its agencies or instrumentalities, in or to the waters of the Upper Colorado River system, or its capacity to acquire rights in and to the use of said waters;

"(*d*) Subjecting any property of the United States, its agencies or instrumentalities, to taxation by any State or subdivision thereof, or creating any obligation on the part of the United States of America, its agencies or instrumentalities, by

reason of the acquisition, construction, or operation of any property or works of whatever kind, to make any payment to any State or political subdivision thereof, State agency, municipality, or entity whatsoever, in reimbursement for the loss of taxes; and

"(e) Subjecting any property of the United States of America, its agencies, or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to the Compact."

VII. MEASUREMENT AND CURTAILMENT OF USE

The provisions in the compact for the measurement of use and for the curtailment of the use of water when required in order to meet the obligations of the upper-basin States with respect to flows at Lee Ferry are fair and equitable to each of the States and manifest the intention of the States concerned to fulfill the joint and several obligations which they undertook in the Colorado River compact. The administrative body provided for under the compact will, in my judgment, constitute a thoroughly useful agency which will operate fairly, equitably, and efficiently and without conflicting in any way with operation by Federal agencies of those reservoirs, heretofore or hereafter constructed, for the purposes for which they were or many hereafter be authorized.

VIII. THE APPORTIONMENT

The apportionment of consumptive use, as provided by article III of the compact, is fair and equitable to each signatory State, is economically sound, and is consistent with the best information available as to potential development in the upper Colorado River Basin. The apportionment in questions is as follows:

"(1) To the State of Arizona the consumptive use of 50,000 acre-feet of water per annum.

"(2) To the States of Colorado, New Mexico, Utah, and Wyoming, respectively, the consumptive use per annum of the quantities resulting from the application of the following percentages to the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by upper basin under the Colorado River Compact and remaining after the deduction of the use, not to exceed 50,000 acre-feet per annum, made in the State of Arizona.

	Percent
"State of Colorado	51.75
State of New Mexico	11.25
State of Utah	23.00
State of Wyoming	14.00"

IX. CONCLUSION

The compact will, in my judgment, effectively accomplish its stated purposes; it will fully protect the interests of the United States of America and of its wards; and, finally, it will tend to assure that the waters of the upper Colorado River Basin will be put to their best and most economical use.

HARRY W. BASHORE,
Representative of the United States of America,
Upper Colorado River Basin Compact Negotiations.

Mr. WILL. It includes the full text of the compact, and perhaps to save expense you may wish to omit that part of it.

Mr. ENGLE. I think that is proper.

Mr. MURDOCK. Yes, to save on printing only the pertinent parts of the report minus the text of the compact which is otherwise included, will be placed in the record.

Mr. ENGLE. Mr. Bashore, due to the presence of Mr. Will, your attorney, I assume that your views are not inconsistent with those of the Government agency which at other times Mr. Will represents?

Mr. BASHORE. All Government agencies that might have any interest in this compact were contacted and I am sure that we have represented those agencies in accordance with their wishes. I cannot anticipate

any objection on the part of any Government agency to any statement that Mr. Will has made or that I have made.

Mr. ENGLE. I understand, Mr. Will, there is a report pending.

Mr. WILL. I believe I should state, Mr. Engle, that I deeply regret that the Secretary of the Interior's report has not yet been received in this committee. The clearances of that report are under way at the present time. I hope it can be up here within something like 24 hours. I cannot guarantee it, but I certainly hope so. I hope that the Chairman's permission will be granted when it reaches here so that it may be included in the record.

(The report of the Secretary of the Interior is as follows:)

UNITED STATES DEPARTMENT OF THE INTERIOR,
Washington 25, D. C., March 21, 1949.

Hon. ANDREW L. SOMERS,
Chairman, Committee on Public Lands, House of Representatives.

MY DEAR MR. SOMERS: We are glad to comply with your request for an expression of this Department's views on H. R. 2325, H. R. 2326, H. R. 2327, H. R. 2328, H. R. 2329, H. R. 2330, H. R. 2331, H. R. 2332, H. R. 2333, and H. R. 2334, bills to grant the consent of the United States to the Upper Colorado River Basin compact.

The Colorado River compact apportioned to the upper basin "the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum * * *." That use was not apportioned among the States concerned, to wit: Arizona, Colorado, New Mexico, Utah, and Wyoming. In its report entitled "The Colorado River" (H. Doc. 419, 80th Cong.) this Department suggested that the States of the Colorado River Basin determine their respective rights to deplete the flow of the Colorado River consistent with the Colorado River compact. This the Upper Basin States have done, after extensive negotiations that were participated in by Mr. Harry W. Bashore as representative of the United States.

Mr. Bashore's report on the negotiations in question has been filed with the Congress and is published as Senate Document No. 8, Eighty-first Congress. I commend that report to the consideration of your committee. Mr. Bashore finds that the Upper Colorado River Basin compact will accomplish the purpose of providing for the equitable division and apportionment of the use of the waters of the Colorado River system, the use of which was apoprtioned in perpetuity to the upper basin by the Colorado River compact; of establishing the obligations of each State of the upper division with respect to the deliveries of waters required to be made at Lee Ferry by the Colorado River compact; of promoting interstate comity; of removing causes of present and future controversies; and of securing the expeditious agricultural and industrial development of the upper basin, the storage of water and the protection of life and property from floods. He recommends that the Congress of the United States grant its consent to the Upper Colorado River Basin compact. I heartily concur in his findings and in his recommendation.

In view of my understanding that your committee wishes an immediate report on the bills enumerated above, I have been unable to ascertain from the Director of the Bureau of the Budget the relation of the recommendation made in this report to the program of the President.

Sincerely yours,

OSCAR L. CHAPMAN,
Under Secretary of the Interior.

Mr. WHITE. Mr. Chairman.

Mr. MURDOCK. Mr. White.

Mr. WHITE. I want to renew my question that I made at the beginning of this hearing. I would like to ask Mr. Stone a few questions.

Mr. MURDOCK. Are there any further questions?

Mr. BARRETT. Mr. Chairman, I would like to compliment Mr. Will and Mr. Bashore for their splendid work on this compact. I know the people in Wyoming and the people in the other States affected are

deeply appreciative of the splendid work that they have performed on this compact.

Off the record.

(Discussion off the record.)

Mr. BARRETT. Will there be a comprehensive bill, or will these projects be presented individually?

Mr. BASHORE. I do not know how the Bureau of Reclamation will handle that. With this compact consented to by the Congress it seems to me there will be no wild scramble for water. They will know approximately how much water they will get. Each State will know approximately and then the projects that fall within that allocation will be presented to the Congress. They will be fostered by the States of Wyoming and Colorado and New Mexico, and so forth, and authorization will be sought in appropriations.

I judge that there will be an orderly development and that the States of the upper basin and lower basin, I hope altogether will push for the development of the Colorado River Basin project.

Mr. BARRETT. It ought to come along then in an orderly and reasonably fast order, should it not?

Mr. BASHORE. I do not know about the order. Of course, Congressman Barrett, there are a lot of things that come into the answer to that question. It would be the condition of the United States Treasury, the drains that are put on it, on account of other necessities, and so forth, but there is one thing about this compact that does please me, and that is any State is assured of its water in perpetuity regardless of its geographical position or of its possibly unfavorable climatic conditions. It has that water reserved for it in perpetuity and nobody can encroach upon it. Its development can come along.

Mr. BARRETT. That is true. That is a matter of great importance to the people of Wyoming.

Our people are somewhat impatient and they would like to have some actual construction before very long. I assume that the Bureau should be bringing up projects to this committee before long for authorization. I think it might be well for the States to determine the matter of priority. There might perhaps be some in each of these States. How about that, Mr. Will? Are you going to be prepared before long to submit some of these projects to the Congress?

Mr. WILL. We are preparing now, Mr. Barrett. The investigation has been proceeding for many years and they are continuing. A plan will be evolved and will be presented to the Congress. There will doubtless be recommendations for authorization in stages. Beyond that I do not feel that I can tell the committee with any degree of definitiveness in what form our recommendations will be made or what their substance will be.

Mr. BARRETT. I understand that you do have a report in the Department on the Seedskadie project now in from the field. I assume there are other projects and I wanted you to know that we have the matter in mind and we would like to have them expedited as much as we possibly can.

Mr. WILL. Yes, sir.

Mr. LEMKE. I noted the other day that there are over 2,000,000 unemployed people. The estimate was that at the end of this year there would be 5,000,000. Being a firm believer in employment assurance rather than unemployment insurance I think the Department can

bear that in mind, and we had better have some work to do for those people who have no employment rather than to pay them for loafing.

Mr. WILL. Yes, sir.

Mr. ENGLE. Can you tell us how soon we can anticipate the report that you say is at the Budget?

Mr. WILL. I did not say that, but that is where it is. I said, Mr. Engle, that I hoped to get it up within 24 hours.

Mr. BARRETT. I do not believe we asked if it was favorable.

Mr. LEMKE. You can guess.

Mr. WILL. At the time the compact was executed the Secretary of the Interior expressed himself as enthusiastic over it. So did the Commissioner of Reclamation.

Mr. MURDOCK. We thank you.

This will conclude our session but Congressman White would like to ask one or two questions of Judge Stone.

Judge Stone, could you return to the stand?

Proceed, Mr. White.

Mr. WHITE. Are you now commissioner of water for the State of Colorado?

Mr. STONE. I am director of the Colorado Water Conservation Board of the State of Colorado. That board has two principal functions. One is to take care of and handle interstate water matters and to aid in the development of the State's water program.

I was also commissioner of the State of Colorado in the negotiation of the upper Colorado River Basin compact.

Mr. WHITE. You have participated in the negotiations and in the proceedings in connection with the division of water of the Colorado River?

Mr. STONE. Yes; I did so on behalf of the State of Colorado.

Mr. WHITE. And you are now concerned with the interstate relations.

Does the provision of that contract in any way affect the division of the water of the Colorado River between the States of Colorado and Arizona?

Mr. STONE. As has been stated here and I concur in the statements that have been made in that regard, this compact is an agreement among five signatory States. Its provisions are binding only on those States and are not binding upon any State not signatory to the compact.

Mr. WHITE. Does the compact in any way affect the division of the water of the Colorado River between the States of California and Arizona? I will repeat the question.

Mr. STONE. This compact only involves the States of the upper basin. California is not a State of the upper basin. It is a State solely of the lower basin, and it, accordingly, cannot and does not adjust or attempt to adjust any controversy that may now exist between the States of Arizona and California.

Mr. WHITE. The utilization of water in the upper basin States will in no way affect the division of the States of California and Arizona, will it?

Mr. BARRETT. I would like to make a little observation. We have spent about a day on that very point.

Mr. WHITE. I do not think the record is very clear on the point, and I think Judge Stone is qualified to give an answer to the question.

Mr. STONE. Will you repeat that question?

Mr. WHITE. I said, "Does this compact in any way affect the division of the water of the Colorado River between California and Arizona?"

Mr. STONE. Since this compact is not binding on California, since it is not a signatory to this compact, and since Arizona has reserved any rights as a lower basin State and as a State of the lower division, my answer to that would be that it does not.

Mr. WHITE. Do you favor advocacy of the division of water between Arizona and California?

Mr. STONE. Congressman White, my advocacy one way or another would——

Mr. MURDOCK. May I interrupt the witness for one moment? Dr. Miller, I note you are about to leave. If you could wait just a moment, I think we can vote on this bill in the subcommittee.

Mr. STONE. I will answer it this way: In my judgment, and I believe in the judgment of everyone who is familiar with the Colorado Basin, it would be most desirable if Arizona and California and Nevada could agree, as we in the upper basin States, have agreed, on the apportionment of the water made available by the Colorado River compact to the lower basin.

Mr. WHITE. As a matter of fact, that is an issue now before the Congress, is it not?

Mr. STONE. Pardon me?

Mr. WHITE. I say that is an issue whether we will have the division by negotiation or by court procedure, and it is an issue before the Congress, is it not?

Mr. STONE. If I understand your question correctly, those of us who have been dealing with these problems believe that it is always more desirable to amicably adjust these interstate water matters rather than go to court. It occasionally happens, however, that an original action of the Supreme Court is the only means by which these controversies may be finally adjusted.

Mr. WHITE. I have one more question. The present reclamation law provides that in the sale of power, generally on Government-owned property or power projects, municipalities who operate will be given preference. Does that policy have your approval?

Mr. STONE. Yes; that is the present law. It has been the reclamation law for many years and has proven to be very desirable policy.

Mr. WHITE. And that has your approval, that the towns and cooperatives have preference in buying that power?

Mr. STONE. I have never opposed that policy. It has been the judgment of the Congress that that is a good policy. It was put in the law by the Congress, and it has remained there. I assume that it is generally accepted by the Congress as appropriate policy.

Mr. WHITE. In your previous participation in the negotiations and dealings you do know that that was an issue?

Mr. STONE. I recall that that has been in issue.

Mr. WHITE. That completes my questioning, Mr. Chairman.

Mr. MURDOCK. Mr. Poulson has a statement which he would like to have included in the record. In the interest of conserving time, unless there is objection, it will be inserted as given.

STATEMENT OF NORRIS POULSON, MEMBER OF CONGRESS, STATE OF CALIFORNIA

Mr. POULSON. Mr. Chairman and my colleagues on the committee, I desire to add my compliments to the upper river basin States for their success in agreeing among themselves as to how they will divide up their Colorado River compact apportionment of 7.5 million acre-feet of beneficial consumptive use annually. I wish that the lower basin States might agree among themselves as to the division of their water rights. This committee is now considering H. R. 2325, which seeks congressional consent to the compact made by the upper basin States.

As has been said here the upper basin States have the right to do with their water as they please, but they must not be permitted to change the basic Colorado River compact of 1922, signed by all seven States, which was approved by the Congress as a six-State compact by the Boulder Canyon Project Act (45 Stat. 10573). I say a "six-State compact" because that is what Congress did approve, and I do not know what the situation now is, since Arizona's ratification of the original seven-State compact in 1944.

Nor are the upper basin States to be permitted to adversely affect the interests of the United States or of the basin States which were not signatory to the upper Colorado River Basin compact. Mind you, I am not contending, at the moment, that the compact before us has any such purpose but we are correct in exploring the situation, and I applaud the attitude of my colleague, Congressman Engle, in his efforts to find out the true situation.

All of the members of this committee have heard of the unfortunate controversy that exists between Arizona and California with Nevada to some extent, caught in the middle. All of these States—Arizona, California, and Nevada—have contracts with the Secretary of the Interior, each calling for the delivery of a specified quantity of mainstream water. Now, each of the contracts contain a clause that makes such water delivery "subject to the availability thereof under the Colorado River compact and the Boulder Canyon Project Act."

So far so good, but the States are not in agreement as to their respective rights under the Colorado River compact and the Project Act. The contest still rages and one of the points in issue is just what the compact meant by the term "beneficial consumptive use" California contends that it means "diversions less returns," but Arizona contends it means something else. Arizona contends, with relation to its use of Gila River waters, that it should be charged not with the water it consumes, but on the theory of "man-made depletions of virgin flow." By this definition of "beneficial consumptive use" Arizona seeks to avoid being charged with its full use of Gila River waters.

Now, Mr. Chairman, the legal definition of "beneficial consumptive use" must still be made by the courts, but we find that in the upper basin compact which we are asked to approve, that the upper basin States, seek, by that compact, to establish for themselves that definition of "man-made depletions of virgin flow" (art. VI). Now that's all right, Mr. Chairman, for the upper basin States to so agree among themselves, but they ask this Congress to approve their compact containing such a definition. Even that may be all right, if they don't

lead the Congress into approving such a definition for itself, and, perhaps, for the States of California and Nevada, neither of which signed the upper basin compact. The upper States should not put us in any such possible position and we, of California, and our colleague from Nevada, are entitled to ask this committee for fair play and for protection. Who can say what the Supreme Court will think of such action by Congress? I don't know and I doubt if any of us know.

I urge you to carefully consider your position and to protect yourselves, the Federal Government, and the States of California and Nevada against the possibility of being injured by your action. All that is needed is definite assurance by amendment to the bill, or by other appropriate action that the United States is not, by consenting to this compact, committing itself to any interpretation, expressed or implied, of the main Colorado River compact, that is contained in the upper-basin compact. With such protection, Mr. Chairman, I am for the upper-basin compact, and I will vote for it.

STATEMENT OF HON. HAROLD A. PATTEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ARIZONA

Mr. PATTEN. Mr. Chairman, as a Congressman from the State of Arizona, I speak in behalf of the people of Arizona before this committee. We in Arizona have been interested in the security and economic well-being assured the State and Nation by the upper Colorado River Basin compact. This compact has been fully satified by Arizona and all parties interested in the improvement and development of this great area.

As a Representative, I heartily concur in all the evidence that has been presented in support of the resolution giving consent of the Congress to such a compact, and I shall earnestly endeavor to lend my full support to see that the resolution, without amendments, will be reported unanimously by the committee.

STATEMENT OF HON. JOHN H. MARSALIS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Mr. MARSALIS. Mr. Chairman, my name is John H. Marsalis. I am a Member of Congress representing the Third District of Colorado. As such I introduced a bill, H. R. 2326, to ratify the upper Colorado River Basin compact, the same being identical to the bill upon which hearings are now being had. I favor the ratification of this compact.

The original compact entered into in 1922 and approved by the United States Government paved the way for development of the main and lower channel of the Colorado River and the erection of the Boulder Dam. This compact apportioned to each of the upper and lower basins in perpetuity a total of 7,500,000 acre-feet for beneficial consumptive use annually.

The time has now come when upper-basin States desire to proceed in the development of their area, and in order to proceed logically and safely with such program, it was necessary that an agreement be reached between them concerning the amount of water to which each was separately entitled under the 1922 compact award. An agreement was finally reached between the States of Arizona, Colorado, New

Mexico, Utah, and Wyoming, and thereafter incorporated into a compact duly ratified by the legislatures of such States and signed by their Governors. It is this compact that we now seek approval of by the United States Government, and it is my earnest hope that early ratification be obtained.

Mr. STONE. Mr. Chairman, were there any other questions?

Mr. MURDOCK. I believe that concludes the questions, Judge Stone.

Mr. BARRETT. If it is in order, I would like to move that H. R. 2325 be reported favorably to the full committee, with the understanding that the language agreed upon this afternoon shall be incorporated into the report of the bill.

Mr. WHITE. I second the motion, Mr. Chairman.

Mr. MURDOCK. You have heard the motion. It has been seconded. All in favor of the same make it known by saying "aye". Opposed, "no." It is carried unanimously.

STATEMENT OF HON. JOHN E. MILES, REPRESENTATIVE IN CONGRESS FROM NEW MEXICO

The adoption of the upper Colorado Basin compact by the legislatures of the signatory States and congressional consent to this compact will mark a great forward step in the development of the Colorado River.

I would like to state particularly for the record that it might be noted that by the terms of article XVIII the State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River compact as States of the lower basin. This has reference to the provisions of the Colorado River compact of 1922, article II, subparagraph (g), whereby the term "lower basin" is defined as "those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now, or shall hereafter be, beneficially served by waters diverted from the Colorado River system below Lee Ferry." This recognizes the interest of New Mexico in the Gila and Little Colorado Rivers and their tributaries which rise in New Mexico. These rights are not affected by the terms of the upper Colorado River Basin compact. They are governed entirely by the terms of the original Colorado River compact of 1922. The portion of the waters of these rivers which New Mexico may be entitled to use consumptively has not been determined. This may have to be done by compact with the other States of the lower division, or in the case of the Gila River by the authorization by Congress of the construction of the central Arizona project, and congressional provisions binding on Arizona, California, and Nevada, apportioning a certain quantity of consumptive use to New Mexico, or by agreement with Arizona alone after Arizona and California settle their controversies over the waters of the lower Colorado and its tributaries.

Mr. MURDOCK. The committee stands adjourned.

(At 4:15 p. m., the hearing was adjourned.)

UPPER COLORADO RIVER BASIN COMPACT

FRIDAY, MARCH 18, 1949

HOUSE OF REPRESENTATIVES,
Committee on Public Lands,
Washington, D. C.

The full Committee on Public Lands met at 10 a. m., Hon. J. Hardin Peterson presiding.

Present: Messrs. Peterson, Murdock, Engle, Redden, Morris, Regan, Bentsen, Baring, Mrs. Bosone, Messrs. Marshall, Aspinall, Miles, Crawford, Lemke, Barrett, LeFevre, Miller, D'Ewart, Poulson, Sanborn, and Bartlett.

Mr. PETERSON. Mr. Murdock says he is ready to report his compact bill. The Subcommittee on Irrigation and Reclamation, which includes the full committee, has had rather extensive hearings on the compact bill with reference to the upper Colorado Basin compact. It is H. R. 2325.

In those rather extensive discussions there were certain things that they wanted written into the report. As I understand it, you reported it out unanimously from your committee?

Mr. MURDOCK. Yes, Mr. Chairman; the Subcommittee on Irrigation and Reclamation unanimously reported H. R. 2325 with the understanding that certain language was to be written into the report accompanying the bill. The bill itself is unamended. The language agreed upon by all parties is in the transcript. I have asked that it be recopied. I have again submitted copies of the language as agreed upon to certain members of the committee. Will it be necessary to read this?

Mr. PETERSON. I can do it quickly. If there is no objection, we will receive the report of the subcommittee recommending the reporting favorably of H. R. 2325, and if there is no objection the report is received.

If there is no objection, the bill will be considered as read.

Is there objection?

I hear none. The bill will be considered as read.

There is a report from the chairman of the subcommittee to the effect that his committee has recommended that this be included in the language of the report, and the member authorized to report the bill is instructed to include in his report the following wording:

The upper Colorado River Basin, compact is an interstate compact between the States of Arizona, Colorado, New Mexico, Utah, and Wyoming. Article 1, section 10, of the Constitution of the United States requires that before a compact or agreement between States is effective, the Congress of the United States must consent thereto. The purpose of S. 790 (H. R. 2325) is to give such congressional consent to the upper Colorado River Basin compact. S. 790 (H. R. 2325) does not, nor does the upper Colorado River Basin compact, alter, amend,

modify, or repeal the Boulder Canyon Project Act (45 Stat. 1057) or the Colorado River compact signed at Santa Fe, N. Mex., on November 24, 1922. It is recognized that the upper Colorado River Basin compact is binding only upon the States which are signatory thereto and does not impair any rights of any State not signatory thereto, and that the upper Colorado River Basin compact is subject in all respects to the provisions and limitations contained in the Colorado River compact.

It is further recognized that Congress, by giving its consent to the upper Colorado River Basin compact, does not commit the United States to any interpretation of the Colorado River compact expressed in or implied from the upper Colorado River Basin compact, and expresses neither agreement nor disagreement with any such interpretation.

Do I hear a motion?

Mr. BARRETT. Mr. Chairman, it occurs to me since we have read that again perhaps the reference to the bills ought to be transposed because the original agreement on the first part of this language was made in the Senate, and they referred to S. 790. Probably that was an agreement in the Senate, whereas we are putting in the "House."

Mr. PETERSON. You mean "H. R." would come ahead of the "S."?

Mr. BARRETT. The "S." ought to be in brackets instead of the "H. R. 2325."

Mr. PETERSON. With that objection, it will be changed. We will amend this language to include H. R. 2325 and then "(S. 790)."

Is there any objection?

The Chair hears none. It is so ordered.

Does the Chair hear a motion to instruct the member who is to report the bill?

Mr. POULSON. I so move.

Mr. BARRETT. I second the motion.

The motion should be explicit that we reported favorably.

Mr. PETERSON. My motion is that such member of the committee as may be designated to report it is hereby instructed to include in the report the following words. All in favor let it be known by saying "aye"; opposed, "no."

It is so ordered.

When the bill is reported, it shall contain those words in the report.

Does the Chair hear a motion to report H. R. 2325 favorably with the provision contained therein?

Mr. POULSON. I so move.

Mrs. BOSONE. I second the motion.

Mr. PETERSON. Is there any discussion?

If not, all those in favor of the motion let it be known by saying "aye"; opposed, "no."

The "ayes" have it. It is so ordered. The vote is unanimous.

(Whereupon, the committee adjourned.)

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COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

EIGHTY-THIRD CONGRESS

SECOND SESSION

ON

H. R. 4449, H. R. 4443, and H. R. 4463

TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

JANUARY 18, 19, 20, 21, 22, 23, 25, 26, 27, AND 28, 1954

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COLORADO RIVER STORAGE PROJECT

THURSDAY, JANUARY 21, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to recess, at 9:30 a. m. in the committee room, New House Office Building, Hon. William H. Harrison (chairman) presiding.

Mr. HARRISON. The committee will come to order.

As stated yesterday, we will hear first today the Senators and Representatives who are interested in the legislation before the committee.

We have Senator Clint Anderson, of New Mexico, present at this time. I want to welcome the Senator, and we will be glad to hear his testimony now.

STATEMENT OF HON. CLINTON P. ANDERSON, A UNITED STATES SENATOR FROM THE STATE OF NEW MEXICO

Senator ANDERSON. Thank you, Mr. Chairman. The State of New Mexico finds itself in the very fortunate position where all groups inside the State are unified as to what the State desires. The representation from the State of New Mexico officially, and from the 2 Senators and 2 Members of the House, will all agree on the unified position. Therefore, I am happy that we can say to the committee and to the public that the State of New Mexico is happy to endorse the project as a whole, that we are happy to have included the projects in other States, and that we hope the entire bill will pass, not only to the benefit of New Mexico but to the benefit of every one of the States in this area.

I see across the table my distinguished colleague from the State of Utah, Senator Watkins, who is a fine authority on reclamation matters. I say that as a person who has served with him in the Senate Committee on Interior and Insular Affairs. We have all come to respect his vast knowledge of reclamation and irrigation law, but I wish this morning to commend him for the fact that he is trying to see that the water allotted to his State is used as the people of his State want it used, and that is what we desire in the State of New Mexico.

Yesterday a very able Member of the United States Senate, the Honorable Price Daniel, appeared before you and had some comments to make on the desires of the State of New Mexico for the San Juan-Chama project. I do not wish to take strong issue with my friend, Senator Daniel, because I hope by the time we get through understanding what we are seeking he will be as enthusiastic as to what New

The completion of the units of the Colorado River storage project and the participating projects proposed under these bills will result in a total water use in the upper basin which is still well under the use allocated to the upper basin under the 1922 Colorado River compact.

We believe the authorization of the units of the Colorado River storage project and participating projects proposed under these bills is the necessary first step in making possible the full utilization of the water and land resources of the upper Colorado River Basin in Wyoming. It is a highly important step in the development of the many and unlimited mineral resources of the basin. It is an important step in the development and utilization of the recreational resources of the basin.

Thank you.

Mr. HARRISON. Is there anything you want to add to that?

Mr. PERSON. No, sir; Mr. Chairman.

Mr. HARRISON. Mr. Aspinall, do you have any questions?

Mr. ASPINALL. No, sir.

Mr. HARRISON. Mr. Hosmer?

Mr. HOSMER. Yes, Mr. Chairman.

You make reference, Mr. Person, to the two units essential to the upper basin States in connection with meeting minimum flow requirements at Lee Ferry. You are discussing only their quantitative flow requirements, are you not?

Mr. PERSON. Yes, sir.

Mr. HARRISON. Any further questions?

Thank you, Mr. Person. I appreciate your coming here and making that statement. We are certainly glad to have you.

As announced prior to adjournment at noon, the next witness will be Hon. Jean S. Breitenstein, special counsel to the Colorado Water Conservation Board, and Commissioner of Colorado on the Upper Colorado River Commission.

STATEMENT OF JEAN S. BREITENSTEIN, COLORADO MEMBER OF UPPER COLORADO RIVER COMMISSION AND ATTORNEY FOR COLORADO WATER CONSERVATION BOARD

Mr. BREITENSTEIN. Thank you, Mr. Chairman.

My name is Jean S. Breitenstein, and my address is 718 Symes Building, Denver, Colo. I am the Colorado member of the Upper Colorado River Commission. For a number of years I have been the attorney for the Colorado Water Conservation Board which is the official agency of the State of Colorado charged with the duty of promoting the conservation of the waters of the State of Colorado in order to secure the greatest utilization of such waters and the utmost prevention of floods. My task here is to present the official position of the State of Colorado, as determined by the Board, on the Colorado River storage project.

Mr. Chairman, in doing that, I will, of necessity, have to discuss matters which are not within the bill as it is now before the committee. They are covered by amendments which have been presented by the Upper Colorado River Commission but not formally submitted to the committee. I very respectfully ask your indulgence in permitting me to go beyond the bill and to cover all the matters in my statement.

Mr. HARRISON. Without objection that permission will be granted to you.

Mr. BREITENSTEIN. The wise and orderly development of the waters of the upper Colorado River system is vitally needed to assure the continued welfare of the people of Colorado. The State is divided into two parts by the Continental Divide. On the east the limited water supplies are fully developed. On the west the drainage area of the Colorado River and its tributaries produce annually about 11 million acre-feet of water—more than 70 percent of the flow of the river at Lee Ferry. Under the applicable compacts, Colorado is allotted the beneficial consumptive use of about 4,000,000 acre-feet annually. Of this quantity about 1,650,000 acre-feet is presently being used or is committed for use. The future economy of Colorado will, in large measure, be fixed and determined by the manner in which the uncommitted Colorado water is put to use.

For many years the Colorado Water Conservation Board has given consideration to the problem. To supplement the studies and investigations of the Bureau of Reclamation and other Federal agencies, the Colorado board has obtained and reviewed engineering reports of its own staff and of an independent engineering firm of national reputation. It has also secured expert economic studies.

Its decisions have not been reached hurriedly. They represent the exercise of informed judgment based upon a patient and painstaking study of all aspects of the Colorado situation.

On January 14, 1954, a few days ago, the Colorado Water Conservation Board adopted the following resolution to assert the policy of Colorado in regard to the Colorado River storage project.

Whereas the Colorado Water Conservation Board has given consideration to the report of the Secretary of the Interior, dated December 22, 1950, on the Colorado River storage project and participating projects, and to the supplemental report, dated December 10, 1953, of the Secretary of the Interior on the same subject; and

Whereas the board in an endeavor to ascertain the attitude of all interested areas and citizens of the State of Colorado in regard to the position which Colorado should take on such reports did at its February 17, 1953, meeting create the Colorado Conference Committee to study the use of Colorado River water in Colorado and particularly the proposed transmountain diversion by Denver from the Blue River, and

Whereas such reports have been made and the conference committee has reported to the board; and

Whereas in a further effort to reconcile conflicting views as to the use of Colorado River water without the natural basin in Colorado the board did on December 30, 1953, appoint a mediation committee, which has this day reported that it could come to no agreement; now, therefore, be it

Resolved by the Colorado Water Conservation Board, the official State agency which is charged by law with the duty and responsibility of promoting the conservation of the waters of the State of Colorado in order to secure the greatest utilization of such waters and the utmost prevention of floods, That:

1. It is the position of the State of Colorado that all waters of the Colorado River system available for use in the State of Colorado under the various instruments constituting the law of the river shall be put to beneficial consumptive use in Colorado as expeditiously as orderly economic development will permit.

2. Because of Lee Ferry delivery obligations imposed by the Colorado River compact of 1922, substantial quantities of regulatory holdover storage must be provided in the upper basin if that basin is to be able to put to beneficial consumptive use its allotted share of Colorado River water.

3. The Colorado River storage project will provide such necessary storage and is essential to the full economic development of the water resources of the upper basin.

4. The plan of the Colorado River storage project to finance the construction of the necessary holdover reservoirs through the revenues derived from the sale of power generated at hydroelectric plants and to utilize a portion of such revenues to assist in the financing of so-called participating projects which meet certain fixed criteria is approved.

5. In connection with the Glen Canyon Reservoir Colorado directs attention to the fact that this reservoir, which is located but a short distance above Lee Ferry, will yield substantial benefits to the lower basin, one of the most important of which is the detention of silt and the resulting prolongation in the useful life of Lake Mead. The official representatives of Colorado should strive to obtain some recognition by the lower basin of these benefits and, if possible, a sharing by the lower basin of such matters as reservoir losses

6. The Echo Park unit is a desirable feature which has the full support of Colorado.

7. Authorizing legislation should contain appropriate provisions for the recapture for use within the upper basin of power generated by the Colorado River storage project when and if any of such power is sold or transmitted for use within the lower basin.

8. Specific provision should be made in authorizing legislation to assure that no rights vest in the use of water for power generation in units of the project which will prevent or handicap the beneficial consumptive use upstream of the waters of the Colorado River system to which any upper basin State is entitled.

9. Colorado has no objections to the report of the Secretary of the Interior on participating projects except that Colorado urges that further study be given to the La Plata and San Miguel projects, which are urgently needed, in order to develop, if possible, a feasible plan therefor and except as hereinafter noted.

10. The report and the supplemental report of the Secretary of the Interior practically ignores any development of Colorado River system water in Colorado. For this reason, Colorado cannot accept the report and supplemental report as now submitted. As conditions precedent to Colorado approval of the report, provisions must be made therein, or in the authorizing legislation, which will assure the following water development in Colorado:

(*a*) The Cross Mountain unit must be included within the initial authorization for construction as a part of the first phase of the project.

(*b*) There is no doubt that further consumptive use of water in Colorado is directly dependent upon high upstream storage. To provide therefor there must be included in the initial authorization approximately 3 million acre-feet of total new storage on the Colorado River and its tributaries above Grand Junction, Colo., a substantial portion of which shall be located on the upper reaches of the Gunnison River. The known reservoir sites which might accomplish this objective are Curecanti on the Gunnison and DeBeque on the Colorado River. Additional investigations may disclose other sites. There is little doubt but that the stated amount of storage will be needed. The Secretary of the Interior is urged to expedite the investigation and study of projects which will furnish the requested storage.

11 Denver, the capital city of Colorado, desires to divert water from the Blue River, a tributary of the Colorado River, for muncipal and industrial uses in the Metropolitan Denver area. The rights of Denver to take and divert such water are alleged to be in conflict with rights for the use of water stored in Green Mountain Reservoir and taken through the Green Mountain powerplant for the generation of power. Green Mountain Dam, Reservoir, and powerplant constitutes a unit of the Colorado-Big Thompson project of the United States Bureau of Reclamation.

The controversy over the relative rights of Denver and the Green Mountain project are in litigation in a lawsuit now pending in the Supreme Court of the State of Colorado and in another lawsuit now pending in the United States District Court for the District of Colorado.

It would be improper for this Board to attempt to invade the province of the courts or to influence the pending litigation. The Board has no intention of doing either. The feasibility of the proposed Denver-Blue River diversion depends, among other things, on the outcome of this litigation, or on some alternative thereto which satisfactorily protects the Colorado-Big Thompson project.

Upon the condition that the legal availability of a reasonable quantity of water for the Denver-Blue River diversion be established, either by litigation or some other arrangement, and the condition that such project be otherwise feasible, the Board approves the Denver-Blue River project for inclusion as a participating project in the authorization of the Colorado River storage project or for such

other Federal legislative or administrative action as may be requested by Denver.

12. The Board recommends that Denver and the representatives of the west slope in Colorado make every effort to arrive at a harmonious solution of the unfortunate transmountain diversion controversy which for years has created dissension in Colorado. The Board pledges that it and its staff will be ready to assist in the amicable settlement of this prolonged conflict.

13. The director of the board and the Colorado member of the Upper Colorado River Commission are directed to do all things necessary and proper to effectuate this resolution.

14. Copies of this resolution shall be forthwith transmitted to the Governor of Colorado and to the members of the Colorado congressional delegation.

Mr. Chairman, I have with me a certified copy of that resolution which I would like to offer for the purposes of the record. I see no reason to have it printed, but here is a certified copy of that resolution.

Mr. HARRISON. Without objection, it will be received and made a part of the file.

(The document above referred to was received and made a part of the file.)

Mr. BREITENSTEIN. This resolution which I have just read was presented to the Upper Colorado River Commission and that commission, on January 17, 1954, unanimously took the action expressed in the following resolution.

Whereas the Upper Colorado River Commission at its February 26, 1953, meeting did unanimously adopt a motion which provided, in part, that at any time during the consideration of the bill for the authorization of the Colorado River storage project by the commission, the congressional delegations from the upper Colorado River Basin, or the Congress of the United States, the commission will support such amendment to the bill or such independent bill or bills as may be recommended by the Colorado Water Conservation Board for the use in Colorado of water alloted to Colorado by the upper Colorado River Basin compact, such projects to meet the minimum criteria set out in section 5 of the February 13, 1953, draft of bill for participating projects; and

Whereas the State of Colorado at this January 15, 1954, meeting did present to the commission a statement of its position in regard to the Colorado River storage project and the bill proposed for the authorizatoin thereof; and

Whereas in said policy statement the State of Colorado did recommend certain Colorado projects for inclusion within the Colorado River storage project and its authorizing legislation; and

Whereas such Colorado projects will constitute additional projects to be included within the Colorado River storage project and its authorizing legislation: Now, therefore, be it

Resolved by the Upper Colorado River Commission, That pursuant to the recommendations and requests of Colorado the draft of bill to authorize the Colorado River storage project shall be so revised and amended as to eliminate therefrom the reference to the Curecanti project and so as to include the following:

1. The Cross Mountain unit, along with the Glen Canyon and Echo Park units, within the initial authorization for construction.

2. The authorization of approximately 3 million acre-feet of total new storage on the Colorado River and its tributaries above Grand Junction, Colo., a substantial portion of which shall be located on the upper reaches of the Gunnison River, provided that no appropriation for or construction of all or any part thereof shall be made or begun until the Secretary of the Interior shall have made a finding of feasibility thereon and the Congress shall have approved the same.

3. The Denver-Blue River diversion as a participating project provided that before any moneys shall be appropriated for or applied thereto the Secretary of the Interior and the Congress shall have approved the Denver plan and the method of repayment proposed by Denver.

4. The legal committee is directed to prepare for consideration by the commission suitable amendments to effectuate this resolution.

The foregoing resolutions speak for themselves. They are the official actions of the State and the commission.

Qualified witnesses have presented to the committee the underlying principles and theories of the Colorado River storage project. They have the approval of Colorado. No comment by me on them will add anything to this hearing.

Regulatory hold-over storage is necessary to equate the Lee Ferry flows so that the upper division States may use their full allotments of water. It is but good sense that as much of this storage as possible shall be located in the upper reaches of the Colorado River and its tributaries where the reservoirs may not only serve to regulate the stream and generate power but also serve agricultural, municipal, and industrial needs of the upper basin. The project units proposed for Colorado will have such multiple purposes. Perhaps more important they will provide a water supply for a region, which, in a report of the Bituminous Coal Institute referring both to the coal deposits of western Colorado and the oil-shale deposits of northwestern Colorado, has been described in the following manner:

> It is no wonder that the fuel authorities in their moments of crystal-gazing envision this region, western Colorado, as the powerhouse—and perhaps the industrial center—of America's future.

The Cross Mountain Dam, located on the Yampa River about 50 miles west of Craig, Colo., will have a total initial capacity of 5,200,000 acre-feet and will generate about 330 million kilowatt-hours of electrical energy annually at a cost which compares very favorably with the cost of energy produced at other project units. The benefit-cost ratio is favorable. It is a feasible and desirable project which, through coordinated operations, will benefit such downstream units as Echo Park and Glen Canyon. It will provide a water supply for the irrigation of lands in the western part of Moffat County, Colo., and will impound substantial quantities of water for stream regulation.

Any substantial increase in the consumptive use of water in Colorado is dependent upon high upstream storage. In recognition of this undeniable fact, Colorado has requested that the project and the authorizing legislation include in the initial authorization 3 million acre-feet of total new storage on the Colorado River and its tributaries above Grand Junction, Colo., a substantial portion of which shall be located on the upper reaches of the Gunnison River.

The Bureau of Reclamation has under study two reservoir sites which might furnish the requested storage. One is the 940,000 acre-feet Curecanti unit on the Gunnison River and the other the 2,200,000 acre-feet DeBeque unit on the main stem of the Colorado River.

The Curecanti Dam is stragetically located on the Gunnison River above an area which has great agricultural and industrial potentials. It will supply supplemental water to an irrigated area. Within the Gunnison River Basin there are about 68,000 acres of irrigable land, classes 1 and 2, which is not now irrigated. Much of this can be brought into cultivation with water made available by Curecanti.

In the Gunnison Basin are vast deposits of high-grade coal which may be the base for a substantial industrial development but only if a water supply is assured by the Curecanti unit. Curecanti would be a multiple-purpose dam which would impound water to irrigate large areas of land, to provide good clear water for municipal and industrial uses, to regulate streamflows and to produce substantial

quantities of electrical energy. It is a development which is greatly desired by the area in which it is located and which it will benefit greatly.

There is no section of the United States which has a greater industrial potential than the Rifle-Grand Junction area on the main stem of the Colorado River. Grand Junction is the business center for much of the uranium development on the Colorado Plateau.

As the committee knows, that plateau is the greatest producer of uranium ores in the United States. Perhaps of even greater importance is oil shale.

In this region there are located the richest and most extensive oil shale deposits in the United States. The Bureau of Mines estimates that these oil-shale deposits cover an area of 2,500 square miles and will yield about 15 gallons of shale oil per ton of shale. About 1,000 square miles have been explored by core drilling and other tests. Experts state that the cost of gasoline made from crude oil obtained from new fields is actually more than the cost which would be incurred in the mining and refining of oil shale.

Resources for Freedom, a report by the President's Materials Policy Commission, June 1952, volume IV, page 175, forecasts that by the year 1975 there will be production of 1.4 million barrels of shale oil a day to supply the fuel needs of the United States. It is inevitable that other industries will follow any commercial shale-oil development without much delay. The principal motivating factors will be abundant cheap fuel for power and byproducts usable economically by the chemical and related industries.

The report of the engineering firm of Leeds, Hill & Jewett to the Colorado Water Conservation Board has this to say concerning the DeBeque Reservoir:

> Opportunity exists for the creation of a suitable reservoir by construction of a dam in DeBeque Canyon at the lower end of the valley in which the industrial development would presumably be centered. Diversion requirements of such industries could be satisfied by the withdrawal of water from the reservoir without regard to the inflow at the time. Return waters, except the very small proportion which might be unduly contaminated by chemical processes, could be returned to the same reservoir without waste downstream. All irrigation requirements in the Grand Junction area could be satisfied, without conflict with any other use, by the release of water from the reservoir, and the average quality of the irrigation water would be somewhat improved over that now available in the summer months.
>
> It is recognized that the cost of construction of such a storage project would be large, primarily because of the necessity of relocating the trunk highway and railroad which now follow the Colorado River. This cost, however, would be insignificant in comparison to the tremendous capital investment which must be made to industrialize the region and which will not be made until there is assurance of ample water.

We say that the Bureau of Reclamation should expedite studies of the proposed Curecanti and DeBeque units. The completion of the investigation of these units will no doubt establish their feasibility. But whether the storage which Colorado requests is located at these sites or some alternate sites, there is real need for such storage. It must be furnished to provide for an economic development which will increase the wealth and preserve the strength of our Nation.

Other agricultural and domestic needs of the western slope of Colorado can be served by the Florida, Pine River Extension, Silt, Smith Fork, and Paonia participating projects. These are desirable developments which satisfy the criteria established by the bill for par-

ticipating projects. Time does not permit comments on each of these units. They are specifically described in report of the Secretary of Interior on the Colorado River project.

The Denver-Blue River diversion is an important and desirable feature of the project under consideration. This diversion will augment an already existing, well-managed, publicly owned water plant through which the city and county of Denver supplies its own inhabitants and the surrounding metropolitan area with domestic and industrial water.

United States Government personnel and their families constitute about one-sixth of the population served by the Denver water system. Denver, the capital of Colorado and the largest city in the upper basin States, is experiencing a growth which demands immediate acceleration of the development of the only remaining practical source of an additional water supply. That source is the Blue River, a tributary of the Colorado.

For the reasons stated, Colorado respectfully requests that this committee, and the Congress, act favorably on the Colorado River storage project as modified by the amendments proposed by the Upper Colorado River Commission.

Thank you.

Mr. HARRISON. Thank you, Mr. Breitenstein.

Dr. Miller, have you any questions?

Mr. MILLER. The only question I would raise would be the question of Denver's rights to the water. I believe you said that some of that was before the courts at the present time?

Mr. BREITENSTEIN. Yes, sir.

Mr. MILLER. I presume that the feeling in Denver, and your feeling, would be that the committee ought not to take any action on the Blue River and the other water rights concerning Denver until they are settled by the courts?

Mr. BREITENSTEIN. The committee and the Colorado Water Conservation Board can neither invade the province of the courts. That is recognized in the resolutions which I have submitted here.

Now, if water is legally available, and made available either by the outcome of the litigation or some other means, and the project is otherwise feasible, then the water conservation board has approved it for consideration by the Congress and the Secretary of the Interior. But it recognizes that there is the question of the legal availability of the water.

Mr. ASPINALL. Would you yield for a question?

Mr. MILLER. Yes.

Mr. ASPINALL. Do you not think perhaps we are invading the jurisdiction of the court in this present proceedings if this body should take cognizance of any matter pertaining to this project at this time?

Mr. BREITENSTEIN. Congressman, I don't think that would constitute an invasion of the province of the court, because these water matters and water cases go on for years and years. If we just do not talk about them while a court procedure is going on, we might never get any development at all. But the board recognizes that it would be improper to influence the pending litigation.

Mr. ASPINALL. And it is your opinion, if Congress gave a qualified approval of this, that it would have no effect whatsoever upon the legal proceedings now in court?

Mr. BREITENSTEIN. I have great confidence, Congressman, in the Colorado courts, both State and Federal, and in my opinion their integrity is such that the consideration of this project by this committee would have no effect upon the ultimate decision. I have confidence in our courts.

Mr. ASPINALL. I don't suppose that you mean to imply that the Congressman from the Fourth District does not have confidence?

Mr. BREITENSTEIN. I definitely do not, Congressman; no, sir. I am sure you have the same confidence I do.

Mr. MILLER. I believe that is all.

Mr. HARRISON. Mr. D'Ewart? We want to remind the committee we are still under the 10-minute rule.

Mr. D'EWART. I am a little disappointed in that part of your resolution that says a mediation committee has this day reported that it could come to no agreement. This committee is generally a little hesitant about building projects that would establish the prior use of the water within the State when the State itself does not agree as to where and how that water should be used. We indicated that when we were out there last summer.

Is there any hope that within the State of Colorado you can reach that determination within a reasonable length of time?

Mr. BREITENSTEIN. Congressman, I have been working on these Colorado River matters for 26 years. At the moment I have really no hope of any unanimous solution of the existing controversy in Colorado. The water conservation board is the only agency charged by Colorado law in the matter. It has acted on a split vote. Every effort has been made to bring about peace and harmony, and thus far the efforts have failed.

Mr. D'EWART You can recognize the hesitancy of this committee to step into a matter which is directly a States rights matter, to take water away from one neighborhood and give it to another without some indication from the State that that is their desire?

Mr. BREITENSTEIN. Congressman, I have given you the official State action on it. In doing that, I recognize that that action was a result of a split vote. But it is the official action. The only machinery which we have to resolve the controversy has acted.

Mr. D'EWART. I am a little disappointed.

Mr. BREITENSTEIN. I was, too.

Mr. D'EWART. I have one more point: You are recognized as an outstanding legal authority on reclamation law. The two principal projects before the committee are the Echo Park and Glen Canyon. Set up in the Bureau of Reclamation, they have very limited irrigation works. I mentioned this yesterday. None of the costs chargeable to irrigation as set up by the Bureau could be repaid by irrigation. In your view, does this committee have the right to establish and build or authorize construction of a hydroelectric project when there is neither flood control nor irrigation directly connected with it?

Mr. BREITENSTEIN. In my opinion, Congressman, this project directly affects irrigation. Without these enormous dams, the upper basin cannot use its allotted share of water. This is a condition precedent, a prerequisite, to the use by the upper basin of the water allocated to it. That water will be consumptively used for irrigation, for industrial purposes, domestic purposes, and so on. But we

have to have these in order to get full irrigation development. So I say that it is directly related to irrigation.

Mr. D'EWART. You know, under the court decisions, it is supposed to be incidental to irrigation and flood control, or to firm up otherwise existing projects. When there can be no direct charge, nothing returned because of irrigation costs, isn't that beyond incidental?

Mr. BREITENSTEIN. Well, on the participating projects, Congressman, there are returns from irrigation.

Mr. D'EWART. Yes. But we are asked to authorize Echo Park and Glen Canyon.

Mr. BREITENSTEIN. Yes, sir.

Mr. D'EWART. With no return from irrigation. The question here is whether we are going beyond the province of the Congress, in view of court decisions in the past, in authorizing these projects when they are not incidental to irrigation and not incidental to flood control. In other words, these things are incidental to the power construction.

Mr. BREITENSTEIN. These two large dams are incidental to the beneficial consumptive use in the upper basin of the water allotted to it. Without them we cannot have that beneficial consumptive use. To me, these large holdover reservoirs are an incident to the upper basin securing the ultimate development to which it is entitled under the Santa Fe compact. Without them we cannot have it. So I say they are an incident to our irrigation development. And I think they are within the law, Congressman.

Mr. D'EWART. Well, I have high regard for your opinion. However, if the power is incidental to irrigation, then should not the irrigation return some of the cost of the dam? That is, to follow your reasoning right through to the logical end.

Mr. BREITENSTEIN. That can be said, yes. And I again point out that on these participating projects, irrigation pays part of the cost.

Mr. D'EWART. Yes, but I am speaking of these two principal projects where they do not.

Mr. BREITENSTEIN. That is correct.

Mr. D'EWART. I am questioning in my mind why some of those costs should not be repaid by irrigation if we are going to argue on the floor of the House that the power is incidental to irrigation.

Mr. BREITENSTEIN. Well, I cannot answer that any further than I have.

Mr. D'EWART. I would like to see it explored by some of the others when they come around to it because it is going to embarrass us on the Floor. There is no question in my mind but we have to have a complete and logical answer to that or we are in trouble. We might just as well recognize it.

Mr. BREITENSTEIN. Of course, Congressman, I think it also helps out for the lower basin, too, in the use of the water down there. It is a further assurance that they will have a water supply for the development of the Imperial Valley and around Yuma.

Mr. D'EWART. Someone on the floor is going to stand up and say "Why don't they pay for it?"

Is that not true?

Mr. BREITENSTEIN. It may be.

Mr. HARRISON. Any further questions?

Mr. D'EWART. No.

Mr. HARRISON. Mr. Aspinall.

Mr. ASPINALL. Following that argument, is there any difference between what this bill attempts to do and what the Pick-Sloan bill accomplished in bringing the two of them together? One of them was entirely a flood-control program and the other was reclamation and when they united them they brought them both under the same legislation.

Mr. BREITENSTEIN. Yes, they did. It was comparable.

Mr. ASPINALL. For the benefit of the record, Mr. Breitenstein, would you state the divided vote that was had upon the Colorado Water Conservation Board resolution as of January 14, 1954?

Mr. BREITENSTEIN. Congressman, do you want it just by the outcome or do you want me to give the vote of the individual members of the Board?

Mr. ASPINALL. Just the total vote, and then if I want an explanation we will go further.

Mr. BREITENSTEIN. The vote as recorded was 10 to 3. I should say that 1 of the 10 voting in favor of the resolution was Mr. George Pughe, of Craig. He originally voted against it. After he had done that, he changed his vote, making the statement that he did so because he might wish to move for a reconsideration at some future date. The vote as recorded was 10 to 3.

Mr. ASPINALL. And where do the four, including Mr. Pughe, have their residence?

Mr. BREITENSTEIN. All in your district, Congressman. Ed Dutcher lives at Gunnison.

Mr. ASPINALL. You do not need to give the names. They all live west of the Continental Divide?

Mr. BREITENSTEIN. Yes, sir.

Mr. ASPINALL. And where do the eight reside that voted in favor of the resolution?

Mr. BREITENSTEIN. Well, George Bailey lives in Walden.

Mr. ASPINALL. Do not give the individual names.

Mr. BREITENSTEIN. They all live east of the divide.

Mr. ASPINALL. Mr. Breitenstein, in No. 6, paragraph No. 6 of the resolution just referred to, you state that the Echo Park unit is a desirable feature which has the full support of Colorado. You don't mean to imply that it has the unanimous support of all of the citizens of Colorado.

Mr. BREITENSTEIN. It has the full support of the Colorado Water Conservation Board. As far as I know, there was no one on the board, Congressman, who was opposed to the Echo Park Dam.

Mr. ASPINALL. But there are certain groups in Colorado who are opposing Echo Park?

Mr. BREITENSTEIN. Yes, sir; that is correct.

Mr. ASPINALL. You referred to the DeBeque Reservoir. Has any work ever been done upon this proposed project, Mr. Breitenstein?

Mr. BREITENSTEIN. I cannot tell you all the work that has been done on that, Congressman. I saw some pictures in the Denver Post the day before I left last week showing a crew in there drilling at the site.

Mr. ASPINALL. Do you know of anything that was done before the first of this year?

Mr. BREITENSTEIN. Yes. Before the first of this year. I saw maps prepared by some office of the Bureau of Reclamation on the site, and

since last summer I have heard the matter discussed at numerous water meetings in Colorado.

Mr. ASPINALL. Where did you get your figure of the possibility of storage of 2,200,000 acre-feet at the DeBeque Reservoir?

Mr. BREITENSTEIN. I talked to Mr. Crawford, the Director, and the consulting engineer for the Board, Mr. J. R. Riter, who is with the Bureau of Reclamation, and I think others. The figures that I got ran from about 2 million to about 2.5 million, and I thought it was fair enough to strike about an average.

Mr. ASPINALL. Do you not think it is rather farfetched, though, to talk about the work that has been done upon the Curecanti and the DeBeque in the same vein?

Mr. BREITENSTEIN. Much more work has been done on Curecanti than DeBeque.

Mr. ASPINALL. I would like the record to show that work has been done on Curecanti and very little on DeBeque.

Mr. BREITENSTEIN. Yes, that is correct.

Mr. ASPINALL. On page 6 of your statement, where you speak about possible authorization by the Secretary and the Congress, do I understand that you mean by the regular procedure of a bill in Congress when a matter comes up?

Mr. BREITENSTEIN. Frankly, I think you would have to do it that way. Now, it might be that it would be handled through an appropriation measure. I do not know. My thinking went beyond that, Congressman.

Mr. ASPINALL. On page 8 of your report, stating the resources of the oil-shale fields, you make the statement of an average of 15 gallons per ton of shale oil. That takes into consideration the low grade and the high grade, does it not?

Mr. BREITENSTEIN. Yes, that does. And, Congressman, if I may I would like to read into the record a statement referring to the high-grade deposits there. May I do that?

This is a quotation from the Leeds, Hill, and Jewett report to the Colorado Water Conservation Board, referring to the oil-shale deposit. This is a quote:

> The Bureau of Mines estimates that approximately 100 million barrels of shale oil could be produced from each square mile of the Mahogany Ledge—that is the high grade section—a section less than 100 feet thick which assays about 30 gallons of shale oil per ton of shale. There can be no doubt that the reserves are more than sufficient to support mining operations at the maximum conceivable rate for several hundreds of years.

Mr. ASPINALL. It is the plan of those who are interested to develop the veins carrying the high-grade shale first?

Mr. BREITENSTEIN. Yes. The Mahogany ledge is high grade.

Mr. ASPINALL. Mr. Breitenstein, may I say to you personally that I know you have had a very difficult job. I just want you to know that as the representative of western Colorado, I appreciate the work that you have done, and that you are trying to do, and I hope we will be able to get together so it may not be quite so difficult in the future.

Mr. BREITENSTEIN. Thank you very much.

Mr. HARRISON. Mr. Dawson?

Mr. DAWSON. I just had one question with regard to the matter that was brought up by my colleague from Montana. Before you were

here, one of the witnesses analyzed this report which was attached as an appendix by Mr. Larson. He observed that opposite the Echo Park and Glen Canyon projects was listed the two writeups which were chargeable to irrigation. In the righthand side the same amounts were charged 100 percent to power. As I understand your statement, these two dams are figured in as part of the whole upper Colorado project, and the participating projects which are listed below, and which the irrigation costs are chargeable, a certain percentage to irrigation and a certain percentage to power, all are lumped into one total. In other words, you could allocate some of the irrigation costs out of here, I assume, which would simply mean that the costs would be lower down below.

Mr. BREITENSTEIN. To me that is a matter of bookkeeping.

Mr. DAWSON. But in your opinion, the legal effect would be that it would be possible to set it up this way without running in violation of the existing reclamation law, is that correct?

Mr. BREITENSTEIN. That is my opinion on the matter, Congressman. And let me say, further, in my opinion the construction of these large dams, these holdover reservoirs, will make possible much greater irrigation and industrial development in the upper basin than is contemplated by the projects now before the committee. You will have other irrigation projects that have not been investigated yet. They will not be possible unless you first have this regulatory holdover storage. That is a prerequisite to the future irrigation development of our area.

Mr. DAWSON. That is all.

Mr. HARRISON. Mr. Young?

Mr. YOUNG. You say that Colorado is entitled to 4 million acre-feet by the terms of the compact?

Mr. BREITENSTEIN. Approximately that, yes.

Mr. YOUNG. It is impossible for the legislature in Colorado to dispose of the utilization of that water?

Mr. BREITENSTEIN. In my opinion, Congressman, the legislature cannot because of our constitutional provisions. We are an appropriation state. Under our constitution he who first diverts the water and applies it to a beneficial use has a priority over the next man. Because of that constitutional provision, I have serious doubts of the validity of any legislation which might try and resolve the east slope-west slope controversy.

Mr. YOUNG. The State did have authority to enter into an agreement to reserve 4 million, but after they received the 4 million they are powerless to dispose of it, is that right?

Mr. BREITENSTEIN. They are powerless without a constitutional amendment, in my opinion, to make any legally binding arrangement which will allocate water to one side of the mountains or the other.

Mr. YOUNG. Do you think the Federal Government has authority to go in and regulate the disposition of that?

Mr. BREITENSTEIN. No, sir; I don't.

Mr. YOUNG. Would the inclusion of those projects, then, have to await the outcome of the two suits, one in the State court and the other in the Federal court?

Mr. BREITENSTEIN. So far as the legal availability of water for the Denver project is concerned, that will have to await the outcome of that legislation, or settlement or some other arrangement of it.

Mr. YOUNG. Can you estimate how long that might take?

Mr. BREITENSTEIN. I can't, Congressman. I don't know.

Mr. YOUNG. You wouldn't advocate holding up the whole project until then?

Mr. BREITENSTEIN. No, sir. This is a conditional authorization only that would be sought for Denver. And in accordance with the statements that I read, Denver would have to come back to the Congress before it could get any money to spend on its project.

Mr. YOUNG. In your testimony you mentioned the fact that the lower basin should recognize the benefits of building this project and possibly share in the evaporation losses. In your opinion could the upper basin make any legal claim to compel them to share any evaporation losses or deduct so much from the 75 million acre-feet to be delivered every 10 years?

Mr. BREITENSTEIN. Congressman, I know of no legal basis for any such claim by the upper basin, because of the provisions of the old 1922 compact. I thought personally for a long, long time that the Glen Canyon Reservoir was such a great benefit to the lower basin that from a standpoint of equity the lower basin might well share some of those evaporation losses. But the upper basin agreed, the upper basin States agreed, to the 1922 compact, and it is my opinion that under that compact they have to stand the reservoir losses in the upper basin.

Mr. YOUNG. You mentioned the San Miguel project. Where is that located?

Mr. BREITENSTEIN. Southwestern Colorado. The San Miguel is a tributary of the Dolores River, which in turn is a tributary of the Colorado.

Mr. YOUNG. Is that shown on the map up here?

Mr. BREITENSTEIN. I don't see the San Miguel on that map. It shows the Dolores.

Mr. YOUNG. Could you briefly explain, or is it too complicated, the two suits which are pending in Colorado, one in the State court and one in the district court?

Mr. BREITENSTEIN. The State court suit is an adjudication of water rights from the Blue River. To get to the specific point which is involved, the query is whether or not the city and county of Denver or the Green Mountain project, has the earlier priority for the use of water. More specifically, it really refers to the direct flow power rights at Green Mountain. The Federal court suit involves that question of the construction of an agreement made between representatives of the east slope and the west slope prior to the authorization of the Colorado-Big Thompson project.

Mr. YOUNG. After these two suits are settled, will the water problems be solved as far as the distribution of the 4 million acre-feet?

Mr. BREITENSTEIN. Not all of them, Congressman.

Mr. YOUNG. In other words, you may have more disputes.

Mr. BREITENSTEIN. Yes.

Mr. YOUNG. It seems to me it would be a good idea to amend your constitution and take care of it once and for all.

Mr. BREITENSTEIN. I am afraid that would be a difficult job.

Mr. YOUNG. That is all the questions I have.

Mr. HARRISON. Mr. Hosmer?

Mr. HOSMER. Mr. Breitenstein, pursuing Mr. D'Ewart's line of questioning a little further, I believe you stated these power dams were directly connected with the irrigation in the upper basin area.

Would you tell us how, for instance, the Glen Canyon Dam would be directly or indirectly connected as a source of revenue to pay for these other things upstream?

Mr. BREITENSTEIN. Congressman, in the 1922 compact, the States of Wyoming, Utah, New Mexico, and Colorado obligated themselves not to deplete the flows of the river at Lee Ferry below 75 million acre-feet in each 10-year period. That is an obligation of those States to furnish water to the lower basin for the use of the lower basin. They have to do that. The engineers say that without substantial regulatory holdover storage, to even out the flows of this erratic and variable stream, the upper basin States can probably use not more than about 4-million acre-feet of water. Glen Canyon, Echo Park, the other holdover reservoirs, help irrigation and other uses of water in the upper basin by permitting the basin to use greater quantities of water than could be used if that storage were not afforded.

Mr. HOSMER. In other words, it is that indirect regulatory connection that you are speaking about?

Mr. BREITENSTEIN. It is the regulatory connection, but I say it is direct, Congressman, rather than indirect.

Mr. HOSMER. The direct purpose and immediate purpose of the dam is to supply water southward in accordance with the commitments?

Mr. BREITENSTEIN. Yes. It is to help the four States that I mentioned to use their share of water without violating the compact which they signed.

Mr. HOSMER. You stated just now and earlier in your testimony that this was a further assurance to the lower basin States that they will have water. They have not so far ever failed to get their total volume of water, have they?

Mr. BREITENSTEIN. No, sir. The flows down there have been in excess of the 75 million acre-feet every 10 years.

Mr. HOSMER. In other words, this is only an assurance in respect to your contemplated uses of it?

Mr. BREITENSTEIN. That is correct; yes.

Mr. HOSMER. Now, I notice in your testimony, Mr. Breitenstein, that you state your task here is to present the official position of the State of Colorado as determined by the board, and that you are attorney and counsel for the board.

Mr. BREITENSTEIN. That is correct.

Mr. HOSMER. I presume, then, that you speak as an official and agent of the State of Colorado?

Mr. BREITENSTEIN. That is my intent, sir.

Mr. HOSMER. And therefore, in so speaking, I would assume that your statement to the effect that there is no legal basis for any claim on the part of the upper basin States that any depletion be assessed against the lower basin States, amounts to an admission on the part of at least the State of Colorado that would carry weight in courts to that effect, is that correct?

Mr. BREITENSTEIN. I don't know about that, Congressman. There is no doubt in my mind from a legal standpoint, we have to stand the evaporation losses on Glen Canyon and Echo Park. Now, it seemed to me for a long, long period of time, that Glen Canyon is such a great benefit to the lower basin that, from the standpoint of equity the lower basin might well accept some of those reservoir losses.

Mr. HOSMER. Well, sir, let me state this: Insofar as there is any contention made on behalf of the backers of this legislation that there is one drop of depletion to be charged off against the lower basin States on account of the upper basin development, I shall be unalterably opposed to it.

That is all.

Mr. BREITENSTEIN. May I say, Congressman, I have said several times this afternoon that so far as my opinion goes, there is no legal basis for any demand, claim, desire, or whatever you wish to call it, of the upper basin to charge any of those to the lower basin. I put it on an entirely different basis than that.

Mr. HOSMER. There is a desire of the State that you represent, and in an official capacity here today, as indicated by point 5 of their resolution, a certified copy of which you made a part of the file, to such effect, and further alleging that it is made on the basis of substantial benefits to the lower basin.

Mr. BREITENSTEIN. I think it is.

Mr. HOSMER. All right. Now let's get into that. One of the most important things is the detention of silt and in the prolongation of the useful life of Lake Mead. Yesterday we had testimony to the effect, from the officials of the Bureau of Reclamation, that it would be 190 years before there would be any effect whatsoever on Lake Mead from sedimentation.

Mr. BREITENSTEIN. They are engineers, Congressman. I can't argue with them. I am just a lawyer.

Mr. HOSMER. Well, somebody put this word "substantial" benefits into the lower basin here, and in light of no detrimental effect for two centuries, it seems to me that that is not an accurate representation of the fact about the benefit to the lower basin. What is your opinion with respect to that?

Mr. BREITENSTEIN. I think it is a substantial benefit, Congressman, but I am a lawyer, and I must say that on these engineering matters you should talk to a technical man, trained in engineering.

Mr. HOSMER. Then your opinion as to substantial benefit is a layman's opinion insofar as that particular point is concerned?

Mr. BREITENSTEIN. That is right.

Mr. HOSMER. Thank you. That is all.

Mr. HARRISON. We thank you very much, Mr. Breitenstein, for your testimony today.

Mr. ASPINALL. Mr. Chairman, before you call the next witness, there was filed with the committee this morning a request from the secretary and general counsel of the Upper Colorado River Commission relative to certain amendments. He has now produced another letter for an amendment to those suggested amendments, and I ask that it be filed with the committee for our future use.

Mr. HARRISON. Without objection it will be received and filed.

(The document referred to is as follows:)

JANUARY 21, 1954.

Hon. WILLIAM H. HARRISON,
Chairman, Irrigation Subcommittee,
Committee on Interior and Insular Affairs,
House of Representatives, Washington, D. C.

MY DEAR MR. HARRISON: Reference is made to my letter of January 18, 1954, in which I called attention to a series of amendments of the bills (H. R. 4443, H. R. 4449, and H. R. 4463) upon which bills hearings are now in progress.

Our commission has directed me to recommend the following perfecting amendment in lieu of the fifth amendment suggested on page 2 of my letter of January 18:

Page 6, lines 13 to 16, delete entire clause beginning "Neither"—and ending with the semicolon at the end of line 16 and substitute:

"No right to impound or use water for the generation of power or energy, created or established by the building, operation, or use of any of the power-plants authorized by this act, shall be deemed to have priority over or otherwise operate to preclude or impair any use regardless of the date of origin of such use, of the waters of the Colorado River and its tributaries for domestic or agricultural purposes within any of the States of the upper Colorado River Basin;"

Sincerely yours,

JOHN GEOFFREY WILL,
Secretary and General Counsel.

Mr. HARRISON. The next witness will be Leonard Kuiper, from Colorado. I understand he has to leave and we are granting him this opportunity of appearing.

Mr. ASPINALL. Mr. Kuiper is city manager of the city of Delta, in an important district of Colorado, and he is a civil engineer of varied and valued experience, considerable experience.

Mr. HARRISON. We are certainly glad to have him before the committee.

STATEMENT OF L. R. KUIPER, CITY MANAGER, DELTA, COLO.

Mr. KUIPER. Mr. Chairman and members of the committee, I am L. R. Kuiper, city manager of Delta, Colo. I have worked as an engineering consultant and contractor in the Gunnison Basin since 1946.

The construction of a storage reservoir high up on the Gunnison River to regulate the flow of that river has become necessary in order to permit further development of the agricultural potential and even, in fact, to maintain at existing levels the present agricultural development of the area, if the Gunnison River is required to furnish its proper share of the water allocated to the lower basin by the 1922 compact.

For many years the waters of the Gunnison River and its tributaries below the proposed Curicanti Dam site have been closely administered by the water officials of the State of Colorado in order to insure the most efficient use of the waters of the Gunnison River and its tributaries in that area. Private development of water resources in this area has continued through the development of small reservoirs and stream diversions. For the most part this development has been by individuals and small groups of individuals.

The development has been limited to the small streams because of the limited means of the people making the developments. The extreme variations in the flow of the uncontrolled Gunnison River, in general, has made small scale development from the Gunnison River itself an impractical matter. The extreme variations in high and low flows make it infeasible for the small operator to install structures that would make full season irrigation possible and practical. As a result of this condition, most of the development that could be supplied from the Gunnison River proper is being supplied from the smaller tributaries where smaller diversion structures and reservoirs are possible.

If the river were regulated it would be feasible to use the waters from the main stream on land presently irrigated from tributary

RG 0037

STATE ENGINEER

UPPER COLORADO RIVER COMMISSION

General Correspondence

1945-54

BOX 1

DS 1718

UPPER COLORADO RIVER COMMISSION
Correspondence
Jan. 24 - March. 30, 1949

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Region 4
Post Office Box 360
Salt Lake City 8, Utah

RECEIVED
MAR 11 1949
STATE ENGINEER
Cheyenne, Wyo.

March 8, 1949

This report summarizes progress made on investigation in Wyoming during February 1949.

(1) Progress of Investigations

(a) New investigations proposed: None
(b) Revision of current program: None
(c) Progress of current investigations (detail listing follows):

Colorado River Storage Project, Colorado-New Mexico-Utah-Wyoming

A considerable portion of the appendix on Engineering, Designs and Estimates for the interim report was prepared. Work progressed on the preparation of the appendix on hydrologic studies for the interim report. Revisions were made to modified historical flow and ultimate flow computations, and tables were prepared for inclusion in the appendices. Reservour operation studies were continued. Combined power studies were continued and revisions were made to previous studies where necessary. A tabulation of financial analysis and physical data for other projects utilizing upper basin water was prepared for inclusion in the interim report. Revisions to the Regional Director's letter and Substantiating Report were made in accordance with reconsiderations made by the Chief, Hydrology Division, and the Regional Office. Considerable progress was also made toward completion of the appendices. The Fish and Wildlife Service report entitled "A Preliminary Report on Fish and Wildlife Resources in Relation to the Colorado River Storage Project, Colorado River and Tributaries above Lee Ferry, Arizona," has been received.

Flaming Gorge Unit, Utah-Wyoming

Modified historical water supply and ultimate water supply at this damsite were revised. Revisions to power studies made necessary by revisions to water supply were accomplished.

Echo Park Unit, Colorado-Utah

Maps, charts, and tables were prepared for inclusion in the Interim Report. Minor revisions to modified historical flow and to ultimate flow computations were made as a result of review of the preliminary draft of Interim Report by the Chief, Hydrology Division and by Regional Office personnel. Revisions in computed

water supply resulted in slight revisions in power operation studies. Such revised studies were partially completed. Changes in hydrologic studies and power studies noted above were incorporated into the substantiating report. Considerable progress was made in preparation of report appendices.

Cross Mountain Unit, Colorado

The White-Yampa Diversion topography maps were prepared. Revisions were made to modified historical flow computations and to estimated ultimate flow. Minor revisions to power studies were made due to changes in estimated water supply.

Glen Canyon Unit, Arizona-Utah

The estimated virgin runoff of the Colorado River at Lees Ferry was revised to conform with comments by the Chief, Hydrology Division. Corresponding revisions were also made to modified historical flow computations and to ultimate flows previously computed. Revisions to power studies made necessary by revisions to computed water supply were calculated. Payout schedules for the Glen Canyon Unit in conjunction with other upper basin power sites were computed.

Seedskadee Project, Wyoming

The Seedskadee Unit of the Sublette Project was formally changed to the Seedskadee Project. A detailed project report with supporting appendices was completed and submitted to the Regional Office where it is being reviewed.

Elkhorn Unit-Sublette Project, Wyoming

Preliminary estimates on the Pole Creek power canal were completed by the Area Office for use in comparing the desirability of this location with other potential alternate locations.

LaBarge Unit-Sublette Project, Wyoming

Field work in laying out drainage systems was scheduled for completion in February but this work was postponed because of unfavorable weather and will probably be finished sometime in April. Land classification base maps were inked. Preparation of a project map for inclusion in the project report was begun and a vicinity map of the LaBarge Reservoir and Damsite was prepared by the area office for submission with a request for preliminary designs and estimates to the Regional Office. Earth samples from potential borrow areas at the LaBarge Reservoir site were shipped to the Regional Laboratory for testing. Project operation studies to determine the extent of the water resources were initiated. Planimetering of land areas from field maps was previously completed and the land totals were summarized by quarter sections, sections, and townships. Land use studies were completed and studies of the anticipated economy after development of the LaBarge Unit were initiated and a tentative farm budget analysis was made.

Bonneville Basin Report, Idaho-Nevada-Utah-Wyoming

The final field draft of the Bonneville Basin Report was nearing completion. The Regional Director's letter was being checked in the Regional Office. Under present schedule, the report will be submitted to the Commissioner in March.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	**25**	**AI, AJ, AK**
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

83d Congress, 2d Session - - - - - House Document No. 364

COLORADO RIVER STORAGE PROJECT

LETTER

FROM

ASSISTANT SECRETARY OF THE INTERIOR

TRANSMITTING

A REPORT ON THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, PROVIDING FOR THE DEVELOPMENT AND UTILIZATION OF THE WATER AND RELATED RESOURCES OF THE UPPER COLORADO RIVER BASIN, PURSUANT TO THE FEDERAL RECLAMATION LAWS

APRIL 6, 1954.—Referred to the Committee on Interior and Insular Affairs and ordered to be printed, with illustrations

UNITED STATES
GOVERNMENT PRINTING OFFICE
45515 WASHINGTON : 1954

LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington 25, D. C., March 31, 1954.

Hon. JOSEPH W. MARTIN, Jr.,
Speaker of the House of Representatives,
Washington 25, D. C.

MY DEAR MR. SPEAKER: Herewith are my report and findings on the Colorado River storage project and participating projects, providing for the development and utilization of the water and related resources of the upper Colorado River Basin, submitted pursuant to the Federal reclamation laws. My report consists of the attached supplemental report dated October 1953, as approved and transmitted to the President on December 10, 1953, and as further elaborated and revised by letters of January 15, March 2, and March 19, 1954. There are also attached comments on the report submitted by the various affected States and Federal agencies and a letter, dated March 18, 1954, from the Director of the Bureau of the Budget.

The recommendations contained in my report to the President of December 10, 1953, are hereby amended to accommodate the views expressed in the letter of March 18, 1954, from the Director of the Bureau of the Budget.

In this connection your attention is invited to the attached press release of March 20, 1954, from the President confirming his official support for the resource development plans proposed for the upper Colorado River Basin and asking that the Congress give early consideration to enactment of legislation to authorize such development.

Sincerely yours,

FRED. G. AANDAHL,
Assistant Secretary of the Interior.

April 6, 1954, approved for printing.

K. M. LECOMPTE,
Chairman, Committee on House Administration.

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COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

[Press release of March 20, 1954]

THE WHITE HOUSE

STATEMENT BY THE PRESIDENT

I have today approved recommendations for the development of the upper Colorado River Basin.

The general plan upon which these recommendations are based has been prepared by the Secretary of the Interior. The Secretary's recommendations have been reviewed by the Bureau of the Budget. Legislation embodying the administration's recommendations is being prepared for introduction in the Congress.

This is a comprehensive, well-planned development of a river basin. The close Federal-State cooperation upon which the Secretary's plan is based also carries out this administration's approach to water-resource development.

The development will conserve water, enabling the region to increase supplies for municipal uses, industrial development, and irrigation. It will develop much-needed electric power.

The development calls for sound financing. The legislation now being drafted will set up a fund for the entire project so that it will be constructed and paid for as a basin program.

Construction of the Echo Park and Glen Canyon Dams, two of the large projects in the basin plan, is recommended. These dams are key units strategically located to provide the necessary storage of water to make the plan work at its maximum efficiency.

The legislation being drafted will authorize a number of projects which will put to use the waters of the upper Colorado. This authorization will become effective following further consideration by the Secretary of the Interior, with the assistance of the Secretary of Agriculture, of the relation of these projects to the wise use and sound development of the basin.

I am deferring my recommendation on the Shiprock unit of the Navaho project until the Secretary has completed his study.

I hope the Congress will give early consideration to enactment of the administration's legislative proposal. I firmly believe development of the upper Colorado River Basin, in accordance with its provisions, is in the national interest.

LETTER OF MARCH 18, 1954, FROM THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington 25, D. C., March 18, 1954.

The honorable the SECRETARY OF THE INTERIOR.

MY DEAR MR. SECRETARY: This is in response to your letters of December 10 to the President and to the Bureau of the Budget, submitting your supplemental report on the Colorado River storage project and participating projects. Further development of the upper Colorado River Basin in general accordance with the recommendations contained in your supplemental report has the support of the President. Legislation for that purpose which would authorize economically justified developments would be in accord with his program. With respect to the supplemental report, you are advised as follows:

1. The basinwide planning and close Federal-State cooperation which underlie your report carry out this administration's approach to water resource development.

2. Subject to the requirements of paragraphs 8 and 9 below, authorization of the Glen Canyon and Echo Park units of the storage project would be in accord with the program of the President. These units are strategically located to provide replacement storage to meet the upper basin's commitment to the lower basin and to permit increased consumptive use of water in the upper basin. In addition, both units will generate substantial amounts of hydroelectric power.

3. Authorization of recreational facilities to be constructed by the National Park Service within the Dinosaur National Monument would be in accord with the program of the President. Appropriations for this purpose should be so authorized that they can be made directly to the Park Service.

4. A requirement that conservancy districts be established to assist in irrigation repayments would be in accord with the program of the President and should be met before any participating project is undertaken.

5. Authorization to make the surplus power revenues of the storage projects available for repayment of construction costs of the Eden project and of the previously authorized portion of the Paonia project would be without objection.

6. Provisional authorization of the Shiprock unit of the Navaho project would not be in accord with the program of the President at this time. This advice is without prejudice to further consideration of the project when a report is completed indicating its economic justification, the views of the affected States and agencies, and the relation of the project to other potential uses of water of the San Juan River.

7. Subject to the requirements of paragraphs 8 and 9 below, a conditional authorization for construction of the other participating projects recommended in your report, including the Minnesota unit of the Paonia project, would be in accord with the program of the President. The authorization would become effective following a new finding of favorable economic justification by the Secretary of the Interior after individual project reports have been prepared which

include (*a*) a joint study with the Department of Agriculture of the direct agricultural benefits of each project; and (*b*) a reevaluation of the nondirect benefits of each project, based upon a reexamination of the methods presently used to compute the indirect and public benefits of reclamation projects.

The development of irrigation in the upper Colorado River Basin to use the increased supply of water made available as a result of the storage project is recognized as an integral part of the basin plan. Reclamation projects in the upper basin which are economically justified and which represent wise use of available resources in a manner consistent with State water laws and interstate compacts have the full support of the administration. Authorization of the participating projects proposed in your report should be contingent on reexamination so that there may be no doubt about the economic justification of the projects finally undertaken. Reexamination is particularly necessary in the case of those projects which show a favorable economic justification only if a useful economic life of 100 years is assumed and if the full estimate of indirect and public benefits—the so-called secondary benefits—used in your report is accepted. It is recognized that a basic purpose of the reclamation laws is to spur development of the West. Consequently, it follows that the justification of a reclamation project is not adequately measured by a simple comparison of project costs with the dollar value of the agricultural produce and other goods and services directly produced by the project. However, the procedures used to compute the secondary benefits of the participating projects proposed for authorization would appear to require a fundamental reexamination.

The standards and procedures for the economic appraisal of water resource projects are now under review in the Executive Office. It is expected that any final recommendations made by the Secretary of the Interior would take into account the conclusions reached as a result of this review.

8. Provision should be made in the authorizing legislation for financing the project through a separate revolving fund established in the Treasury which would (*a*) receive all appropriations for construction and operation and maintenance as advances from the general fund, (*b*) receive all revenues collected in connection with the operation of the project, (*c*) be available for the operation and maintenance of the project, subject to such limitations as may be imposed by the Congress in annual appropriation acts, (*d*) be available for construction in accordance with the appropriations made therefor, (*e*) provide funds for the payments referred to in paragraph 5 above, and (*f*) pay to the general fund of the Treasury annually, after completion of any feature or unit, a sum sufficient to return within 50 years, exclusive of authorized development periods, the full reimbursable costs of that unit or feature including interest on the commercial power and municipal water supply investment. It is expected that the interest-bearing and non-interest-bearing investments will be repaid concurrently to the extent practicable.

9. The cost allocations proposed in your report for the storage project and the participating projects should, prior to initiation of construction, be refined and adjusted to conform to the standards

and procedures established for use by all agencies at that time. In this connection, it is suggested that Assistant Secretary Aandahl's letter to this Bureau of March 2, 1954, dealing with future refinement of the cost allocation of the storage project be made a part of your report to the Congress.

10. Authorization for a development fund for use in conducting investigations in the basin would not be in accord with the President's program. Existing statutory authority is adequate for these purposes and the regular general investigations appropriation, rather than the revenues of any project, should be used to finance such investigations.

11. The revolving fund discussed in paragraph 8 above will eliminate the need for a separate continuing fund of $1 million recommended in your report. The revolving fund will provide the basis for financing operations, maintenance, and emergency work of the project.

12. The necessity for authorization for agencies of the Department other than the Bureau of Reclamation to participate in the project, as your report recommends, is not clear. It would appear that participation by such agencies could be accomplished under the existing authority of each agency, and that work to be performed by these agencies could be financed directly as a part of their regular programs. Participation by these agencies in the basin development should, of course, be coordinated by the Department.

We shall be glad to work with your representatives in the preparation of legislation for authorization of the upper Colorado Basin development which would accord with the conditions set forth above and which could be presented to the Congress as a substitute for S. 1555, H. R. 4443, H. R. 4449, and H. R. 4463.

It is requested that a copy of this letter accompany your modified report when it is submitted to the Congress.

Sincerely yours,

JOS. M. DODGE, *Director.*

Projects in the upper Colorado River Basin recommended for authorization by the administration

Project or unit	State	Irrigation		Power		Municipal water, acre-feet annually	Holdover storage capacity (acre-feet)	Cost of project
		New acres	Supplemental acres	Installed kilowatts	Annual generation (million kilowatt-hours)			
RECOMMENDED FOR AUTHORIZATION								
Glen Canyon storage and power unit	Arizona-Utah			800,000	4,100		26,000,000	$421,300,000
Echo Park storage and power unit	Colorado-Utah			200,000	1,094		6,460,000	176,400,000
Recreational development of Dinosaur National Monument	do							21,000,000
Subtotal								618,700,000
RECOMMENDED FOR CONDITIONAL AUTHORIZATION [1]								
Central Utah (initial phase)	Utah	28,540	131,840	61,000	373	48,800		231,044,000
Emery County	do	3,630	20,450					9,865,500
Florida	Colorado	6,300	12,650					6,941,500
Hammond	New Mexico	3,670						2,302,000
LaBarge	Wyoming	7,970						1,673,000
Lyman	do		40,600					10,564,000
Pine River Extension	Colorado-New Mexico	15,150						5,027,000
Seedskadee	Wyoming	60,720						23,272,000
Silt	Colorado	1,900	5,400					3,356,000
Smith Fork	do	2,270	8,150					3,367,000
Paonia [2]	do	2,210	14,830					6,944,000
Subtotal								304,356,000
Total recommended for authorization								923,056,000
DEFERRED								
Navaho project, Shiprock division	New Mexico	104,000						178,825,000

[1] In addition, the authorized Eden project, estimated to cost $7,287,000, will be included in the plan.
[2] Partially authorized.

LETTER OF MARCH 2, 1954, FROM ASSISTANT SECRETARY AANDAHL TO THE BUREAU OF THE BUDGET

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington 25, D. C., March 2, 1954.

MR. JOSEPH M. DODGE,
Director, Bureau of the Budget,
Washington 25, D. C.

MY DEAR MR. DODGE: Members of your staff have been reviewing the Colorado River storage project report and have suggested, in discussion with staff members of the Bureau of Reclamation, that the cost of the alternative single-purpose reservoirs for irrigation be discounted for purposes of cost allocation in order to reflect the fact that the irrigation storage probably will not be actually required for a number of years. This Department recognizes that the suggestion is a refinement of the broad assumptions which the Bureau found necessary to make. Any estimates of the time when the various units of storage will be required for irrigation will necessarily have to be quite arbitrary but inasmuch as an allowance for time is technically correct, the Bureau of Reclamation has made preliminary estimates of the probable effect of the suggested recalculation based on a deferred period of 25 years. Those estimates indicate that the allocation to power would be increased about $34 million and a corresponding decrease in the allocation to irrigation. The repayment period for the project would be extended from 44 years to 46 years without any increase in power rates, or the 44-year payout period could be retained by increasing power rates from 6 mills to about 6.25 mills.

It is our opinion that since the proposed project would be feasible even with the lesser allocation to irrigation and since the practical effect of following the technically correct suggestion of your staff would result in relatively little change in the project payout analysis, the report should not be revised for that minor correction. If the storage project is authorized, the suggestion made by your staff can be readily incorporated in definite plan reports prepared in advance of construction.

If your staff feels that additional information on this matter is necessary, the Bureau of Reclamation will be glad to supply such material.

Sincerely yours,

FRED G. AANDAHL,
Assistant Secretary of the Interior.

SECRETARY'S LETTER OF MARCH 19, 1954, TO THE PRESIDENT

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington 25, D. C., March 19, 1954.

(Through: The Bureau of the Budget.)

THE PRESIDENT,
The White House.

MY DEAR MR. PRESIDENT: By letter of January 19, 1954, we submitted to you as a supplement to our report of December 10, 1953, on the Colorado River storage project and participating projects, the

statements of the official position of the States of the upper division of the Colorado River Basin.

We indicated also that comments of the other States of the basin which are not so directly affected and of the Federal agencies which had not been received would be forwarded at a later date. The comments of the States of Arizona and California, the Departments of the Army and Commerce, and the Federal Power Commission have now been received and I am submitting them herewith as a further supplement to this Department's report of December 10, 1953.

The State of Arizona expresses itself as in favor of the storage project and looks forward to its early construction as another logical step in the utilization of Colorado River water. The State further expresses its belief that equalization of the yearly river flows at Lee Ferry will be of maximum benefit to both the upper and lower basins. It also points out that there is "no clear declaration that Arizona is included in the States having power priority although the Glen Canyon Dam and powerplant would be located entirely in Arizona" the northeastern part of which is in the upper basin. As stated in our supplemental report, the power-marketing studies in the project report should be regarded as examples only and not as evidence of any intention of excluding Arizona from the use of power from the project. The Congress is presently considering bills to authorize certain initial units of the project which include provisions relating to the disposal of power.

It is the State of California's view that there are many problems needing careful study and solution before authorizing or proceeding with the overall plan of development in the upper basin. It is the further view of California, however, that some additional development could proceed in the meantime if found justified for authorization by the Congress and that the early construction of the Glen Canyon unit would be justified and therefore merits authorization at this time. As has been mentioned above, the Congress is presently considering bills to authorize initial units of the storage project including certain initial participating projects desired by the States of the upper division.

The Congress will no doubt also consider the several problems with which the State of California is concerned, principal among which are: (*a*) effect of the construction and operation of the project on established rights of California and its agencies in and to Colorado River water and lower-basin developments, (*b*) questions of policy pertaining to the financial feasibility and economic justification of new reclamation developments, and (*c*) disposal of the greatly needed power output from the project, particularly from its Glen Canyon unit.

The letter from the Chief of Engineers, on behalf of the Secretary of the Army, advises that the supplemental report substantially meets one of the major objections given in his previous comments "in that interest on the power investment will be returned to the Treasury until the power investment has been liquidated." The Chief of Engineers also states that the Glen Canyon and Echo Park units of the storage project appear to be justified.

The Department of Commerce advises that it has no further comments on the supplemental report.

The Federal Power Commission reiterates its previously expressed opinion that the Echo Park and Glen Canyon units are of such importance as to warrant their consideration for inclusion in any early programs for the future development of the Colorado River Basin.

Attachment No. 1 to the October 1953 Supplemental Report on Colorado River Storage Project and Participating Projects, transmitted with our December 10 letter, is a financial operation study for examination of investment repayment from power revenues, dated October 9, 1953. Further studies by the Bureau of Reclamation of the proposed financial operations of the project disclosed certain errors involving duplication of power transmission losses. A copy of the financial operation study, revised as of December 24, 1953, correcting these errors and reflecting other improvements in its presentation, is submitted herewith as a substitute for the study previously submitted as attachment No. 1. The principal change in the study involves the length of the power repayment period which has been reduced from 56 years to 44 years.

Substitution of the revised financial operation study also requires a modification of paragraph 27 of the October 1953 supplemental report with respect to project repayment from power revenues. Copies of revised pages 9 and 10, covering paragraph 27, are also attached for substitution in the supplemental report transmitted to you with the December 10 letter.

Sincerely yours,

DOUGLAS MCKAY,
Secretary of the Interior.

LETTER OF JANUARY 16, 1954, FROM THE STATE OF ARIZONA

OFFICE OF THE GOVERNOR,
Phoenix, Ariz., January 16, 1954.

H. F. MCPHAIL,
Acting Commissioner, Bureau of Reclamation,
Department of Interior, Washington, D. C.

DEAR MR. MCPHAIL: This letter is in response to your request of December 15 that Arizona make such additional comments as it may wish on the supplemental form of the report of the Secretary of the Interior on the Colorado River storage project and participating projects, as approved December 10, 1953, by Secretary of the Interior, Douglas McKay.

We respectfully call your attention to the fact that our letter of comment of June 19, 1951, addressed to Mr. Wesley R. Nelson, Assistant Commissioner of the Bureau of Reclamation, includes the following paragraph:

> In view of the fact that Arizona is one of the upper Colorado River Basin States and that the Glen Canyon Dam site and powerplant are located within and constitute a natural resource of the State of Arizona together with consideration of the estimated cost of power generation at Glen Canyon and the possible power market needs of Arizona, it is recommended that the Secretary of the Interior be requested to include the State of Arizona in the project power market area as fringe area D (Arizona) and that energy be made available to that fringe area on the same basis as proposed for the other three fringe areas. In this connection, it would likewise seem equitable that fringe area C (New Mexico) be increased to include the western edge of that State and that the southwestern portion of Utah also be included in the project power market area.

The above quoted paragraph refers to the fact that while item 10 of the supplemental report implies that Arizona will not be excluded from obtaining power from the Glen Canyon project and item 9 says that an effort will be made on the part of the "States of the upper division" to retain a permanent power user's priority over users elsewhere, attention is respectfully called to these facts:

The northeastern corner of Arizona is in the upper basin but Arizona is not specifically one of the States of the upper division, and there therefore is no clear declaration that Arizona is included in the States having power priority although the Glen Canyon Dam and powerplant would be located entirely in Arizona. Furthermore, Arizona has not been included in previous power-market studies and there exists a stated policy of the upper division States to establish differential treatment for the several areas.

We are disappointed that the supplemental report does not recommend authorization of all of the facilities included in the original report. The failure to approve these additional facilities is a matter of grave concern to the upper basin, and we hope that when final action is taken all of these facilities will be approved.

Other than the foregoing, we have only this comment: We have heretofore expressed ourselves in favor of the storage project and look forward to its early construction as another logical step in the utilization of Colorado River water, and further believe that equalization of yearly river flows at Lee Ferry will be of maximum benefit to both the upper and lower basins.

Sincerely,

HOWARD PYLE, *Governor.*

LETTER OF FEBRUARY 15, 1954, FROM THE STATE OF CALIFORNIA

STATE OF CALIFORNIA,
DEPARTMENT OF PUBLIC WORKS,
Sacramento, Calif., February 15, 1954.

Hon. DOUGLAS MCKAY,
Secretary of the Interior, Department of the Interior,
Washington, D. C.

DEAR SIR: Your proposed supplemental report on the Colorado River storage project and participating projects, transmitted to the President on December 10, 1953, was received in this office on December 28, 1953, with letter of transmittal from the Acting Commissioner of Reclamation to Gov. Goodwin J. Knight, and forwarded to the division of water resources of this department for study and review.

On February 2, 1954, a request was sent to you for additional detailed sustantiating information in order to permit a thorough analysis and appraisal of the proposed developments.

Since it appears that the proposed developments are now under active consideration by the executive departments and the Congress, looking toward an early decision, it is understood that comments of all interested States are desired without delay. Accordingly, a report has been prepared by the division of water resources in collaboration with the Colorado River Board of California, setting forth the general views of the State of California; subject, however, to such modifications as are deemed necessary when and if detailed substantiating

information has been received and the proposals have been given further consideration. This report has been received and is transmitted herewith.

I concur in the comments submitted and request that they be considered as expressing the views of the State of California on your proposed report. It is further respectfully requested that the report, dated February 15, 1954, on this subject, be transmitted to the President of the United States and to the Congress along with the other material that may be so transmitted.

Very truly yours,

FRANK B. DURKEE,
Director of Public Works.

STATEMENT OF THE STATE OF CALIFORNIA ON PROPOSED SUPPLEMENTAL REPORT OF THE SECRETARY OF THE INTERIOR ON COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, DATED DECEMBER 10, 1953

INTRODUCTION

Reference is made to letter of December 15, 1953, by Acting Commissioner of Reclamation H. F. McPhail to Governor Goodwin J. Knight of California, transmitting copies of a supplemental report of the Secretary of the Interior, dated December 10, 1953, on the Colorado River storage project and participating projects, and inviting comments. The project was originally reported upon by the Bureau of Reclamation in Project Planning Report No. 4–8a.81–1 dated December 1950. That report is incorporated, with modifications, in the Secretary's supplemental report.

The 1950 report presented a plan of development of the upper Colorado River Basin comprising 10 major dams and reservoirs with hydroelectric plants on the Colorado River and principal tributaries above Lee Ferry, and an indefinite number of water using projects designated "participating projects." That report recommended approval of the overall plan and initial authorization and construction of 5 units of the storage project and 10 new participating projects, and inclusion as participating projects of 2 irrigation developments already authorized and under construction.

The supplemental report of December 1953 recommends approval of the overall plan, initial authorization and construction of the Glen Canyon and Echo Park units of the storage project, authorization for immediate construction of the same 10 new participating projects, inclusion of the same 2 previously authorized projects as participating projects and authorization of the Shiprock division of the Navaho project, including Navaho Dam and Reservoir, with actual construction of the Navaho project to be deferred until a report thereon has been approved by the Congress.

Cost estimates for the storage units and the participating projects in the Secretary's supplemental report are revised upward as compared to the estimates in the 1950 report. There also appears to be some revision in the assumptions as to power output and revenues and allocation of costs of the storage project, although no explanation is given.

A proposed repayment program is recommended, which would involve postponement of repayment of the irrigation costs beyond the

ability of the water users to repay until after the power investment in the storage units is repaid with interest. It is estimated in the financial operation study attached to the report that it would take 56 years to pay off the power investment with interest.

This proposal differs from the repayment program proposed in the 1950 report, under which it was planned to divert and use the interest charged on power investment to repay the portion of the irrigation costs beyond the ability of the water users to repay.

PREVIOUS VIEWS AND RECOMMENDATIONS

Under date of June 14, 1951, the State of California submitted to former Secretary of the Interior Oscar L. Chapman its views and recommendations on the original project planning report, dated December 1950. From those views and recommendations the following is quoted:

> Therefore, the State of California favors congressional authorization of the specific projects set forth in the proposed report of the Secretary of the Interior or as may be modified, and their construction with Federal funds consistent with national welfare if (*a*) such projects qualify under criteria, policies and procedures of the Congress; and (*b*) the diversion and utilization of the waters of the Colorado River system by and through these projects will not impair the rights of the State of California or any of its agencies to the waters of that system as defined and set forth in the Colorado River compact and related laws and documents.

It was further stated that the phrase "criteria, policies and procedures of the Congress" was intended to refer to "uniform criteria, policies and procedures to be established by the Congress."

COMMENTS ON SUPPLEMENTAL REPORT

California agencies have rights established by prior appropriation and by contract with the Secretary of the Interior under the authority of the Boulder Canyon Project Act, providing for the use in California of 5,362,000 acre-feet annually of water from the Colorado River system. It is the duty of the State to protect and preserve those rights of its citizens. California is, therefore, rightfully concerned in proposals for the further development of the water resources of the Colorado River Basin wherever such developments may be. For this reason it is necessary for the State to analyze thoroughly any proposals for further development and take whatever steps appear required to insure that such developments would not impair the rights of California and its agencies in and to the waters of the Colorado River system.

The Colorado River storage project and participating projects as proposed in the report under review would obviously have substantial effect upon the available water supply and the operation of facilities in the lower basin and California. Furthermore, the plan of financial operation of the project as proposed by the Department of the Interior departs materially from existing reclamation law and is not in accordance with sound standards and policies.

The comments herein are directed, first, to the effects of the proposed project on California's rights to Colorado River water and, secondly, to basic questions of criteria, policies, and procedures involved in the proposals. These have been prepared by the Division

of Water Resources in collaboration with the Colorado River Board of California.

Because of the lack of supporting detail in the supplemental report under review, the comments are necessarily based largely on the substantiating material presented in the original 1950 report and the accompanying special reports on individual participating projects.

Effects on California's rights to Colorado River water

The engineering studies presented in the original 1950 report and the related special reports on participating projects and the supplemental report of the Secretary of the Interior are vague and uncertain with respect to the effects of proposed upper basin developments on the water supply available to the lower basin, the rights of California thereto and the operation of facilities in the lower basin. The plans for construction and operation of the proposed developments, insofar as revealed in these reports, give no proper or adequate consideration to the interests of the lower basin States. Furthermore, the studies involve or imply what California considers to be erroneous interpretations of the Colorado River compact.

The erroneous interpretations of the compact include: (1) That article III (a) apportions to the upper basin a water use of 7,500,000 acre-feet a year in terms of depletion of the virgin flow at Lee Ferry instead of a beneficial consumptive use of 7,500,000 acre-feet a year at places of use; (2) that the upper basin would be entitled to the consumptive use of an average annual amount of 7,500,000 acre-feet instead of a maximum of 7,500,000 acre-feet in any 1 year. Because of these erroneous interpretations, the report is invalid as regards the showing of how soon and how much holdover storage will be needed and as regards the ultimate quantity and pattern of residual flow into the lower basin at Lee Ferry.

There are at least 10 serious questions of interpretation of the compact which would be involved in and affect the proposed storage project and related reclamation developments. (See statement of Northcutt Ely on behalf of Colorado River Board of California at hearings on H. R. 4449 before Subcommittee on Irrigation and Reclamation of Committee on Interior and Insular Affairs of House of Representatives, January 26, 1954.) All of these questions are at issue in the pending case of *Arizona* v. *California, et al.;* United States Supreme Court, October term, 1953, No. 10 original.

California's basic position is that this State is conforming to the Colorado River compact and must insist that the Bureau of Reclamation and the States of the upper basin do so in the planning and administration of the Colorado River storage project and participating projects.

As to annual variation in consumptive-use requirements, there appears to be no justification for the assumption in the report that under full development, with a regulated water supply and with practically all the irrigated land receiving a full supply each year, the water requirement and use would be highest in wet years and lowest in dry years. This assumption cannot be reconciled with the results of the latest scientific investigations of the subject, and therefore is a probable source of further error in the findings in the reports on the storage project and participating projects.

It is evident that the building, filling, and operation of the proposed main-stream reservoirs, with an ultimate total capacity of about 48

million acre-feet, would have substantial effect upon lower-basin facilities and operations. Even the filling of the 2 reservoirs, Glen Canyon and Echo Park, now proposed for initial authorization with combined capacity of 32 million acre-feet, would have a material effect and would present serious problems.

Who is to have the final decision and control as to the operation of these holdover reservoirs, including storage and release of water? Article III (e) of the Colorado River compact provides that the States of the upper division shall not withhold water and the States of the lower division shall not require the delivery of water which cannot reasonably be applied to domestic and agricultural use. Glen Canyon Reservoir and certain other proposed upper-basin main-stream reservoirs will be so located physically that no water stored therein can ever be applied to domestic or agricultural uses in the upper basin. All of the water stored in such reservoirs will be required for domestic and agricultural use in the lower basin and Mexico. Furthermore, consideration must be given to the Government's obligations to maintain the contracted firm power output at Hoover Dam.

No discussion of such problems, including the inevitable reduction in power output at lower-basin plants and its economic effect from a national standpoint, is presented in the reports. Insofar as the original basic report or the 1953 supplement indicate, there is no evidence that the effects on operation of lower basin storage and power facilities have been given due consideration in planning the schedules of constructing, filling, and operating the proposed upper basin storage and power facilities.

Of equal concern to the problems of quantity and fluctuation of flow into the lower basin at Lee Ferry is the problem of quality of water. This problem concerns water users throughout the basin, but especially those in the lower-basin States. Increased consumptive use of the waters of the Colorado River and its tributaries in the upper basin, particularly the relatively pure water of the headwater streams, will result in higher concentrations of mineral salts in the residual flow downstream.

The provisions in the Colorado River compact of water for the lower basin would be largely nullified if the supply were unsuited in quality for all beneficial purposes. Furthermore, article VIII of the compact provides:

> Present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact.

Certainly this means unimpaired in quality as well as quantity.

The reports are completely lacking of information that would provide answers to the questions concerning quality of water. It is California's position that before development proceeds on any additional large scale consumptive use projects in the upper basin, the entire problem of quality of water should be fully explored; that determination should be made as to the effects of increased upper basin uses up to full development, upon the quality of the flow at Lee Ferry; and that authorization of such additional projects, particularly transmountain diversion projects, in the upper basin should be deferred until satisfactory evidence is presented that such projects, in combination with existing projects and other projects contemplated under full development, would not have harmful effects on the quality of water remaining for use in the lower basin.

It is evident from the foregoing that there are a number of unknowns remaining to be determined as to water supply and use in the upper basin, and as to the amount of water that would be expected to be available to the lower basin passing Lee Ferry under conditions of ultimate development in the upper basin with full practicable utilization of the water supply apportioned to the upper basin under the Colorado River compact. This points up the need for a comprehensive system of gaging and sampling stations to measure both quantity and quality of water throughout the basin in order to determine the water supply available and the actual use of water. It is considered essential that more adequate measurements and records of water supply and use be obtained which will permit reliable studies to be made of the operation of existing and proposed developments in the upper basin and of the resulting available water supply, both as to quantity and quality, passing Lee Ferry for the lower basin.

Criteria, policies, and procedures

The laws governing Federal reclamation development are embodied in the original Reclamation Project Act of 1902 and the Reclamation Project Act of 1939, as amended. Therein are set forth the criteria, policies, and procedures of general application which may be collectively designated as existing reclamation law. For the purposes of this review only certain features of the law will be referred to.

Existing reclamation law provides that the reimbursable construction costs of irrigation reclamation projects shall be repaid within a period of 40 years, without interest, in 40 equal annual installments. In the case of a project for irrigation of new lands it permits a development period not to exceed 10 years, during which no repayment may be required.

Where a project includes facilities for municipal water supplies, the law provides that the reimbursable cost chargeable thereto shall be repaid in 40 years, with interest if deemed proper by the Secretary of the Interior.

Where a reclamation project includes hydroelectric power features, the law provides for reimbursable cost to be repaid with interest within a period of 40 to 50 years.

Present law permits nonreimbursable allocations of reclamation project costs for flood control, navigation, and fish and wildlife in the case of projects which include features to perform these purposes.

The repayment program recommended by the Secretary in the supplemental report constitutes a material departure from established criteria, policies, and procedures of general application in existing reclamation law.

It appears to be similar to that authorized by the Congress specifically for the Collbran project, Colorado (Public Law 445, 82d Cong., approved July 3, 1952). The special repayment provisions in that act are set forth as exceptions to existing reclamation law. It was stated at recent hearings before the House Interior and Insular Affairs Committee that at the time the committee passed upon the Collbran project bill, approval of the repayment formula therein was specifically for that project alone and was not to be considered as establishing a precedent for other reclamation projects.

The proposed repayment program, if adopted, would involve the postponement of the repayment of the costs allocated to irrigation

on the storage units and on a major portion of the irrigation costs of the participating projects, for a period of about 50 years. These irrigation costs for which repayment would be deferred would comprise, according to the report, a minimum of about $268 million, plus an unknown amount for the Navaho project.

Studies of the original reports on the participating projects indicate that about 85 percent of the irrigation costs would be repaid without interest by power revenues. Considering the time value of money, the postponement for about 50 years of repayment of a large part of the construction cost of the proposed development would obviously require a subsidy from the Federal Treasury that would have to be paid out of Federal taxes. The interest charges on the funds borrowed by the Federal Government to defray the irrigation costs of the project would never be repaid from project revenues and would have to be paid out of taxes even if the capital investments were eventually repaid.

It is recognized that the provision, under existing law, of interest-free money for irrigation-reclamation projects involves a substantial subsidy from the Federal Treasury which must be borne out of taxes, comprising the cost of interest on funds advanced, which in a period of 40 years would aggregate an amount almost equal to the original capital investment even though the principal be fully repaid in equal annual installments during the 40-year period.

It would appear that the Secretary's proposal in the report under review, for repayment would in effect extend the development period, during which no repayment would be made on a major portion of the investment, to about 50 years for both new land and old lands receiving a supplemental water supply. Such a postponement in repayment obviously would greatly multiply the amount of the Federal subsidy involved.

Owing to the lack of detailed information on the revised costs, no exact figure for the amount of the subsidy that would be involved in the proposed repayment program can be given. However, it could be readily calculated if detailed information on costs were available. In any case, the accumulated debt or total subsidy would amount to several times the original investment. Whether this would be in the national interest is for the Executive and the Congress to determine. However, it is believed that a report should be made as to the true cost of the Federal subsidy involved under the proposed repayment program, so that the Executive and the Congress will be fully informed before making a decision with respect thereto.

Under the proposed program and method of financing, it appears that justification of the initially proposed participating irrigation projects and future decisions to build additional participating irrigation projects would depend not so much upon the merits of the individual projects as upon the availability of revenues, 50 or more years in the future, from power projects generally unrelated thereto physically. None of the participating projects recommended for initial construction would be in themselves financially sound according to information in the basic storage project report and the reports of 1950 and 1951 on the individual participating projects.

On the average the water users would be able to pay only about 15 percent of the irrigation investment on the 12 participating projects. The balance of the cost would have to be subsidized—the capital in-

vestment by power revenue and the interest charges in even greater amount for an indefinite period by the Federal Treasury through taxes.

To the extent that high power rates could and would be maintained for the next 75 to 100 years or more to subsidize additional participating irrigation projects, authorization of the overall plan of upper basin development as proposed in the report, with such program and procedure would constitute an advance appropriation of funds for the construction of future projects of unknown engineering and financial feasibility.

The Colorado River storage project appears to be basically a hydroelectric power project. The only showing of economic justification in the report is based solely on power revenues. Considered in this light, the financial feasibility of the storage project appears open to question for several reasons. Repayment of the reimbursable construction costs within the periods and at the power rates proposed would depend entirely upon: (1) Allocation of a large portion of the construction cost to irrigation on an interest-free basis; (2) postponement of the starting of repayment of the irrigation allocation for about 50 years; and (3) subsidization of the more costly units with surplus power revenues earned by the less costly units.

No clear and adequate justification is shown in support of the allocation of a large part of the cost of the storage project to irrigation. Justification for the allocation to irrigation of several hundred million dollars (over $98 million for the initial two units) depends upon the future authorization of projects for consumptive use of water in the upper basin. Only minor use could be made of the regulatory reservoirs of the storage project directly for water consuming projects. Future irrigation projects as a rule would require individual storage facilities.

The one reason given for the proposed allocation to irrigation on the storage project is that the storage units would provide holdover capacity so that the upper basin can proceed with the development and use of water without violating the Colorado River compact. Information in the basic report shows that at the present and anticipated future rate of upper basin development, Glen Canyon alone would suffice for this purpose for 40 to 50 years hence. Furthermore, it appears that the additional consumptive use estimated for the participating reclamation projects proposed for initial authorization in the Secretary's report could be made even without Glen Canyon Reservoir.

However, the early construction of Glen Canyon Reservoir would be justified from other considerations and advantages. Based upon the cost analyses in the report, the Glen Canyon Reservoir and power development could be constructed and operated on a sound financial basis and therefore merits authorization at this time.

Analyses indicate that the cost of power from most of the other proposed units of the storage project, considered individually and on the basis of either the total cost or the power allocations alone, would be greater than the proposed selling price, and that, in fact, power revenues from the Glen Canyon unit would have to subsidize most, if not all, of the other storage units in addition to subsidizing participating irrigation projects. It appears questionable, therefore, whether certain of the storage units would be justified or needed, from

the standpoint of either the holdover storage requirements or the value of the power produced.

The original 1950 report indicates an intent to market the power output of the upper basin storage and power units in the upper basin States, with little regard to potential market and needs for electric power in the lower basin States. This question of power disposal is referred to in the supplemental report as a matter of policy to be determined.

There appears to be some question in the report as to the ability of the power market in the upper basin States to absorb all of the power output, even of the initial two storage and power units, for a number of years in the future. Glen Canyon power could be readily disposed of in the lower basin, where there is a great need for additional power. It is believed that the question of policy on disposal of power, particularly from Glen Canyon, merits the special consideration of the Executive and the Congress.

CONCLUDING COMMENTS

1. California agencies have established rights in and to the waters of the Colorado River system under the Colorado River compact and related documents. The State of California has the duty of protecting and preserving those rights. Obviously, construction and operation of the proposed Colorado River storage project and participating projects would have substantial effect upon the quantity and quality of the available water supply and the operation of facilities in the lower basin and in California. The State is concerned that such developments shall not impair the established rights of California and its agencies in and to Colorado River water.

2. There are at least 10 major questions of interpretation of the compact which would be involved in and affect the proposed storage project and related reclamation developments. With respect to several of these questions the report under review is based upon what California believes are erroneous interpretations of the compact. All of the questions are at issue in the pending case of *Arizona* v. *California et al.*, in the United States Supreme Court. California's basic position is that this State is conforming to the Colorado River compact and must insist that the Bureau of Reclamation and the States of the upper basin do so in the planning and administration of the Colorado River storage project and participating projects.

3. Revised analyses should be made and reported upon, based upon proper interpretation of the Colorado River compact, as to the need for holdover storage and as to the probable effects of its construction, filling and operation upon the quantity and pattern of flow into the lower basin at Lee Ferry and upon the operation of lower-basin facilities.

4. Before development proceeds on any additional large scale consumptive-use projects in the upper basin, a determination should be made as to the effects of increased upper basin uses up to full development, upon the quality of the flow at Lee Ferry; and authorization of such additional projects, particularly transmountain diversion projects, in the upper basin should be deferred until satisfactory evidence is presented that such projects, in combination with existing projects and other projects contemplated under full development, would not

have harmful effects on the quality of water remaining for use in the lower basin.

5. The plans for construction and operation of the upper basin storage project and related reclamation projects, insofar as revealed in the original 1950 report and the Secretary's supplemental report under review, give no proper or adequate consideration to the effect of the proposals on the lower-basin developments, and evidence little if any regard to the interests of the lower basin. Moreover, the engineering studies are vague and uncertain with respect to the effect of proposed upper-basin developments on the lower basin and additional studies are essential with respect thereto. The State of California desires full information as to what the effect of the proposed plan will be on existing and future developments below Lee Ferry and particularly on the quality and quantity of water available for use in California.

6. There are many problems that should and must be carefully studied and solved before authorizing or proceeding with any overall plan of development in the upper basin. In the meantime, some additional development could proceed if found justified for authorization by the Congress. However, it is the position of the State of California that the interests of the lower basin, and of California in particular, must be fully protected with proper safeguards in connection with any legislation for authorizing of additional development in the upper basin, to the end that the construction and operation of the proposed projects shall fully conform with the Colorado River compact and related laws and documents.

7. The plan of financial operation of the project recommended by the Secretary departs materially from existing reclamation law and is not in accord with sound standards and policies. The proposed postponement for about 50 years of the repayment of a large part of the cost would result in a substantial increase in the national debt, constituting a subsidy to irrigation on the part of the Nation's taxpayers far beyond the subsidy contemplated under existing law. The magnitude of such subsidy should be clearly stated and explained in the report.

8. None of the participating reclamation projects recommended for initial authorization would be in themselves financially feasible. The water users could repay only small proportions of the reimbursable construction costs. The balance of the cost would have to be subsidized—the capital investment by power revenue and the interest charges in even greater amount for an indefinite period by the Federal Treasury through taxes.

9. No clear and adequate justification is shown in support of the allocation of a large part of the storage project cost to irrigation on an interest-free basis. Only minor use could be made of the regulatory reservoirs of the storage project directly for water-consuming projects. The report indicates that the proposed allocation to irrigation on the storage project is based upon the need of holdover capacity to permit the upper basin to develop and use the water without violating the compact. However, it appears from the report that the additional consumptive use estimated for the reclamation projects proposed for initial authorization could be made without holdover storage; and that at the anticipated rate of development, Glen Canyon Reservoir alone would suffice for this purpose

for 40 to 50 years hence. Therefore, the justification for immediate construction of initial units of the storage project would be based upon other considerations and purposes to be served.

10. The early construction of Glen Canyon Reservoir would be justified from the standpoint of other immediate advantages. Based upon the cost analyses in the report, the Glen Canyon Reservoir and power development could be constructed and operated on a sound financial basis and therefore merits authorization at this time.

11. Glen Canyon power could be readily disposed of in the lower basin where there is a great need for additional power. The question of policy regarding its disposal merits the special consideration of the Executive and the Congress.

12. The cost of power for most of the proposed major storage and power units, other than Glen Canyon, would be greater than the proposed selling price for power, and interunit subsidies would be required principally from Glen Canyon power revenues to support the other units. It appears questionable, therefore, whether certain of the storage units would be justified or needed, from the standpoint of either the holdover storage requirements or the value of the power produced.

13. The proposal recommended by the Secretary for the Colorado River storage project and participating projects raises basic questions as to the proper criteria to determine the financial feasibility and economic justification of new reclamation developments, and particularly the criteria, policies, and procedures for repayment, and the amount of Federal subsidy that is justified. These basic questions are a matter of national policy which must and should be decided by the Executive and the Congress.

14. The State of California in analyzing its own projects and in reviewing proposed Federal reclamation projects in California has consistently stood for sound financial and economic standards upon which proposed developments should be evaluated and qualified for approval and authorization. It is the view of the State of California that all water-development projects, including the proposed projects under review herein, should qualify under sound criteria of feasibility and repayment, as a matter of national policy in the best public interest.

Submitted by:

A. D. EDMONSTON,
State Engineer.

Approval recommended:

RAYMOND MATTHEW,
Chief Engineer, Colorado River Board of California.

Approved:

FRED W. SIMPSON,
Chairman, Colorado River Board of California.

SACRAMENTO, CALIF., *February 15, 1954.*

LETTER OF FEBRUARY 4, 1954, FROM THE DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington 25, D. C., February 4, 1954.

Hon. WILBUR A. DEXHEIMER,
Commissioner of Reclamation,
Department of the Interior,
Washington, D. C.

DEAR MR. DEXHEIMER: Reference is made to the Acting Commissioner's letters of December 15, 1953, to the Secretary of the Army and to the Chief of Engineers, enclosing the revised report of the Secretary of the Interior on the Colorado River storage project and participating projects. The letter referred to Department of the Army comments on the original report which had been furnished the Department of the Interior by letter of July 3, 1951. The revised report was furnished for information and for any further comments deemed desirable.

The supplemental report accompanying the revised report states that the Colorado River account and the interest component of power revenues will not be used to provide financial assistance to the participating irrigation projects. This substantially meets one of the major objections given in our previous comments in that interest on the power investment will be returned to the Treasury until the power investment has been liquidated.

It is noted that only the 2 most favorable storage projects (Glen Canyon and Echo Park) are recommended for authorization instead of the 5 projects previously recommended. Although no detailed information is given on annual charges and annual benefits, it appears that the Glen Canyon and Echo Park storage projects are justified. It is understood that the Department of the Interior has made an economic reevaluation of the participating projects which is the basis of the statement in the supplemental report that each of the participating projects has favorable economic justification. As this Department has not had the opportunity of reviewing these revised computations, I am not in a position to comment in this regard.

The opportunity to review the report is appreciated.

Sincerely yours,

S. D. STURGIS, JR.,
Major General, Chief of Engineers.

LETTER OF JANUARY 21, 1954, FROM THE DEPARTMENT OF COMMERCE

DEPARTMENT OF COMMERCE,
OFFICE OF TECHNICAL SERVICES,
Washington, D. C., January 21, 1954.

Mr. H. F. MCPHAIL,
Acting Commissioner, Bureau of Reclamation,
Department of the Interior, Washington, D. C.

DEAR MR. MCPHAIL: Thank you for your letter of December 15, 1953, attaching two copies of supplemental report on Colorado River

storage project and participating projects, upper Colorado River Basin, October 1953.

We are glad to have the report for reference purposes and have no further comments.

Sincerely yours,

H. B. McCoy,
Deputy Administrator.

LETTER OF FEBRUARY 26, 1954, FROM THE FEDERAL POWER COMMISSION

FEDERAL POWER COMMISSION,
Washington, D. C., February 26, 1954.

Subject: Colorado River storage project and participating projects.

Hon. DOUGLAS McKAY,
Secretary of the Interior, Washington, D. C.

DEAR MR. SECRETARY: The comments herein relative to your revised report on the Colorado River storage project and participating projects are transmitted in response to Acting Commissioner McPhail's letter of December 15, 1953. The revised report consists of the supplemental report of the Commissioner of Reclamation on the Colorado River storage project and participating projects, dated October 1953, and related material. The Commissioner's report, approved and adopted by you on December 10, 1953, supersedes previous reports by your Department on this project.

The revised report presents a plan for the ultimate development of the water resources of the upper Colorado River Basin consisting of nine dam and reservoir projects, with power-generating facilities at each project and with associated transmission facilities, and a group of participating irrigation projects. Recommendation is made for the approval of this plan and for authorization at this time of only a partial or initial plan of development. The initial plan of development would consist of the Echo Park and Glen Canyon Dam and Reservoir projects, with power-generating facilities at each unit and with transmission facilities to interconnect them and other Federal plants and to market the power produced. The initial plan also includes 13 participating projects.

The combined total storage capacity of the Echo Park and Glen Canyon Reservoirs would be 32,460,000 acre-feet, of which 25,460,000 acre-feet would be active storage capacity. The installed generating capacity at Echo Park would be 200,000 kilowatts and at Glen Canyon 800,000 kilowatts, making a total of 1 million kilowatts. The average annual salable energy output during 50 years of full operation is estimated in the report to be 1,017 million kilowatt-hours for Echo Park and 3,813 million kilowatt-hours for Glen Canyon.

The capital costs of the initial plan of development are estimated in the report to be $1,134,643,000 based on January 1953 prices. Of this amount $597,700,000 would be chargeable to the Echo Park and Glen Canyon projects and $536,943,000 to the 13 participating projects. In regard to the total cost of the Echo Park and Glen Canyon projects, $499,400,000 would be allocated to power and $98,300,000 to irrigation and other water consuming uses. The ratio of annual power benefits to annual power costs is estimated in the report to be 1.64 to 1.0.

By letter dated May 21, 1951, the Commission furnished you with its views on your Department's previous reports on the Colorado storage project and participating projects. The letter expressed the opinion that the Echo Park and Glen Canyon projects are of such importance as to warrant their consideration for inclusion in any early programs for the future development of the Colorado River Basin. It pointed out that Echo Park, possibly with an installation somewhat higher than the 200,000 kilowatts recommended by your Department, was favorably located to assist in serving powerloads of the northerly part of the upper Colorado River Basin, and that the Glen Canyon project was favorably located for assisting in serving powerloads to the south.

The Commission staff has reviewed your revised report and advises that it is still of the opinion that northern Utah constitutes the logical market area for the power from the Echo Park project, and that the lower Colorado River Basin constitutes the logical market area for the power from the Glen Canyon project. Studies by the Commission staff indicate that the power from the Echo Park project could be utilized in northern Utah in about 5 years, and that the power from the Glen Canyon project could be utilized in the lower basin in about 10 years from the time that the first unit would become available. If it is assumed that the upper Colorado River Basin constitutes the market for the power from both projects, the staff studies indicate that it would require about 20 years to utilize the power from the projects.

In connection with the above, it is noted that the revised report recommends authorization of transmission facilities to interconnect the Glen Canyon and Echo Park projects. The staff advises that based upon its studies and having consideration for the situation outlined in the preceding paragraph, and having regard for other related factors, it sees no necessity for interconnection of these two projects as a part of the initial plan of development.

According to information received by our staff from your Salt Lake City office, transmission costs included in your Department's estimate for the Echo Park and Glen Canyon projects amount to $160,400,000, of which $133,600,000 were allocated to Glen Canyon. The staff estimates the capital cost of the transmission facilities needed to market the power from the Echo Park project in northern Utah to be $9,823,000, and to market the power from the Glen Canyon project in the lower basin to be $67,205,000. The total estimated capital cost of these transmission lines is $77,028,000, or $83,372,000 less than your Department's transmission estimate. A substantial part of this difference in estimate of cost is attributable to the elimination at this time of a transmission line connecting the two projects.

The staff's estimates of value of power are based on both Federal and private financing of alternative steam-electric plants, and on Federal financing of facilities required to transmit the output of the hydroelectric plants to load centers. The cost of steam-electric power was based on plants operating at an annual plant factor of 60 percent. It is understood that the at-market value of power of 7.3 mills per kilowatt-hour shown in your report was based on the cost of power from alternative steam-electric plants federally financed. The staff's corresponding estimate of the at-market value of Glen Canyon power is 4.7 mills per kilowatt-hour, and of Echo Park is 5.6 mills per kilowatt-hour.

For the purposes of benefit-cost analysis, the staff is of the opinion that the power benefits attributable to the Glen Canyon and Echo Park projects should be based on the cost of equivalent amounts of power from modern privately financed steam-electric plants and on Federal financing of the hydroelectric transmission facilities. On this basis the at-market value of Glen Canyon power is 6.9 mills per kilowatt-hour, and of Echo Park, 7.7 mills. Using these values the annual power benefits from the Glen Canyon and Echo Park projects are estimated to be about $26,300,000 and about $7,850,000 respectively.

The report of your Department does not contain information necessary for the staff to advise the Commission with respect to the proposed allocation of costs to irrigation and to power. Assuming the division of costs of the two projects to be as shown in your report, and using transmission costs as estimated by the Commission staff, the investment cost for power at Glen Canyon would be $304,605,000, and at Echo Park, $111,423,000. These figures compare with $371 million and $128,400,000, respectively, given in your report. Using the above staff estimates of power costs, amortizing the investments in 50 years with interest at 2.5 percent, and using operation, maintenance, and replacement charges as estimated by the staff, the total annual cost of the Glen Canyon power development, including transmission, would be $15,074,000, and of the Echo Park power development, $5,540,000.

On the basis of the above staff estimates of benefits and costs the benefit-cost ratio for the Glen Canyon power development is 1.74 and for the Echo Park power development, 1.42. If it be assumed that the alternate source of power supply would be wholly federally financed steam-electric power, a situation that is most unlikely, these benefit-cost ratios would be substantially reduced although these power developments would still appear to be economically justified.

The Commission in commenting upon your revised report has directed its attention to the power features of the Echo Park and Glen Canyon projects as recommended by you. It is observed that your Department has considered several alternatives for the Echo Park project because of its encroachment on the Dinosaur National Monument, but that in your opinion no adequate substitute for the Echo Park project has been found because of the increased evaporation which will take place from the greater surface areas of the alternative reservoirs. Sufficient data are not available to the Commission and its staff to permit them to weigh the relative merits of the Echo Park project and its alternatives in terms of their relation to the Dinosaur National Monument.

In addition to authorization of the Echo Park and Glen Canyon projects, your revised report recommends authorization of 13 participating reclamation and power projects. It is stated in your report that the benefit-cost ratios for these participating projects all exceed unity under present conditions, but substantiating data are not presented to permit the Commission staff to reach conclusions with respect to the power features of these projects.

The Commission appreciates the opportunity to review and to comment on your revised report.

Sincerely yours,

JEROME K. KUYKENDALL, *Chairman.*

LETTER OF MARCH 23, 1954, FROM THE DEPARTMENT OF AGRICULTURE

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., March 23, 1954.

The honorable the SECRETARY OF THE INTERIOR.

DEAR MR. SECRETARY: This is in reply to Acting Reclamation Commissioner H. F. McPhail's letter of December 15, 1953, transmitting and inviting comments on your supplemental report on the Colorado River storage project and participating projects, upper Colorado River Basin, October 1953.

This supplemental report modifies the original report dated December 1950, upon which this Department commented on May 28, 1951. As now proposed, the report seeks authorization for the Glen Canyon and Echo Park Dams and interconnecting electric transmission facilities as initial units of the Colorado River storage project and for 13 initial participating projects at a total cost of $1,134,643,000.

As the detailed plans for the works called for in the supplemental report are developed, close cooperation between the field offices of the Forest Service and of the Bureau of Reclamation should be maintained so that roads and other installations relating to the Colorado River storage projects can be developed in such a way as to make maximum contribution to the protection and utilization of national forest resources. Where services afforded by national forest facilities, improvements, or routes of access may be eliminated or impaired by reason of the installation of any features of this project, such facilities should be replaced by the Bureau of Reclamation to the extent feasible.

When definite project planning for the central Utah project gets underway, we offer the cooperation of the Forest Service to participate with the Bureau of Reclamation in working out ways and means of coordinating the development with the high Uinta primitive area on the Wasatch and Ashley National Forests.

The supplemental and regional director's reports raised the question of watershed management in relation to the life and operation of the project. The original project report points out that one-half billion dollars (including interest) will be expended for the purpose of providing storage space for sediment coming off the watersheds. Approximately one-half the total reservoir storage space to be provided is for the purpose of storing sediment during the first 200 years of the life of the project. In this connection, paragraph 16 of the supplemental report makes reference to an upper Colorado River development fund. The $1 million annually provided for would be used

> for studies and investigations relating to the development, conservation and utilization of the waters of the upper Colorado River Basin. * * *

Inasmuch as problems of development, conservation and utilization of waters involve agricultural uses of land and irrigation techniques, some provision might well be made for allocating an appropriate portion of this fund for studies and investigations in these fields.

Paragraph 22 of the supplemental report states:

> As the increased use of the Green River water increases its salinity, the Echo Park Reservoir will permit mixing it with relatively pure waters of the Yampa.

This recognition of the problem of increasing salinity gives rise to the recommendation that this problem be given further serious study.

The supplemental report indicates an incremental analysis of the power production of the nine units of the storage project. This is in accordance with a generally accepted principle. We note the statement that the benefit-cost ratios of the initial participating projects all exceed unity as computed in accordance with present Bureau of Reclamation practice. This practice includes the use of secondary benefits. This Department's position on the use of secondary benefits has been made clear in comments on other reports.

We appreciate the opportunity to review this report dealing with water storage in this area of critical water supply.

Sincerely yours,

E. T. BENSON, *Secretary.*

LETTER OF APRIL 5, 1954, FROM THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
PUBLIC HEALTH SERVICE,
Washington 25, D. C., April 5, 1954.

Hon. DOUGLAS MCKAY,
Secretary of the Interior,
Department of the Interior, Washington 25, D. C.

DEAR MR. SECRETARY: Pursuant to the policies and procedures established by the Federal Interagency River Basin Committee, we have reviewed the Department of the Interior's Supplemental Report on the Colorado River Storage Project and Participating Projects, Upper Colorado River Basin, Ariz., Colo., N. Mex., Utah, and Wyo.

Our letter of March 27, 1951, contained the comments of this Department on the proposed project. These comments are still considered to be pertinent. We have no further comments to offer.

The opportunity to review this supplemental report is appreciated.

Sincerely yours,

M. D. HOLLIS,
Chief Sanitary Engineering Officer, PHS,
HEW Member, Federal Interagency
River Basin Committee.

SECRETARY'S LETTER OF JANUARY 15, 1954, TO THE PRESIDENT

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1954.

(Through: The Bureau of the Budget.)

The PRESIDENT,
The White House.

MY DEAR MR. PRESIDENT: The States of the upper division of the Colorado River Basin have now advised me of their present official positions in regard to development of the upper Colorado River Basin. I am submitting herewith as a supplement to my report of December 10, 1953, their statements and my comments thereon.

The State of Colorado, in connection with the physical plan of development, agrees with the plan contained in the report, but asks that further study be given to the La Plata and San Miguel participating projects. Colorado also asks, as conditions precedent to Colorado approval of the report, that provision be made therein, or in the authorizing legislation, for the following:

(*a*) Inclusion of the Cross Mountain unit within the initial authorization;

(*b*) Inclusion in the initial authorization of approximately 3 million acre-feet of total new storage on the Colorado River and its tributaries above Grand Junction, Colo., a substantial portion thereof to be located on the upper reaches of the Gunnison River.

Colorado also gives its approval to the city of Denver's Blue River transmountain diversion as a participating project subject to the establishment, by litigation or otherwise, of the legal availability of water for such diversion and to a showing of its feasibility in other necessary respects.

The Bureau of Reclamation already has the La Plata and San Miguel projects under investigation and we recognize the urgent need to develop the water supplies of the area. That the Cross Mountain unit is a feasible development is shown by the supplemental report. Although we did not recommend its authorization in the supplemental report, we would have no objection to its authorization as a part of the storage plan in addition to the Echo Park and Glen Canyon units without which Cross Mountain would supply only a limited amount of firm power.

There are several reservoir sites available which might meet condition (*b*) above and there would appear to be opportunity to secure the storage capacity desired by Colorado. Detailed study may well show the listed sites, or others, as feasible. We would have no objection to a conditional authorization of any or all of these reservoirs and would undertake the investigations necessary to determine feasibility as rapidly as the fund situation would permit. It would be our intention, of course, to recommend construction of those units if they are found feasible.

Denver's Blue River transmountain diversion proposal, insofar as we are aware, is basically a matter of seeking Federal financing of a plan to be carried forward by the city. Litigation affecting the use of Blue River water is now pending. The feasibility of such a diversion depends, among other things, on the outcome of this litigation or on some alternative thereto which satisfactorily protects the Colorado-Big Thompson project. When a firm and detailed proposal is received, we will be glad to review it and if satisfactory from all aspects make suitable recommendations. It may well be that arrangements would result such that the proposal could be recommended as a participating project.

The State of New Mexico supports our recommendation for including Navaho Dam and Reservoir as the first unit of the Shiprock Division to be constructed but feels that the San Juan-Chama project must be authorized concurrently in order that coordinated authorization and operation can be assured. The bills which have been introduced in the Congress to authorize the Colorado River storage project and participating projects include authorization of the San Juan-Chama project on the same basis as the Shiprock-South San

Juan or Navaho project. The Department of the Interior is willing to support conditional authorization of the San Juan-Chama project on this basis, in order that coordination of the two projects can be assured. The Bureau of Reclamation and the Bureau of Indian Affairs of this Department, acting under instructions from this office, are already working jointly toward the completion of coordinated reports on these projects.

The State of New Mexico also hopes that the La Plata unit of the Animas-La Plata project can be included for early consideration among the participating projects of the Colorado River storage project. Investigations by the Bureau of Reclamation of this unit will continue toward the end of finding a project which can be recommended.

The State of Utah endorses the supplemental report and asks that the Gooseberry project be included as one of the participating projects to be constructed in the initial phase. The Bureau of Reclamation has completed a report on the Gooseberry project which is now under consideration in this Department and will be transmitted to the States for their views and recommendations shortly. A copy of the report on the project is being made available to the Bureau of the Budget for study.

The State of Wyoming makes no objection to the supplemental report. Wyoming concurs with the inclusion of the several participating projects in Wyoming selected for initial construction and suggests that the advance planning studies for the Seedskadee project should include further study of the possibility of project storage at the Kendall site to increase the project acreage and of the possibility of including a high-diversion dam at the Fontenelle site in lieu of the low-diversion dam, diversion canal, and Green River siphon. As pointed out in the supplemental report, the Department anticipates modification of individual projects or units at the time appropriations are sought, if such appears to be necessary in the light of any additional information and economic studies that have been completed. We will be glad to accommodate the suggestions of the State of Wyoming in carrying out the detailed planning for the Seedskadee project.

Copies of the comments of the aforementioned States of the upper division are enclosed. Comments of the other States of the basin which are not so directly affected and of the Federal agencies have not yet been received but they will be forwarded as soon as they are received.

Sincerely yours,

RALPH A. TUDOR,
Acting Secretary of the Interior.

LETTERS OF JANUARY 4 AND 15, 1954, FROM THE STATE OF COLORADO

COLORADO WATER CONSERVATION BOARD,
Denver, Colo., January 4, 1954.

Hon. WILBUR A. DEXHEIMER,
Commissioner of Reclamation, Department of Interior,
Washington, D. C.

MY DEAR MR. DEXHEIMER: I am enclosing with this note an extract from the minutes of the Colorado Water Conservation Board

meeting held December 11, 1953. You will note these minutes refer to the Curecanti Reservoir and this, of course, is the small one—940,000 acre-feet, the De Beque Reservoir, and Denver's proposed Blue River transmountain diversion.

Sincerely yours,

IVAN C. CRAWFORD,
Director.

EXTRACT FROM MINUTES OF COLORADO WATER CONSERVATION BOARD MEETING HELD DECEMBER 11, 1953

Mr. ROBERTS. I want to move the adoption by this board of the findings and recommendations of the Colorado Conference Committee meeting of December 10 in the form in which they have been presented here as the policy of this board and the basis of the instructions of the State of Colorado to its representative on the Upper Colorado River Commission.

FINDINGS AND RECOMMENDATIONS OF COLORADO CONFERENCE COMMITTEE, DECEMBER 10, 1953

1. Mr. Petry moved that the Colorado Conference Committee make findings and recommendations to the Colorado Water Conservation Board for the use of that board at its meeting December 11, 1953, as follows:

2. We find the Hill report correct in its finding that regulatory storage to take care of the Lee Ferry requirements is necessary for full development of Colorado's share of Colorado River water.

3. We desire that a substantial portion of that storage be established in Colorado.

4. That Colorado should insist on provision for substantial storage in Colorado as a condition of its approval of the Colorado River storage project bill.

5. As a further condition for its approval of the storage bill that Colorado should insist on explicit language to insure that downstream storage built preceding Colorado development could not have any priority to interfere with upstream domestic, agricultural, or industrial development.

6. That Colorado should insist, as a further condition of approval of the storage bill, that explicit and binding language be included therein which would clearly make available the net revenue of first-phase construction at an early period after completion of first-phase projects for the benefit of participating projects.

7. That Colorado favor the inclusion of the De Beque Reservoir as a first-phase project subject only to submission of a feasibility report by the Bureau of Reclamation.

8. That Colorado favor the construction of Curecanti Reservoir as a first-phase project with such modification as might be necessary to assure its feasibility.

9. That the water-conservation board approve the Hill report as to availability of water supply.

10. That this committee approves constructing Denver's Blue River transmountain diversion within the limitations of total supply contained in the Hill report, by Federal financing, whether such financing is provided in the current storage project bill or by some other means to be selected by the proponent of the project and that Denver participate in regulation to meet demands at Lee Ferry or other Colorado River commitments to the full extent required to meet Denver's share of Lee Ferry or Colorado obligations as ultimately determined with reference to all adjudicated rights affected.

11. We recommend to the water board that it be understood that the water board will make investigations of further plans for water use in Colorado when conditions change or additional data becomes available.

(The motion was seconded by Mr. Christy. After discussion, was put to a vote and passed. Aye votes were Bailey, Christy, and Petry; Noes, Delaney and Cory.)

Mr. DILLE. I have a great deal of sympathy for the feelings of the people on the Western Slope and I still think something can be worked out along the line that has been developed by Mr. Roberts. We must take some action. Therefore, I want to second the motion of Mr. Roberts.

* * * * * * *

Mr. PUGHE. I think we ought to vote on it section by section. I move to amend Mr. Robert's motion so as to vote on it section by section.

* * * * * * *

Mr. BAILEY. All in favor of the amendment to the motion signify so by raising their right hand. Amendment lost. All in favor of the motion signify so by raising their right hand. Eight in favor; four opposed. Motion carried.

* * * * * * *

I certify that the above is a true copy of a portion of the minutes of a meeting held by the Colorado Water Conservation Board, December 11, 1953.

IVAN C. CRAWFORD, *Director.*

COLORADO WATER CONSERVATION BOARD,
Denver, Colo., January 15, 1954.

Hon. WILBUR A. DEXHEIMER,
Commissioner of Reclamation,
Department of Interior,
Washington 25, D. C.

DEAR MR. DEXHEIMER: I am attaching to this letter a resolution adopted by the Colorado Water Conservation Board at a meeting held in Denver on Jnauary 14, 1954, in which is embodied the official position of the State of Colorado with respect to the upper Colorado River Basin storage project.

Sincerely,

IVAN C. CRAWFORD,
Director, Colorado Water Conservation Board.

RESOLUTION ADOPTED BY THE COLORADO WATER CONSERVATION BOARD JANUARY 14, 1954

Whereas the Colorado Water Conservation Board has given consideration to the report of the Secretary of the Interior, dated December 22, 1950, on the Colorado River storage project and participating projects, and to the supplemental report, dated December 10, 1953, of the Secretary of the Interior on the same subject; and

Whereas the board in an endeavor to ascertain the attitude of all interested areas and citizens of the State of Colorado in regard to the position which Colorado should take on such reports did at its February 17, 1953, meeting create the Colorado Conference Committee to study the use of Colorado River water in Colorado and particularly the proposed transmountain diversion by Denver from the Blue River; and

Whereas the general assembly made available to the board an appropriation of $100,000 to finance such study and with the funds so made available the engineering firm of Leeds, Hill & Jewett was employed to make a study of the depletion of surface water supplies west of the Continental Divide and did also arrange for a report from the University of Colorado on the economic potential of western Colorado; and

Whereas such reports have been made and the conference committee has reported to the board; and

Whereas in a further effort to reconcile conflicting views as to the use of Colorado River water without the natural basin in Colorado the board did on December 30, 1953, appoint a mediation committee which has this day reported that it could come to no agreement: now, therefore, be it

Resolved by the Colorado Water Conservation Board, the official State agency which is charged by law with the duty and responsibility of promoting the conservation of the waters of the State of Colorado in order to secure the greatest utilization of such waters and the utmost prevention of floods, That

1. It is the position of the State of Colorado that all waters of the Colorado River system available for use in the State of Colorado under the various instruments constituting the law of the river shall be put to beneficial consumptive use in Colorado as expeditiously as orderly economic development will permit.

2. Because of Lee Ferry delivery obligations imposed by the Colorado River compact of 1922, substantial quantities of regulatory holdover storage must be provided in the upper basin if that basin is to be able to put to beneficial consumptive use its allotted share of Colorado River water.

3. The Colorado River storage project will provide such necessary storage and is essential to the full economic development of the water resources of the upper basin.

4. The plan of the Colorado River storage project to finance the construction of the necessary holdover reservoirs through the revenues derived from the sale of power generated at hydroelectric plants and to utilize a portion of such revenues to assist in the financing of so-called participating projects which meet certain fixed criteria is approved.

5. In connection with the Glen Canyon Reservoir, Colorado directs attention to the fact that this reservoir, which is located but a short distance above Lee Ferry, will yield substantial benefits to the lower basin, one of the most important of which is the detention of silt and the resulting prolongation in the useful life of Lake Mead. The official representatives of Colorado should strive to obtain some recognition by the lower basin of these benefits and, if possible, a sharing by the lower basin of such matters as reservoir losses.

6. The Echo Park unit is a desirable feature which has the full support of Colorado.

7. Authorizing legislation should contain appropriate provisions for the recapture for use within the upper basin of power generated by the Colorado River storage project when and if any of such power is sold or transmitted for use within the lower basin.

8. Specific provision should be made in authorizing legislation to assure that no rights vest in the use of water for power generation in units of the project which will prevent or handicap the beneficial consumptive use upstream of the waters of the Colorado River system to which any upper-basin State is entitled.

9. Colorado has no objections to the report of the Secretary of the Interior on participating projects except that Colorado urges that further study be given to the La Plata and San Miguel projects, which are urgently needed, in order to develop, if possible, a feasible plan therefor and except as hereinafter noted.

10. The report and the supplemental report of the Secretary of the Interior practically ignores any development of Colorado River system water in Colorado. For this reason, Colorado cannot accept the report and supplemental report as now submitted. As conditions precedent to Colorado approval of the report, provisions must be made therein, or in the authorizing legislation, which will assure the following water development in Colorado:

(*a*) The Cross Mountain unit must be included within the initial authorization for construction as a part of the first phase of the project.

(*b*) There is no doubt that further consumptive use of water in Colorado is directly dependent upon high upstream storage. To provide therefor there must be included in the initial authorization approximately 3 million acre-feet of total new storage on the Colorado River and its tributaries above Grand Junction, Colo., a substantial portion of which shall be located on the upper reaches of the Gunnison River. The known reservoir sites which might accomplish this objective are Curecanti on the Gunnison and DeBeque on the Colorado River. Additional investigations may disclose other sites. There is little doubt but that the stated amount of storage will be needed. The Secretary of the Interior is urged to expedite the investigation and study of projects which will furnish the requested storage.

11. Denver, the capitol city of Colorado, desires to divert water from the Blue River, a tributary of the Colorado River, for use for municipal and industrial purposes in the metropolitan Denver area. The rights of Denver to take and divert such water are alleged to be in conflict with rights for the use of water stored in Green Mountain Reservoir and taken through the Green Mountain powerplant for the generation of power. Green Mountain Dam, Reservoir, and powerplant constitute a unit of the Colorado-Big Thompson project of the United States Bureau of Reclamation. The controversy over the relative rights of Denver and the Green Mountain project are in litigation in a lawsuit now pending in the Supreme Court of the State of Colorado and in another lawsuit now pending in the United States District Court for the District of Colorado. It would be improper for this board to attempt to invade the process of the courts or to influence the pending litigation. The board has no intention of doing either. The feasibility of the proposed Denver-Blue River diversion depends, among other things, on the outcome of this litigation, or on some alternative thereto which satisfactorily protects the Colorado-Big Thompson project. Upon the condition that the legal availability of a reasonable quantity of water for the Denver-Blue River diversion be established, either by litigation or some other arrangement, and the condition that such project be otherwise feasible, the board

approves the Denver-Blue River project for inclusion as a participating project in the authorization of the Colorado River storage project or for such other Federal legislative or administrative action as may be requested by Denver.

12. The board recommends that Denver and the representatives of the west slope in Colorado make every effort to arrive at a harmonious solution of the unfortunate transmountain diversion controversy which for years has created dissension in Colorado. The board pledges that it and its staff will be ready to assist in the amicable settlement of this prolonged conflict.

13. The director of the board and the Colorado member of the Upper Colorado River Commission are directed to do all things necessary and proper to effectuate this resolution.

14. Copies of this resolution shall be forthwith transmitted to the Governor of Colorado and to the members of the Colorado congressional delegation.

It was moved by Mr. Dille that the above resolution be adopted. The motion was seconded by Mr. Roberts and carried, the vote being 10 ayes and 3 noes.

I certify that the above is a true copy of a portion of the Colorado Water Conservation Board's minutes of the meeting of the board held January 14, 1954.

IVAN C. CRAWFORD, *Director.*

LETTER OF DECEMBER 28, 1953, FROM THE STATE OF NEW MEXICO

STATE OF NEW MEXICO,
EXECUTIVE OFFICE,
Santa Fe, N. Mex., December 28, 1953.

The Honorable DOUGLAS MCKAY,
Secretary of the Interior,
Washington, D. C.

DEAR GOVERNOR MCKAY: Your supplemental report on the Colorado River storage project and participating projects, Upper Colorado River Basin, was released to the Upper Colorado River Commission by Commissioner Dexheimer on December 12, 1953. This supplemental report was discussed by our San Juan policy committee in my office on December 18. This letter constitutes New Mexico's comments on the supplemental report.

We wish to commend you and the Department for your efforts to incorporate the views of the State in your report and recommendations.

It is now the view of New Mexico that it can support your recommendation as set out in paragraph 14 of the supplemental report. There it is stated that the Navaho Dam and Reservoir should be eliminated as a unit of the storage project and that it should become a part of the Shiprock irrigation project, and that it should be the first unit of the Shiprock project to be constructed. Also, that the South Juan and Shiprock developments should be incorporated as one project to be called the Navaho project consisting of two divisions. New Mexico will seek and support the proper amendments to the authorization bill to carry out this change.

Comments and recommendations included in the supplemental report in paragraphs 12, 13, 24, and 29 (d) do not adequately reflect the views and recommendations of the State of New Mexico. Those views and recommendations were set out in a letter of June 12, 1951, by the State engineer of New Mexico.

Another official statement which should be recognized, although it is not specifically directed to the Colorado storage project, is my letter of March 4, 1953, requesting feasibility reports on projects in New Mexico utilizing San Juan River water. Accompanying that letter was a short review of the San Juan River problem in New Mexico.

The record is adequately clear that a Shiprock project or a Navaho project, as now envisioned, cannot be considered independent of the San Juan-Chama-transmountain diversion project. It is clear that the operation of either of the projects must be concurrent with the other on a predetermined operational plan. Also, it is apparent that not only the acreage for the Shiprock and South San Juan units of the Navaho project need to be determined, but a limitation must be put on the water supply the same as a limitation must be put on the water supply of the transmountain diversion. These projects cannot in any way be considered separately. It was the intention of the State of New Mexico that feasibility reports on these projects should show how each would operate in relation to the other.

Since authorization of large Federal projects is sometimes considered to be identical to a declaration of intent to use the water, and is sometimes felt to constitute a priority date, it appears that concurrent authorization of these projects is necessary. The feasibility reports should indicate to what extent the authorizations can be sustained.

New Mexico regrets the exclusion of the LaPlata unit of the Animas-LaPlata project from the present recommendations. The conditions are understood. It must be noted, however, that this is a very badly needed project for that particular area and it is hoped that every consideration may be given to its inclusion or early consideration among the participating projects of the Colorado River storage plan.

New Mexico hopes that you will again review the comments of June 12 and my letter of March 4 with the accompanying report and make such changes in your report and recommendations that you feel are possible and compatible with the views of the State.

Sincerely,

E. L. MECHEM.

LETTER OF DECEMBER 22, 1953, FROM THE STATE OF UTAH

THE STATE OF UTAH,
UTAH WATER AND POWER BOARD,
Salt Lake City, Utah, December 22, 1953.

Re Colorado River storage project and participating projects—views and comments.

Hon. DOUGLAS MCKAY,
Secretary of the Interior,
Washington 25, D. C.

DEAR SECRETARY MCKAY: Your supplemental report on the Colorado River storage project and participating projects dated October 1953 was handed to me by Commissioner Dexheimer at a special meeting of the Upper Colorado River Compact Commission held in Denver, Colo., December 12, 1953, with the suggestion that comments be filed with the Secretary of the Interior.

Under date of June 12, 1951, and signed by the Utah State engineer, the State of Utah submitted to your office its comments and stated among other things:

* * * the State of Utah approves the plan of development of the water resources of the upper Colorado River Basin described in the report and requests authorization for the construction of the projects listed in paragraph (6) of the Commissioner's letter of December 22, 1950.

Subsequent to this endorsement by the State of Utah, certain revisions have been made as set forth in the Supplemental Report on the Colorado River Storage Project and Participating Projects, Upper Colorado River Basin, October 1953.

Under the authority of Utah's Gov. J. Bracken Lee, and Statute 73–10, Utah Code Annotated, 1953, creating the Utah Water and Power Board, it becomes my responsibility to submit official views and recommendations on the reports for the State of Utah.

I wish to commend the Department of the Interior, the Bureau of Reclamation, and their staffs on the painstaking investigations that have made the original and supplemental reports possible. The basic principles underlying the report and the supplement are sound. The original report is comprehensive and the revisions set forth in the supplement are fully justified. Region IV of the Bureau of Reclamation is to be particularly commended and Utah appreciates the complete cooperation and congenial working relationships that have continuously existed between the State and the Bureau during the period of investigation and report. Full compliance with the spirit and purpose of section I of the Flood Control Act of 1944 has been made.

The original report, with minor exceptions as to details, was officially endorsed and approved by the Utah Water and Power Board, the Utah Water Users Association, the Colorado River Development Association, representing 21 affected counties in the State, chambers of commerce, Utah Fish and Game Commission, the Utah State Agricultural College and its agricultural experiment station, the Metropolitan Water District of Salt Lake City and consulting engineers, individual water users, and citizens of the State.

Now comes the Supplemental Report on the Colorado River Storage Project and Participating Projects, Upper Colorado River Basin dated October 1953. The Utah Water and Power Board, acting for the State of Utah and with the approval of the Governor, endorses this report and subscribes to the recommendations of the Bureau of Reclamation as set forth in section 29, items "a" to "k" inclusive.

Endorsement of this supplemental report by the State of Utah must not be considered as limiting the extent to which the authorizing bill already introduced may be amended to cover the matter of including the Gooseberry project as a participating project or other phases of the Colorado River storage project and participating projects as set forth in the 1950 report. The matter of amending the bill will be left to the discretion of the congressional delegation from Utah.

The Gooseberry project located on the Price River, a tributary to the Colorado River, and designed to store for and convey water to lands in the Bonneville Basin in Sanpete County, Utah, was not included in the Colorado River storage project as a participating project because at the time the Colorado River storage project and participating projects was submitted, the Gooseberry project was not eligible to participate.

In 1946 the original Gooseberry project report was released at field level and circulated to all interested Federal and State agencies for comment. In November 1946 the report was revised as per comments and sent to Washington. This project, as developed, did not qualify as a participating project of the Colorado River storage

project. In January 1952 this report was revised as a participating project and submitted to Washington for review but not distributed for comments. It was later revised in harmony with comments made by the chief engineer and Chief of the Hydrology Division and in January 1953 it was resubmitted to Washington and recommended as a participating project in the Colorado River storage project.

This project, as now proposed, satisfies all criteria governing participating projects and should be included as one of the participating projects to be constructed in the initial phase of the Colorado River storage project and participating projects. Inasmuch as the Gooseberry project was among the first developments recommended by the States of the upper Colorado River Basin for participation in the benefits and revenues of the storage project, it is recommended that you include the Gooseberry project in your final recommendations to the Budget Bureau, the President, and the Congress, as a participating project in the Colorado River storage project.

Sincerely yours,

GEORGE D. CLYDE,
Executive Secretary, Utah Water and Power Board and Commissioner of Interstate Streams for Utah.

Approved:

J. A. HOWELL,
Chairman, Utah Water and Power Board.

LETTER OF DECEMBER 21, 1953, FROM THE STATE OF WYOMING

STATE OF WYOMING,
STATE ENGINEER'S OFFICE,
Cheyenne, Wyo., December 21, 1953.

Hon. DOUGLAS MCKAY,
Secretary of the Interior, Washington, D. C.

DEAR MR. SECRETARY: A copy of your revised report on the Colorado River storage project and participating projects sent to Hon. C. J. Rogers, Governor of Wyoming, by Acting Commissioner McPhail of the Bureau of Reclamation, has been referred for comment to me by Governor Rogers.

Since I have already reviewed the report of December 4, 1952, and commented thereon in behalf of Governor Rogers, I will offer only additional comments concerning the revision.

First I will comment that I find nothing in the revised report to which I take exception or make objection for the State of Wyoming.

As I read the revised report, I conclude that it was intended, as was the original report, to be subject to changes as further studies may warrant. We concur with your revised report's inclusion of the Eden, LaBarge, Lyman, and Seedskadee units among the participating projects for initial construction. In regard to the Seedskadee unit, I believe that the advance planning for the project should include further study of the possibility of providing storage at Kendall Reservoir to increase the project acreage, and a possibility of including a high diversion dam at the Fontenelle site in lieu of the low diversion dam, diversion canal, and Green River siphon.

While I concur generally with the memorandum of the Under Secretary concerning the construction of dams in Dinosaur National Monument, I will comment that I have: (1) visited both Echo Park

and Split Mountain Dam sites on the ground and have traversed a greater part of the area proposed to be inundated, (2) viewed them from the air, (3) carefully considered the alternate dam sites and (4) weighed the benefits against the possible damages. My conclusion is that, in addition to the saving of about 300,000 acre-feet of water per year over the best alternate plan, the increase in recreational value will much more than offset any primitive area value. People will visit the area by the hundred of thousands when the dams are built and in operation, while at best only a few hundred will visit the area as it is today. My conclusion is that I would prefer in any event to see the reservoirs constructed than to see the monument remain in its natural state.

In conclusion, I consider the modifications contained in the review report, dated October 1953, to be sensible and sound, and while I see no objection to inclusion of all the projects in the initial authorization, since none can be built until appropriations are made by the Congress, I have no objection to the plan as changed.

Everything considered, I am convinced that in compiling this report that the Bureau of Reclamation has performed a monumental task in a very excellent manner.

Sincerely yours,

L. C. BISHOP, *State Engineer.*

SECRETARY'S LETTER OF DECEMBER 10, 1953, TO THE PRESIDENT

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., December 10, 1953.

(Through: Bureau of the Budget)

The PRESIDENT,
The White House.

MY DEAR MR. PRESIDENT: On December 4, 1952, my predecessor in office submitted a report on a proposed plan for the development and utilization of a portion of the water resources of the upper Colorado River Basin by construction of the Colorado River storage project and participating projects. By letter of January 27, 1953, Budget Director Dodge asked that I review this report to determine whether it conforms to my program in terms of present policies and whether any modification or revision should be made.

After review of the report and reanalysis of the recommended units and projects by the Commissioner of Reclamation at my request, I submit herewith my revised report on the Colorado River storage project and participating projects, which supersedes the previous report of December 4, 1952.

A proposed report on this project was transmitted to the affected States and to the Secretary of the Army as required by the Flood Control Act of December 22, 1944 (58 Stat. 887), and to other Federal agencies in accordance with interagency agreements, and copies of all the comments are included with the report. The comments of the heads of the agencies exercising administration over the wildlife resources of the States in which project works would be located are also included.

It should be noted that my revised report approves the Echo Park Dam and the Split Mountain Dam, both of which would be constructed within the Dinosaur National Monument. Because of the conflicting interests which have arisen in connection with these dams, I requested the Under Secretary to undertake a personal investigation of these proposed dam sites, the extent to which Dinosaur National Monument would be modified by their construction, and the possibility of alternative dam sites. I am attaching a copy of his memorandum on this subject.

The Department of the Interior in submitting this report anticipates modification of its opinion on any individual projects or units, at the time appropriations are sought, if necessary in the light of any additional information and economic studies that might then be available.

We shall appreciate having advice concerning the relationship of this proposed project to your program before I transmit the report to the Congress for its consideration and appropriate action.

Sincerely yours,

DOUGLAS MCKAY,
Secretary of the Interior.

UNDER SECRETARY TUDOR'S NOVEMBER 27, 1953, MEMORANDUM TO THE SECRETARY

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., November 27, 1953.

Memorandum
To: The Secretary.
From: Under Secretary.
Subject: Construction of dams in the Dinosaur National Monument.

In accordance with your verbal instructions, I have made a study concerning the proposal to build the Echo Park Dam and the Split Mountain Dam as a part of the upper Colorado River Basin development. These two dams, if built, will be located within the Dinosaur National Monument. They were originally proposed to be included in the plan of development of the basin which was prepared by the Bureau of Reclamation and recommended for approval by the Secretary of the Interior in January 1951. Opposition developed to the construction of these two dams in the Dinosaur National Monument, and on December 4, 1952, the then Secretary of the Interior revised his recommendation and proposed that further consideration be given to studies of alternate sites. It was under these circumstances that you directed me to investigate the matter with particular reference to the suggested alternate sites.

In connection with this investigation I have reviewed the reports, sought and been furnished data and information from both the National Park Service and the Bureau of Reclamation, conferred with various interested parties and organizations, and have, in company with the Director of the National Park Service and the Commissioner of the Bureau of Reclamation, personally visited the two dam sites in question and inspected a considerable portion of the Dinosaur National

Monument. I also inspected on the ground and from the air other portions of the upper Colorado River area.

The opposition to the two dams in question arises from persons and organizations interested in the national parks and their desire to preserve the Dinosaur National Monument in its present natural state. The Echo Park Dam, in particular, will create a large reservoir within this monument and will certainly alter its appearance and the existing conditions. It is a matter of personal opinion as to the extent of the harm that may be created by this reservoir. My own feeling is that the alteration will be substantial and if conflicting interests did not exist, I would prefer to see the monument remain in its natural state. However, I do feel that if the dam is built, the beauty of the park will by no means be destroyed and it will remain an area of great attraction to many people.

It should be noted that neither of these proposed reservoirs will inundate any portion of the quarry where the dinosaur skeletons have been found.

I have examined the proposals for various alternate reservoirs. To be effective these alternates must provide approximately the same storage of water and must waste as little water as possible. The latter is extremely important for the available water for consumptive uses in the upper Colorado River Basin is far less than will be needed for the full economy of this region.

I have been furnished with information on the New Moab, Dewey, Desolation dam sites, and have considered the possibility of increasing the height of the proposed Glen Canyon Dam. I am particularly impressed with the showing that any of these alternate dam and reservoir sites would result in a net loss of water from evaporation from approximately 100,000 to 200,000 acre-feet per year. Even the lower figure is enough to provide all of the domestic, commercial, and industrial water for a city the size of Denver. In an area where water is so precious this is a matter of very serious consequence. Such lost water cannot be replaced at any cost and the ultimate regional economy would have to be reduced accordingly.

There has been some question as to the accuracy of the estimates of evaporation and the application of the formulas used to compute losses. I have reviewed this matter and, while there may be some error due to a shortage of experimental data, I am convinced that the calculations are reasonable and any error that exists is equally applicable to the calculations for all reservoirs. Therefore, the error in net differences in calculated losses between any two reservoirs must be small.

There would be substantial loss in electric generating capacity if any one of the alternate sites were selected. While this is a matter of economic importance, I do not attach as much weight to it as to the loss of water. The power loss could be replaced by steam power at some increased cost.

I share the concern of those who would preserve the beauties of the Dinosaur National Monument in their present natural state, but as between a choice of altering this scenery without destroying it in a basin which is and will remain rich in scenery, or the irreplaceable loss of enough water to supply all the needs of a city the size of Denver, I believe the conservation of the water in the interest of the Nation is of greatest importance.

In view of the foregoing, I recommend that the plan for the development of the upper Colorado River Basin include the Echo Park and Split Mountain Dams and Reservoirs within the Dinosaur National Monument. This is in keeping with the original recommendation made by the former Secretary of the Interior.

RALPH A. TUDOR,
Under Secretary.

Approved:

DOUGLAS MCKAY,
Secretary of the Interior.

NOVEMBER 30, 1953.

COMMISSIONER'S LETTER OF NOVEMBER 13, 1953, TO THE SECRETARY

DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION,
Washington 25, D. C., November 13, 1953.

The SECRETARY OF THE INTERIOR.

SIR: At your request and pursuant to the request of the Director of the Bureau of the Budget contained in his letter to you of January 27, 1953, the report of the previous administration on the Colorado River storage project and participating projects has been reviewed. The attached supplemental report on the project dated October 1953, has been prepared to supersede the previous reports of the Commissioner of Reclamation and Secretary of the Interior and to bring up to date the December 15, 1950, report.

The new report is based on the December 15, 1950, report of Reclamation's regional director and it includes the comments of the affected States and agencies on that previous report.

I find that the elements recommended for initial authorization in the attached report have economic and engineering feasibility and that they will soon be needed to meet the requirements of the compacts and the international commitments with respect to the waters of the Colorado River and to provide for economic stability and development of the upper Colorado River Basin. I, therefore, submit this report, incorporating with modifications the report of the regional director of the Bureau of Reclamation and superseding all other previous reports, as my report on the upper Colorado River storage project and participating projects.

I recommend that you approve and adopt the report and that you submit it to the President for advice concerning its relationship to his program.

Respectfully submitted.

W. A. DEXHEIMER, *Commissioner.*

December 10, 1953.

Approved and adopted:

DOUGLAS MCKAY,
Secretary of the Interior.

SUPPLEMENTAL REPORT ON COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, UPPER COLORADO RIVER BASIN, OCTOBER 1953

1. This supplemental report on the Colorado River storage project and participating projects in the States of Arizona, Colorado, New Mexico, Utah, and Wyoming is based on the accompanying report of the regional director, Bureau of Reclamation, Salt Lake City, Utah, dated December 15, 1950, and is a departmentwide report recommending authorization of programs of all the agencies of the Department. The report supersedes and replaces, with modifications, the previous reports of the Commissioner of the Bureau of Reclamation and the Secretary of the Department of the Interior on this project, and modifies and brings the report of the regional director up to date. Comments of the affected States and of interested Federal agencies on our proposed report, obtained in accordance with the provisions of the Flood Control Act of December 22, 1944 (58 Stat. 887), the act of August 14, 1946 (60 Stat. 1080), and applicable interagency agreements, are enclosed and made a part of this report.

2. The report of the Department of the Interior on the inventory of potential developments in the Colorado River Basin, House Document 419, 80th Congress, pointed out that, in view of the fact that there is not enough water available in the Colorado River system to permit construction of all of the potential projects and have full expansion of existing and authorized projects, the States of the Colorado River Basin should determine their respective rights to deplete the flow of the Colorado River consistent with the Colorado River compact. Following issuance of that document, the States of the upper Colorado River Basin negotiated and formalized a compact called the Upper Colorado River Basin compact to which the Congress granted its consent in the act of April 6, 1949 (63 Stat. 31). Completion of that compact has permitted formulation of at least an initial stage of further development of the upper Colorado River Basin. The plan proposed and presented in the regional director's report was worked out in close cooperation with representatives of the States of the upper Colorado River Basin, and their favorable comments are enclosed.

3. A plan of ultimate development in terms of storage is presented in this supplemental report but recommendation is made for authorization at this time of only a partial development in terms both of storage and of water utilization. Selection of the plan for ultimate storage is based in general upon securing the needed reservoir capacity for all purposes, while attaining the minimum in evaporation losses, water being prerequisite to the livelihood of the area. The initial units have been selected as being those best adapted to meeting the most pressing needs of the area. As indicated in the recommendations included herein, the proposal is such as to permit additions to the plan as other units and participating projects are investigated and weighed in the light of the criteria expressed herein. The total storage capacity contemplated ultimately is designed to assure that the flow of the river at Lee Ferry will not be depleted below 75 million acre-feet in any 10 consecutive years while permitting continued development of the upper basin as contemplated when the Colorado

River compact was drawn up. Thus, upon the authorization of the units recommended, the upper basin may continue and increase its utilization of its waters and the lower basin may be assured that its rights under the compact are protected.

4. It is not contemplated that all units of the ultimate storage plan should be constructed or even authorized at this time. The project is planned to ultimately provide about 48 million acre-feet of total capacity which it now appears can best be accomplished by a series of 9 storage reservoirs. Recommendations for the authorization of other than the initially recommended units will be based on continued hydrologic investigations. Revenues from the sale of power generated at or made possible by these reservoirs should be used to assist in the repayment of reimbursable costs of worthy irrigation projects which might not otherwise be feasible under the Federal reclamation law. Additional storage project units should be constructed as required to meet the needs for consumptive use of water and for generation of electric energy.

5. In addition to permitting the upper basin to move forward with utilization of its waters, the Colorado River storage project and participating projects will provide electrical energy to a large area where it is urgently needed. Flood protection, sediment retention, fish and wildlife conservation, and recreational opportunities will also be provided. Detailed recommendations and plans to accomplish these purposes will be prepared as a part of the detailed planning for the individual units and projects.

6. The underlying report of the regional director recommended approval of a system of 10 major dams and reservoirs as units of the storage project, with initial authorization of the Glen Canyon, Echo Park, Flaming Gorge, Navaho, and Whitewater units. Authorization of 12 initial participating projects was recommended, with provision for including 1 additional project, which is already authorized and under construction, as a participating project.

7. As mentioned hereinbefore, copies of the report of the regional director were submitted as a part of the proposed report of the Department of the Interior to the Secretary of the Army and to the States signatory to the Colorado River compact for their views and recommendations in accordance with the provisions of section 1 of the Flood Control Act of December 22, 1944, to the heads of the agencies of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming exercising administration over the wildlife resources of the States for their report and recommendations in accordance with the provisions of the act of August 14, 1946, and to other interested Federal agencies for their views and comments. Copies of all the comments which have been received are enclosed with this supplemental report.

8. The reviewing officials of the States directly affected; namely, the upper division States of Colorado, New Mexico, Utah, and Wyoming, approved the proposed report, and commended the Department for the coordination between the States and the Department during the course of investigations and preparation of the report. They noted that there has been full compliance with the spirit and purpose of the Flood Control Act of 1944. They endorsed the recommendations in the proposed report and called attention to and made recommendations on matters beyond the scope of the proposed report.

9. Three of the upper division States recommended that the hydroelectric plants of the project be operated in conjunction with other Federal powerplants on the Colorado River in such manner as to produce the greatest practicable amount of power and energy that can be disposed of at firm power and energy rates. The States of the upper division appeared also to desire that ultimately some provision be made that would give power users in those States or in the upper basin a permanent priority over users elsewhere to the energy generated by the project units. They appeared to be concerned over the possibility that highly developed areas outside their confines will be in a position to contract for the power output of the projects before potential users in the upper division States or in the upper basin are in a position to do so. It is noted that bills introduced in the Congress by Senators and Representatives from the upper basin States include a provision relating to this matter. The Congress will no doubt consider this problem in the course of hearings on the bills.

10. The State of Arizona also concurred in the report, and expressed a desire to be included in the power marketing area of the project on the same basis as the other upper basin States. The power marketing studies in the report were made as examples only, and the method of preparing those studies does not evidence any intention to exclude Arizona from the use of power from the project.

11. The States of Colorado, New Mexico, and Utah recommended that the Shiprock Indian reclamation project be authorized as one of the initial participating projects but not constructed until a detailed project report is completed, made available to the States for review, and approved by the Congress. The State of New Mexico also recommended that the South San Juan and the San Juan-Chama projects be included for authorization as initial participating projects on the same basis as the Shiprock project.

12. At the time the Colorado River storage project report was being prepared, the Commissioner, Bureau of Indian Affairs, anticipated that a detailed report on the Shiprock project would soon be available. The difficulty of reaching an agreement among the various parties who are interested in the development of the waters of the San Juan River in New Mexico has prevented the completion of such a report up to this time. For this reason it is now recommended, and the report is revised, in partial accord with the views of the States and at the request of the Commissioner of the Bureau of Indian Affairs, to provide for authorization of the Shiprock project now, as one of the initial participating projects with, however, initiation of actual construction deferred until there has been made available to the affected States and approved by the Congress a report on the project establishing the acreage to be served by the project and its feasibility.

13. With respect to the San Juan projects, a great quantity of data is being collected and analyzed. The need for the San Juan-Chama project in particular is acute to relieve pressing and impending water shortages both for irrigation and for municipal and industrial purposes in New Mexico and to provide an important block of hydroelectric power in a power-short area. The South San Juan project is closely associated with the Shiprock Indian project, and the 2 should be developed as divisions of 1 project. The Congress may give consideration to the authorization of the San Juan-Chama and South San

Juan projects as initial participating projects, as they are included in the bills which have been introduced in the Congress.

14. Prospects are good for an early agreement among the parties concerned as to the use of the waters of the San Juan River on Indian and non-Indian lands in New Mexico. When the underlying report was prepared, agreement to this division of water had not been anticipated quite so soon and, accordingly, the Navaho Dam and Reservoir had been considered as one of the units of the storage project for initial authorization rather than as a participating project reservoir. It had been expected that during its early life the principal purpose of this control structure, which will also assist in preventing sediment encroachment in Glen Canyon Reservoir, would be that of aiding in meeting water deliveries at Lee Ferry. It was recognized, however, that ultimately it would be needed to assure continuous water supply for the Shiprock Indian irrigation project and South San Juan development and as replacement storage for the San Juan-Chama Diversion project, and that its use would be restricted to supplying the participating projects when its full capacity was needed for consumptive use purposes. With the present hopeful outlook toward full agreement being reached within the next few years, full conservation use of the Navaho Reservoir will be needed at an earlier date than heretofore assumed. For this reason it is recommended that the Navaho Dam and Reservoir be eliminated as a unit of the storage project, and that it become a part of the Shiprock Indian irrigation project, with portions of its cost, along with portions of the costs of other joint facilities, to be charged later against the potential South San Juan and San Juan-Chama projects. It should be the first unit of the Shiprock project to be constructed. In view of the close relationship between the South San Juan and Shiprock developments, it is believed to be appropriate to incorporate them as one project, to be called the Navaho project, consisting of two divisions, the Shiprock (Indian) division and the South San Juan division. The Navaho Reservoir is recommended herein initially as a part of the Shiprock division as it is an essential integral part of the Indian development without which the program to make the Navaho Indian self-sufficient cannot be fully carried out.

15. After reviewing the proposed report the State of Colorado recommended that the Whitewater unit on the Gunnison River not be included as an initial unit of the Colorado River storage project. Although desiring one of the initial units to be located on the Gunnison River, the State at that time had not decided which of the several possible units should be selected, and recommended that certain further studies be made of the Gunnison River units before final selection is made. Further study was given by the Bureau of Reclamation to the location of storage units on the Gunnison River, in accordance with this recommendation, and information was made available to the State. The director of the Colorado Water Conservation Board has recently advised us that the board has approved a reservoir at the Curecanti site with a storage capacity of 940,000 acre-feet, and has urged that this project be included as a part of the initial authorization of the Colorado River storage project. Analyses of the Colorado River storage project with both the large Curecanti (2,500,000 acre-feet) and the small Curecanti (940,000 acre-feet) are included as attachments to this report. These analyses indicate that power from

either unit would be more expensive, under present-day estimated costs, than power from alternative sources. We believe that power needs of the western slope area can be taken care of, for the time being at least, by use of energy from the recommended units. Colorado will need more power as well as storage capacity in the immediate future. Every effort should be made to assure means of meeting that need, and to that end the Congress may wish to consider authorization of the Curecanti or some other storage unit in western Colorado.

16. The States of the upper division of the Colorado River Basin recommended that provision be made for additional funds for investigations in the upper Colorado River Basin prior to the time the investigations fund recommended in the proposed report comes into operation. Their recommendation for establishment of an upper Colorado River development fund, which is not covered in the regional director's report, is incorporated herein pursuant to recommendations previously received from the States of the upper basin. In addition, the need for additional funds during the interim period prior to the time the fund is effectuated is recognized. The recommendations of the States for additional investigations funds will undoubtedly be given consideration by the Congress.

17. Colorado recommended that the La Plata project be included as a participating project. The plan for the project as presently contemplated does not appear to be economically justified at this time. The La Plata project area is, however, being reanalyzed and, in addition, further consideration can always be given to the present plan of development under changed economic conditions. If the results are favorable, the La Plata project can be recommended as a participating project at an appropriate time.

18. New Mexico recommended that the project construction schedule be revised so that the Navaho unit could be constructed at the same time as the other initial units. Although the Navaho Dam and Reservoir is no longer recommended as one of the initial storage project units, its inclusion as a part of the Navaho project will permit its construction to be initiated as soon as it is needed and concurrently with the schedule of construction for the initial storage units if necessary requirements can be met.

19. The reviewing official of the State of Nevada stated that Nevada had no objection to the report. Subsequently the Bureau of Reclamation was requested to include the detailed comments made by the State on an earlier draft of the report as a part of Nevada's official comments. This has been done, although some of the matters discussed are not applicable to the report which was under review.

20. The views of the fish and game departments of the States of Arizona, Colorado, New Mexico, and Utah, commenting on the 6-year program of the Fish and Wildlife Service, are favorable. Copies of these comments are included as a part of this report and the fish and wildlife program has been incorporated in the substantiating materials to the report of the regional director.

21. Numerous other comments have been made which are summarized in the attached digest of comments and recommendations by States and Federal agencies on the Colorado River storage project report. As is the case on any project of this magnitude there will be many details, such as exchanges of water rights, the use of existing facilities, and similar items, to be worked out by negotiations with

water users and others prior to construction of the affected parts of the project.

22. Subsequent to the review of the proposed report by the States and agencies, further careful consideration has been given to a selection of the units of the storage project which should be recommended for initial authorization. Immediate needs of the basin are for storage space to permit holdover of water for release to the lower basin as required by the Colorado River compact while allowing substantial growth in consumptive use in the upper basin, and for power generating facilities to assist in meeting power load growth in and adjacent to the Colorado River Basin. The reservoirs must be completed and filling started at the earliest practicable date, because as consumptive uses in the upper basin increase there will be less and less water available for filling the reservoirs. Under the terms of the Colorado River compact, requiring delivery of water at Lee Ferry, the Glen Canyon Reservoir, located just above this point, occupies a key position for regulating water deliveries to the lower basin. Likewise, the Echo Park Reservoir, centrally located in the upper basin and controlling the upper Green and Yampa Rivers, occupies a strategic position. In particular, as the increased use of Green River water increases its salinity, the Echo Park Reservoir will permit mixing it with the relatively pure waters of the Yampa, so that the quality of water releases from the reservoir will be improved. The powerplants of the two reservoirs likewise are strategically located to permit economically serving the major loads expected to grow in the area. For these reasons, it has been concluded that the Glen Canyon and Echo Park units should be recommended for authorization at this time with transmission facilities necessary to interconnect these and other Federal hydroelectric plants and to market the power, and with recreational and associated facilities as recommended by the Director of the National Park Service which are incidental to the construction of dams and reservoirs in the Dinosaur National Monument. Every effort has been made to find suitable alternatives for the Echo Park and Split Mountain units because of their encroachment on the Dinosaur National Monument, but no adequate substitute for the Echo Park unit has been found because of the increased evaporation which will take place from the greater surface areas, at lower elevations, of the alternative reservoirs. Reasons for the elimination of the initial recommendations of the Whitewater unit and of the Navaho unit as two of the initial storage project units have been covered earlier in this report. After review of the purposes to be served by the Flaming Gorge unit, which was formerly recommended for initial authorization, it is believed that it might well be deferred for future development. The Echo Park unit will probably meet immediate needs in this area and Flaming Gorge can be recommended at a later date when it is required.

23. The necessary coordination of the storage project units and the participating projects for financial assistance can be accomplished without the establishment of the upper Colorado River account recommended in the underlying report and without applying the interest component of the power revenues to irrigation repayment. In order that all reimbursable costs of the project can be repaid to the Treasury without applying the interest component of the power revenues and without the establishment of the basin account, it is

our recommendation that repayment of the costs which are allocated to irrigation and assigned to be repaid from power revenues be made from net power revenues after completion of the return of the commercial power investment, including interest during construction, with interest on the unamortized balance at a rate equal to the average rate paid by the United States on its long-term loans outstanding at the date of authorization of the project.

24. The estimated cost of the recommended units of the Colorado River storage project and the initial participating projects as recommended for authorization herein is $1,134,643,000 at January 1953 price levels, itemized as follows:

Echo Park unit	$176, 400, 000
Glen Canyon unit	421, 300, 000
Central Utah (initial phase), Utah	231, 044, 000
Emery County, Utah	9, 865, 500
Florida, Colo.	6, 941, 500
Hammond, N. Mex.	2, 302, 000
LaBarge, Wyo.	1, 673, 000
Lyman, Wyo.	10, 564, 000
Pine River extension, Colorado-New Mexico	5, 027, 000
Seedskadee, Wyo.	23, 272, 000
Silt, Colo.	3, 356, 000
Smith Fork, Colo.	3, 367, 000
Paonia, Colo.	6, 944, 000
Eden, Wyo.	7, 287, 000
Shiprock (Indian) division of Navaho project, including Navaho Reservoir and canal capacity for South San Juan Division	225, 300, 000
Total	1, 134, 643, 000

Construction of the Shiprock division would not be initiated until a report thereon has been submitted to the States and approved by the Congress. The cost of the Eden project, Wyoming, $7,287,000, which would be one of the initial participating projects under the recommendation contained herein, is included in the above tabulation although it is already authorized by the Congress and no further authority is required to complete construction. The full cost of the Paonia project is also included, although a portion of this project has been authorized, is already constructed, and the water users have contracted to repay the construction costs. The proposed reauthorization would increase the scope of the project, and incorporate it into the storage project for repayment of that part of the costs which exceeds the water users' repayment ability.

25. In addition to the aforementioned costs, the recreational planning and construction program and the archeological, wildlife, and geological programs, to be accomplished by the National Park Service in connection with the work in Dinosaur National Monument, are estimated to cost $21 million. This work is of national significance, and the cost thereof should be nonreimbursable, and the funds should be appropriated as part of the National Park Service program.

26. Of the cost of the two initial units of the storage project, $98,300,000 would be allocated to irrigation and other water consuming uses, and $499, 400,000 would be allocated to power, under the alternative-justifiable expenditure theory of cost allocation. Allocation of costs of the participating projects will be the subject of further study in connection with preparation of detailed plans.

27. The Colorado River storage project and the initial participating projects, as recommended herein, have engineering feasibility, are economically justified, and, as a whole, would have financial feasibility if authorized by the Congress substantially in accordance with the recommendations contained herein. The project units and the participating projects recommended for initial authorization and development are sorely needed to permit meeting the requirements of the compacts and the international commitments with respect to the Colorado River and to provide for economic stability and development of the upper Colorado River Basin. Benefits from irrigation and other beneficial water consuming uses would be realized through construction of the dependent participating projects. The evaluated annual power benefits from the initially recommended units of the storage project exceed their annual costs in the ratio of 1.64 to 1. The benefit cost ratios for the initial participating projects computed in accordance with present Bureau of Reclamation practice, all exceed unity under present conditions. Irrigation revenues from the participating projects will pay the operation, maintenance, and replacement costs of those projects allocated to irrigation, and, in addition, for each project recommended, will repay a part of the capital cost of the participating project. Repayment of the power allocation of each of the recommended storage project units and the power allocation of the central Utah project, including interest during construction and including interest on the unamortized balance at a rate equal to the average cost to the Government of long-term money, now estimated at 2½ percent, can be accomplished by power revenues based on an average rate of 6 mills per kilowatt-hour within a 44-year period from the date the initial power unit is placed in operation. The 6-mill rate is used for illustrative purposes only. The actual selling price of the power will be established at rates consistent with sound business principles and taking into account the irrigation costs which are to be assigned for repayment from power revenues. Repayment of the irrigation allocation of the initial storage project units and the portion of the costs of the 12 non-Indian participating projects allocated to irrigation and other water-consuming uses that exceeds the repayment ability of the water users, a total of $268,829,000, and the portion, $165,525,000, of the costs of the Shiprock Indian division of the Navajo project which is expected to be assigned for repayment from power revenues will be accomplished by the application of the net power revenues after the power costs are repaid. With annual net power revenues at the 6-mill average rate of about $17 million from only the 2 initial units, as indicated on the attached financial operations study, repayment of the known irrigation costs could be accomplished within approximately 16 years after the close of the 44-year period of operations required for repayment of the power allocations of the first 2 units. Repayment of the costs of the Shiprock Indian Division would require an estimated additional 10 or 12 years. Even if all of the units, including the Shiprock division, were started and completed simultaneously, the period required for repayment of all reimbursable costs would not be in excess of the 50-year period recommended in Budget Circular A–47. Differences in complexities of construction and magnitude of the various units, lengths of development periods, and practicalities of appropriations will all dictate a staggered starting and completion schedule.

28. The units of the storage project would be operated as a system in order to produce by integration the maximum benefits from the sale of hydroelectric energy. Analyses of the power production of the nine units of the storage project on an incremental basis are contained on the attached summary sheets in order to show how each unit will fit into the system. One analysis is of the system including the 2.5 million acre-feet Curecanti Reservoir as originally planned by the Bureau of Reclamation. The other analysis includes the 940,000 acre-foot Curecanti desired by Colorado. Recommendation for authorization of other than the initial units will be supported by further additional studies.

29. The recommendations of the Bureau of Reclamation follow. They incorporate all the modifications to the recommendations of the regional director discussed above and thereby supersede all previous recommendations:

It is recommended—

(*a*) That the physical plan of development of the water resources of the upper Colorado River Basin as described in the underlying report of the regional director and as modified by this supplement report be approved;

(*b*) That authority be sought for the Secretary of the Interior, acting pursuant to the Federal reclamation laws (act of June 17, 1902) (32 Stat. 388) and acts amendatory thereof or supplementary thereto, to construct, operate, and maintain (i) the following units of the Colorado River storage project:

Echo Park
Glen Canyon

including transmission facilities to interconnect them and other Federal plants and to market the power produced, and (ii) the following initial participating projects subject to the other appropriate portions of these recommendations:

Central Utah (initial phase), Utah
Emery County, Utah
Florida, Colo.
Hammond, N. Mex.
LaBarge, Wyo.
Lyman, Wyo.
Pine River extension, Colorado-New Mexico
Seedskadee, Wyo.
Silt, Colo.
Smith Fork, Colo.
Paonia, Colo. (including Minnesota unit)

all as described in the report of the regional director but with such modification of, omissions from, or additions to the works as the Commissioner of Reclamation, with the approval of the Secretary, may find proper;

(*c*) That, as contemplated in its authorizing legislation, the Eden project, Wyoming, which has previously been authorized and is partially constructed, be included in the plan of development and that the storage project be charged with that portion of the reimbursable construction costs of the Eden project which is in excess of the amount specified to be repaid by the water users in the act of June 28, 1949 (63 Stat. 277); and that the Paonia project, Colorado, as described in the regional director's report, which is also partially constructed, be included in the plan of development and that the storage project be charged with that portion of the reimbursable costs of the Paonia project which is in excess of the amount which will be repaid within the period specified in the act of June 25, 1947 (61 Stat. 181);

(*d*) That, pursuant to the recommendation of the Commissioner of Indian Affairs, and in order to consolidate the recommendations of the

Secretary for dependent projects in the upper Colorado River Basin, the Shiprock (Indian) division of the Navaho project, including the Navaho Dam and Reservoir, be authorized for construction, operation, and maintenance in accordance with laws applicable to the development of irrigation projects on Indian reservations, including the provisions of the act of July 1, 1932 (47 Stat. 564, 25 U. S. C., 1946 ed., 368a), the benefits of which act should be extended also to the Indian lands to be served by the Florida and the Pine River extension projects, provided, however, that the Shiprock division shall receive assistance from the project power revenues in the same manner and to the same degree as other participating projects and that initiation of actual construction shall be deferred until there has been made available to the affected States and approved by the Congress a report on the division establishing the acreage to be served and the feasibility of the development;

(*e*) That authority be sought for the Secretary, acting pursuant to the laws applicable to the development of national parks, monuments, or recreational areas, to the extent to which those laws are not inconsistent with operation of the Colorado River storage project units for their primary purposes, to construct, operate, and maintain the recreational facilities proposed in this report;

(*f*) That irrigation repayment contracts entered into provide, except in the case of the Eden and Paonia projects, for repayment of the obligation assumed thereunder over a period of not more than 50 years exclusive of any development period authorized by law;

(*g*) That authority be sought such that repayment of that part of the construction cost of the project (including the participating projects) which is allocated to irrigation and assigned to be repaid without interest from net power revenues will be accomplished from such revenues after completion of the return of the commercial power investment with interest on the unamortized balance at a rate not less than the average rate paid by the United States on its long-term loans outstanding at the time the project is authorized. Revenues and costs in connection with other undertakings hereafter authorized to be constructed should be included as a part of the Colorado River storage project upon specific authorization by act of Congress;

(*h*) That the Secretary from time to time recommend to Congress for authorization additional units of the Colorado River storage project and additional participating projects;

(*i*) That there shall be available to aid each participating project, or group of participating projects, an appropriate district, preferably of the water conservancy type, which shall be satisfactory to the Secretary of the Interior, one purpose of which shall be to provide revenues for the project, over and above those paid by irrigators, to assist in repayment of construction costs allocated to irrigation;

(*j*) That the investigations and programs proposed to be undertaken by certain agencies of the Department of the Interior, as summarized in paragraphs 33 through 39 of the regional director's report and presented in detail in the appended substantiating materials, be authorized; and that appropriations, therefore, be nonreimbursable,

COLORADO RIVER STORAGE PROJECT & PARTICIPATING PROJECTS

FINANCIAL OPERATION STUDY FOR EXAMINATION OF INVESTMENT REPAYMENT FROM POWER REVENUES

(Colorado River Storage Project Consisting of Glen Canyon, Echo Park, and the Power Features of the Initial Phase of the Central Utah Project)

Date: October 9, 1953
Revised December 24, 1953
Units: Columns 3-7 Million kwh.
Columns 8-20 Thousand Dollars

Year of study	Fiscal Year	Sales of Electric Energy					Power Revenues Sales of Electric Energy			Revenue Deductions			Net Power revenue (Cols. 10-13)	Transfers to Upper Colorado River Development Fund 2/	Power investment during year including interest during construction 1/	Amortization of Power Investment		Irrigation assistance from net power revenues	Assistance needed for irrigation
		Central Utah		Echo Park Unit Firm	Glen Canyon Unit Firm	Total (Cols. 4+5+6)	Pumping at (3.0 Mills)	Firm at (6.0 mills)	Total (Cols. 8+9)	Provisions for emergency expense	Operation Maintenance Overhead and Replacement	Total (Cols. 11+12)				2-1/2% Interest on unpaid balance	Unpaid balance		
		Pumping	Firm																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	1961														364,970		364,970		
1	62	0	17	562	1,164	1,743	0	10,458	10,458	125	1,972	2,097	8,361	627	53,830	9,124	420,190		
2	63		17	1,117	1,740	2,874		17,244	17,244	125	3,191	3,316	13,928	1,000	30,366	10,505	448,133		
3	64		23	1,111	2,312	3,446		20,676	20,676	125	3,861	3,986	16,690		30,366	11,203	474,012		
4	65		23	1,104	2,880	4,007		24,042	24,042	125	4,531	4,656	19,386		30,356	11,850	497,842		
5	66		23	1,097	3,444	4,564		27,384	27,384	125	5,201	5,326	22,058		31,373	12,446	520,603		
6	67		25	1,091	4,003	5,119		30,714	30,714	125	5,898	6,023	24,691		25,235	13,015	535,162		
7	68		125	1,084	3,989	5,198		31,188	31,188	125	6,118	6,243	24,945		19,700	13,379	544,296		
8	69		362	1,077	3,975	5,414		32,484	32,484	125	6,278	6,403	26,081			13,607	532,822		
9	1970		362	1,071	3,961	5,394		32,364	32,364	0	6,403	6,403	25,961			13,321	521,182		
10	71		362	1,064	3,947	5,373		32,238	32,238				25,835			13,030	509,377		
11	72	0	362	1,057	3,933	5,352	0	32,112	32,112				25,709			12,734	497,402		
12	73	1.3	361	1,051	3,919	5,331	4	31,986	31,990				25,587			12,435	485,250		
13	74	2.2	360	1,044	3,904	5,308	7	31,848	31,855				25,452			12,131	472,929		
14	75	2.2		1,037	3,890	5,287		31,722	31,729				25,326			11,823	460,426		
15	76			1,031	3,876	5,267		31,602	31,609				25,206			11,511	447,731		
16	77			1,024	3,862	5,246		31,476	31,483				25,080			11,193	434,844		
17	78			1,017	3,848	5,225		31,350	31,357				24,954			10,871	421,761		
18	79			1,011	3,834	5,205		31,230	31,237				24,834			10,544	408,471		
19	1980			1,004	3,820	5,184		31,104	31,111				24,708			10,212	394,975		
20	81			997	3,805	5,162		30,972	30,979				24,576			9,874	381,273		
21	82			988	3,781	5,129		30,774	30,781				24,378			9,532	367,427		
22	83			980	3,757	5,097		30,582	30,589				24,186			9,186	353,427		
23	84			971	3,733	5,064		30,384	30,391				23,988			8,836	339,275		
24	85			962	3,709	5,031		30,186	30,193				23,790			8,482	324,967		
25	86			954	3,685	4,999		29,994	30,001				23,598			8,124	310,493		
26	87			945	3,661	4,966		29,796	29,803				23,400			7,762	295,855		
27	88			936	3,637	4,933		29,598	29,605				23,202			7,396	281,049		
28	89			928	3,613	4,901		29,406	29,413				23,010			7,026	266,065		
29	1990			919	3,589	4,868		29,208	29,215				22,812			6,652	250,905		
30	91			910	3,564	4,834		29,004	29,011				22,608			6,273	235,570		
31	92			902	3,540	4,802		28,812	28,819				22,416			5,889	220,043		
32	93			893	3,516	4,769		28,614	28,621				22,218			5,501	204,326		
33	94			884	3,492	4,736		28,416	28,423				22,020			5,108	188,414		
34	95			876	3,468	4,704		28,224	28,231				21,828			4,710	172,296		
35	96			867	3,444	4,671		28,026	28,033				21,630			4,307	155,973		
36	97			858	3,420	4,638		27,828	27,835				21,432			3,899	139,440		
37	98			850	3,396	4,606		27,636	27,643				21,240			3,486	122,686		
38	99			841	3,372	4,573		27,438	27,445				21,042			3,067	105,711		
39	2000			832	3,348	4,540		27,240	27,247				20,844			2,643	88,510		
40	01			824	3,323	4,507		27,042	27,049				20,646			2,213	71,077		
41	02			815	3,299	4,474		26,844	26,851				20,448			1,777	53,406		
42	03			806	3,275	4,441		26,646	26,653				20,250			1,335	35,491		
43	04			798	3,251	4,409		26,454	26,461				20,058			887	17,320		
44	05	2.2	360	789	3,227	4,376	7	26,256	26,263	0	6,403	6,403	19,860	1,000		433	0		
Totals		71.7	13,582	41,979	154,206	209,767	228	1,258,602	1,258,830	1,000	267,558	268,558	990,272	43,627	586,204	359,332		2/ 443,251	3/ 434,354

Notes:

1/ Includes accrued interest during construction.

2/ Net power revenues during a 16-year period beyond the repayment period of the power investment would be required to provide the assistance needed by irrigation in the repayment of the irrigation allocation of Glen Canyon and Echo Park costs plus the irrigation costs of 12 initial participating projects beyond the abilities of the irrigators to repay over a repayment period as specified in the proposed legislation. The assistance needed to repay the irrigation allocation of Echo Park and Glen Canyon is $98,339,000; the assistance needed to repay the irrigation costs of the 12 initial participating projects is $170,489,900. NET POWER REVENUES DURING AN ADDED 80-YEAR PERIOD WOULD BE REQUIRED FOR SHIPROCK DIVISION NEEDS—$165,525,000.

3/ Revenues transferred to the Upper Colorado River Development Fund equal 7-1/2 percent of the net power revenues for the first year and $1,000,000 annually thereafter. Transfers to this account during the 60-year period of $59,627 are in addition to irrigation assistance totalled in Col. 19.

and that in the case of investigations conducted by the Bureau of Reclamation, except those financed under (l) below, the provisions of the act of April 19, 1945, should govern;

(*k*) That there be set up and maintained in the Treasury from the receipts of the Colorado River storage project a continuing fund of $1 million to the credit of and subject to expenditure by the Secretary to defray emergency expenses and to insure continuous operation of the project;

(*l*) That there be set up and maintained in the Treasury from the receipts of the Colorado River storage project a special fund, to be known as the upper Colorado River development fund, to which shall be transferred at the end of each fiscal year, beginning with the initial year of commercial power production by the Colorado River storage project and the participating projects, 7½ percent of the net power revenues for that year after such net revenues exceed $5 million annually, but not to exceed $1 million in any one fiscal year, which should be available, upon appropriation (such appropriation to remain available until expended), for expenditure by the Secretary, without prejudice to the use by him for the same purposes of other appropriated moneys, for studies and investigations relating to the development, conservation and utilization of the waters of the upper Colorado River Basin, all expenditures from said fund to be nonreimbursable and nonreturnable under the Federal reclamation laws.

Preliminary incremental analysis, Colorado River storage project units

Project unit (in assumed order of construction)	Allocation of joint costs		Specific power costs, including transmission	Total power costs	Cost reassignments	Power costs assigned to unit	Annual operation, maintenance, and replacement			Average annual salable energy	Cost of power delivered to market	Cost of steam power to meet same market	Benefit-cost ratios
	To irrigation	To power					At site costs	Assigned costs	Net costs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14
INITIAL UNITS	*Million*	*Million*	*Million*	*Million*	*Million*	*Million*	*Thousand*	*Thousand*	*Thousand*	*Million kilowatt-hours*	*Mills/kilowatt-hour*	*Mills/kilowatt-hour*	
Glen Canyon	$50.3	$141.7	$229.3	$371.0	−$16.9	$382.0	$4,902	−$336	$4,466	3,813	4.7	7.3	1.71
Echo Park	48.0	76.8	51.6	128.4	−.5	137.5	1,155	−10	1,145	1,017	5.9	7.3	1.42
DATA ON UNITS IN ULTIMATE PLAN													
Cross Mountain	12.9	19.4	16.9	36.3	3.7	42.7	296	75	371	376	5.0	7.3	1.65
Split Mountain			84.4	84.4	7.2	96.9	644	144	788	643	6.5	7.3	1.26
Gray Canyon	9.2	127.4	54.3	181.7	6.0	201.3	1,212	121	1,333	1,186	7.1	7.3	1.15
Flaming Gorge	28.9	39.8	14.3	54.1	.9	59.1	364	17	381	388	6.4	7.3	1.36
Curecanti (2,500,000 acre-feet)	30.3	40.9	14.8	55.7	1.7	61.6	376	35	411	308	8.4	7.3	1.04
Crystal			40.9	40.9	−1.2	42.3	325	−26	299	227	7.9	7.3	1.00
Whitewater	5.0	20.4	18.9	39.3	−.9	40.9	360	−20	340	232	7.7	7.3	1.05
Total	185.6	466.4	525.4	991.8	0	1,064.3	9,534	0	9,534	8,190			

NOTES

Column 6—Incremental powerplant and transmission line costs reassigned among the project units in accordance with the energy credited to each site.

Column 7—Total power costs assigned to each unit including allocated joint costs, powerplant, transmission, and interest during construction.

Column 10—The estimated annual cost of operation, maintenance, and replacement assigned to each unit.

Column 11—Average annual salable generation credited to each unit during 50 years of full operation.

Column 12—Mill rate required to repay all costs allocated to power at each unit, including interest during construction, in 50 years of full operation with 2½ percent interest charged on the unpaid balance.

Column 14—The benefit-cost ratios shown are based on primary power benefits only but give consideration to the expected useful life of facilities extending beyond 50 years by the present value of the estimated salvage after 50 years.

Preliminary incremental analysis, Colorado River storage project units

Project unit (in assumed order of construction)	Allocation of joint costs		Specific power costs including transmission	Total power cost	Cost reassignments	Power costs assigned to unit	Annual operation, maintenance, and replacement			Average annual salable energy	Cost of power delivered to market	Benefit-cost ratios
	To irrigation	To power					At-site costs	Assigned costs	Net costs			
1	2	3	4	5	6	7	8	9	10	11	12	13
	Million	*Million*	*Million*	*Million*	*Million*	*Million*	*Thousand*	*Thousand*	*Thousand*	*Million kilowatt-hours*	*Mills/kilowatt-hour*	
Glen Canyon	$55.7	$136.3	$229.3	$365.6	−$16.9	$376.6	$4,802	−$336	$4,466	3,813	4.7	1.74
Echo Park	43.7	81.1	51.6	132.7	−.5	141.8	1,155	−10	1,145	1,017	6.0	1.40
Cross Mountain	14.0	19.3	16.9	36.2	3.7	42.6	296	75	371	376	5.0	1.67
Split Mountain			84.4	84.4	7.2	96.9	644	144	788	643	6.5	1.22
Gray Canyon	9.5	127.1	54.3	181.4	6.0	201.0	1,212	121	1,333	1,186	7.1	1.15
Flaming Gorge	30.9	37.8	14.3	52.1	.9	57.1	364	17	381	388	6.2	1.42
Curecanti (940,000 acre-feet)	8.1	29.8	11.4	41.2	0	44.9	280	0	280	195	9.6	.86
Crystal			40.9	40.9	0	43.5	325	0	325	210	8.8	.92
Whitewater	4.9	20.5	18.9	39.4	−.4	41.5	360	−11	349	220	7.9	.98
Total	166.8	451.9	522.0	973.9	0	1,045.9	9,438	0	9,538	8,048		

NOTES

Column 6. Incremental powerplant and transmission line costs reassigned among the project units in accordance with the energy credited to each site.

Column 7. Total power costs assigned to each unit including allocated joint costs, powerplant, transmission, and interest during construction totaling $72 million.

Column 10. The estimated annual cost of operation, maintenance, and replacement assigned to each unit.

Column 11. Average annual salable generation credited to each unit during 50 years of full operation.

Column 13. The benefit-cost ratios shown are based on primary power benefits only but give consideration to the expected useful life of facilities extending beyond 50 years by the present value of the estimated salvage after 50 years. An average basin steam power rate of 7.3 mills per kilowatt-hour was used to compute direct-power benefits.

DIGEST OF COMMENTS AND RECOMMENDATIONS BY STATES AND FEDERAL AGENCIES ON THE COLORADO RIVER STORAGE PROJECT REPORT

ARIZONA

Arizona concurs in the conclusions of the report and recommends that all assistance possible be given to the States of Colorado, New Mexico, Utah, and Wyoming, and the Bureau of Reclamation in securing the expeditious construction of the features proposed in the report.

Arizona comments specifically that the power market area shown in the report does not include Arizona. In view of the fact that Arizona is one of the upper Colorado River Basin States and that the Glen Canyon Dam site and powerplant are located within and constitute a natural resource of the State of Arizona, together with consideration of the estimated cost of power generation and the possible power market needs of Arizona, the State of Arizona recommended that it be included in the project power market area as fringe area D (Arizona) and that energy be made available to that fringe area on the same basis as proposed for the other three fringe areas.

The director, Arizona Game and Fish Commission, comments that the State of Arizona agrees wholeheartedly with the program for the upper Colorado Basin submitted by the Fish and Wildlife Service. No definite recommendation has been made as to which agency shall be responsible for requesting the funds and for carrying out this program. Public Law 732 provides that when wildlife values are destroyed by river basin development they should be replaced in kind. No appropriation should be made for river basin development unless at the same time appropriation is made to restore wildlife values which would be destroyed by completion of the project.

CALIFORNIA

The State of California favors congressional authorization of the specific projects set forth in the proposed report of the Secretary of the Interior or as may be modified, and their construction with Federal funds consistent with national welfare if (*a*) such projects qualify under criteria, policies, and procedures of the Congress, and (*b*) the diversion and utilization of the waters of the Colorado River system by and through these projects will not impair the rights of the State of California or any of its agencies to the waters of that system as defined and set forth in the Colorado River compact and related laws and documents.

COLORADO

Colorado greatly appreciates the expeditious manner in which the Secretary of the Interior and the Bureau of Reclamation have prepared and submitted the report. The Bureau of Reclamation, in full compliance with the spirit and intent of the Flood Control Act of 1944, has kept the States directly affected fully informed during the course of its investigations. The general plan set forth in the report is acceptable to and approved by Colorado. Colorado wholeheartedly supports the plan to use a portion of the power revenues to support irrigation projects and gives general approval to the criteria estab-

lished for the determination of the right of a project to qualify for aid from the revenues made available by the project.

Colorado comments further that there is no exportation project in the State of Colorado comparable to the central Utah project which will utilize water exported from the Colorado River Basin. It suggests that there should be full and complete cooperation between region 4 and region 7 to determine what, if any, Colorado exportation projects should be approved as participating projects.

The question of access roads to the Echo Park Reservoir and to the Split Mountain unit is a matter of great importance to Colorado. Colorado believes that access roads from Colorado points will satisfy all requirements and requests that before any final decisions are made as to road locations full opportunity be afforded Colorado to be heard on this subject.

The State of Colorado requests that the Whitewater unit on the Gunnison River not be included in the initial list of units and that further study and consideration should be given to the location of storage units on the Gunnison River which develop, as far as possible under all the conditions, the full power potential of the stream, permit the early construction of participating projects, and provide holdover storage, all with the least possible disruption of the local economy. Colorado desires that a unit of the storage project located on the Gunnison River be included in the initial authorizing legislation.

Colorado requests that the La Plata project be included among the participating projects for initial authorization. This project is desperately needed to provide a dependable water supply for lands lying in the La Plata Valley and located in both Colorado and New Mexico.

While the Shiprock project may be a desirable one and may well constitute an initial part of the plan for the development of the San Juan River, Colorado recommends that no appropriation for, or construction of, the project should be authorized or made until there has been made available to the effected States and approved by the Congress a report on the project comparable to the reports already prepared for the other participating projects.

Provision should be made for the termination upon a reasonable notice of all contracts relating to the disposition for use, outside the Upper Division States and outside that portion of the State of Arizona within and from which waters naturally drain into the Colorado River above Lee Ferry, of power generated at such plants to the extent that the power so contracted for is required to satisfy the needs of customers in the mentioned area.

Colorado urges that the report be revised so as to include a recommendation that the Congress authorize the creation of a special fund as a basis for future appropriations to carry on investigations in the upper Colorado River Basin in the period prior to the time funds will become available from the Upper Colorado River account.

Consideration should be given to revision of the present law relative to excess lands so that the principle of family operation may be retained in the mountain area.

The director, Colorado Game and Fish Commission, urges that the program for the upper basin proposed by the Fish and Wildlife Service be included as a part of the departmental report.

NEVADA

Nevada has no objection to publication of the report as submitted. It is well prepared and the Bureau of Reclamation is to be complimented upon the vast amount of excellent work it has done in preparing the report for publication.

Alfred Merritt Smith, State engineer, states that he is not sold on irrigation projects that will be unable to repay construction costs within a reasonable period of years, if ever, and that it would appear to be a sound business procedure to fix a minimum ratio of capital cost that must be paid rather than an amount based on the irrigators' ability to pay in a period of 50 years.

The immediate and best market for the power would probably be within the lower basin at the rapidly expanding independent center of the basic magnesium project in Nevada and in densely populated southern California. It is suggested that a large portion of Glen Canyon power should be allocated in perpetuity to this fully developed market.

NEW MEXICO

The report is an excellently prepared document evidencing a great deal of investigation and study over a period of years. The Department of the Interior and its various branches and employees are to be highly commended, particularly the Bureau of Reclamation. Subject to the specific recommendations hereinafter made, the State of New Mexico approves the plan of development of the water resources of the Upper Colorado River Basin as described in this report.

New Mexico is concerned that the power and energy generated by the project may be sold to users outside the Upper Basin. New Mexico requests the privilege of seeking at an appropriate time adequate provisions of law or procedures for such power operations as will insure the greatest future benefits for the States of the Upper Basin from the power produced by the Colorado River storage project. New Mexico believes that the power needs in the State will be greater than shown in the report and recommends that the State's power and energy needs be given careful review and considered before power contracts are entered into which might leave the State in the position of having to obtain power from other sources at rates which might be considerably higher than those which could be obtained from the storage project.

Although it is recognized that the La Plata project does not comply with present criteria for participating projects, this project is one of the most deserving projects within the entire basin from the standpoint of need for rehabilitation and reclamation of a project now deficient in water supply. Water shortages in that area are chronic. For this reason New Mexico urges that every effort be made to work out a revised project for the La Plata unit which could be included in the near future as a participating project.

New Mexico has the same comment regarding the Shiprock project as did Colorado; that is, they recommend deferment of actual construction until a report has been completed, submitted to the States and to the Congress.

New Mexico recommends inclusion in the report of the South San Juan and the San Juan-Chama projects on the same basis as the

Shiprock project; that is, authorization of these two projects with actual construction deferred until reports on the projects are completed, submitted to the States and to the Congress.

New Mexico recommends and urges that the construction schedule in the report be revised so that the Navaho Reservoir is included as one of the initial units of the storage plan, thereby permitting development in the State to proceed on an even basis with that in the other States of the upper basin.

New Mexico made the same recommendation as Colorado relative to authorization of additional investigation funds to be used during the interim period before investigation funds are available from the Upper Colorado River account.

The State game warden for New Mexico comments that the program of the Fish and Wildlife Service for the upper Colorado Basin meets with the approval of New Mexico.

UTAH

Utah commends the Department of the Interior, the Bureau of Reclamation, and their staffs on the investigations that have made the report possible. Full compliance with the spirit and purpose of section 1 of the Flood Control Act of 1944 has been exemplified.

The State of Utah is in accord with and fully endorses (*a*) the proposed plan of development, (*b*) the Upper Colorado River Basin account, and (*c*) the upper Colorado River development fund.

Utah makes essentially the same comment regarding the Shiprock project as Colorado and New Mexico; that is, deferment of actual construction until a report has been completed, submitted to the States and to the Congress.

Utah makes essentially the same comment as New Mexico relative to the use of power from the project. Utah reserves the privilege to seek at the appropriate time adequate provisions of law or approval of plans or procedures for such power operations as will insure the use of the power output of the Colorado River storage project in a manner consistent with greatest future benefits for the upper Colorado River storage States.

Utah also states that provisions should be made either in the report or in ensuing legislation for the specific authorization of appropriations of additional investigation funds during the interim period before funds from the upper Colorado River account are available.

In connection with the central Utah project, Utah comments that: (1) Any legislation authorizing the central Utah project should be sufficiently broad to permit scheduling the available water to Salt Lake County and repayment with respect thereto so as to permit full use of the water now available from the Provo River project. (2) Project authorization should also permit the metropolitan water district of Salt Lake City, and other proper organizations, to obtain water made available by the central Utah project for use in Salt Lake County, and (3) legislation authorizing the central Utah project should be sufficiently flexible to permit arrangements between the Provo River Water users Association, the metropolitan water district of Salt Lake City, and other proper interested parties for the use of any works of the Provo River project. These questions should not be interpreted as objections to the project plan but are matters that

can be dealt with appropriately during the final planning stages of central Utah project.

While recommending construction of the projects proposed in the report, Utah believes that such construction should be deferred, if it in any way impedes the defense effort or injures our economy. It would appear to be desirable in view of the shortage of material and manpower to defer such projects until these shortages no longer exist.

The director, Utah fish and game commission, comments that the report of the Fish and Wildlife Service has been examined and that Utah is in agreement with its contents.

WYOMING

From the report it appears that the storage project and participating projects are feasible, economically justified, and financially sound. The upper Colorado River account will permit uniform power rates, equate costs of the developments with revenues from all sources, and assist in repayment of the costs of participating irrigation projects made possible by the storage reservoirs. The setting up of the upper Colorado River development fund is a sound and equitable basis upon which to construct the entire project. The report appears to be comprehensive and very well prepared and Wyoming urges its approval.

Wyoming notes that there is no recommendation in the proposed report for legislation permitting preferential use in the upper basin of electric energy generated by Colorado River storage project units. It is the belief of Wyoming that such a provision should be included in the bill for authorization of the project.

DEPARTMENT OF AGRICULTURE

It is of vital importance that the Nation make the most of the resources with which nature has so richly endowed the Colorado Basin. A comprehensive and coordinated long-range plan should be developed for the Colorado Basin at an early date. It is especially important that the system of storage reservoirs proposed in the report be complemented by a coordinate program for the land. To insure that the overall project will yield a maximum return and that individual projects will constitute harmonious and effective elements in the ultimate program for the basin, additional economic studies should be undertaken. The desirability of establishing the upper Colorado River account is questionable. Such an account might prevent full and equitable consideration of all components of a comprehensive program and would thus set an undesirable precedent.

DEPARTMENT OF THE ARMY

The comments of the Chief of Engineers, writing on behalf of the Secretary of the Army, are summarized as follows: It appears that the report on the Colorado River storage project and participating projects is insufficiently advanced to permit satisfactory comments to be made on the engineering and economic justification of the plan at this time. Substantiating data are not available to permit reaching conclusions with respect to the justification of the project units

or the project as a whole at this time. In addition, some of the basic premises and assumptions used in the economic analysis appear to be questionable, and the effect of modification of these premises may be of major importance in the computation of the benefit-cost ratio. The questions of policy regarding subsidization of irrigation projects which cannot be paid for by irrigators under existing reclamation law is a matter which should require the most careful consideration because of its far-reaching implications in the field of Federal public works. In conclusion, the Chief of Engineers states that he is unable to concur in the recommendations in the report with respect to approval of the overall plan and the immediate authorization of the initial phase.

DEPARTMENT OF COMMERCE

The Bureau of Public Roads comments that the project report indicates that the Bureau of Reclamation's estimates are generally sufficient to take care of necessary replacement of roads to be inundated. However, in regard to the Glen Canyon Reservoir, there is some doubt whether provision has been made for the increment in cost of the Blending-Henksville Federal-aid secondary route which will be constructed at some time in the future. The Coast and Geodetic Survey comments that the various maps included in the report do not have any projection lines.

FEDERAL POWER COMMISSION

The Federal Power Commission comments that its staff has given considerable study to problems of the development of the Colorado River Basin over the past several years and that the results of these studies with respect to generation of power at the proposed projects are in substantial agreement with the estimates in the report.

In their futher comments, the Federal Power Commission reanalyzed the project on the basis of their method of determining power benefits, and found that, even on the basis of this conservative method, the storage project was economically justified. The Federal Power Commission observes that economic justification for each unit in the storage project was not given in the report and suggests that in the continuing studies such economic analysis be made for each unit. The Federal Power Commission states that its staff has made independent studies of the present and future needs for power in the areas that could be served with power produced at Colorado River storage project powerplants, and that its estimates are somewhat lower than the estimates given in the report. The difference in the estimates results from the differing determinations as to the needs for power in the fringe areas of the upper basin and differing assumption as to the export of power to adjacent areas. In respect to use of the interest component, the Federal Power Commission states that it has consistently taken the position that the public interest would best be served if the interest component were returned to the Treasury of the United States. The Commission recognizes that the program proposed is long-range in character and that modifications may be found desirable from time to time as studies continue. The Com-

mission suggests discussions between its staff and representatives of the Bureau of Reclamation as studies and detailed consideration of the Colorado storage project continue.

PUBLIC HEALTH SERVICE

The Public Health Service suggests that a paragraph covering taste and odor control relative to domestic water be added to their portion of the report.

UNITED STATES DEPARTMENT OF THE INTERIOR

DOUGLAS McKAY, SECRETARY

BUREAU OF RECLAMATION

W. A. DEXHEIMER, COMMISSIONER

REGION 4

E. O. LARSON, REGIONAL DIRECTOR

REGIONAL DIRECTOR'S REPORT OF DECEMBER 1950 ON COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS UPPER COLORADO RIVER BASIN

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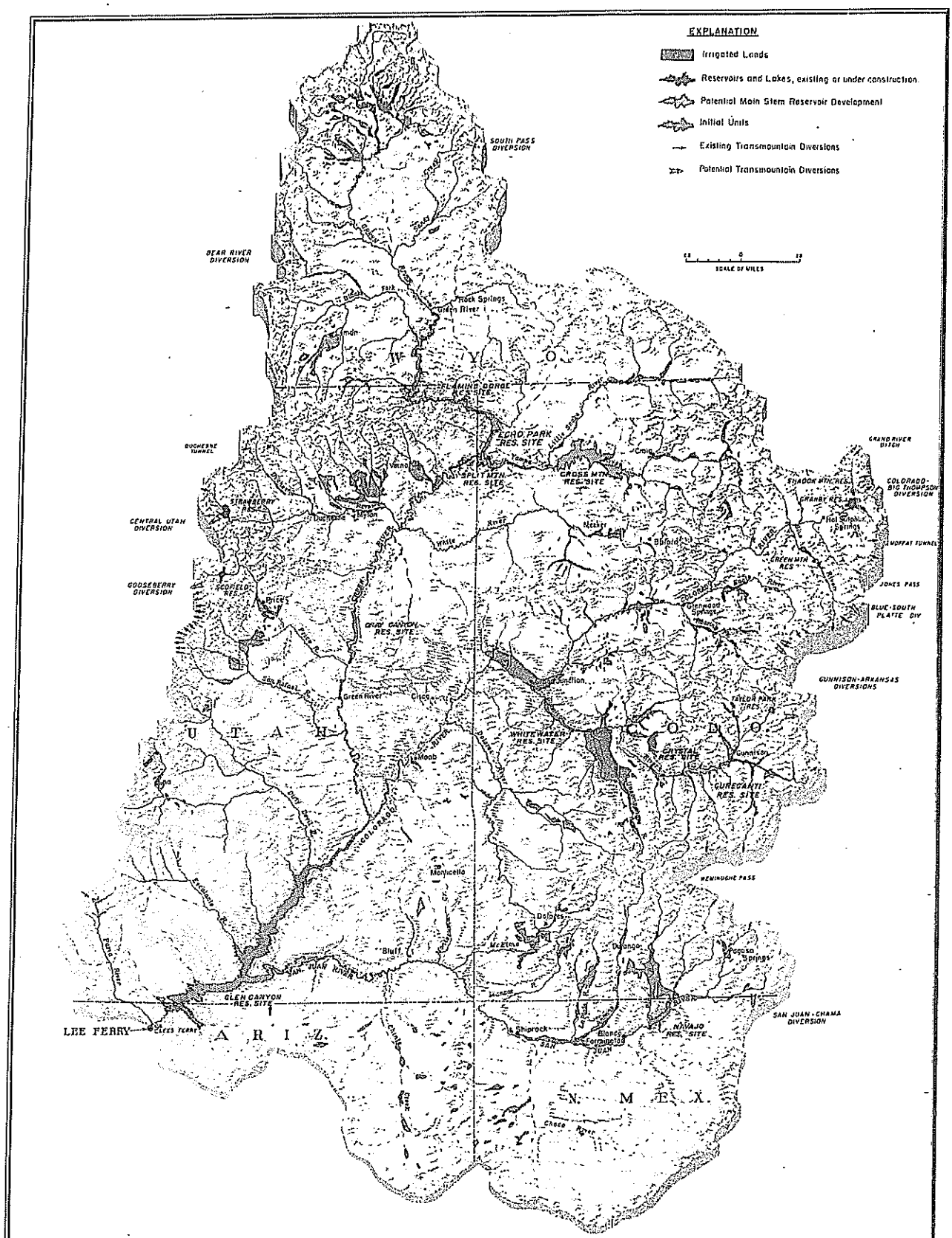

UPPER COLORADO RIVER BASIN

REVISED 7-1-50

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REGIONAL DIRECTOR'S REPORT OF DECEMBER 1950

DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION, REGION 4,
Salt Lake City 10, Utah, December 15, 1950.

To: Commissioner.
From: Regional Director.
Subject: Interim report on Colorado River storage project and participating projects, upper Colorado River Basin.

1. This letter is submitted as my interim report on the potential Colorado River storage project and other reclamation projects that would participate in the benefits and revenues of the storage project. The report outlines a plan of development and recommends an initial construction program. As investigations progress, further recommendations for construction will be made through other interim reports. The plans and programs of Federal agencies cooperating with the Bureau of Reclamation in the storage project investigations are a part of this report. Substantiating materials for the storage project, including statements of cooperating Federal agencies, are appended. Supplemental reports cover the details of each participating project.

2. The Colorado River storage project would consist of a combination of dams, reservoirs, powerplants, and other appurtenant structures on the upper Colorado River and its principal tributaries. Included as appurtenant structures would be facilities recommended by cooperating Federal agencies for multiple-purpose development of the upper Colorado River Basin's water resources. The project reservoirs would regulate the flow of the river, assure the delivery of water to the lower basin as required by the Colorado River compact, and further the use in the upper basin of water apportioned by the compact. Part of the capacity of some of the reservoirs would store water for direct use in the upper basin. Revenues from the sale of project-generated power would be sufficient to pay all reimbursable Colorado River storage-project costs and assist irrigators in payment of costs of other projects that would utilize water of the upper Colorado River system. Projects that would be so assisted are referred to as "participating projects." All projects authorized subsequent to approval of the upper Colorado River Basin compact that would consume water of the upper Colorado River system are considered to be dependent on the storage project for an assured water supply. Such projects, therefore, are designated "dependent projects."

3. Authority to make this report and supporting investigations is provided in the Federal reclamation laws (act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto, particularly the Boulder Canyon Project Adjustment Act, 54 Stat. 744).

4. Important contributions to this report and the substantiating materials were made by the Upper Colorado River Compact Commission and States of the upper Colorado River Basin. Valuable background information on the Colorado River Basin, its present and potential development, its resources, needs, and problems, was obtained from The Colorado River, a Department of the Interior report, dated March 1946, and printed as House Document 419, 80th Congress, 1st session.

Compact and Treaty Obligations

5. In its studies the Bureau of Reclamation has taken full account of agreements affecting the use of Colorado River system water in the upper basin, namely, the Colorado River Compact signed in 1922, the Mexican Water Treaty signed in 1944, and the upper Colorado River Basin compact signed in 1948. The Colorado River compact apportions the use of certain quantities of Colorado River system water to the upper and lower basins and establishes the obligations of Colorado, New Mexico, Utah, and Wyoming, designated "States of the upper division," with respect to deliveries of water at Lee Ferry. Rights of Mexico to the use of water from the Colorado River system are defined in the Mexican Water Treaty. By the upper Colorado River Basin compact the use of water apportioned the upper basin is divided among the upper basin States and principles are established to govern deliveries of water to meet the Lee Ferry flow obligations.

6. The upper basin, as defined by the compacts, means "those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River system above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry." The compact definition of the upper basin is used in the report. For distinction, the natural river basin above Lee Ferry is referred to as the upper drainage basin. Lee Ferry, the dividing point on the Colorado River between the upper and lower basins, is located in northern Arizona. It is defined by the Colorado River compact as "a point in the main stream of the Colorado River 1 mile below the mouth of the Paria River."

Need for Development

7. Now that the upper basin compact has become effective, urgently needed irrigation projects may be undertaken to turn dry land into productive farms and to supplement the meager water supply on some presently irrigated land. An urgent need also exists for water developments to supply municipalities and to permit utilization of the upper basin's vast resources of hydroelectric power, fuels, oils, phosphate, other minerals, and timber. The States of the upper division, however, can realize the use of their apportioned water only when extensive river regulation is provided to assist them in meeting downstream flow obligations established by the Colorado River compact. With full use of water apportioned the upper basin, an aggre-

gate active reservoir capacity of at least 23 million acre-feet will be required to assure upper division deliveries at Lee Ferry, exclusive of any deliveries required for Mexico.[1] In addition, capacity must be provided for sediment, power head, and direct use of water in the upper basin.

8. Electric energy requirements are rapidly increasing in the area within and adjacent to the upper basin. In recent years the growing industrialization of the West and the accelerated development of natural resources have taxed existing generating facilities to capacity. Practically every power utility in the market area has plans to increase its generating capacity to meet requirements of the immediate future. By 1980, however, power demands in the area are expected to exceed by far the output of all the installations now scheduled, including installations planned for the Colorado River storage project. Power demands in the lower basin are even greater than those in the upper basin and are expected to increase at a rapid rate. River regulation and sediment control are needed at an early date to assure maximum utilization of several important power potentialities on the Colorado River below Lee Ferry and above Lake Mead.

Plan of Development

9. The plan of development is presented by a discussion of the Colorado River storage project, followed by a discussion of participating projects.

COLORADO RIVER STORAGE PROJECT

10. Ten units, each including a dam, reservoir, and appurtenant power facilities, would constitute the Colorado River storage project. The dams would be located above Lee Ferry on the Colorado River and its principal tributaries. Eight of the dams would provide river regulation, namely, Whitewater Dam (Whitewater unit), Cross Mountain Dam (Cross Mountain unit), Blue Mesa Dam (Curecanti unit), Echo Park Dam (Echo Park unit), Ashley Dam (Flaming Gorge unit), Glen Canyon Dam (Glen Canyon unit), Gray Canyon Dam (Gray Canyon unit), and Navaho Dam (Navaho unit). The two additional dams would be built for power head only. One would be the Crystal Dam (Crystal unit) which would benefit from river regulation provided by the upstream Curecanti Reservoir. The other would be the Split Mountain Dam (Split Mountain unit) which would benefit from upstream regulation provided by the Echo Park Reservoir. The various units would be constructed and operated by the Bureau of Reclamation in a manner consistent with agreements affecting the Colorado River. Title to the works would remain in the United States. Information on the 10 potential units is summarized in the following table.

[1] The extent of storage, if any, required for assistance in the administration of the Mexican Water Treaty cannot be determined at this time. The plan outlined herein does not provide for, nor preclude, storage for this purpose.

Summarized data on Colorado River storage project

Project unit	River	Height of dam above river (feet)	Total reservoir capacity (acre-feet)	Active storage capacity (acre-feet)		Power installation (kilowatts)
				Initially	After 200 years of sediment encroachment	
Cross Mountain	Yampa	295	5,200,000	4,200,000	4,030,000	60,000
Crystal [1]	Gunnison	305	40,000	0	0	48,000
Curecanti	do	475	2,500,000	2,010,000	1,970,000	54,000
Echo Park	Green	525	6,460,000	5,460,000	5,160,000	200,000
Flaming Gorge	do	440	3,940,000	2,950,000	2,550,000	72,000
Glen Canyon	Colorado	580	26,000,000	20,000,000	10,455,000	800,000
Gray Canyon	Green	445	2,000,000	1,390,000	698,000	210,000
Navaho	San Juan	335	1,200,000	1,050,000	734,000	30,000
Split Mountain [1]	Green	245	335,000	0	0	100,000
Whitewater	Gunnison	255	880,000	470,000	326,000	48,000
Total			48,555,000	37,530,000	25,941,000	1,622,000

[1] Would benefit from upstream storage. Storage at site would be used only for short period power regulation.

11. Investigations to date show that the project as planned would economically provide maximum water utilization and power production with minimum loss of water from evaporation. The project would control sediment, abate floods, facilitate recreational development, and aid in fish and wildlife conservation. As detailed studies progress, some changes in the selected units may be found desirable. So far as practicable, adjustments in the plan also will be made from time to time to accommodate supplemental works proposed by interested State and Federal agencies.

Storage system

12. Project reservoirs initially would have a total capacity of 48,555,000 acre-feet, including 37,530,000 acre-feet of active storage and 11,025,000 acre-feet of inactive storage. In a 200-year period at the present rate of erosion, about 20 million acre-feet of capacity would be required for sediment storage—nearly 80 percent of which would be provided at the Glen Canyon site. An estimated 11,589,000 acre-feet of the sediment would settle out in the active storage sections, leaving at the end of 200 years about 25,941,000 acre-feet of active capacity for river regulation and direct use of water in the upper basin. The remaining 8,411,000 acre-feet of sediment would find its way to the dead-storage pools, leaving about 2,614,000 acre-feet of inactive capacity for power head, fish propagation, and recreation. The silt deposits would not reduce the original power head. With reduced erosion on the watersheds by improved practices of land management agencies, the period of protection against sediment encroachment would be extended. Future generations could further extend this protection by developing additional upstream sediment storage sites.

13. With full use of water apportioned the upper basin, an active storage capacity of at least 23 million acre-feet would be maintained exclusively for river regulation. The space reserved for river regulation would remain nearly full as long as the river flow was sufficient to meet the 10-year Lee Ferry flow obligation of the Colorado River compact. During periods of critically low flow, water from the regulatory reserves would be released to meet the 10-year Lee Ferry flow

obligation. The reserves would be replenished during years of favorable water supply.

14. Some of the regulatory reservoirs may provide direct storage for irrigation and other water-consuming uses in the upper basin. For example, water for the central Utah project could be provided by a gravity diversion from the Flaming Gorge Reservoir or by pumping from the Echo Park Reservoir. The Whitewater Reservoir by providing replacement water for use on presently irrigated land in western Colorado could permit new irrigation and industrial developments on the west slope of the Continental Divide in Colorado and transmountain diversions to the east slope of the Divide, also in Colorado. Only through the Navaho Reservoir could New Mexico attain full use of its apportioned water. Water from the Navaho Reservoir could directly supply the Shiprock Indian project, the South San Juan project, or by exchange it could benefit possible projects for the exportation of water to the Rio Grande Basin in Colorado and New Mexico.

15. Initial filling of the project reservoirs may require temporary adjustments in the operation of power facilities on the Colorado River below Lee Ferry. Any adjustments required, however, could be accomplished without prejudice to developments both above and below Lee Ferry. Because of their strategic location, the large Glen Canyon Reservoir and powerplant would be of particular importance in effecting the proper integration of power and river operations.

Power development

16. Powerplants at the 8 regulatory reservoirs and at the Crystal and Split Mountain sites would have a total installed generating capacity of 1,622,000 kilowatts. Power generation would reach a maximum of about 9 billion kilowatt-hours annually and would decrease to about 6 billion kilowatt-hours annually with ultimate upstream depletions. Transmission lines would connect the plants with various load centers, either directly or through interconnections with other power systems. Energy requirements in the project service area would be met first from existing and potential local power developments not included in the project. Additional requirements would be met with energy produced by the project facilities.

Construction schedule

17. The project units would be constructed as required to meet the needs for consumptive use of water and for electric energy. To make certain that project units could be in operation when needed, consideration must be given to cyclic shifts in runoff conditions and the advantages that would be gained by initial filling of the reservoirs while unused apportioned water is available. The Echo Park, Flaming Gorge, Glen Canyon, Navaho, and Whitewater units are scheduled for initial construction. Construction of the Whitewater, Echo Park, and Glen Canyon units could be undertaken immediately, followed by the Navaho and Flaming Gorge units.

18. The initial five units are favorably situated to supply immediate power market needs in the upper basin and adjacent areas. The Echo Park unit would provide a large amount of power and extensive river regulation with small losses to evaporation. The Echo Park Reservoir would not be seriously impaired by sediment. The Glen

Canyon unit could readily meet critical power deficiencies in the lower part of the upper basin and adjacent areas and would permit immediate coordination of power and river operations above and below Lee Ferry. The Glen Canyon powerplant would provide a source of power which could be used to meet deficiencies which might arise due to use of water for reservoir filling if drought conditions should curtail power generation at other plants. The Whitewater, Flaming Gorge, and Navaho units would facilitate transmission of project energy to Colorado, Wyoming, and New Mexico, respectively. Features of these three units would subsequently assist in the diversion of water for consumptive uses.

Costs

19. The construction cost of the entire Colorado River storage project is estimated at $1,139,100,000 on the basis of December 1949 prices which are essentially the same as current prices. This estimate includes the cost of dams, powerplants, transmission facilities, access facilities, construction camps, rights-of-way, relocation of transportation and communication facilities, investigations, engineering, and overhead. Based on current prices, operation, maintenance, and replacement costs are expected to average about $9,732,100 annually with full project development. A breakdown of costs by project units is shown in the tabulation below:

Project unit	Estimated construction cost	Estimated annual operation, maintenance, and replacement costs
Cross Mountain	$51,000,000	$114,700
Crystal	37,000,000	325,500
Curecanti	80,400,000	378,100
Echo Park	105,400,000	1,199,200
Flaming Gorge	82,700,000	483,000
Glen Canyon	363,900,000	4,428,600
Gray Canyon	178,400,000	1,230,300
Navaho	63,000,000	251,000
Split Mountain	76,400,000	659,000
Whitewater	40,000,000	352,800
Total	1,139,100,000	9,732,100

Benefits

20. The Nation, particularly the States of the Colorado River Basin, would realize substantial benefits from the Colorado River storage project. Benefit values from power production are estimated at $59,084,000 annually on the basis of average annual equivalents computed at 2.5 percent interest over a 100-year period of operation for each generating unit. Benefits from irrigation and other water-consuming uses in the upper basin would be realized only with the construction of dependent projects. Therefore, benefits from these uses are being evaluated in connection with dependent projects and will be shown in the analysis of each such project. Tangible and intangible benefits that have not yet been evaluated would be realized in the upper basin from recreation, flood control, and fish and wildlife conservation and in the lower basin from sediment retention and river regulation for power production and flood control. These benefits will be evaluated when additional information is provided from further project investigations.

Benefit-cost ratio

21. To permit a comparison of project benefits and cost the estimated costs of the Colorado River storage project were converted to average annual equivalents computed over a 100-year period for each project unit. The annual cost thus computed is $41,994,700. It includes about $32,262,600 for amortization of the net project investment over the period of analysis at 2.5 percent interest and an average of about $9,732,100 for annual operation, maintenance, and replacements over the period of analysis. Allowances were made for interest during construction and the value of salvage at the end of the 100-year period. Inasmuch as benefits from irrigation and other water-consuming uses will be evaluated and shown in the analysis of each dependent project, an appropriate share of the cost of the Colorado River storage project, totaling $9,671,000 annually, has been assigned to dependent projects. The remainder of the cost, $32,323,700 annually, has been assigned to the storage project. These assignments are for the purpose of benefit-cost analyses.

22. Annual evaluated benefits from the Colorado River storage project ($59,084,000) would compare with the annual costs assigned the project ($32,323,700) in a ratio of 1.8 to 1.0.

Cost allocations

23. Costs of the Colorado River storage project have been tentatively allocated to irrigation and other water-consuming uses and to power as shown in the following tabulation. The allocations were made by averaging the results of the priority-of-use and alternative-justifiable-expenditure methods. No allocations were made to fish and wildlife conservation, flood control, recreation, sediment retention, or other purposes although in the future such allocations may be found desirable and justified.

Purpose	Construction cost	Annual operation, maintenance, and replacement costs
Irrigation and other water consuming uses	$332,950,000	$107,700
Power	806,150,000	9,564,400
Total	1,139,100,000	9,732,100

Upper Colorado River account

24. Power revenues would be obtained from the sale of firm energy at an average rate of 5.5 mills a kilowatt-hour and from the sale of secondary energy available in early operations of developments at 3 mills a kilowatt-hour. Such rates would be sufficient to cover, among other things, an interest charge of 3 percent on the unamortized power investment. The indicated rates are based on present expectations as to construction costs. Any appreciable rise in price levels would be reflected in the average rates.

25. All scheduled power revenues from units of the Colorado River storage project and from participating projects located within the upper drainage basin, and all scheduled net power revenues derived from the central Utah project (initial phase) subsequent to complete reimbursement of the reimbursable costs of that project, would be

credited to an account to be known as the upper Colorado River account. The account would be charged with all scheduled payments on the construction, operation, maintenance, and replacement costs of the Colorado River storage project and participating projects located within the upper drainage basin which costs are allocated to power purposes or assigned to be returned from power revenues. The account would also be charged with scheduled payments on that portion of the construction cost of each participating project allocated to irrigation which is required to be so paid in order to show full reimbursement of the irrigation allocation within 50 years following a suitable development period for that project.

26. Under the suggested construction schedule and plan the total construction cost of the storage project would be repaid 65 years after the first generating unit was placed in operation. The power allocation would be retired within 50 years following installation of the last generating unit.

27. Credits to the upper Colorado River account from the revenues of the Colorado River storage project are expected to exceed charges against the account by the storage project in cumulative amounts shown below.

Net credits from Colorado River storage project

Years:		Years—Continued	
10	$70, 600, 000	50	$382, 600, 000
20	196, 800, 000	60	454, 300, 000
30	310, 600, 000	70	674, 900, 000
40	374, 200, 000		

PARTICIPATING PROJECTS

28. Criteria, listed below, have been established for consideration in the selection of projects to participate in the upper Colorado River account. Under these criteria financial assistance would be given only to practicable irrigation projects. Assistance is required by nearly all potential projects in the upper basin since projects already constructed have utilized the least expensive sites and most convenient water supplies.

(*a*) A project, unit, or phase thereof may be eligible to participate only when and to the extent that all sources of estimated revenue directly available to said project, unit, or phase are insufficient to return its reimbursable costs during its payout period as hereafter specified in (*d*).

(*b*) It shall be a project for the use in one or more of the States designated in article III of the upper Colorado River Basin compact, of water of the upper Colorado River system, as that system is defined in such compact, the consumptive use of which is apportioned to those States by that article.

(*c*) Its total benefits shall exceed its total costs, including, but without limitation, any costs attributable to its direct use of the facilities of the Colorado River storage project or any other project, and an appropriate share of the costs of the Colorado River storage project.

(*d*) With anticipated revenues from irrigation, based on the irrigators' ability to pay, it shall be able to pay the operation, maintenance, and replacement costs allocated to irrigation, and to pay in a

period of 50 years following a suitable development period, at least part of the construction costs allocated to irrigation.

(*e*) There shall be available to aid such participating project, or group of participating projects, an appropriate district, preferably of the water conservancy type, which shall be satisfactory to the Secretary of the Interior, one purpose of which shall be to provide revenues for the project over and above those paid by irrigators to assist in repayment of construction costs allocated to irrigation.

(*f*) It shall not require assistance from the upper Colorado River account in an amount, which, taking into consideration the prior obligations of the account and the anticipated revenues from its existing and authorized units, will leave the account in a deficit position at the end of the payout period for the participating project as specified in (*d*) above or will require an increase in the general level of Colorado River storage project power rates.

(*g*) Charges to the upper Colorado River account for the benefit of a project commingling water specified in (*b*) with other water shall not exceed an appropriate share of the construction cost of the works required by that project to use water specified in (*b*).

(*h*) Pertinent data sufficient to determine its probable engineering and economic justification and feasibility shall be available.

29. The criteria outlined are suggested for all participating projects except the Eden project in Wyoming and Paonia project in Colorado, which have previously been authorized. The Act of June 28, 1949 (Public Law 132, 81st Cong., 1st sess.), which authorized the completion of the Eden project, provides:

> That construction costs of the irrigation features of the project which are not hereby made reimbursable by the water users shall be set aside in a special account against which net revenues derived from the sale of power generated at the hydroelectric plants of the Colorado River storage project in the upper basin shall be charged when such plants are constructed.

The Paonia project was authorized by the act of June 25, 1947 (Public Law 117, 80th Cong., 1st sess.). Enlargement of the Fire Mountain Canal is in progress under that act. After authorization it was determined that it would not be feasible to construct the Spring Creek Dam at the site prescribed in the project report and that the cost would greatly exceed the estimate. A bill (H. R. 9244, 81st Cong., 2d sess.) to amend the authorized act is now before Congress. The bill provides that the plan of development be revised and that net revenues derived from the sale of power generated at the hydroelectric plants of the Colorado River storage project be used to pay reimbursable construction costs that could not be paid by the water users within the repayment period of 68 years specified in the act of June 25, 1947.

30. Special consideration would be required for projects planned for irrigation of Indian lands. Such projects, however, would be evaluated by the same criteria as the non-Indian projects in order to determine the extent to which they would be assisted by the upper Colorado River account. Any additional assistance required by Indian irrigators would have to be provided by means other than the upper Colorado River account.

31. Water available to the upper basin is inadequate for all potential projects. Considerable study will be required of the many potentialities before a complete group of dependent projects may be chosen

that have water requirements compatible with the apportionments of the respective States of the upper basin and that are in the best interests of the individual States and the Nation as a whole. Sufficient investigations have been completed, however, to permit selection of a few projects for initial construction and participation in the upper Colorado River account. Other participating projects will be selected on the completion of further investigations.

32. Sixteen projects have been recommended cooperatively by the States of the upper Colorado River Basin for initial participation in the upper Colorado River account. Twelve of these projects have been found to meet the criteria set out in paragraph 28. These are described briefly in the following paragraphs and pertinent data from supplemental reports are summarized in tabular form on page 81. Plans for two of the other projects recommended, the Gooseberry project in Utah and the La Plata division of the Animas-La Plata project in Colorado and New Mexico, would have to be revised before these projects would fully meet the criteria outlined. Sufficient investigations have not been made of the Little Snake River project in Wyoming and Colorado, which has also been recommended, to determine whether it would meet the criteria. The Shiprock Indian project also recommended is being investigated by the Bureau of Indian Affairs.

(*a*) *Authorized projects*

(1) *Eden project, Wyoming.*—The Big Sandy Dam is being constructed on Big Sandy Creek, 35 miles north of Rock Springs, Wyo., to impound 40,000 acre-feet of water. The reservoir will provide a supplemental water supply for 9,000 acres now irrigated and a full irrigation supply for 11,000 acres of arable dry land. The Means Canal will be constructed to convey reservoir water to the existing Eden Canal and lateral system which will be enlarged and extended.

Construction of the Eden project, approved by the President September 18, 1940, was stopped by order of the War Production Board in December 1942. Completion was authorized by the act of June 28, 1949 (Public Law 132, 81st Cong., 1st sess.) and construction is now underway. The authorizing act provides "That of the construction costs of the irrigation features of the project not less than $1,500,000 for the project of 20,000 irrigable acres, or a proportionate part thereof based on the actual irrigable area * * *, shall be reimbursable by the water users in not to exceed 60 years * * *."

(2) *Paonia project, Colorado.*—H. R. 9244 to amend the act authorizing the Paonia project provides for construction of a dam at Spring Creek B site on Muddy Creek, a tributary of the North Fork of the Gunnison River. The dam will form a reservoir of 18,000-acre-foot capacity in west central Colorado near Paonia. The reservoir will provide supplemental water for 14,830 acres now irrigated with only a partial water supply and a full supply for 2,210 acres not heretofore irrigated. Work is nearing completion on the enlargement and extension of the Fire Mountain Canal which will distribute project water. Land served from the extension will include land now irrigated from Minnesota Creek and land on Rogers Mesa now irrigated from Leroux Creek. Leroux Creek water will then be diverted higher upstream and used for irrigation on Redlands Mesa.

(*b*) *Projects recommended for authorization*

(1) *Central Utah project, Utah.*—The comprehensive central Utah project, a large multiple-purpose development, is of such magnitude that it has been planned in two parts—the initial phase, a unified portion that could operate independently, and the ultimate phase. Only the initial phase is included in the group recommended for initial participation in the upper Colorado River account.

The initial phase would intercept the flow of streams on the south slope of the Uinta Mountains as far east as Rock Creek and would convey the water westward by gravity flow for use in the Bonneville Basin. Water for replacement and expanded irrigation in the Uinta Basin would be provided by storage on local streams. Several regulatory reservoirs would be required in both the Bonneville and Uinta Basins, the principal one being the enlarged Strawberry Reservoir on the Strawberry River. By construction of Soldier Creek Dam the capacity of the reservoir would be increased from 283,000 acre-feet to 1,370,000 acre-feet. The initial phase would provide for the irrigation of 28,540 acres of new land and 131,840 acres now irrigated but in need of more water or improved water regulation. It would also provide 48,800 acre-feet of water annually for municipal, industrial, and related uses. It would generate each year approximately 373 million kilowatt-hours of energy.

(2) *Emery County project, Utah.*—Irrigation water would be furnished 24,080 acres of land under existing canals diverting from Cottonwood Creek and Huntington Creek in east-central Utah near Castle Dale. Supplemental water would be provided for 20,450 acres of the land and a full new supply would be provided for 3,630 acres. The irrigation water would be made available through storage of surplus spring runoff at a 57,000-acre-foot reservoir at the Joes Valley site on Cottonwood Creek. Water for lands in the Huntington Creek area would be conveyed by canal from Cottonwood Creek.

(3) *Florida project, Colorado.*—Lemon Reservoir, with a capacity of 23,300 acre-feet, would be formed by the Lemon Dam on the Florida River in southwestern Colorado, southeast of Durango. This reservoir would regulate the Florida River runoff to provide an irrigation water supply for 18,950 acres, including 12,650 acres now irrigated with only a partial supply and 6,300 acres not now irrigated. Approximately 1,000 acres of the land in the project area are Indian owned, The regulatory storage provided for irrigation would reduce floods which nearly every year cause extensive damage along the river course.

(4) *Hammond project, New Mexico.*—The Hammond project would divert natural flow of the San Juan River to provide an irrigation supply for 3,670 acres of presently unirrigated land along the south side of the river near Bloomfield, N. Mex. The water would be diverted from the river by a low diversion dam and conveyed to the project land by a gravity canal. A pumping unit would be installed to lift water 49 feet from the gravity canal to two highline laterals that would serve about 1,110 acres of the project land.

(5) *La Barge project, Wyoming.*—Unregulated natural flow of the Green River would be diverted for the irrigation of 7,970 acres of new land located west of the river between Big Piney and La Barge in southwestern Wyoming. The principal construction feature would be a canal 38 miles long, mostly of earth section.

(6) *Lyman project, Wyoming.*—Water would be stored in an offstream reservoir of 43,000-acre-foot capacity at the Bridger site on Willow Creek to furnish supplemental irrigation water for 40,600 acres of land along Blacks Fork near the town of Lyman in southwestern Wyoming. The reservoir would be fed by canals from Blacks Fork and West Fork of Smiths Fork.

(7) *Pine River project extension, Colorado and New Mexico.*—The extension is planned to enlarge and lengthen distribution works in order that storage water already available in Vallecito Reservoir of the Pine River project might be furnished to some of the arable project land still unirrigated in southwestern Colorado and northwestern New Mexico. The extension would serve 15,150 acres of land, including 1,940 acres administered by the Bureau of Indian Affairs.

(8) *Seedskadee project, Wyoming.*—This project would irrigate 60,720 acres of presently unsettled land located along both sides of the Green River in southwestern Wyoming, about 35 miles east of Kemmerer. The land would be irrigated by gravity diversions from the Green River. Two drops in distribution canals would drive turbines to lift water to higher land. No reservoir storage would be required.

(9) *Silt project, Colorado.*—A reservoir of 10,000 acre-foot capacity would be constructed on Rifle Creek in west-central Colorado near Rifle. Most of the reservoir water would be released to water users downstream, replacing part of the natural flow heretofore used. In exchange for the storage water, an equivalent amount of natural flow water would be diverted from East Rifle Creek above the reservoir and conveyed to project land in Dry Elk Valley and on Harvey Mesa. Water would also be conveyed from the reservoir to land under the Davie ditch in Rifle Creek Valley. During the low stages of the reservoir, pumping would be required. In all, 5,400 acres of land would be provided a supplemental water supply and 1,900 acres would be provided a full new supply.

(10) *Smith Fork project, Colorado.*—Surplus runoff of Smith Fork and Iron Creek would be regulated in a reservoir of 14,000 acre-foot capacity at the Crawford site on Iron Creek in west-central Colorado near Crawford. Water from Smith Fork would be diverted to the reservoir by feeder canal. The stored water would be conveyed by canal to land on Grand View Mesa and land adjacent to Cottonwood Creek. Part of the released storage water would replace natural flow on this land, permitting additional diversions of natural flow to land above the reservoir in the upper Smith Fork Basin. A total of 10,430 acres would be benefited, including 8,160 acres now inadequately irrigated and 2,270 acres of dry land.

Initial participating projects—Upper Colorado River Basin

Project	Irrigable area (acres)			Increased stream depletion [1] (acre-feet annually)	Construction cost			Cost payable from project revenues [3]	Costs payable from upper Colorado River account
	New land	Furnished supplemental water	Total		Total [2]	Nonreimbursable	Reimbursable		
Authorized projects:									
Eden	11,000	9,000	20,000	17,800	$5,986,000		$5,986,000	$1,500,000	$4,486,000
Paonia	2,210	14,830	17,040	9,000	6,191,000	$147,300	6,043,700	2,415,200	3,628,500
Subtotal	13,210	23,830	37,040	26,800	12,177,000	147,300	12,029,700	3,915,200	8,114,500
Recommended for authorization:									
Central Utah (initial phase)	28,540	131,840	160,380	189,400	198,840,000	2,570,000	196,270,000	181,097,260	15,172,740
Emery County	3,630	20,450	24,080	15,500	7,840,000	140,000	7,700,000	3,415,000	4,285,000
Florida	6,300	12,650	18,950	12,900	6,211,500	363,600	[4] 5,847,900	1,059,500	4,788,400
Hammond	3,670		3,670	7,900	1,892,300		1,892,300	238,500	1,653,800
LaBarge	7,970		7,970	14,200	1,476,000		1,476,000	416,500	1,059,500
Lyman		40,600	40,600		9,847,000		9,847,000	2,125,000	7,722,000
Pine River extension	15,150		15,150	28,300	4,088,000		[4] 4,088,250	1,653,646	2,434,604
Seedskadee	60,720		60,720	110,400	20,379,000		20,379,000	4,135,000	16,244,000
Silt	1,900	5,400	7,300	5,800	3,190,000	73,600	3,166,400	885,000	2,231,400
Smith Fork	2,270	8,160	10,430	7,500	2,148,000		3,148,000	860,000	2,288,000
Subtotal	130,150	219,100	349,250	391,900	256,911,800	3,147,200	253,764,850	195,835,406	57,879,444
Total	143,360	242,930	386,290	418,700	269,088,800	3,294,500	265,794,550	199,800,606	65,993,944

[1] Estimated for each project from climatic data for the particular period of water supply study adopted for the preliminary project investigation.

[2] Costs estimated at prices prevailing in December 1949. Do not include nonreimbursable Colorado River development funds spent for investigations.

[3] Estimated irrigation revenues at average crop prices prevailing in 1939–44 period; central Utah project revenues also would include revenues from power and municipal use.

[4] Includes $78,000 (Florida project) and $211,848 (Pine River project extension) that would be repaid or adjusted under an extension of the Leavitt Act of July 1, 1932 (47 Stat. 564) authorizing the Secretary of the Interior to adjust reimbursable debts of Indians.

Investigations of Cooperating Federal Agencies

33. The varied and extensive resources of the upper Colorado River Basin have been under study by several Federal agencies, each charged with specific responsibilities pertaining to the development and protection of natural resources. These studies, however, have not provided all the information required for the detailed planning of complete basin development. Therefore it is necessary that the types of investigations conducted in the past be extended and that the investigations be intensified to provide the detail essential for scheduling the full use of basin natural resources. The continuing studies needed will be conducted by numerous agencies under programs justified by each agency concerned. The results of the studies will be made available to all under cooperative arrangements established by the agencies and by Congress. The Department of the Interior, because of responsibilities delegated to its constituent agencies by Congress, has a major responsibility for resource development in the upper Colorado River Basin. A fully integrated investigational program by the Department is planned which will include the kind and scope of studies discussed in the following paragraphs.

34. Accurate knowledge of the vital water resources of the basin is obviously indispensable to the consideration of any project involving water control and utilization. To secure additional detailed information required the Geological Survey plans (1) to add about 20 stream-gaging stations to the 80 stations now in operation to facilitate administration of the various interstate compacts and to add about 140 stations to the 200 now in operation to collect the basic data required in the planning of the basin's future water-use projects; (2) to continue the topographic mapping of the entire upper Colorado River Basin, now only 11 percent complete, with an accelerated program in the areas to be covered by storage project reservoirs; (3) to expand the program for measuring sediment transported by the Colorado River and its principal tributaries in order to confirm estimates of sediment storage capacities required in the project reservoirs; (4) to investigate measures to control erosion at its source; (5) to continue special studies of water losses in the stream channels and adjoining flood overflow areas; (6) to evaluate regional groundwater levels and contributions to stream flow from groundwater sources; (7) to expand the program for analyzing water from all parts of the basin and to maintain a continuing record of water quality; and (8) to complete geologic mapping and inventory of areas which may contain valuable mineral resources.

35. Investigations by the Fish and Wildlife Service provide the basic biological information necessary to evaluate the effects of water-use projects on fish and wildlife resources and to suggest means that may be employed to mitigate the effect of adverse features or operations which are necessary to achieve the primary purposes of the projects. An overall wildlife study is desired in the upper Colorado River Basin to determine (1) the relative importance of developing different portions of the area for migratory birds; (2) the methods and areas that might be developed to relieve the congested big game ranges and increase upland game habitat, especially those to be further restricted by proposed developments; and (3) the possibilities of im-

proving the fisheries by introducing game fish in the reservoirs and by improving streams.

36. The National Park Service has made a general survey of recreational resources of the upper Colorado River Basin as its part in formulating a comprehensive plan for basin development. Preliminary examinations have been made of each site contemplated for use in the Colorado River storage project. Detailed studies of each storage project reservoir will be required to plan appropriate facilities for recreational use and to provide for their management. These detailed studies will include (1) determination of additional land areas adjacent to the reservoirs that would be necessary for the construction and operation of recreational facilities, (2) surveys and salvage in cooperation with the Smithsonian Institution and local interests of archeological remains endangered by water conservation projects, (3) planning of the specific facilities at each site which can be integrated into the National Park system or managed by State or other Federal agencies, and (4) preparation of estimates of the benefits to result from the planned developments.

37. The Bureau of Land Management is responsible for cadastral surveys on public lands within the upper Colorado River Basin, maintains records of all land transactions, issues patents to the land, handles applications for all mineral resources, and regulates grazing on the Federal range within the grazing districts and on other lands leased for grazing. The Bureau of Land Management plans to make large-scale studies in erosion control and sediment abatement. It also plans to accelerate the cadastral survey program and land classification and resources inventories.

38. To keep abreast of the increasing national demands for minerals, it is necessary to step up the rate of discovery of new reserves, reduce the cost of mining and handling ores by improvements in techniques, improve methods of recovery and separation, and develop better usage of the minerals and metals. The Bureau of Mines is expanding the search for petroleum and natural gas. It is discovering new reserves of minerals in short supply as well as new ores. Mining research is being done at a demonstration mine at Rifle, Colo., to determine methods and costs of mining oil shale, and a program is being formulated to develop methods of mining thick coal beds to increase extraction as a conservation measure. In the metallurgical field the Bureau of Mines is working closely with the Atomic Energy Commission on the recovery of uranium from complex low-grade ores. Research is being done on the recovery of vanadium and phosphate from low-grade shales and the utilization of phosphate rock. The production of silico-manganese from rhodonite is being studied as a possible method of making available more manganese. Coal utilization studies are being conducted to improve the heat value of coal in order to justify shipping greater distances, particularly to the Pacific coast area. Studies are being made of the production of synthetic liquid fuel from coal and methods of improving the heat value of coal for utilization as thermal power on a competitive basis to firm up hydroelectric power. Retorting and refining research is being done on oil shale at Rifle, Colo., and Laramie, Wyo., to produce synthetic liquid fuel. The work being done on petroleum and natural gas is directed toward increasing the yield from various fields and thereby increasing reserves.

39. Special responsibilities to the Indians make it necessary that the Bureau of Indian Affairs continue its studies of the utilization of reservation lands in the upper basin. Further studies will be made to develop Indian lands and to assure the protection of the resources and rights now held by the basin's Indians in order that they may attain an economic independence comparable to that of other citizens of the basin.

Conclusions

40. The Colorado River storage project would provide necessary regulatory storage by a combination of reservoirs on the Colorado River and its tributaries above Lee Ferry. All projects that would consume water of the upper Colorado River system, authorized subsequent to approval of the upper Colorado River Basin compact, are considered to be dependent on river regulation for an assured water supply.

41. Reservoirs of the Colorado River storage project would provide a total storage capacity of about 48,555,000 acre-feet. In 200 years at the present rate of erosion about 20 million acre-feet of the capacity would be occupied by sediment, leaving 25,941,000 acre-feet of active capacity for river regulation and direct use of water in the upper basin and 2,614,000 acre-feet of inactive capacity for creation of power heads, fish and wildlife propagation, recreation, and other purposes.

42. Releases from regulatory reservoirs would produce substantial amounts of electric energy. Power load growth trends indicate that the project power output would readily be absorbed in the power market area.

43. The Colorado River storage project has engineering feasibility and is economically justified.

44. The initial construction program would include the Echo Park, Flaming Gorge, Glen Canyon, Navaho, and Whitewater units. These would be constructed in an orderly schedule. Construction of the Whitewater, Echo Park, and Glen Canyon units should be started immediately.

45. Revenues from the sale of electric energy generated by units of the Colorado River storage project would be more than sufficient to pay all reimbursable costs of the project within a period of 50 years after installation of the last generating unit. Project power revenues also would be available to assist irrigators in the payment of construction costs of economically justified and urgently needed participating projects. Financial assistance could best be rendered irrigators through establishment of an upper Colorado River account.

46. Development of the Colorado River storage project and participating projects is essential to the comprehensive development of the upper basin's natural resources. It would provide flexibility in the basin development and coordination of the interests of the Nation and States of the upper Colorado River Basin.

Recommendations

47. It is recommended:

(*a*) That the plan of development of the water resources of the upper Colorado River Basin described in this report be approved;

(*b*) That authority be sought for the Secretary of the Interior, acting pursuant to the Federal reclamation laws (act of June 17, 1902,

32 Stat. 388, and acts amendatory thereof or supplementary thereto), to construct, operate, and maintain (i) the following units of the Colorado River storage project:

Echo Park
Flaming Gorge
Glen Canyon
Navaho
Whitewater

and (ii) the following initial participating projects subject to the terms of paragraph (*g*) of this recommendation:

Central Utah (initial phase), Utah
Emery County, Utah
Florida, Colo.
Hammond, N. Mex.
LaBarge, Wyo.
Lyman, Wyo.
Pine River extension, Colorado-New Mexico
Seedskadee, Wyo.
Silt, Colo.
Smith Fork, Colo.

all as described in this report but with such modification of, omissions from, or additions to the works as the Commissioner of Reclamation, with the approval of the Secretary, may find proper;

(*c*) That the Eden project, Wyoming, and the Paonia project, Colorado, which have previously been authorized and are partially constructed, be included in the plan of development and, if H. R. 9244, discussed in paragraph 29, is not passed, that the Paonia project be included as a participating project with those described in (*b*) (ii) above;

(*d*) That, pursuant to the recommendation of the Commissioner of Indian Affairs, and in order to consolidate the recommendations of the Secretary for dependent projects in the upper Colorado River Basin, the Shiprock Indian project be authorized for construction, operation, and maintenance in accordance with applicable laws to the development of irrigation projects on Indian reservations including the provisions of the act of July 1, 1932 (47 Stat. 564, 25 U. S. C. 386A): *Provided, however*, That this project shall receive assistance from the upper Colorado River account in the same manner and to the same degree as other participating projects;

(*e*) That authority be sought for the Secretary, acting pursuant to the laws applicable to the development of national parks, monuments, or recreational areas to the extent to which those laws are not inconsistent with operation of the Colorado River storage project units for their primary purposes, to construct, operate, and maintain the recreational facilities proposed in this report;

(*f*) That, because of interrelationship of the projects in the upper Colorado River Basin, authority be sought for the Secretary of the Interior to establish an upper Colorado River account. The account should be credited with all power revenues derived from (i) units of the Colorado River storage project, and (ii) participating projects located within the natural confines of the Colorado River Basin above Lee Ferry and with all net power revenues derived from the central Utah project (initial phase) subsequent to complete reimbursement of the reimbursable costs of that project. The account should be charged with all construction, operation, maintenance, and replacement costs of the Colorado River storage project and participating projects located within the natural confines of the Colorado River Basin above Lee Ferry that are allocated to power purposes or assigned to be returned from power revenues. The account should also be

charged with that portion of the irrigation allocation of each participating project's construction cost which is required to be so charged in order to show full reimbursement thereof within 50 years following a suitable development period for that project. Revenues and costs in connection with other undertakings hereafter authorized to be constructed should be included in the upper Colorado River account only upon specific authorization by act of Congress;

(*g*) That the Secretary from time to time recommend to Congress for authorization additional units of the Colorado River storage project and additional participating projects and that all participating projects be required to meet the following qualifications:

(1) A project, unit, or phase thereof may be eligible to participate only when and to the extent that all sources of estimated revenue directly available to said project, unit, or phase are insufficient to return its reimbursable costs during its payout period as hereafter specified in (4).

(2) It shall be a project for the use in one or more of the States designated in article III of the upper Colorado River Basin compact, of water of the upper Colorado River system, as that system is defined in such compact, the consumptive use of which is apportioned to those States by that article.

(3) Its total benefits shall exceed its total costs, including, but without limitation, any costs attributable to its direct use of the facilities of the Colorado River storage project or any other project, and an appropriate share of the costs of the Colorado River storage project.

(4) With anticipated revenues from irrigation, based on the irrigators' ability to pay, it shall be able to pay the operation, maintenance, and replacement costs allocated to irrigation and to pay in a period of 50 years following a suitable development period at least part of the construction cost allocated to irrigation.

(5) There shall be available to aid such participating project, or group of participating projects, an appropriate district, preferably of the water-conservancy type, which shall be satisfactory to the Secretary of the Interior, one purpose of which shall be to provide revenues for the project over and above those paid by irrigators, to assist in repayment of construction costs allocated to irrigation.

(6) It shall not require assistance from the upper Colorado River account in an amount, which, taking into consideration the prior obligations of the account and the anticipated revenues from its existing and authorized units, will leave the account in a deficit position at the end of the payout period for the participating project as specified in (4) above or will require an increase in the general level of Colorado River storage project power rates.

(7) Charges to the upper Colorado River account for the benefit of a project commingling water specified in (2) with other water shall not exceed an appropriate share of the construction cost of the works required by that project to use water specified in (2).

(8) Pertinent data sufficient to determine its probable engineering and economic justification and feasibility shall be available.

(*h*) That the investigations and programs proposed to be undertaken by certain agencies of the Department of the Interior, as summarized in paragraphs 33 through 39 of this report and presented in detail in the appended substantiating materials, be authorized; and that appropriations therefor be nonreimbursable, and that in the case of investigations conducted by the Bureau of Reclamation the provisions of the act of April 19, 1945, should govern;

(*i*) That there be set up and maintained in the Treasury from the receipts of the Colorado River storage project a continuing fund of $1 million to the credit of and subject to expenditure by the Secretary to defray emergency expenses and to insure continuous operation of the project;

(*j*) That as of the close of each fiscal year, beginning with fiscal year 1955, the Secretary of the Interior report to the Congress on the status of the upper Colorado River Basin account and on the revenues from and costs of constructing, operating, and maintaining the Colorado River storage project and participating projects. The Secretary's report should be prepared in such manner as accurately to reflect the Federal investment allocated to power, to irrigation, and to other water supply purposes and the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

E. O. LARSON.

SUBSTANTIATING MATERIALS

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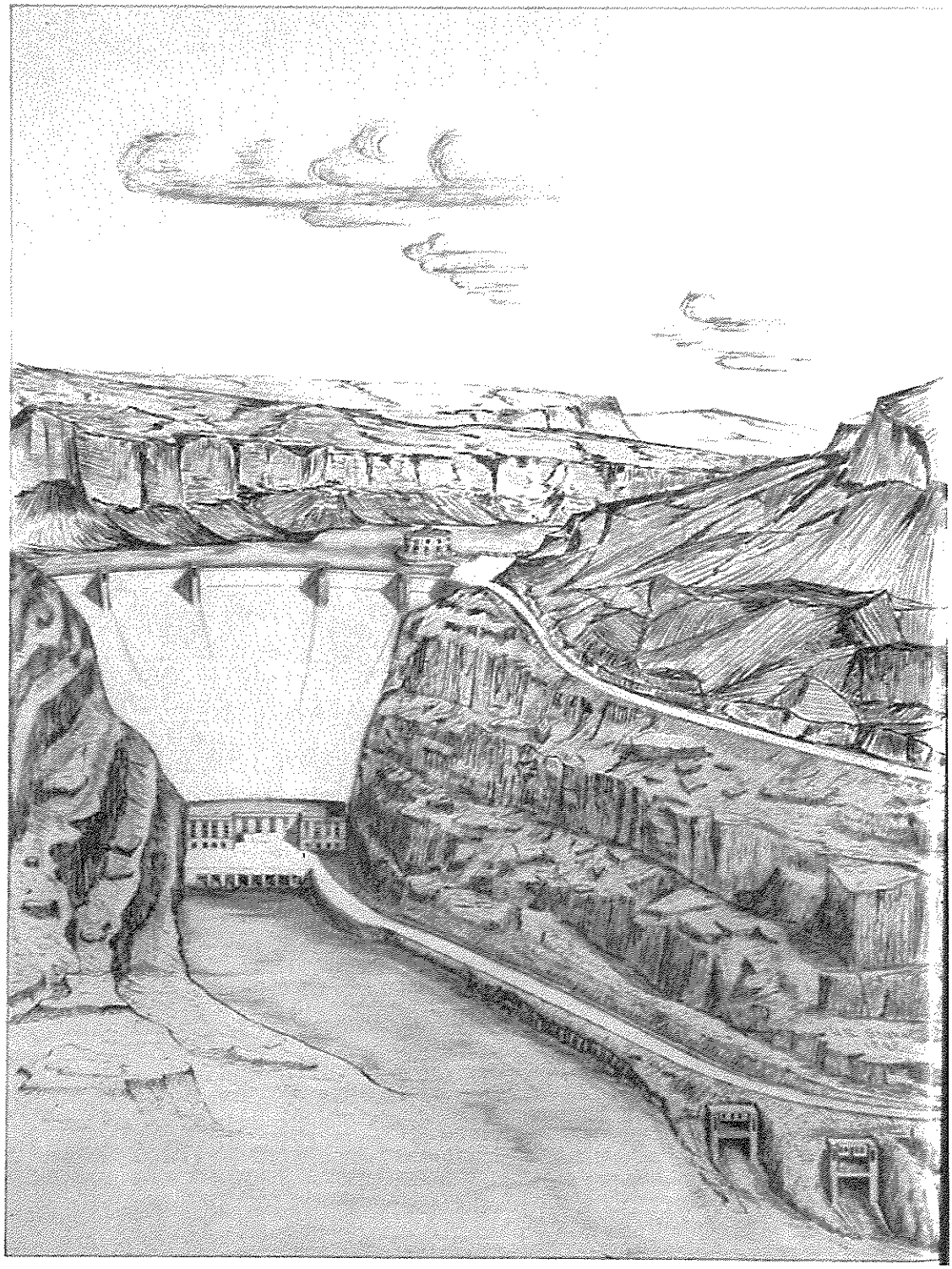


SUBSTANTIATING MATERIALS

CHAPTER I. GENERAL DESCRIPTION

The Colorado River storage project and participating projects would provide a means for the full development of the water resources of the Colorado River system above Lee Ferry. Lee Ferry in northern Arizona is the dividing point on the river between the upper and lower Colorado River basins. The upper basin, as defined by the Colorado River compact, includes, in addition to the natural drainage basins above Lee Ferry, all parts of Arizona, Colorado, New Mexico, Utah, and Wyoming located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry. These outside areas include the east slope area of Colorado and the Wasatch front area of Utah representing the largest centers of population, agriculture, and industry in these States. The outside areas also include important areas in New Mexico and Wyoming. The upper basin as referred to in this report, is the large area defined by the compact. For distinction, the natural drainage basin above Lee Ferry is referred to as the upper drainage basin.

PHYSICAL FEATURES

With a drainage area of 110,000 square miles, the upper drainage basin is larger than New York, Pennsylvania, and New Jersey combined. It is bound on the east and north by mountains forming the Continental Divide and on the west by other Rocky Mountain Ranges. On the south it opens to the lower basin through which the Colorado River continues to the Gulf of California.

The Colorado River rises among lofty peaks more than 14,000 feet in height in the northwest portion of Rocky Mountain National Park, 70 miles northwest of Denver. It meanders southwest 640 miles through the upper basin to Lee Ferry. The Green River, its major tributary, rises in western Wyoming and discharges into the Colorado River in southeastern Utah, 730 river miles south of its origin and 220 river miles above Lee Ferry. The Green River drains 70 percent more area than the Colorado River above their junction but produces only about three-fourths as much water. Other principal tributaries of the Colorado are the west-flowing Gunnison and San Juan Rivers. The Yampa and White Rivers from the east and the Duchesne River from the west are the principal contributors to the Green River.

Many small tributary streams flow inward from the mountains, traversing fertile valleys. In or beyond these valleys the streams converge into the Colorado River and its larger tributaries and become deeply entrenched in the expansive and rugged plateau country which makes up the central and southern portion of the upper drainage basin.

CLIMATE

A wide range of climate in various parts of the upper drainage basin is caused by differences in altitude and latitude and to a lesser extent by topographic features. Extremes of temperatures range from 52° below zero at Kendall, Wyo., to 109° above zero at Shiprock, N. Mex. The northern portion of the drainage basin is characterized by short, warm summers and long, cold winters. In the southern portion summers are longer and winters are moderate at low altitudes but colder temperatures prevail in the mountains. A peculiar climatic condition exists in parts of western Colorado where topographic features create an air drainage in localized sections along the foothills. This condition mitigates frost damage and favors the growing of such fruits as peaches, pears, apricots, cherries, and berries.

Precipitation increases with altitude, being heaviest in the high eastern and northern portions of the basin. Most precipitation falls in the form of winter snows and spring rains. The higher mountain peaks are snow capped most of the year.

Weather records for representative stations are summarized in the following table.

Weather records at representative stations in upper drainage basin

	Kendall, Wyo.	Vernal, Utah	Gunnison, Colo.	Grand Junction, Colo.	Shiprock, N. Mex.
Elevation above sea level..... feet..	7,600	5,200	7,683	4,587	4,950
Number of years of record.....	28	52	59	60	20
Mean annual temperature..... degrees..	33.3	45	37	52	53.2
Minimum temperature..... do....	−52	−38	−47	−21	−18
Maximum temperature..... do....	103	103	105	105	109
Average annual precipitation..... inches..	17.3	8.8	10.2	8.9	8.0
Average snowfall..... do..	138.6	26.0	50.2	.....	9.9
Average number of days between killing frost.....	53	118	95	223	157

SETTLEMENT

History

Settlement of the upper drainage basin began in 1854 when Mormon pioneers established Old Fort Supply in Wyoming on their immigrant trail and diverted water from Blacks Fork onto adjacent land. Breckenridge, Colo., on the basin's eastern rim was settled in 1859 by miners and prospectors pushing over the mountains from older mining districts on the eastern slope of the Continental Divide. Within the next decade other mining camps were established nearby. Unsuccessful miners turned to farming and supplied agricultural products to the mining communities. Settlement grew downward from the mountains to the valleys, the advance being slowed somewhat by conflicts with the Indians who occupied the territory. Grand Junction, Colo., now the largest community in the upper drainage basin, was not settled until 1882.

The greater part of the Uinta Basin in northeastern Utah was established as an Indian reservation in 1861 and lands unoccupied by Indians were not opened to settlement until 1905. Most lands of agricultural importance in the San Juan River Basin in Colorado, New Mexico, and Arizona were once included in Indian reservations,

and substantial areas are still under Indian control. The United States, however, purchased 3 million acres from the Indians in 1873 and in 1899 opened to white settlers reservation land unoccupied by Indians. Some Indian alloted lands have been purchased by individual whites.

Population

The upper Colorado River drainage basin is sparsely populated. The 1940 census showed 286,450 people in the basin. The average density was 2.6 persons a square mile compared with a national average of 44.2 persons a square mile. The 1940 population was a little more than double that of 1900. The growth over the 40-year period was slightly faster than the national average but far slower than the average for the Western States. A substantial increase in population is expected to be shown by the 1950 census primarily because of the accelerated development of mineral resources in the last 10 years. The population of the upper drainage basin by decades is shown below.

	Population		*Population*
1900	131, 500	1930	224, 300
1910	191, 930	1940	286, 450
1920	223, 150		

About 92 percent of the people in the upper drainage basin are white. Of the nonwhites, Indians are in greatest number. In 1940 about 20,000 Indians lived in the San Juan River Basin and about 1,200 in the Uinta Basin.

The six largest towns in the upper drainage basin with their 1940 and 1950 populations are listed below.

Town	Population	
	1940	1950
Grand Junction, Colo	12, 470	14, 454
Rock Springs, Wyo	9, 827	10, 785
Durango, Colo	5, 887	7, 437
Price, Utah	5, 214	5, 909
Montrose, Colo	4, 704	4, 848
Delta, Colo	3, 717	4, 077

The growth of Grand Junction, Montrose, and Delta is largely attributable to Federal reclamation projects constructed early in the century. Federal reclamation projects also have been important factors in the economy of Durango and Price. Durango, Price, and Rock Springs, however, depend primarily on mining and railroading. Farmington, N. Mex., is an important agricultural center and is rapidly developing as an oil and gas producer.

Immediately east of the upper Colorado River drainage basin is the most densely populated part of Colorado including Denver, Pueblo, Colorado Springs, Fort Collins, and other cities and towns. Just west of the basin are Ogden, Salt Lake City, Provo, and other communities containing Utah's heaviest concentrations of population. Important population centers such as Rawlins, Laramie, and Cheyenne, Wyo., and Santa Fe, Los Alamos, and Albuquerque, N. Mex., also lie adjacent to the upper Colorado River Basin.

INDUSTRIAL DEVELOPMENT

Local industry

Agriculture, particularly livestock raising, and mining are the principal industries of the upper drainage basin. Oil refining, lumbering, transportation, trade, recreation, and construction are of lesser but growing importance.

The processing of agricultural products on a small scale is practically the only manufacturing undertaken in the upper drainage basin. Three factories process fruits and vegetables and two beet sugar factories are in operation. In several farming areas small grain mills produce flour and other grain products, largely for local use. A few small creameries and cheese plants also operate in the area.

Industrial development of minerals and exploration for new minerals have been retarded by the remoteness of large portions of the drainage basin from industrial and transportation centers. The basin, however, provides many raw materials for important industrial areas centered at Denver, Pueblo, Provo, and Salt Lake City.

Large coal fields in the upper drainage basin are being extensively worked. About 15 million tons of coal were mined in 1943. Oil and gas are produced in the San Juan River Basin, the Uinta Basin, and in northwestern Colorado. Several producing fields have been developed recently, and widespread exploration is continuing. Pilot plants are being operated to determine the best methods of extracting oil from shale. These plants portend an important industry for the future.

The largest industrial centers of the Intermountain West are located in Colorado and Utah, immediately east and west of the upper Colorado River drainage basin. The greater part of these industrial areas may utilize water from the upper Colorado River system, since by compact definition these areas are potentially a part of the upper basin. In both of these adjacent areas fertile agricultural lands support a diversified agriculture with livestock raising predominating. Agriculture in turn supports various manufacturing establishments engaged in the processing of food and kindred products. Both areas have important meat packing and beet sugar refining plants. Other industries closely related to agriculture, such as milling and baking and the processing of dairy products, eggs, poultry, fruits, and vegetables, are prominent. The mining, milling, and refining of metals and the manufacture of steel are basic industries in both Colorado and Utah. Oil refineries in each State are sustained in large measure by crude oil from the upper Colorado River drainage basin. A great variety of products is manufactured for world trade. During World War II the industrial areas in both Colorado and Utah were developed on a broad scale for the manufacture, repair, processing, and storage of military supplies and equipment.

Transportation and power

The Union Pacific Railroad crosses the upper drainage basin in Wyoming. Farther south in Colorado and Utah the basin is crossed by the Denver & Rio Grande Western Railroad which has shipping points at Price and Greenriver, Utah, and at various places along the Colorado, Gunnison, and Uncompahgre Rivers in Colorado. A narrow-gage branch of the Denver & Rio Grande Western Railroad connects with the standard-gage line at Alamosa, Colo., extends west

to Durango, Colo., and then continues south to Farmington, N. Mex. A branch of the Denver & Rio Grande Western Railroad enters the upper drainage basin from the east and terminates at Craig, Colo.

Pinedale, Wyo., in the extreme north of the drainage basin must transport its livestock and crops 102 miles to Rock Springs, the nearest railroad point. Closest rail centers to Vernal, Utah, are Helper, Utah, 105 miles distant, and Craig, Colo., 123 miles distant. Other important areas in southern and eastern Utah and in the Dolores River Basin in Colorado are many miles from rail connections.

United States Highways Nos. 6, 30, 40, 50, and 160 extend east and west across the drainage basin. North-South Highways Nos. 187 and 189 serve the Wyoming portion of the basin and Highways Nos. 160 and 550 extend from Crescent Junction, Utah, and Grand Junction, Colo., respectively, into the San Juan River Basin. Many Federal, State, and local highways are interconnected. Good roads have fostered the trucking systems that serve the area. A few unimproved roads traverse the barren and badland regions.

Electric generating installations in the upper Colorado River drainage basin have a total capacity of approximately 120,000 kilowatts. About 9,000 kilowatts is driven by internal-combustion engines and the remainder is divided almost equally between hydroelectric and steam-electric plants. About two-thirds of the total capacity is in Colorado where hydroelectric installations predominate. About one-fourth of the basin capacity is in the Wyoming area, mostly at steam-electric plants owned by two coal mining companies. In the Utah and New Mexico portions of the basin, internal-combustion installations provide the largest part of the generating capacity. Power requirements in the coal-mining areas near Price, Utah, are supplied with power transmitted into the basin from the west. Small internal-combustion installations provide most of the energy used in the New Mexico area.

Land uses

Of the land in the upper drainage basin only about 22 percent is privately owned. The remaining 78 percent is owned by either the county, State or Federal Government or by Indians. The approximate pattern of land use is shown below.

	Acres	Percent of total area
Irrigated land	1,385,000	2.0
Cultivated without irrigation	272,000	.4
Grazing land:		
Publicly owned	29,221,000	41.5
Privately owned	8,775,000	12.5
State and county owned	2,850,000	4.1
Indian reservations	8,775,000	12.5
National forests	13,378,000	19.0
National parks and monuments	580,300	.8
Miscellaneous areas	5,077,700	7.2
Total	70,330,000	100.0

About 70 percent of the total land area is classed as grazing land in the tabulation. Grazing is also extensive on national forest lands and on other areas so that much more than 70 percent of the total area is actually grazed. The 1940 United States census reported 285,000 acres of irrigated land used as pasture.

The better grazing lands are in the high stream valleys and on the mountains and foothills. These lands are used for summer grazing of cattle and sheep, and the scanty vegetation in the lower desert areas provides winter range for sheep.

Cropland, both irrigated and dry-farmed, comprised only 2.4 percent of the total acreage in 1939 and only 2 percent was actually cropped.

Farming without irrigation is generally unsuccessful in the upper drainage basin because of the uncertain rainfall. It is practiced, however, to some extent in the Yampa and White River Basins. Favorable climatic conditions in the past few years together with high prices have encouraged expansion of dry farming in the dry side area of the LaPlata River Basin and on the upland mesa between Cortez, Colo., and Monticello, Utah. In general, at altitudes where rainfall is sufficient during the summer to grow crops without irrigation, the season is too short for crops to mature.

Irrigation

Numerous tributary streams in the upper drainage basin have been diverted to irrigate meadows in mountain valleys and more general farmlands in broader valleys at the base of the mountains. About 1,385,000 acres are now irrigated in the upper basin distributed among the States as follows: Arizona, 10,000 acres; Colorado, 791,000 acres; New Mexico, 43,000 acres; Utah, 304,000 acres; and Wyoming, 237,000 acres.

Many of the larger irrigation projects have been undertaken with Federal assistance. The Bureau of Reclamation has constructed or is constructing nine projects to utilize water in the upper basin. The increase in areas irrigated by reclamation projects is illustrated below.

	Acres irrigated in upper drainage basin		*Acres irrigated in upper drainage basin*
1910	24,000	1940	160,600
1920	74,500	1946	209,500
1930	81,200		

About 200,000 acre-feet of water is exported annually from the upper drainage basin for use in adjacent areas where local water supplies are inadequate. The exportations are made largely through five Bureau of Reclamation projects and the city of Denver systems that convey water to adjacent areas to the east, southeast, and west. When projects now authorized are fully constructed, and when existing systems are expanded to utilize their full water rights, a total of about 680,000 acre-feet will be exported annually.

Other water uses

Because of the sparse settlement in the upper drainage basin, present domestic and municipal water requirements are relatively small and are usually supplied from local sources. As a rule water for the livestock which graze throughout the area is provided directly from natural springs and streams. Industrial requirements for water are presently insignificant but could become important, particularly in the processing of oil shale, coal, and wood pulp. The small beginning made in the development of hydroelectric power resources is almost wholly in Colorado. Mountain streams through-

out the basin provide excellent trout fishing, and streams, lakes, and reservoirs are recreational attractions.

Local flood damage frequently occurs along tributary streams, but the lower stretches of the river and its major tributaries are confined in deep and barren canyons where floods can do no damage. From these lower regions, however, and particularly from the San Juan Basin, enormous quantities of sediment enter the river. The sediment is now carried to Lake Mead in the lower basin, constantly decreasing the storage capacity of this reservoir formed by Hoover Dam. The tremendous capacity of Lake Mead could retain the sediment for many years but potential lower basin reservoirs with smaller capacities at Bridge Canyon and Marble Canyon upstream from Lake Mead would soon be filled unless the sediment is controlled by other upstream structures.

Undeveloped resources

Mineral resources of the upper Colorado River drainage basin are varied and extensive. Reserves of bituminous and sub-bituminous coal are roughly estimated at 400 billion tons or about a third of all the known coal deposits in the United States and one-sixth of those in the world. Some of this coal is below present minerable depths, but mineable reserves alone equal nearly one-fourth of the country's total deposits.

Oil and gas have been discovered in more than 40 widely distributed fields in the upper drainage basin. Development has been accelerated in recent years. Extensive oil shale deposits are estimated to contain 80 percent of the recoverable oil in shale in the United States. Important deposits of bituminous sandstone and rare hydrocarbons are also found.

The upper drainage basin is the leading domestic source of vanadium, uranium, molybdenum, and radium ore. Zinc, lead, silver, and gold are commercially important. Estimated reserves of phosphate rock amount to a total of 1.6 billion tons, part of which could be mined by open-pit methods.

Timber stands are widely distributed over the upper drainage basin but are most heavily concentrated in western Colorado. Present development is largely for local uses. A large pulping plant is planned.

The upper drainage basin contains more than a million and a half acres of arable dry land. Only about 272,000 acres, however, are capable of producing crops without irrigation. Extensive good land in adjoining areas now receives some water from the Colorado River system. Additional diversions are desired for this land.

The extent of the upper drainage basin's water resources is indicated by an estimated 32-year average virgin or undepleted flow at Lee Ferry of 15,638,000 acre-feet annually. Average depletions from present and authorized water uses, including exportations from the drainage basin, are estimated at a total of 2,548,000 acre-feet annually. These depletions will leave an actual average yearly flow at Lee Ferry of 13,090,000 acre-feet. Under the terms of the Colorado River compact and the Mexican Water Treaty nearly 5 million acre-feet of this amount will be available for further development in the upper basin.

Tributary streams as they descend from their mountain sources offer numerous opportunities for the development of hydroelectric power. By far the greatest opportunities for power development are on the main river and its major tributaries which flow for many hundreds of miles deeply entrenched in narrow canyons.

ECONOMIC CONDITIONS

General conditions

The prosperity of agriculture in the upper Colorado River drainage basin generally reflects the prosperity of the livestock industry, the dominant agricultural pursuit. With vast areas of fine range land available for summer grazing, livestock production is limited by the production of hay for winter feed. Hay production, in turn, is determined largely by the irrigation supply, and in many instances the supply is undependable because of lack of reservoirs for stream regulation. Drouth periods of the past have brought hardship to the livestock industry and to agriculture generally. In these periods relief loads have been unusually high. For the past decade high agricultural prices and favorable water supplies have been responsible for general prosperity on farms and ranches. A notable exception is the case of the Navaho Indians in the San Juan River Basin where extensive outside help has been necessary to allay conditions of abject poverty.

Intensified development of mineral resources in recent years has created new employment opportunities, including off-the-farm work for many farmers. The increase in population resulting from new job opportunities has created new markets for locally produced and imported products, has taxed municipal facilities and water supplies in several areas, and has increased demands for electric energy. Raw materials are stimulating industrial activities in areas adjoining the upper drainage basin, particularly areas near Denver, Pueblo, Provo, and Salt Lake City.

Community needs

The development of water resources is a critical need of the upper drainage basin. Dependable irrigation supplies are needed to stabilize existing agriculture and to make productive tracts of arable dry land that now yield only scanty range forage. Water, and the power that can be generated by water, are required to serve the growing population and to aid in the processing of the upper basin's vast mineral resources. Farm lands, industries, and municipalities in adjoining areas that by definition are potentially parts of the upper basin are in need of water from the Colorado River. These adjoining areas also urgently need electric energy that could be generated in the canyons of the Colorado River and its tributaries.

WATER COMPACTS AND TREATY

Two compacts between interested States and a treaty between the United States and Mexico govern the division of Colorado River waters. The Colorado River compact of 1922 allocates waters to the upper and lower basins. Waters allocated the upper basin are divided among the States in the upper basin by the upper Colorado

River Basin compact of 1949. The Mexican Water Treaty of 1945 defines Mexico's rights to the use of water from the Colorado River system.

Colorado River compact

The Colorado River compact, signed November 24, 1922, and subsequently ratified by all signatory States and approved by Congress, has often been referred to as the "law of the river."

Articles II and III of the Colorado River compact are of particular significance and are quoted in full as follows:

ARTICLE II

As used in this compact:

(a) The term "Colorado River system" means that portion of the Colorado River and its tributaries within the United States of America.

(b) The term "Colorado River Basin" means all of the drainage area of the Colorado River system and all other territory within the United States of America to which the waters of the Colorado River system shall be beneficially applied.

(c) The term "States of the upper division" means the States of Colorado, New Mexico, Utah, and Wyoming.

(d) The term "States of the lower division" means the States of Arizona, California, and Nevada.

(e) The term "Lee Ferry" means a point in the main stream of the Colorado River 1 mile below the mouth of the Paria River.

(f) The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River system above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry.

(g) The term "Lower Basin" means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry.

(h) The term "domestic use" shall include the use of water for household, stock, municipal, mining, milling, industrial, and other like purposes, but shall exclude the generation of electrical power.

ARTICLE III

(a) There is hereby apportioned from the Colorado River system in perpetuity to the upper basin and to the lower basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist.

(b) In addition to the apportionment in paragraph (a), the lower basin is hereby given the right to increase its beneficial consumptive use of such waters by 1,000,000 acre-feet per annum.

(c) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River system, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus should prove insufficient for this purpose, then, the burden of such deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d).

(d) The States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact.

(e) The States of the upper division shall not withhold water, and the States of the lower division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural uses.

(f) Further equitable apportionment of the beneficial uses of the waters of the Colorado River system unapportioned by paragraphs (a), (b), and (c) may be made in the manner provided in paragraph (g) at any time after October 1, 1963, if and when either basin shall have reached its total beneficial consumptive use as set out in paragraphs (a) and (b).

(g) In the event of a desire for further apportionment as provided in paragraph (f) any two signatory States, acting through their governors, may give joint notice of such desire to the governors of the other signatory States and to the President of the United States of America, and it shall be the duty of the governors of the signatory States and of the President of the United States of America forthwith to appoint representatives, whose duty it shall be to divide and apportion equitably between the upper basin and lower basin the beneficial use of the unapportioned water of the Colorado River system as mentioned in paragraph (f), subject to the legislative ratification of the signatory States and the Congress of the United States of America.

Mexican water treaty

The treaty between the United States of America and the United States of Mexico, effective November 8, 1945, allots to Mexico a guaranteed annual quantity of 1,500,000 acre-feet to be delivered in accordance with a schedule specifically set out in the treaty. When the United States section of the International Boundary Commission decides that there is a surplus of water in the Colorado River in excess of the amount necessary to supply uses in the United States and the guaranteed quantity of 1,500,000 acre-feet allotted to Mexico, the United States, by the express terms of the treaty, would undertake to provide a total quantity of 1,700,000 acre-feet to Mexico. Provision is made in the treaty for reduction of the guaranteed quantity to be delivered to Mexico in the event of extraordinary drought or serious accident to the irrigation system in the United States.

Upper Colorado River Basin compact

By the upper Colorado River Basin compact, approved by Congress April 6, 1949, the use of water apportioned the upper basin under the Colorado River compact is divided among the upper basin States. The upper basin compact also establishes the obligations of each State of the upper division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River compact.

Article III of the compact, part of which is quoted below, provides for the apportionment of the consumptive use of water.

(a) Subject to the provisions and limitations contained in the Colorado River Compact and in this compact, there is hereby apportioned from the Upper Colorado River system in perpetuity to the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, respectively, the consumptive use of water as follows:

(1) To the State of Arizona the consumptive use of 50,000 acre-feet of water per annum.

(2) To the States of Colorado, New Mexico, Utah, and Wyoming, respectively, the consumptive use per annum of the quantities resulting from the application of the following percentages to the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by the upper basin under the Colorado River Compact and remaining after the deduction of the use, not to exceed 50,000 acre-feet per annum, made in the State of Arizona.

	Percent
State of Colorado	51.75
State of New Mexico	11.25
State of Utah	23.00
State of Wyoming	14.00

Article IV outlines certain principles to be applied in determining the extent to which each State of the upper division will be required to curtail its apportioned consumptive use if a curtailment is necessary to permit the States to meet the Lee Ferry flow obligations provided in article III of the Colorado River Compact.

Article V pertains largely to the charging of storage losses. Paragraph (c) of this article, quoted below, is concerned with the use of reservoir sites and is of importance in the development of the water resources of the States of the upper division.

(c) In the event the Commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the Upper Division, the storage of water for consumptive use shall be given preference. Any reservoir or reservoir capacity hereafter used to assure deliveries at Lee Ferry shall by order of the Commission be used to store water for consumptive use in a State, provided the Commission finds that such storage is reasonably necessary to permit such State to make the use of the water apportioned to it by this Compact.

Article VI, quoted below, provides for a determination of the quantity of the consumptive use of water for the upper basin and for each State of the upper basin.

The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the upper basin and for each State of the upper basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the Commission, by unanimous action, shall adopt a different method of determination.

Article VIII creates an interstate administrative agency to be known as the Upper Colorado River Commission. This article provides that the commission be composed of one commissioner representing each of the States of the upper division, designated or appointed in accordance with the laws of each such State and, if designated by the President, one commissioner representing the United States of America.

In anticipation of projects which require diversion and storage of water in one State for use in another State, article IX is included in the compact. This article, part of which is quoted in the following paragraphs, is of significance to the Colorado River storage project because, as to the appropriations of Colorado River water, it supersedes existing statutory law in some of the upper basin States which deny the right to divert water in one State for use in another State.

(a) No State shall deny the right of the United States of America and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity of any signatory State to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals and conduits in one State for the purpose of diverting, conveying, storing, regulating, and releasing water to satisfy the provisions of the Colordao River Compact relating to the obligation of the States of the upper division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper signatory State for consumptive use in a lower signatory State, when such use is within the apportionment to such lower State made by this Compact. Such rights shall be subject to the rights of water users, in a State in which such reservoir or works are located, to receive and use water, the use of which is within the apportionment to such State by this Compact.

Article IX also provides for acquisition of out-of-State property by donation, purchase, or through the exercise of the power of eminent domain. In addition it provides for administration of water-control facilities in one State for use of water in another State.

INVESTIGATIONS AND REPORTS

Previous investigations

Investigations of means to develop the waters of the upper Colorado River system were started by the Bureau of Reclamation in 1902, the year of the Bureau's organization. Within 3 years two major projects in the upper basin, the Uncompahgre in Colorado and the Strawberry Valley in Utah, were authorized for construction. A few years later the Grand Valley project in Colorado also was authorized. No significant action was then taken until 1928 when Congress, recognizing the need for further development, wrote into the Boulder Canyon Project Act a directive to the Secretary of the Interior to make investigations and publish reports on the feasibility of projects for irrigation, power, and other multiple uses for the purpose of formulating a comprehensive scheme of control and the improvement and utilization of the water of the Colorado River and its tributaries. In accordance with the congressional mandate, work was undertaken after 1928 on the tremendous task of classifying lands in the upper drainage basin, making water supply studies on the numerous tributary streams, and locating and investigating reservoir and canal sites. Prior to completion of these studies the Colorado-Big Thompson project and a few smaller projects were selected for construction. The basinwide studies, retarded by the war, were reported in a publication of March 1946, entitled "The Colorado River," a comprehensive report on the development of the water resources of the Colorado River Basin. The report was later printed as House Document 419, 80th Congress, 1st session. The report includes a description of the basin, its natural resources, needs, and problems. It describes present developments in the basin and presents a descriptive inventory of potential developments.

The Colorado River report lists 134 projects as possibilities for future development of water resources within the natural drainage basin of the Colorado River. One hundred of these projects are located in the upper drainage basin. The report also lists potential projects for the export of water from the Colorado River system to adjoining basins. It points out that a comprehensive plan of water resources development could not be formulated until further detailed investigations were made and allotments of Colorado River water made to each of the States of the upper and lower basins. The report provided a basis for compact negotiations among the upper basin States which resulted in their compact of 1949.

Cooperating with the Bureau of Reclamation in the basinwide investigations and contributing to the 1946 report were other agencies of the Department of the Interior, including the Geological Survey, National Park Service, Fish and Wildlife Service, Grazing Service, Bureau of Mines, Office of Indian Affairs, and General Land Office. The Forest Service of the Department of Agriculture and the Federal Power Commission also contributed to the report.

Scope of present investigations

Investigations leading to the present report have been conducted since 1946 to determine in greater detail than was done in the basin investigation the most attractive plan for providing river regulation, sediment retention, power production, and other benefits on the

Colorado River and its major tributaries above Lee Ferry. The investigations have been carried out in sufficient detail to establish an overall plan and to determine its engineering and economic feasibility. The various dams and other related works required by the plan are collectively designated the Colorado River storage project.

The main stream investigations have been closely correlated with concurrent studies made of various projects to utilize the waters of the upper Colorado River system for irrigation and other purposes. Correlations have been made from the standpoints of water supply and storage requirements, and suggested financial relationships have been developed through which surplus power revenues of the Colorado River storage project would be used to assist irrigators in payment of costs of other projects that would utilize water of the upper Colorado River system. Projects that would be so assisted are referred to as "participating projects." Detailed reports have been completed on some participating projects and others are being prepared. All projects authorized subsequent to approval of the upper Colorado River Basin compact that would consume water of the upper Colorado River system are considered to be dependent on the storage project for an assured water supply. Such projects therefore are designated "dependent projects."

Acknowledgments

This report has been prepared by the Department of the Interior and assembled under sponsorship of the Bureau of Reclamation. Important contributions to the report were made by the Upper Colorado River Compact Commission and States of the upper Colorado River Basin. Information also was obtained from the Federal Power Commission and other Federal agencies.

Chapter II. Plan of Development

The Colorado River storage project would provide the longtime regulatory storage needed to permit States of the upper division to meet their flow obligation at Lee Ferry, as defined in article III (d) of the Colorado River compact, and still utilize their apportioned water. During periods of low streamflow, the States would release storage water to meet the Lee Ferry flow obligation and in exchange they would divert upstream flow for use in the upper basin. The project would provide some storage water for direct use in the upper basin. In addition, the project would control sediment, abate floods, facilitate recreational development, and aid in fish and wildlife conservation. It also would permit production of a substantial amount of the electric energy needed in the upper basin and adjacent areas. Revenues from the sale of project-generated power would be sufficient to pay all reimbursable Colorado River storage project costs and to assist irrigators in payment of costs of other projects that would utilize waters of the upper Colorado River system.

COLORADO RIVER STORAGE PROJECT

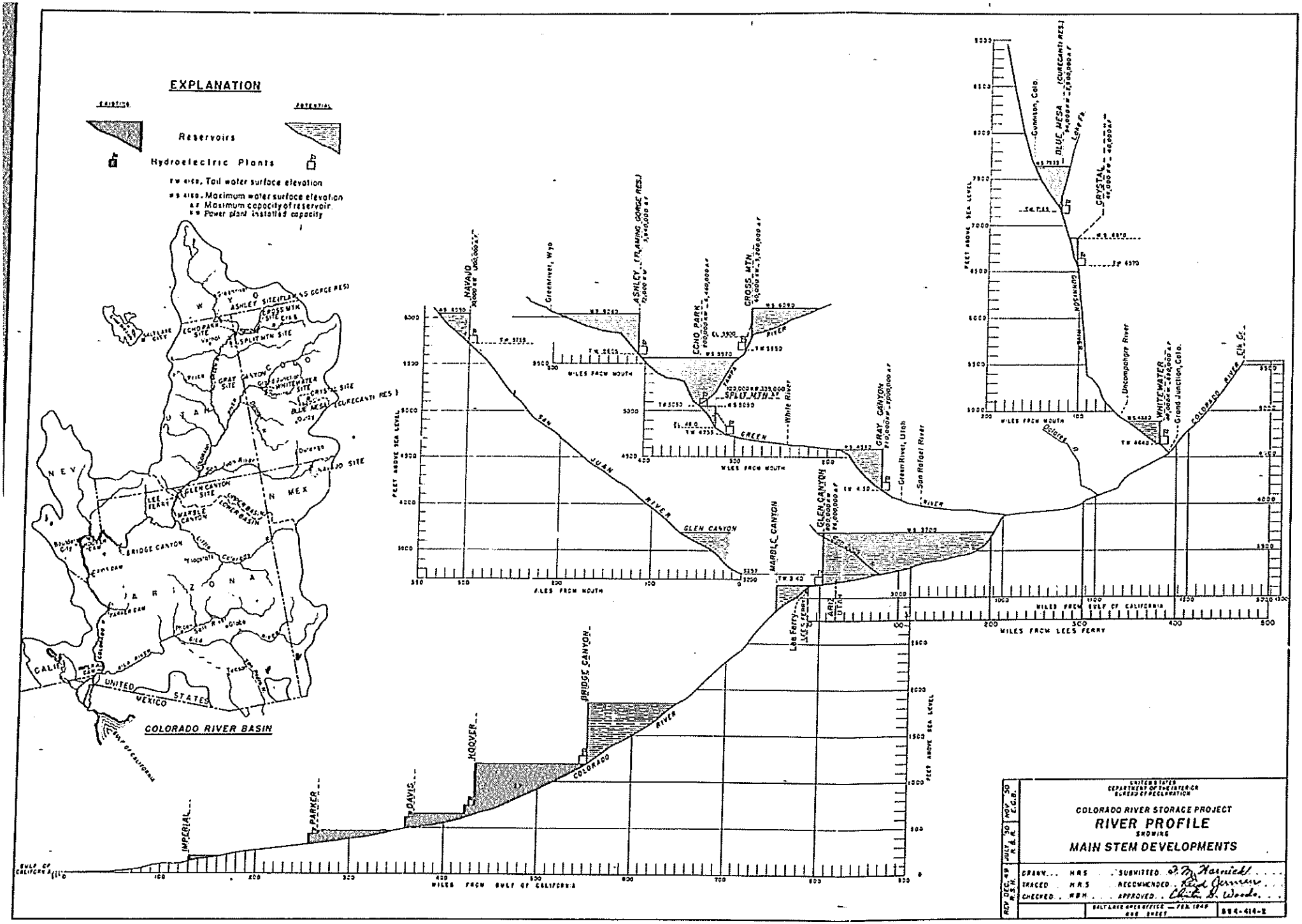
Project works

Eight major storage dams and two high dams providing only minor storage would be constructed on the Colorado River and its principal tributaries above Lee Ferry. The reservoirs formed by the dams would have a total capacity of 48,555,000 acre-feet. Powerplants and other appurtenant facilities would be provided at each dam and necessary transmission lines would be built.

The highest dam and the one creating more initial storage capacity than all others combined would be the Glen Canyon Dam of the Glen Canyon unit. This dam, only 17 miles upstream from Lee Ferry, would be a key structure in controlling water releases to the lower basin and in impounding the heavy silt accumulations which enter the river in the southern part of the upper basin. It is the only dam planned on the upper Colorado River proper.

Four of the dams would be on the Green River. In order, moving upstream, these would be the Gray Canyon Dam of the Gray Canyon unit, Split Mountain Dam of the Split Mountain unit, Echo Park Dam of the Echo Park unit, and the Ashley Dam of the Flaming Gorge unit. The Split Mountain Dam would provide no active storage capacity and would be useful primarily for power generation, with stream regulation provided by the Echo Park Dam only 21 river miles upstream. The Echo Park Dam, located 3 river miles below the junction of the Green and Yampa Rivers, would back water up both streams, creating the system's second largest reservoir. Above Echo Park on the Yampa River would be the Cross Mountain Dam.

The Whitewater Dam of the Whitewater unit would be located on the Gunnison River 15 river-miles above Grand Junction, Colo. Above the Whitewater Dam would be Crystal Dam of the Crystal


EXPLANATION
EXISTING
POTENTIAL
Reservoirs
Hydroelectric Plants
TW 4160, Tail water surface elevation
WS 4160, Maximum water surface elevation
AF Maximum capacity of reservoir
KW Power plant installed capacity
COLORADO RIVER BASIN
UNITED STATES
MEXICO
GULF OF CALIFORNIA
NAVAJO
ASHLEY (FLAMING GORGE RES.)
ECHO PARK
CROSS MTN.
SPLIT MTN.
GRAY CANYON
GLEN CANYON
MARBLE CANYON
BRIDGE CANYON
HOOVER
DAVIS
PARKER
IMPERIAL
BLUE MESA (CURECANTI RES.)
CRYSTAL
WHITEWATER
Grand Junction, Colo.
Uncompahgre River
Gunnison, Colo.
Lee Ferry
Green River, Utah
San Rafael River
White River
Greenriver, Wyo
SAN JUAN RIVER
GREEN RIVER
COLORADO RIVER
Elk Cr.
FEET ABOVE SEA LEVEL
MILES FROM MOUTH
MILES FROM LEES FERRY
MILES FROM GULF OF CALIFORNIA
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
RIVER PROFILE
SHOWING
MAIN STEM DEVELOPMENTS
DRAWN H.R.S.
TRACED H.R.S.
CHECKED W.B.H.
SUBMITTED
RECOMMENDED
APPROVED
SALT LAKE AREA OFFICE — FEB. 1949
REV DEC. 49 R.S.H.
JULY '50 R.B.R.
NOV '50 E.C.B.
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unit which would have limited storage and the Blue Mesa Dam of the Curecanti unit which would provide storage regulation for its own and the Crystal powerplants. The Navaho Dam of the Navaho unit would be located on the San Juan River about 19.5 river-miles upstream from Blanco, N. Mex.

Locations of the potential project units are shown on the accompanying profile. The profile also shows the locations of existing and potential developments in the lower basin. Detailed data on the structures included in the various project units are given in Chapter III—Designs and Estimates.

Regulatory storage

A capacity of 23 million acre-feet would be reserved in project reservoirs for long-time regulatory storage. The water stored would be released as needed in drought periods to meet the compact obligations at Lee Ferry. The reservoirs would be refilled during years of favorable water supply. In a dry decade such as that of 1931–40, release of the entire 23 million acre-feet would be necessary to meet the Lee Ferry obligation. A storage release in that amount would be necessary even if water uses in the upper basin were naturally curtailed by the drought, resulting in a depletion at Lee Ferry somewhat less than the compact-permitted 7,500,000 acre-feet annually.

Present flows in the upper basin are adequate to meet the 10-year Lee Ferry obligation. Within 20 or 25 years, however, the depletions are expected to increase to the extent that curtailment of consumptive uses will be necessary in protracted dry periods unless some storage water is available for delivery to the lower basin. If the required storage works are to be available when needed, steps toward construction should be taken immediately. An extended construction period will be required and the reservoirs should be filled initially while unused apportioned water is available. The amount of storage capacity, if any, required for assistance in the administration of the Mexican Water Treaty cannot be determined at this time. The plan outlined herein does not provide for, nor preclude, storage for this purpose. It is assumed, however, that any additional water required at Lee Ferry for Mexican use will be made available by applying the principles of curtailment outlined in article IV of the upper Colorado River Basin compact.

Irrigation and other water-consuming uses

Reservoirs planned for the Colorado River storage project would be located too low on the streams to provide water directly to major segments of lands and to industrial centers in the upper basin. In some instances, however, direct uses would be possible. At the Flaming Gorge Reservoir, for instance, an inactive storage pool of almost a million acre-feet would be maintained to permit a gravity diversion to the Uinta Basin as contemplated under the central Utah project. Also, a considerable amount of active capacity in the reservoir would be provided for regulation of the water reserved for direct diversion. As an alternative, water for the Uinta Basin could be provided by pumping from Echo Park Reservoir. Gunnison River water could be diverted from Whitewater Reservoir above an inactive storage pool of 410,000 acre-feet and conveyed to Grand Valley to replace water now provided from the Colorado River. In exchange, the Colorado River water would become available to potential upstream develop-

ments including export diversions. Active capacity in the Whitewater Reservoir would be required to provide regulation for the replacement diversion. The entire active capacity of the Navaho Reservoir would eventually be required to regulate San Juan River water for potential developments both upstream and downstream on the San Juan River. Water from the Navaho Reservoir could directly supply the Shiprock project (Indian), the South San Juan project, or by exchange it could benefit possible projects for the exportation of water to the Rio Grande River Basin in Colorado and New Mexico.

Capacities in the Flaming Gorge, Whitewater, and Navaho Reservoirs reserved to regulate water for use in the upper basin, if not required immediately for that purpose, could serve in the interim to facilitate the generation of electric energy.

As additional investigations are made, it may be found desirable to use other Colorado River storage project reservoirs to store water for irrigation and other consumptive uses in the States of the upper division. Preference to the use of reservoirs for such storage is given in article V (b) of the upper Colorado River Basin compact over the use of reservoirs for assurance of deliveries at Lee Ferry.

Sediment control

A total capacity of about 20 million acre-feet would be provided in project reservoirs to accommodate the sediment that would be deposited in a period of 200 years. With reduced erosion of the watersheds by improved practices of land management agencies, the period of protection against sediment encroachment would be extended. In the future it may also be desirable to develop other sediment storage sites in the upper basin.

More than three-fourths of the sediment in the river will enter the river below all potential reservoirs except Glen Canyon. Fortunately, ample sediment storage capacity can be economically developed in the Glen Canyon Reservoir to protect present and future reservoirs in the lower basin from sediment encroachment. Next largest capacities for sediment retention would be provided at the Flaming Gorge and Gray Canyon Reservoirs on the Green River.

A part of the sediment would be carried into the lower levels of the reservoirs where it would occupy inactive reservoir capacity. The major part, however, would settle in shallower reservoir areas and reduce the active capacity useful for other purposes.

Power production

Powerplants would be installed as project features to utilize the regulated river flows and the hydrostatic heads at project dams for the generation of electric energy. The plants would have a total generating capacity of 1,622,000 kilowatts. Initially, with all the units in coordinated operation, they would have a firm annual output of about 9 billion kilowatt-hours and with ultimate development in the upper basin they would have a firm annual output of about 6 billion kilowatt-hours.

Hydrostatic heads at the dams would vary with changes in reservoir content. Minimum power pool elevations, however, would be maintained at project reservoirs. To aid in creating power heads a minimum inactive capacity of about 11 million acre-feet would initially be provided. Although more than 8 million acre-feet of this capacity



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would eventually be occupied by sediment, it would still be useful in maintaining the power heads. Until needed for river regulation, the active capacity would also be used to assist in power production.

PARTICIPATING PROJECTS

In general, future projects for irrigation and other water-consuming uses in the upper basin will be complex and expensive to construct since the most dependable water supplies and the most favorable construction sites are already developed. New projects, as a rule, will require individual storage reservoirs in addition to the large regulatory reservoirs of the Colorado River storage project. In many instances, the new projects will require the construction of long tunnels and siphons or canals over difficult terrain.

Because of their relatively high cost, the irrigation features of most of the projects could not be paid for by those who would benefit directly. The far-reaching indirect benefits, however, would justify the giving of financial assistance from other sources. Such assistance could be provided from power revenues of the Colorado River storage project. A suggested financial arrangement requiring the establishment of the upper Colorado River account and qualifying criteria for participating projects are discussed in the chapter, Financial Analysis. Projects suggested by the States of the upper Colorado River Basin for early assistance from the account include the Eden and Paonia, now under construction, and the central Utah (initial phase), Emery County, Fla., Hammond, La Barge, Lyman, Pine River extension, Seedskadee, Silt, and Smith Fork.

Chapter III. Designs and Estimates

PROJECT WORKS AND COSTS

The following discussions describe features in each unit of the Colorado River storage project and give estimates of project construction costs and annual operation, maintenance, and replacement costs.

Designs and estimates for the Echo Park, Glen Canyon, and Whitewater units were made from extensive data obtained from preliminary field investigations. Field surveys have not yet been completed for the other units and therefore their designs and estimates were based on data from reconnaissance investigations. More detailed designs will be made of project features as additional basic data are obtained. Estimates of the project costs are not expected to increase as a result of the detailed designs.

Estimated costs are based on December 1949 prices which are essentially the same as current prices. The estimated construction costs include costs of overhead, contingencies, and preconstruction investigations. The replacement costs were computed on a sinking fund basis at 3 percent interest over a 50-year period.

CROSS MOUNTAIN UNIT

Dam and reservoir

Cross Mountain Dam would be located in Moffatt County in northwestern Colorado, approximately 4 miles north of the settlement of Cross Mountain, Colo., and about 50 miles west of Craig, Colo. The dam would be situated near the head of Cross Mountain Canyon on the Yampa River 58.5 river miles upstream from the river's confluence with the Green River and 7 miles upstream from its confluence with the Little Snake River.

The dam would be a concrete, gravity structure, rising 295 feet above the river and 355 feet above the bedrock foundation. The crest would be at elevation 6,095 feet, where the length between canyon walls is 550 feet. Five feet of freeboard would be provided over the maximum water surface elevation of 6,090 feet.

Cross Mountain Reservoir would have a total initial capacity of 5,200,000 acre-feet, including an active capacity of 4,200,000 acre-feet and an inactive capacity of 1 million acre-feet. In 200 years silt deposits would reduce the active capacity to 4,030,000 acre-feet and the inactive capacity to 887,000 acre-feet. When filled to capacity, the reservoir would have a water surface area of 52,200 acres and it would extend about 76 river miles upstream, nearly to the town of Craig.

Diversion, spillway, and outlet works.—During construction of the dam the Yampa River would be diverted through a tunnel in the right abutment. The tunnel would have a capacity of about 10,000 second-feet.

The spillway would be a controlled-type structure with a capacity of 45,000 second-feet. It would discharge into an inclined tunnel leading to the diversion tunnel. Control of the spill would be provided by two 20-foot by 70-foot gates over a crest at elevation 6,070 feet.

River outlet works of 5,000 second-foot capacity would be provided through the dam.

Power features

The powerplant would be located at the lower end of Cross Mountain Canyon, about 3 miles downstream from the dam. The water would be conducted from the reservoir to the powerplant through a tunnel cut through rock on the left, or south side of the river. The tunnel would be 17.5 feet in diameter and 11,700 feet in length.

Two 30,000-kilowatt generating units would be installed in the powerplant. They would operate under a mean head of about 400 feet. About 150 feet of the head would be gained in the river gradient through the canyon below the dam. The initial energy generation of the Cross Mountain plant with all the project units in coordinated operation would amount to about 330 million kilowatt-hours annually. With ultimate upstream depletions approximately 310 million kilowatt-hours could be produced annually. Tailwater elevation at the powerplant would be about 5,650 feet.

Transmission facilities would be constructed as necessary to distribute the electric energy produced to various load centers and interconnection points.

Access

The upper end of Cross Mountain Canyon can now be reached over a 4- or 5-mile-long dirt road which extends north from United States Highway No. 40 at the settlement of Cross Mountain. The distance from the upper end of the canyon to the dam site, about 3,000 feet, must be traveled by foot. An access road for construction purposes would follow the general route of the existing dirt road over gently rolling terrain. After entering the canyon, the road would follow the river to the dam site.

Rights-of-way and relocation

The reservoir area contains 3,150 acres of farmland and 3 small centers of population, Sunbeam, Maybell, and Juniper Springs, with a combined population of about 100. United States Highway No. 40 and an oil pipeline cross the reservoir area and would require relocation. The length of each of these facilities within the reservoir area is approximately 20 miles. In connection with the relocation of the pipeline, a pumping station at Sunbeam, consisting of six diesel units, would also have to be moved.

Geology

Geological conditions at the Cross Mountain Dam site are favorable for construction of the type of dam contemplated. The foundation bedrock is quartzite and quartzose sandstone of the highest quality. The bedrock, however, contains some open fractures which would require grouting. Foundation drilling showed the maximum depth of river fill to be 45 feet. The drilling disclosed no unfavorable geologic conditions except the rock fractures. The general quality of the rock

is excellent. After grouting of the fractures the bearing capacity of the foundation would be high and entirely competent to support either a gravity- or arch-type concrete dam.

Suitable construction materials can be found along the banks of the Yampa River near Sunbeam, about 11 miles upstream from the dam site. Riprap is available in unlimited quantities immediately downstream from the dam site.

Cost estimates

Estimated costs of the Cross Mountain unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Cross Mountain unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$22,700,000	$27,000	$4,700	$31,700
Access road	300,000			
Rights-of-way and relocation	7,000,000			
Construction camp	600,000			
Powerplant	6,300,000	122,300	56,200	178,500
Power tunnel	5,200,000			
Transmission system	8,100,000	113,000	91,500	204,500
Total	51,000,000	262,300	152,400	414,700

CRYSTAL UNIT

Dam and reservoir

Crystal Dam would be located on the Gunnison River about 14 miles east of Montrose, Colo.

Crystal Dam would be a concrete, gravity-type structure. It would rise 305 feet above the river and 355 feet above the assumed bedrock foundation. The crest would be at elevation 6,875 feet, 5 feet above the maximum water surface elevation. The distance between the canyon walls at the crest elevation is about 620 feet.

Crystal Reservoir would have a capacity of 40,000 acre-feet. The entire capacity is considered inactive since it would serve only to maintain a power head and to regulate the hourly and daily releases from the Curecanti Reservoir. Because of its location below Curecanti Reservoir, the Crystal Reservoir would not receive significant quantities of sediment. When full, Crystal Reservoir would cover about 560 acres and would extend about 10 river miles up the Gunnison River.

Diversion, spillway, and outlet works.—A tunnel with a capacity of 22,500 second-feet would be constructed through the left abutment to divert the river flow during construction of the dam.

The spillway, with a capacity of 48,000 second-feet, would discharge through an inclined tunnel leading to the diversion tunnel. Control of the spill would be provided by two 26-foot by 50-foot gates over a crest at elevation 6,844 feet.

The river outlet works would have a capacity of 2,000 second-feet.

Power features

The Crystal powerplant would be located at the toe of the dam. It would consist of three 16,000-kilowatt generating units operating

under a constant head of about 300 feet. Tailwater elevation at the plant would be about 6,570 feet. The initial energy generation of the plant with all project units in coordinated operation would amount to 244 million kilowatt-hours annually. With ultimate upstream depletions approximately 206 million kilowatt-hours would be produced annually.

Facilities would be constructed to transmit the energy produced and to interconnect the Crystal plant with other powerplants.

Access

The dam site can now be reached only by foot. For construction purposes an access road could be built from a point on United States Highway No. 50. This highway parallels the river 5 or 6 miles south of the dam site. The canyon is particularly deep and steep at the dam site and access is quite difficult.

Rights-of-way and relocation

Right-of-way costs would be low since the reservoir basin is small and confined to the river channel. There are no facilities of any importance which would require relocation.

Geology

The abutments and foundation at the dam site are igneous and metamorphosed intrusive rocks. The rocks are well exposed, massive, and unfractured and are considered of excellent quality to support a dam. Construction materials are limited in the area. Investigations will be made to determine the suitability of crushed aggregate taken from the canyon walls.

Cost estimates

Estimated costs of the Crystal unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Crystal unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$24,200,000	$2,000	$5,000	$7,000
Access facilities	1,300,000			
Construction camp	400,000			
Powerplant	5,600,000	105,600	40,000	154,600
Transmission system	6,500,000	90,700	73,200	163,900
Total	37,000,000	198,300	127,200	325,500

CURECANTI UNIT

Dam and reservoir

Blue Mesa Dam, key feature of the Curecanti unit, would be located on the Gunnison River about 3½ miles downstream from the town of Sapinero, Colo. The site for this dam has previously been called the Cottonwood site.

The Blue Mesa Dam would be a concrete, gravity-type structure, rising 475 feet and 510 feet above the river and bedrock foundation, respectively. The crest of the dam would be at elevation 7,640 feet,

5 feet above the maximum water surface elevation. At the crest elevation the distance between the canyon walls is about 1,240 feet.

Curecanti Reservoir formed by the dam would have an initial capacity of 2,500,000 acre-feet, including an active capacity of 2,010,000 acre-feet and an inactive capacity of 490,000 acre-feet. In 200 years silt deposits would reduce the active capacity to 1,979,000 acre-feet and the inactive capacity to 463,000 acre-feet. When filled to capacity, the reservoir would cover 18,200 acres and it would extend about 30 river-miles upstream to within about a mile of Gunnison, Colo.

Diversion, spillway, and outlet works.—During construction of the dam the river flow would be diverted through a tunnel in the right abutment. The tunnel would provide protection against a flood of 22,500 second-feet. After construction of the dam the diversion tunnel would be plugged and utilized as part of the spillway.

The spillway, which would have a capacity of 48,000 second-feet, would be located in the right abutment and would discharge into an inclined tunnel leading to the diversion tunnel. Control of the spill would be provided by two 50-foot by 28-foot gates over a crest at elevation 7,607 feet.

Outlet works with a capacity of about 2,000 second-feet would be provided.

Power features

The powerplant would be located at the toe of the dam. It would consist of three 18,000-kilowatt units and would have a total installed capacity of 54,000 kilowatts. The plant would operate under a maximum static head of 470 feet and a mean operating head of about 425 feet. Tailwater elevation at the powerplant would be about 7,165 feet. The initial energy generation of the plant with all the project units in coordinated operation would amount to 300 million kilowatt-hours annually. With ultimate upstream depletions approximately 227 million kilowatt-hours would be produced annually.

The necessary transmission facilities would be constructed to distribute the electric energy produced to various load centers and points of interconnection.

Access

United States Highway No. 50, which traverses the reservoir area, would be relocated to provide access to the Blue Mesa Dam site. Colorado State Highway No. 92 now extends to the dam site from a point on United States Highway No. 50 at Sapinero, Colo. Portions of the State highway and the junction of the State and national highways, however, would be inundated by the reservoir.

Rights-of-way and relocation

As previously mentioned, United States Highway No. 50 would be relocated to provide access to the dam. The relocated route would cross the river over the dam. At one time, the Denver & Rio Grande Western Railroad operated a narrow gage line through the reservoir area but this line was recently abandoned. Rights-of-way would be required for five small towns which lie within the reservoir area, including Sapinero, Cebolla, Iloa, Kezar, and Hierro. The cost of the towns' combined improvements is relatively low.

Geology

Rock structures in the reservoir basin are well consolidated and therefore no appreciable seepage losses are expected. At the dam site no faulting is noted. Local shear and joint planes do exist but these are not expected to offer significant construction problems. The rocks forming the abutments and foundation at the dam site are of pre-Cambrian granite, gneiss, and schist. The dam site is considered competent to support either a concrete gravity- or arch-type dam.

Five holes have been drilled at the dam site. These have shown a depth of river fill of 15 feet but suggest that the maximum depth may be about 20 feet.

Investigations indicate that there are sufficient quantities of suitable construction materials for either an earth-fill or concrete dam within 11 miles of the dam site. All of the borrow areas are situated along United States Highway No. 50.

Cost estimates

Estimated costs of the Curecanti unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Curecanti unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$58,700,000	$19,000	$12,100	$31,100
Highway relocation	7,300,000			
Rights-of-way	700,000			
Construction camp	900,000			
Powerplant	5,500,000	112,900	49,500	162,500
Transmission system	7,300,000	102,100	82,400	184,500
Total	80,400,000	234,000	144,100	378,100

ECHO PARK UNIT

Dam and reservoir

Echo Park Dam would be located on the Green River about 3 miles east of the Utah-Colorado State line and about 3 miles downstream from the confluence of the Green and Yampa Rivers.

Preliminary designs for Echo Park Dam are shown on the drawings on the following pages.

Echo Park Dam would be a concrete, curved, gravity-type structure. It would rise 525 feet above the river bed and 690 feet above bedrock. The crest would be at elevation 5,575 feet, 5 feet above the maximum reservoir water surface elevation. The crest length would be 920 feet.

The reservoir formed by the dam would have a total initial capacity of 6,460,000 acre-feet, including an active capacity of 5,460,000 acre-feet and an inactive capacity of 1 million acre-feet. Over a 200-year period silt deposits would reduce the active capacity by about 291,000 acre-feet and the inactive capacity by 247,000 acre-feet. After 200 years the active storage capacity at Echo Park would comprise 20 percent of the total active storage provided by the project. When filled to capacity, the reservoir would have a water surface area of

43,000 acres and it would extend 63 miles up the Green River and 44 miles up the Yampa River. Most of the reservoir basin would be in narrow canyon sections and thus a minimum amount of water would be lost through evaporation. At some later date it may be found desirable to pump water from Echo Park Reservoir for use in the Uinta Basin of Utah.

Diversion, spillway, and outlet works.—A concrete-lined tunnel would be constructed through the left abutment to divert the river flow around the dam site during construction. This tunnel would provide protection against a flood flow of 27,500 second-feet. After construction of the dam the diversion tunnel would be plugged and utilized as part of the spillway.

The spillway would have a capacity of 81,500 second-feet. It would discharge water through an inclined tunnel in the left abutment leading to the diversion tunnel which, in turn, would carry the water back to the river channel on the downstream side of the dam. The spill would be controlled by two 30- by 55-foot stoney gates over a crest at elevation 5,515 feet.

An outlet works, consisting of an intake tower of the type constructed at Hoover Dam and a tunnel through the left canyon wall, would discharge 20,000 second-feet with the reservoir at maximum water surface elevation. A temporary outlet valve would be installed in the diversion tunnel plug to control the river flow until the water level reaches the sill of the permanent outlet works at elevation 5,325 feet.

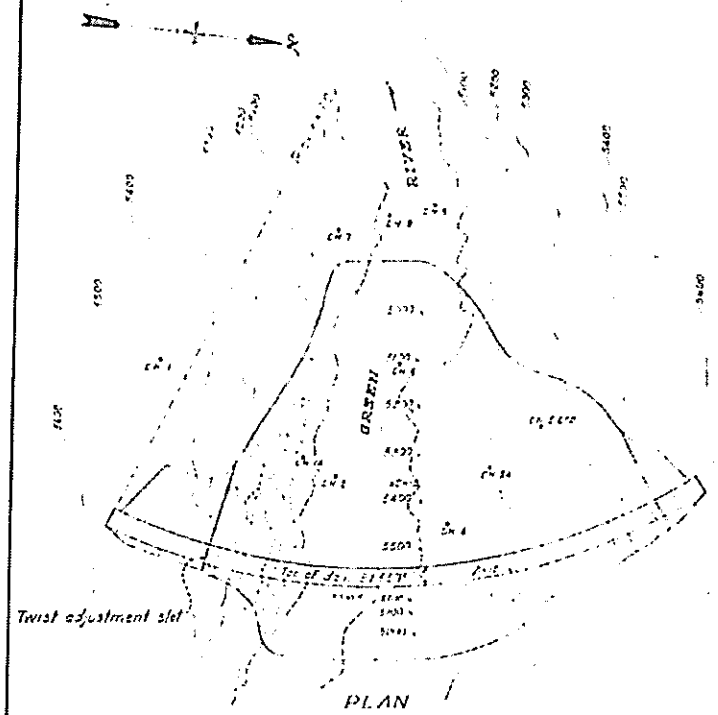
Power features

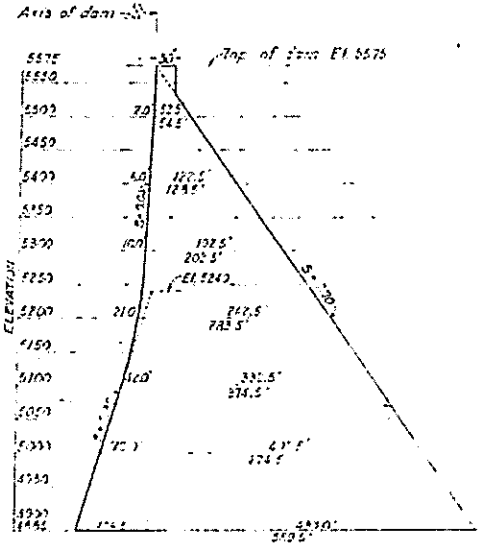
Echo Park powerplant would be located at the toe of the dam. The plant would consist of four 50,000-kilowatt units and would have a total installed capacity of 200,000 kilowatts. Each generating unit would receive water through an individual penstock passing through the dam. Each penstock would have its own trashrack and gate structure. Initially, with all the project units in coordinated operation, the plant would produce 995 million kilowatt-hours annually. With ultimate upstream depletions approximately 677 million kilowatt-hours would be produced annually. The plant would operate under a maximum static head of 520 feet and a mean operating head of about 475 feet. Tailwater elevation at the powerplant would be about 5,050 feet.

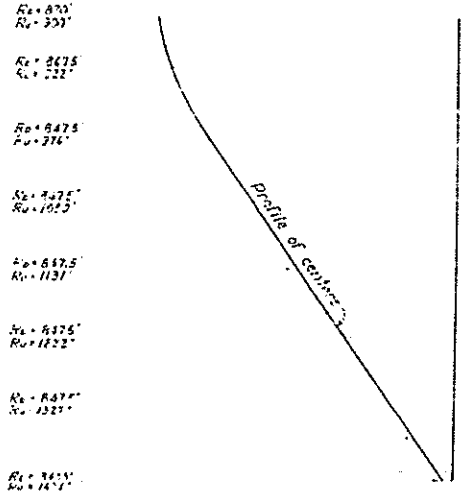
The necessary transmission facilities would be constructed to deliver the electric energy produced to load centers and points of interconnection.

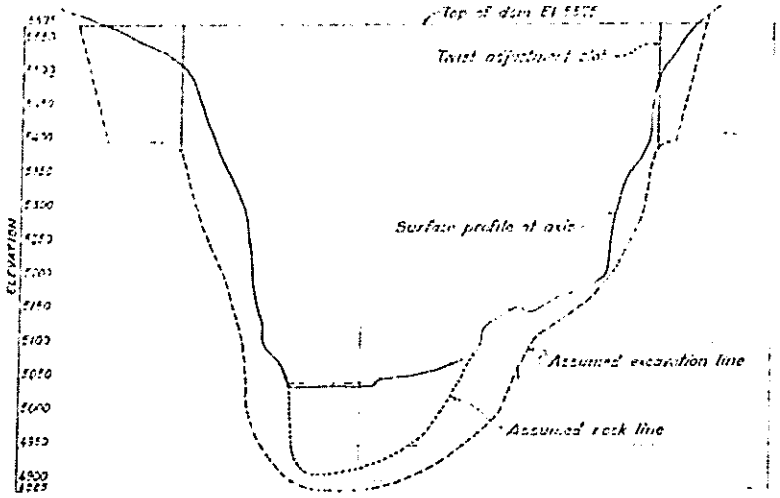
Geology

Geological explorations of the Echo Park Dam and Reservoir sites were made in 1940 by the Bureau of Reclamation. The investigations showed the sites to be suitable for the features contemplated. The foundation and lower part of the abutment walls would be in the Uinta quartzitic sandstone. The upper part of the abutments would be in the Lodore sandstone. Both of these rocks possess satisfactory characteristics for the construction of a high concrete dam. River fill material extends to a maximum depth of 148 feet. Considerable jointing was found in the dam-site vicinity, but no









Reference drawings: 317-D-11
317-D-12

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SCALE OF FEET

STUDY NO G-2

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT

ECHO PARK DAM

PLAN, PROFILE, & SECTION
ROUGH PRELIMINARY DESIGN DRAWING

DRAWN EMD SJMC SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED

DENVER, COLORADO JULY 20, 1944 | 317-D-10

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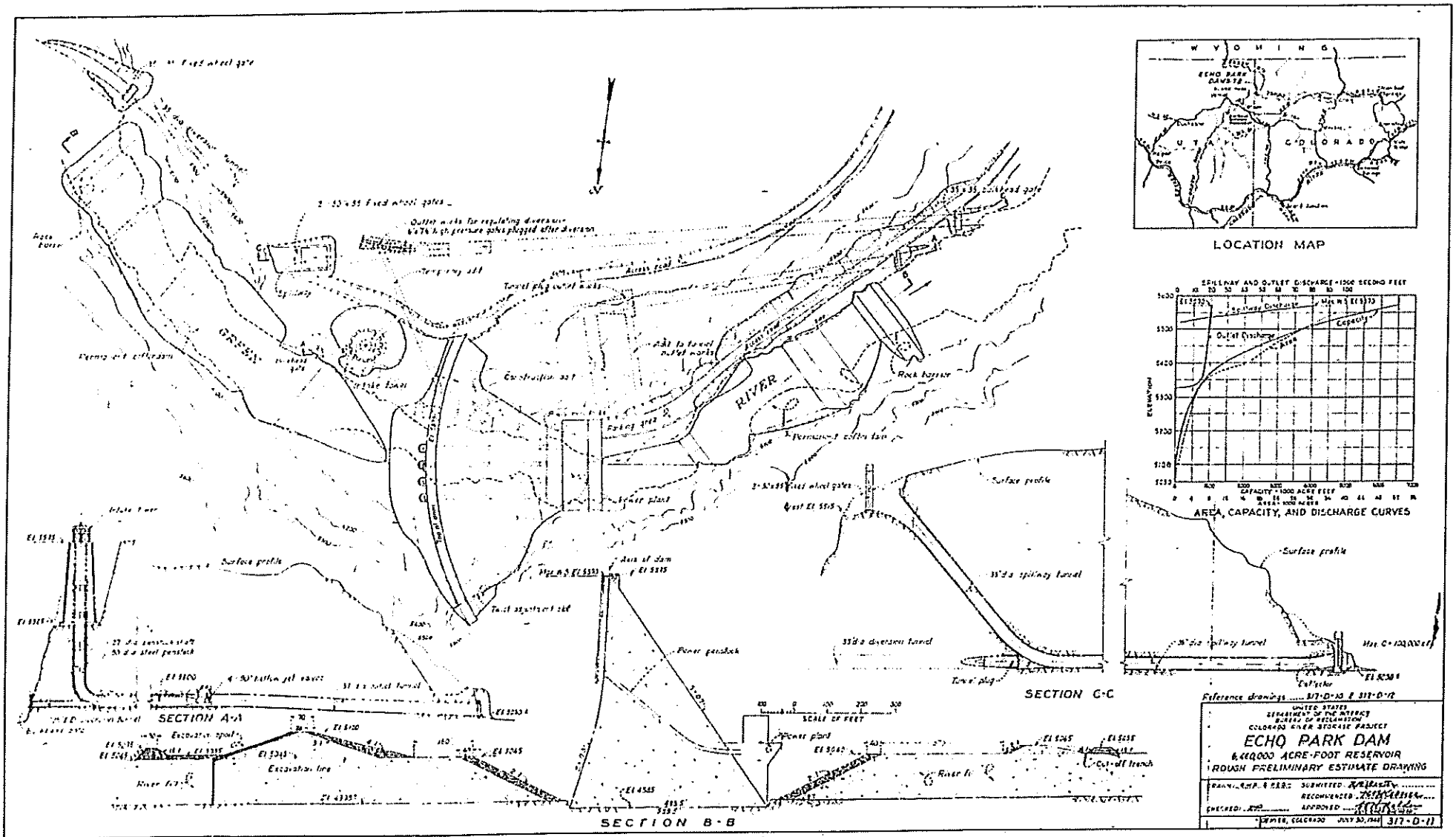

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faults were found. A reasonable grouting program should effectively seal all paths of seepage.

Deposits of concrete aggregate lie in the Island Park area 8 to 10 miles downstream from the dam site. These deposits have been extensively investigated, and tests made on representative samples have shown aggregate to be of satisfactory quality for use in the construction of the dam. There is, however, a shortage of aggregate in sizes in excess of 3 inches in diameter. Coarse aggregate, however, could be quarried from limestone formations near the dam site. Investigations will be made of other construction material sources as a part of the preconstruction studies.

Access

Preliminary investigations have been completed for an access road that would extend from Vernal, Utah, on United States Highway No. 40 to Island Park and that would then continue along the south side of the Green River through Whirlpool Canyon to the dam site. Other routes will be studied during the preconstruction surveys. In the investigations of alternative routes, consideration should be given to the desirability of routing the road by the construction camp and deposits of construction materials. Consideration should also be given to the possibility of locating the road so that it would provide access to facilities of the Split Mountain unit and permit at least part of the Echo Park construction camp to be used for the Split Mountain unit.

Rights-of-way and relocation

Echo Park Reservoir would occupy all of the Yampa and Green River channels within the Dinosaur National Monument upstream from the dam site. The original 80 acres of the monument, the area which includes the fossil deposits and the monument headquarters, would not be affected by the reservoir or any of the construction features. The reservoir, however, would open to the public an area now almost inaccessible. Rights-of-way for the reservoir would have to be acquired on about 17,000 acres of private or State-owned lands that lie within the exterior boundaries of the monument. Of the 17,000 acres less than 2,000 acres are irrigated or otherwise developed for agricultural use. Most of the developed lands are used for pasture or hay production while the undeveloped land is used principally for grazing. The upper portion of the reservoir on the Green River would extend about 8 miles into the Ashley National Forest. Only rights-of-way for privately owned land in this area would be required.

A few mining claims in the reservoir area have been renewed since 1940, but no mines are operating. No producing oil wells are located in the area. No facilities within the area would require relocation.

Cost estimates

Cost estimates for the Echo Park unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Echo Park unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$106,700,000	$31,000	$21,000	$52,000
Access road	10,000,000			
Rights-of-way	100,000			
Construction camp	1,800,000			
Powerplant	10,800,000	280,000	183,200	463,200
Transmission system	27,000,000	378,000	305,100	683,100
Total	165,400,000	689,000	510,200	1,199,200

FLAMING GORGE UNIT

Dam and reservoir

Ashley Dam, key feature of the Flaming Gorge unit, would be located in northeastern Utah about 32 air miles north of Vernal, Utah. It would be located on the Green River, 290 river miles upstream from Green River, Utah, and about 32 river miles downstream from the Utah-Wyoming State line.

Ashley Dam would be a concrete, gravity-type structure, rising 440 feet above the river and 491 feet above its bedrock foundation. The crest would be at elevation 6,045 feet, 5 feet above the maximum water surface elevation. The distance between the canyon walls at the crest elevation is about 900 feet.

Flaming Gorge Reservoir formed by the dam would have a total initial capacity of 3,940,000 acre-feet, including an active capacity of 2,950,000 acre-feet and an inactive capacity of 990,000 acre-feet. In 200 years silt deposits would reduce the active capacity to 2,550,000 acre-feet and the inactive capacity to 11,000 acre-feet. When filled to capacity, the reservoir would have a water surface area of 40,800 acres and would extend 91 miles upstream, to within 3 or 4 miles of the town of Green River, Wyo.

Diversion, spillway, and outlet works.—During the construction period water would be diverted around the dam site through a tunnel in the right abutment. The tunnel would have a capacity of 20,000 second-feet.

The spillway would discharge into an inclined tunnel leading to the diversion tunnel. It would have a capacity of 85,000 second-feet. Control of the spill would be provided by three 22- by 50-foot stoney gates over a crest at elevation 5,990 feet.

Outlet works of 5,000-second-foot capacity would be provided through the dam.

Power features

The powerplant, located at the toe of the dam, would consist of 3 units with a total installed capacity of 72,000 kilowatts. The plant would operate under a maximum head of 435 feet and a mean head of about 395 feet. Initially, with all the project units in coordinated operation, 337 million kilowatt-hours would be produced annually. After all streamflow depletions were made by future upstream developments, about 105 million kilowatt-hours would be produced annually. Estimated tailwater elevation at the powerplant would be 5,605 feet.

The necessary transmission facilities would be constructed.

Access

Utah State Highway No. 44 extends 40 miles from Vernal, Utah, to a point about 7 miles from the dam site. From the highway a mountain road, about 6 miles long, and a foot trail, about 1 mile long, extend to the site. Improved roads also reach south from Lyman and Green River to the head of the mountain road. Either the route from Utah or the one from Wyoming could be used for access to the dam during the construction period. New construction would be required over the greater part of either route. Rail facilities are available at Green River, Wyo., for the approach from the north and at Heber, Utah, or Craig, Colo., for the approach from the south.

Rights-of-way and relocation

The lower portion of the reservoir basin lies in the Ashley National Forest. Only small rights-of-way costs in this area would be required. The upper end of the reservoir would reach nearly to Green River, Wyo., but would not interfere with any of the city's improvements. A portion of a secondary road crossing Blacks Fork between Green River, Wyo., and Manila, Utah, would have to be relocated. No other major work is expected in connection with relocating facilities in the reservoir area.

Geology

The rock at this dam site belongs to the Uinta formation and consists of hard, massive, purplish-red quartzose sandstone. Bedding planes are from 1 to 20 feet apart with some minor shale partings. The geological characteristics at the dam site are satisfactory for the type of dam contemplated. A fairly prominent system of joints cuts across the river at the axis. Although some of the joints are open, they can be successfully sealed with grouting. Drilling in the river bottom shows the maximum depth of river fill to be 31 feet.

One fairly large gravel deposit, located near the mouth of Gorge Creek 7 or 8 miles downstream from the dam axis, is a possible source of construction materials. Other deposits are in the vicinity but will require further investigation.

Cost estimates

Estimated costs of the Flaming Gorge unit, based on December 1949 prices, are summarized in the following table:

Estimated costs of Flaming Gorge unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$57,700,000	$23,000	$11,800	$35,400
Access facilities	6,500,000			
Rights-of-way	200,000			
Construction camp	900,000			
Power plant	7,700,000	133,900	68,700	202,600
Transmission system	9,700,000	136,100	109,800	245,900
Total	82,700,000	293,600	190,300	483,900

GLEN CANYON UNIT

Dam and reservoir

The Glen Canyon Dam site is located on the Colorado River in northern Arizona, about 13 river miles downstream from the Utah-Arizona State line and 15 miles upstream from Lees Ferry.

Preliminary design drawings for the Glen Canyon Dam are shown on the following pages.

The dam would be a concrete, arch-type structure, rising 580 feet above the river and 700 feet above the bedrock foundation. The crest would be at elevation 3,715 feet. Ten feet of surcharge, amounting to about 2 million acre-feet of capacity, would be provided above the normal water surface. Five feet of freeboard would be provided above the flood storage. The crest length of the dam would be about 1,400 feet.

The reservoir would have an initial capacity of 26 million acre-feet, including 20 million acre-feet of active capacity and 6 million acre-feet of inactive capacity. In 200 years silt deposits would reduce the active capacity to 10,455,000 acre-feet and would completely fill the inactive storage pool. The reservoir would have a maximum water surface area of about 153,000 acres. When filled to capacity, it would extend about 186 river miles up the Colorado River, nearly to the mouth of the Green River, and 71 river miles up the San Juan River.

Diversion, spillway, and outlet works.—During the construction period the river flow would be diverted around the dam site through a tunnel in each abutment. The tunnels would provide protection against a flood flow of 120,000 second-feet, a flow slightly higher than the highest discharge recorded during the period 1923 to 1945.

Two spillways, one in each abutment, would be provided to discharge a total of 253,000 second-feet at a water surface elevation of 3,710 feet. The spillways would be identical. Each would discharge into an inclined tunnel leading to a diversion tunnel. Control of each spillway would be provided by two 40- by 60-foot radial gates over a crest at elevation 3,650 feet.

The outlet works would have a capacity of 27,000 second-feet with the reservoir water surface at elevation 3,490 feet.

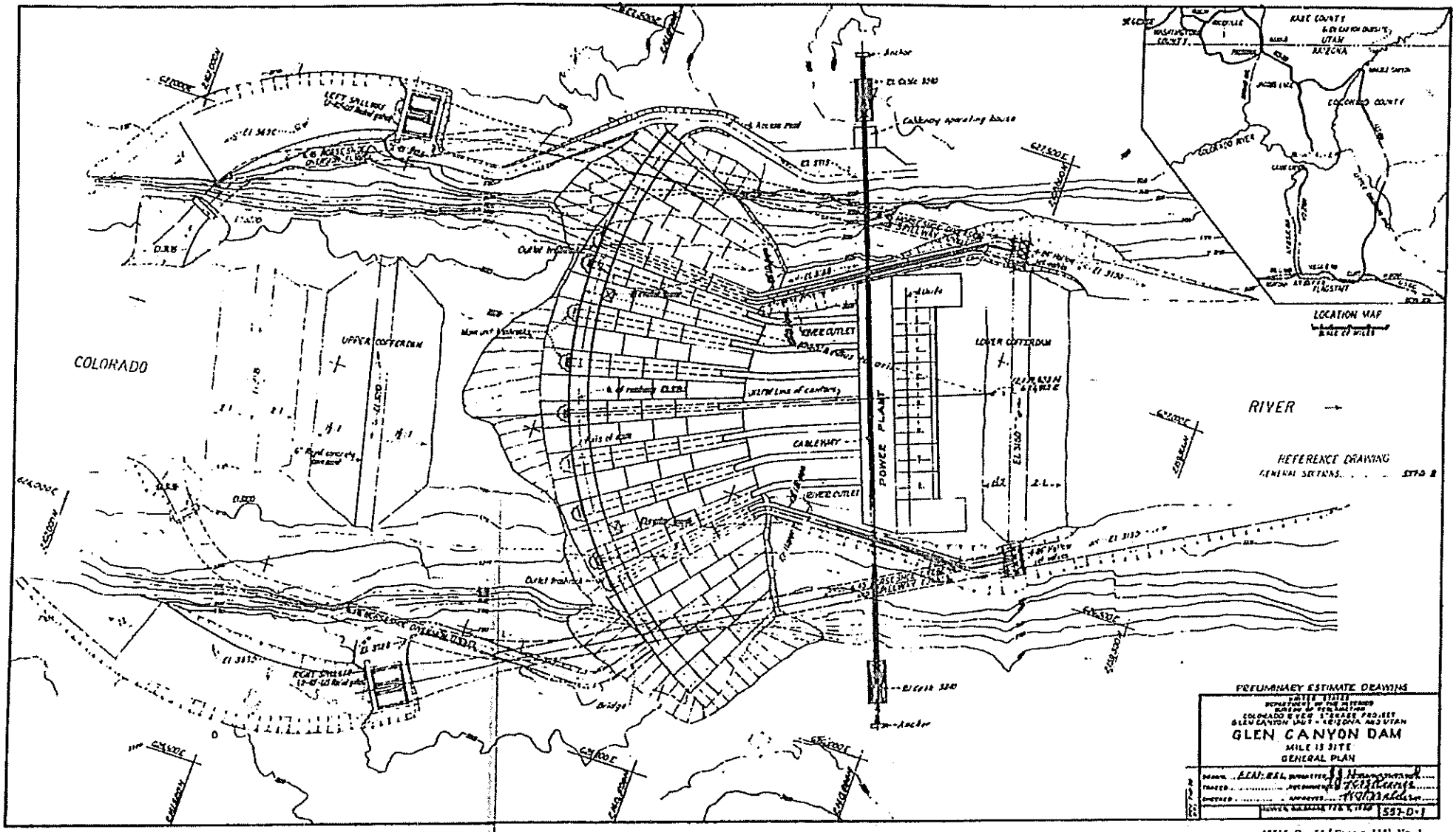
Power features

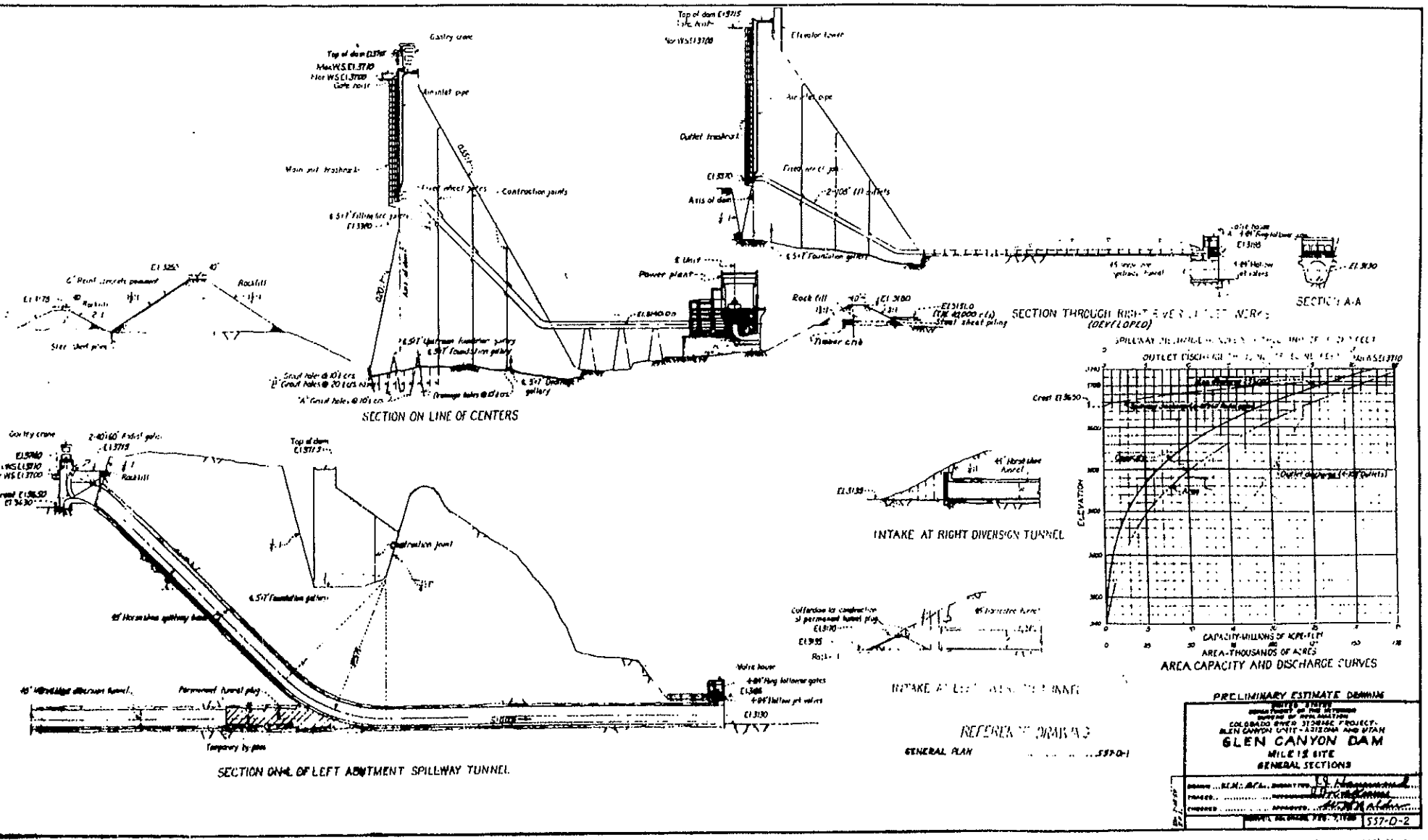
The Glen Canyon powerplant would be located near the toe of the dam. The plant, consisting of 7 generating units, would have a total installed capacity of 800,000 kilowatts. The plant would operate under a mean head of about 480 feet. Initially, with all the project units in coordinated operation, it would produce about 4,337 million kilowatt-hours annually. With ultimate streamflow depletions, it would produce approximately 2,992 million kilowatt-hours annually. Minimum and maximum tailwater elevations at the plant would be 3,135 feet and 3,181 feet, respectively.

The necessary transmission facilities would be constructed to distribute the electric energy to load centers or points of interconnection.

Geology

The Glen Canyon site is geologically favorable for a high concrete dam. At the site the sides of the canyon rise abruptly from the river bed in nearly vertical walls 650 feet high. The rock forming the


COLORADO
RIVER
POWER PLANT
UPPER COFFERDAM
LOWER COFFERDAM
CABLEWAY
RIVER OUTLET
LOCATION MAP
REFERENCE DRAWING
GLEN CANYON DAM
MILE 15 SITE
GENERAL PLAN



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abutments and the foundation is the massive Navaho sandstone of Jurassic age. This massive formation is a medium- to fine-grained sandstone, buff to red in color. The rock is remarkably free of structural defects. No folds are found in the dam site area, and the massive sandstone lies in a nearly horizontal position except for a slight dip upstream into the left abutment.

Twenty-eight holes have been drilled at the Glen Canyon site. The rock conditions were shown by the exploratory work to be generally satisfactory.

Overburden in the river channel consists of sand, silt, gravel, and a few medium-sized boulders and ranges in depth from a few feet near the canyon wall to 110 feet near the center of the river bed.

Construction materials of satisfactory quality and adequate quantity can be obtained from deposits in Wahweap Creek about 7 miles northwest of the dam site.

Access

The dam site can now be reached over an ungraded road, which extends about 7 miles to Lees Ferry from a point near Marble Canyon Lodge on United States Highway No. 89, and then by a fairly good horse trail, which extends about 15 miles from Lees Ferry to the dam site. A highway would be built from a point near the Navaho bridge to the dam site on the east side of the river. A highway could be built to the west side of the dam site from a point on Highway No. 89 south of Kanab, Utah. It may be desirable after construction of the dam to connect these two roads using the dam as a bridge, thus forming a loop or alternate highway to the present Highway 89.

Rights-of-way and relocation

No improvements nor improved lands of any consequence are in the reservoir area, and no major facilities would require relocation. A large portion of the reservoir basin, however, lies in the Navaho Indian Reservation.

Cost estimates

Estimated costs of the Glen Canyon unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Glen Canyon unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$148,600,000	$63,000	$30,500	$93,500
Access facilities	27,000,000			
Rights-of-way	400,000			
Construction camp	4,200,000			
Powerplant	75,800,000	864,000	738,700	1,602,700
Transmission system	108,000,000	1,512,000	1,220,400	2,732,400
Total	363,900,000	2,439,000	1,989,600	4,428,600

GRAY CANYON UNIT

Dam and reservoir

Gray Canyon Dam would be located in Utah on the Green River about 22 river miles upstream from Green River, Utah. The site, formerly called Rattlesnake site, is about 4 miles upstream from the

mouth of the Price River and immediately downstream from the mouth of Rattlesnake Creek.

The dam would be a concrete, gravity-type structure, rising 445 feet above the river and 575 feet above the assumed bedrock foundation. The crest would be at elevation 4,595 feet, 5 feet over the maximum water-surface elevation. At the crest elevation the distance between the canyon walls is about 2,100 feet.

The reservoir formed by the dam would have an initial capacity of 2 million acre-feet, including an active capacity of 1,390,000 acre-feet and an inactive capacity of 610,000 acre-feet. In 200 years silt deposits would reduce the active capacity to 698,000 acre-feet and would completely fill the inactive storage pool. When filled to capacity the reservoir would have a water surface area of 10,750 acres and it would extend about 53 river miles up the Green River. The narrow canyon section would confine the reservoir to a maximum width of about half a mile.

Diversion, spillway, and outlet works.—During construction of the dam the river flow would be diverted through 2 tunnels, 1 on each side of the canyon. The tunnels would have a combined capacity of 100,000 second-feet.

A gate-controlled spillway of 95,000 second-foot capacity would be provided on each side of the canyon. Each of the spillways would discharge through an inclined tunnel leading to a diversion tunnel. Control of each spillway would be provided by three 20- by 60-foot gates over a crest at elevation 4,530 feet.

River-outlet works of 10,000 second-foot capacity would be provided through the dam.

Power features

Gray Canyon powerplant would be located at the toe of the dam. It would consist of 4 units, each with a capacity of about 52,500 kilowatts, and thus would have a total installed capacity of 210,000 kilowatts. It would operate under a mean head of about 400 feet and a maximum head of 440 feet. Initially, with all the project units in coordinated operation, the plant would produce more than 1,303 million kilowatt-hours annually. With ultimate upstream depletions, it would produce about 826 million kilowatt-hours annually. Tailwater elevation at the powerplant would be 4,150 feet.

Besides the powerplant, the power features would include the necessary transmission facilities to distribute the electric energy produced to the various load centers and points of interconnection.

Access

An unimproved road, heading north at Green River, Utah, extends approximately 12 miles along the east side of Green River to a point about 10 miles from the dam site. For access purposes a highway could be constructed along the route of the existing road and extended as necessary to the dam site. The road extension would be through a canyon section but construction is not expected to be particularly difficult. A railhead could be established at Green River.

Rights-of-way and relocation

There are no facilities requiring relocation within the reservoir area. With the exception of one ranch, all of the area consists of

barren canyon lands. Lands in the area on the east side of the river are in the Hill Creek extension of the Uinta and Ouray Indian Reservation.

Geology

Because of geologic conditions at the Gray Canyon site, special measures would be required to insure a stable dam. Bedrock at the dam site is a black sandy shale that grades in depth to a clay shale. The abutments are vertical cliffs of Mesaverde sandstone, a hard, gray, but somewhat friable rock. A coal seam, 2 to 5 feet thick, lies about 50 feet above the stream level. The strata dip very slightly upstream. No drilling has been done at the site but the depth of river fill material is variously estimated up to 100 feet.

The only construction materials near the site are the Mesaverde sandstone, which would make fairly good concrete aggregate, and sand and gravel found on several bars along the river. Other materials will probably have to be brought in from the vicinity of Green River, Utah, about 20 miles away.

Cost estimates

Estimated costs of the Gray Canyon unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Gray Canyon unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$120,400,000	$16,600	$26,000	$42,600
Access facilities	1,600,000			
Construction camp	2,000,000			
Powerplant	23,600,000	204,000	185,300	470,300
Transmission system	28,400,000	397,000	320,400	717,400
Total	178,400,000	707,600	531,700	1,239,300

NAVAHO UNIT

Dam and reservoir

Navaho Dam site is located on the San Juan River in northwestern New Mexico about 19.5 river miles upstream from the small town of Blanco, N. Mex., and 34 miles east of Farmington, N. Mex. It is about 3.5 miles downstream from the confluence of the Pine and San Juan Rivers.

The dam would be a rolled, earth-fill embankment. It would rise 335 feet above stream bed and by means of a cutoff trench would be extended an additional 25 feet to bedrock. The structure would be about 3,280 feet long at the crest. The crest would be at elevation 6,060 feet, 10 feet above the normal water surface elevation. The dam would contain 17 million cubic yards of earth and rock fill.

Initially Navaho Reservoir would have a total capacity of 1,200,000 acre-feet, including an active capacity of 1,050,000 acre-feet and an inactive capacity of 150,000 acre-feet. In 200 years silt deposits would reduce the actvie capacity to 734,000 acre-feet and the inactive capacity to 33,000 acre-feet. When filled to capacity, the reservoir would have a water surface area of about 10,800 acres and it would

extend about 33 miles up the San Juan River, to a point about 3.5 miles beyond the town of Arboles, Colo.

Diversion, spillway, and outlet works.—During the construction period the river flow would be diverted through a tunnel in the right abutment. The tunnel would discharge a maximum of 20,000 second-feet.

An open channel spillway, with a capacity of 175,000 second-feet, would be located on the right abutment. The spill would be controlled by four 25- by 87½-foot gates over a crest at elevation 6,025 feet. Outlet works, with a capacity of 3,000 second-feet, would be installed in the diversion tunnel in the right abutment.

Power features

Navaho powerplant would be located at the toe of the dam. It would consist of three 10,000 kilowatt units and thus would have a total installed capacity of 30,000 kilowatts. The plant would operate under a maximum head of 325 feet and a mean head of 275 feet. Initially, with all the project units in coordinated operation, the plant would produce 157 million kilowatt-hours annually. Ultimately, after all upstream water developments are made, it would produce 32 million kilowatt-hours annually. The estimated tailwater elevation of the powerplant would be the present river elevation of 5,725 feet.

The necessary transmission facilities would be constructed to deliver the electric energy produced to load centers and points of interconnection.

Access

New Mexico State Highway No. 44 is the paved highway nearest the Navaho site. It passes through Bloomfield approximately 26 miles from the site. A narrow gage line of the Denver & Rio Grande Western Railroad passes through Aztec, N. Mex., 35 miles from the site. The nearest standard gage railhead is at Gallup, N. Mex., 138 miles from Bloomfield and 164 miles from the dam site.

The highways from both Aztec and Gallup to Bloomfield are paved and the bridges are capable of handling heavy trucking. From Bloomfield to the dam site the roads would have to be improved or rebuilt to accommodate heavy trucking.

Rights-of way and relocation

A portion of the Denver & Rio Grande Western Railroad narrow gage line between Antonito and Durango, Colo., would have to be relocated. Sections of Colorado State Highways Nos. 151 and 172 would also require relocation. The roads consist of second class or unimproved sections.

The major right-of-way costs involved would be in obtaining the land and improvements of the town of Arboles.

Geology

The rock at the dam site is principally sandstone with minor beds of shale. It belongs to the Wasatch formation. The rock is moderately hard, fairly massive, and is considered completely adequate to support a dam of the height contemplated. Drilling at the site showed the rock to be reasonably tight with no unfavorable conditions. The maximum depth of overburden in the river channel is

34 feet. Except for riprap, suitable construction materials can be found in the area. Riprap would have to be brought in from a distance of 80 or 90 miles.

Cost estimates

Estimated costs of the Navaho unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Navaho unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$49,400,000	$13,000	$10,100	$23,100
Access facilities	1,300,000			
Rights-of-way and relocation	1,800,000			
Construction camp	700,000			
Powerplant	5,800,000	82,500	42,900	125,400
Transmission system	4,000,000	56,700	45,800	102,500
Total	63,000,000	152,200	98,800	251,000

SPLIT MOUNTAIN UNIT

Dam and reservoir

Split Mountain Dam would be located on the Green River in Uintah County, northeastern Utah, about 14 air miles east of Vernal, Utah, and about 2 miles from the headquarters of the Dinosaur National Monument. It would be near the lower end of Split Mountain Canyon and 201 river miles upstream from Green River, Utah. Split Mountain Reservoir would extend upstream to the base of the potential Echo Park Dam.

Split Mountain Dam would be a concrete, gravity-type structure, rising 245 feet above the river and 305 feet above the assumed bedrock foundation. The crest would be at elevation 5,055 feet, 5 feet above the maximum water-surface elevation. At the crest elevation the distance between canyon walls is about 990 feet.

Split Mountain Reservoir would have a total capacity of 335,000 acre-feet. It would serve to maintain a power head and would provide regulation only for the daily or hourly releases from the Echo Park unit. Since the reservoir would provide no long-time river regulation nor irrigation storage, its entire capacity is considered inactive. Because of its location below Echo Park Reservoir, Split Mountain Reservoir would not receive significant quantities of sediment. The maximum water surface elevation of Split Mountain Reservoir would not exceed 5,050 feet, the tailwater elevation of Echo Park powerplant. When full, the reservoir would cover about 4,250 acres and would extend about 21 river miles upstream to the base of Echo Park Dam.

Diversion, spillway, and outlet works.—During the construction period the river flow would be diverted around Split Mountain Dam site by an open flume with a capacity of 35,000 second-feet.

The spillway would be a controlled overflow section with a capacity of 112,000 second-feet. Its crest would be at elevation 5,028 feet. The spill would be controlled by three 100-foot by 22-foot gates.

The river outlet works would have a capacity of 8,000 second-feet. They would discharge into the spillway.

Power features

Split Mountain powerplant would be located about 12 river miles downstream from the dam, on the opposite side of a horseshoe bend. Water would be conveyed from the dam to the powerplant through a tunnel and penstock, with a total length of 15,200 feet. The penstock, which would traverse the relatively level river bottom lands, would be buried and vegetation would be allowed to cover its location in order that as little as possible of the natural appearance of the Dinosaur National Monument in the vicinity of the dinosaur beds and the monument headquarters would be disturbed.

The generating equipment of Split Mountain powerplant would consist of two 50,000-kilowatt units, making a total installed capacity of 100,000 kilowatts. The plant would operate under a mean head of about 300 feet. Sixty feet of this head would be gained in the river gradient between the dam and the powerplant. The initial power generation with all the project units in coordinated operation would amount to about 710 million kilowatt-hours annually. With ultimate streamflow conditions, the power generation would amount to about 441 million kilowatt-hours annually. Tailwater elevation at the powerplant would be about 4,735 feet.

Necessary facilities would be constructed to distribute the electric energy to the various load centers and points of interconnection.

Access

A secondary road now extends 10 miles from Jensen, Utah, on United States Highway No. 40, to a point about a mile downstream from Split Mountain Dam site. The distance from the end of the road to the dam site must now be traveled by foot. An access highway could be constructed along the existing road. By use of a bridge this road could be extended across the river and then continued up the north side of the river to the dam. A connecting highway between the Split Mountain unit and the Echo Park unit may be found desirable.

Rights-of-way and relocation

There are no facilities within the reservoir area that would require relocation. The reservoir would inundate the center area of Island Park, part of which is privately owned.

Geology

Split Mountain Dam would rest on a foundation of Madison limestone. This rock has some undesirable characteristics but it is considered adequate to support a concrete, gravity-type dam. There is one fault in the vicinity of the dam site, with the strike extending in a north-south direction. The displacement is nearly zero at the point where the fault intersects the dam axis.

Drilling explorations in the vicinity of the site indicate the river fill material is about 30 feet deep at the dam axis.

Extensive gravel deposits are found downstream from the mouth of the canyon on widespread terraces. These deposits are composed of well assorted gravels, some cobbles, and considerable sand. Ample quantities of acceptable aggregate for construction of the dam are available within a 3- or 4-mile haul.

Cost estimates

Estimated costs of the Split Mountain unit, based on December 1949 prices, are summarized in the following table.

Estimated costs of Split Mountain unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$32,700,000	$6,600	$6,700	$13,300
Access road	1,700,000			
Rights-of-way	100,000			
Construction camp	700,000			
Powerplant	10,000,000	171,800	132,300	304,100
Power tunnel	10,800,000			
Transmission facilities	13,500,000	189,000	152,600	341,600
Total	76,400,000	367,400	291,600	659,000

WHITEWATER UNIT

Dam and reservoir

Whitewater Dam, key feature of the Whitewater unit, would be located in Mesa County, western Colorado. It would be on the Gunnison River, 2 miles south of Whitewater, Colo., and 9½ miles southeast of Grand Junction, Colo. The dam would be located 15 river miles upstream from the confluence of the Gunnison and Colorado Rivers.

Preliminary designs for the Whitewater Dam are shown on the drawings on the following pages.

The dam would be a rolled, earth-fill embankment with a volume of 6,656,000 cubic yards. It would rise 255 feet above stream bed and 335 feet above bedrock. The crest would be at elevation 4,890 feet, 10 feet above the normal water surface elevation. The crest would be 1,830 feet in length. To complete the reservoir basin three dikes would be constructed in low saddles on the north side of Kannah Creek about 4 miles upstream from the dam.

The reservoir formed by the dam and dikes would have a total initial capacity of 880,000 acre-feet, including an active capacity of 470,000 acre-feet and an inactive capacity of 410,000 acre-feet. In 200 years silt deposits would reduce the active capacity to 320,000 acre-feet and the inactive capacity to 92,000 acre-feet. When filled to capacity, the reservoir would have a water surface area of 10,250 acres and would extend about 35 river miles upstream to a point about 4 miles west of Delta, Colo.

Diversion, spillway, and outlet works.—During construction of Whitewater Dam the river flow would be diverted through two permanent outlet tunnels in the left abutment. These tunnels would discharge a maximum of 22,700 second-feet.

A side-channel, chute-type spillway would be located on the right abutment of the dam. It would discharge a maximum of 75,000 second-feet over a crest elevation of 4,860 feet.

River outlet works would be provided in the left abutment in conjunction with the outlets of the Whitewater powerplant. These

would discharge 1,500 second-feet with the water surface at elevation 4,756 feet.

An outlet with a capacity of 800 second-feet would be installed in one of the dikes (dike 2A) to deliver water to the potential Kannah Creek Irrigation Canal.

Power features

Whitewater powerplant would be located at the toe of the dam and would consist of 3 equal-sized units with a total installed capacity of 48,000 kilowatts. The plant would operate under a maximum head of 240 feet and a mean head of about 220 feet. The initial energy generation of the plant with all project units in coordinated operation would amount to 249 million kilowatt-hours annually. With ultimate stream flow depletions, approximately 187 million kilowatt-hours could be produced annually. The power penstocks would be placed in the outlet tunnel. Tailwater elevation at the powerplant would be about 4,640 feet.

Transmission facilities would be provided as necessary to distribute the electric energy produced to various load centers and points of interconnection.

Access

The dam site is readily accessible since it is located only 1 mile from United States Highway No. 50 and is situated directly on a branch line of the Denver & Rio Grande Western Railroad. At the present time both abutments can be reached by dirt roads.

Rights-of-way and relocation

A small part of the reservoir area consists of improved farmlands. It contains no centers of population. About 28 miles of the Denver & Rio Grande Western Railroad would require relocation. Other facilities requiring relocation within the reservoir area are United States Highway No. 50, some secondary roads, a Mountain States Telephone & Telegraph Co. line, and a Western Union telegraph line.

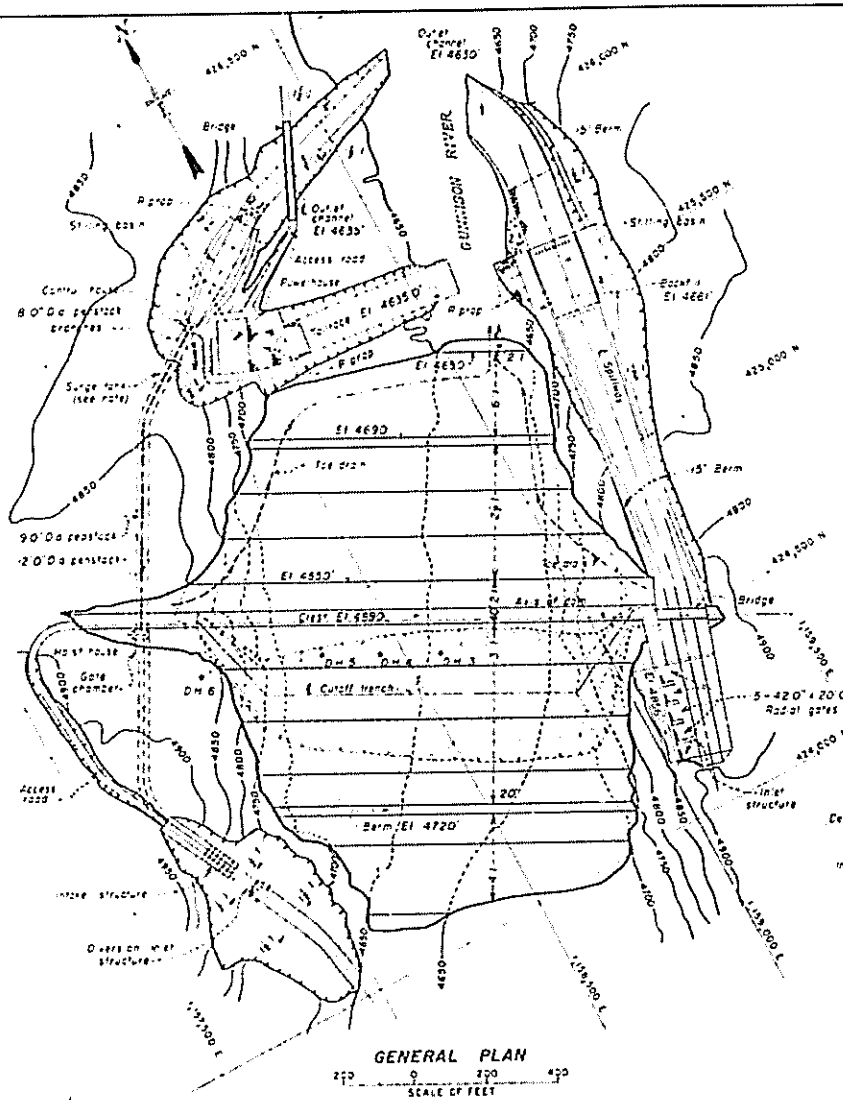
Geology

At the dam site the Gunnison River has cut through Mancos shale and Dakota sandstone and has exposed the upper part of the Morrison formation. This Morrison formation would form the foundation for the dam. It is generally soft and easily weathered. The Dakota sandstone, which would form the abutments for the dam, is predominantly hard and resistant. Six holes, drilled to investigate the foundation, showed the maximum depth of overburden to be 68.5 feet. Percolation tests showed no abnormal seepage losses. The three dikes would have adequate foundation support and tight abutments.

Four borrow areas have been explored as possible sources of construction materials. Tests made on the samples taken show the materials to be ample and acceptable for the fill. Concrete aggregate and riprap are also available.

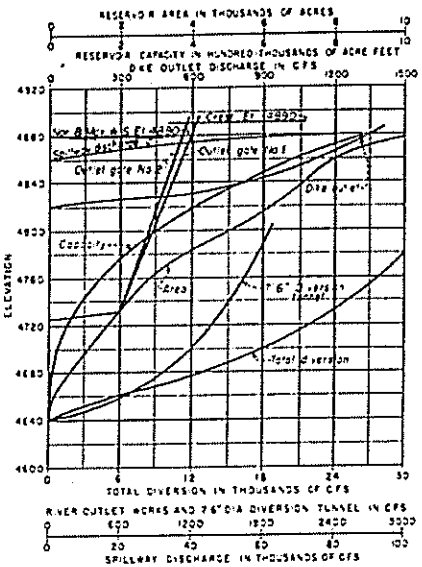
Cost estimates

Estimated costs of the Whitewater unit, based on December 1949 prices, are summarized in the following table:

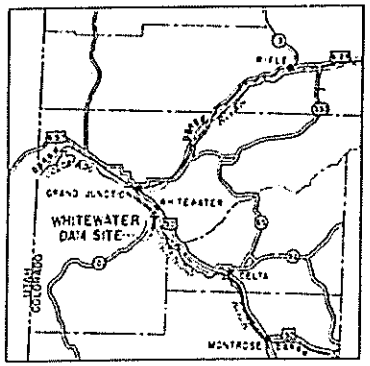


GENERAL PLAN

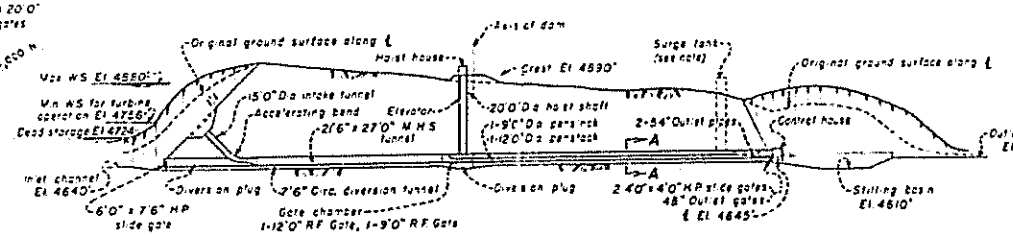
SCALE OF FEET



AREA-CAPACITY-DISCHARGE CURVES

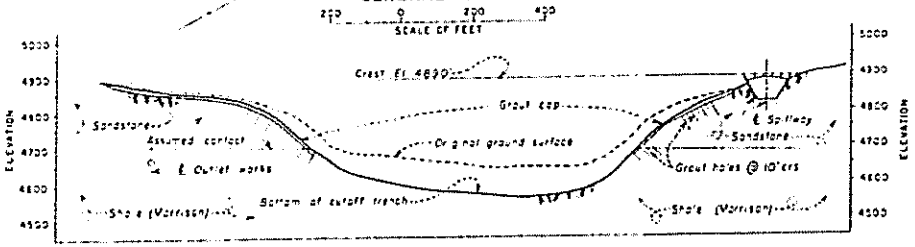


LOCATION MAP

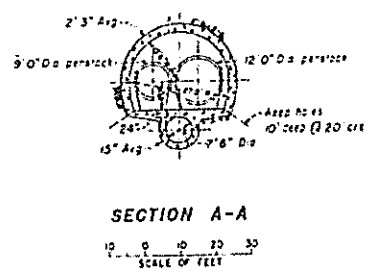


PROFILE ON ℄ OF OUTLET WORKS

NOTE: A surge tank may or may not be be required for the River outlet works depending on further detailed studies
Material on this drawing traced from Denver office drawing 588-D-1.



PROFILE ON ℄ OF CUTOFF TRENCH



SECTION A-A

SCALE OF FEET

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WHITEWATER UNIT-COLORADO RIVER STORAGE PROJECT

WHITEWATER DAM AND DIKES

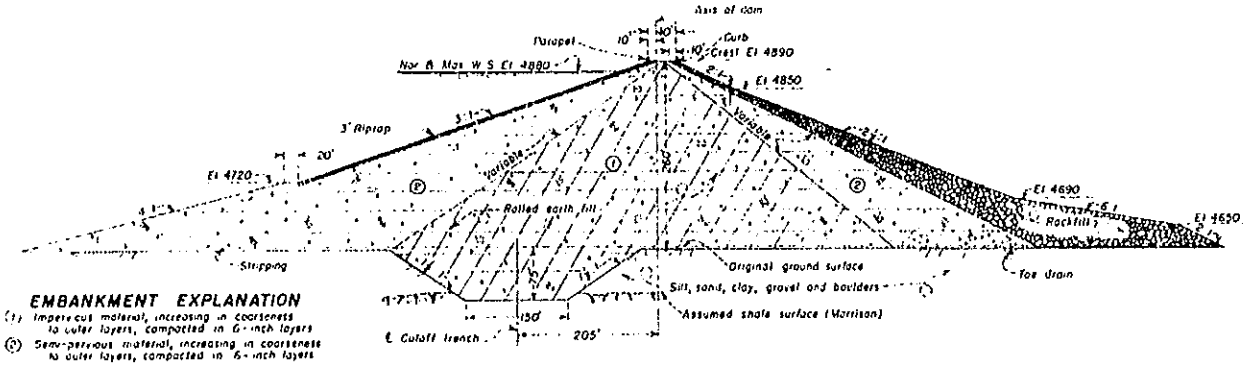
GENERAL PLAN AND SECTIONS
PRELIMINARY ESTIMATE DRAWING

DRAWN	H.W.C.	SUBMITTED	F.G.W.
TRACED	R.B.A.	RECOMMENDED	K.B. Keener
CHECKED	E.C.B. E.P.G.	APPROVED	D.L. Rice

SALT LAKE CITY, UTAH JULY 28, 1960 SHEET ONE OF TWO

588-414-5

45515 O - 54 (Face p.126) No.1



EMBANKMENT EXPLANATION

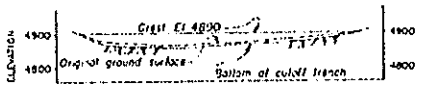
(1) Impervious material, increasing in coarseness to outer layers, compacted in 6-inch layers

(2) Semi-pervious material, increasing in coarseness to outer layers, compacted in 6-inch layers

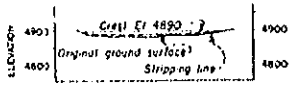
MAXIMUM SECTION OF DAM

100 0 100 200

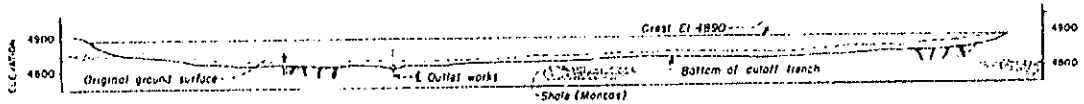
SCALE IN FEET



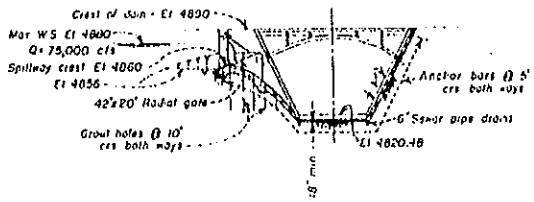
PROFILE ON ℄ OF CUTOFF TRENCH DIKE 2-C



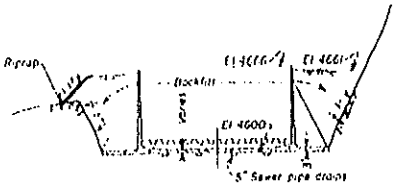
PROFILE ON AXIS OF DIKE 2-B



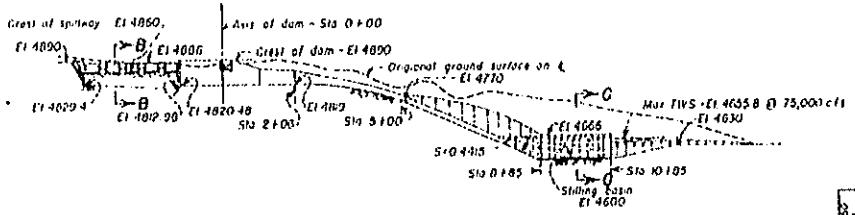
PROFILE ON ℄ OF CUTOFF TRENCH OF DIKE 2-A



SECTION B-B



SECTION C-C



PROFILE ALONG ℄ SPILLWAY

NOTE: Material on this drawing traced from Denver office drawing 508-D-1.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WHITEWATER UNIT · COLORADO RIVER STORAGE PROJECT

WHITEWATER DAM AND DIKES

GENERAL PLAN AND SECTIONS

PRELIMINARY ESTIMATE DRAWING

DRAWN...RMG..... SUBMITTED E.G.M. .....

TRACED...J.R.A..... RECOMMENDED. .....

CHECKED E.G.P...E.P.R..... APPROVED. .....

SALT LAKE CITY, UTAH JULY 29, 1954 SHEET 1 OF 1 SHEET

508-414-6

Estimated costs of Whitewater unit

Feature	Construction costs	Annual costs		
		Operation and maintenance costs	Replacement costs	Total
Dam and reservoir	$18,400,000	$11,000	$3,800	$14,800
Access facilities	100,000			
Rights-of-way and relocation	5,100,000			
Construction camp	400,000			
Powerplant	9,500,000	105,600	68,500	174,100
Transmission system	6,500,000	90,700	73,200	163,900
Total	40,000,000	207,300	145,500	352,800

SUMMARY

Design data

Information on the units included in the storage project is summarized in the following table.

Summarized data on units of Colorado River storage project

Unit	River	Height of dam above river (feet)	Active storage capacity (acre-feet)		Inactive storage capacity (acre-feet)		Power installation (kilowatts)
			Initial	After 200 years of sediment encroachment	Initial	After 200 years of sediment encroachment	
Cross Mountain	Yampa	205	4,200,000	4,030,000	1,000,000	887,000	90,000
Crystal	Gunnison	305	0	0	40,000	40,000	48,000
Curecanti	do	475	2,010,000	1,970,000	490,000	403,000	54,000
Echo Park	Green	525	5,460,000	5,160,000	1,000,000	753,000	200,000
Flaming Gorge	do	440	2,950,000	2,550,000	990,000	11,000	72,000
Glen Canyon	Colorado	580	20,000,000	10,455,000	6,000,000	0	800,000
Gray Canyon	Green	445	1,390,000	698,000	610,000	0	210,000
Navajo	San Juan	335	1,050,000	734,000	150,000	33,000	30,000
Split Mountain	Green	245	0	0	335,000	335,000	100,000
Whitewater	Gunnison	255	470,000	326,000	410,000	92,000	48,000
Total			37,530,000	25,911,000	11,025,000	2,614,000	1,022,000

Cost estimates

Total construction costs and total annual costs, including operation, maintenance, and replacement costs, of the various project units are summarized in the following table. Estimated construction costs of the individual project features and detailed engineering data on the features are given on the following pages. The estimates given are based on December 1949 prices.

Total project costs

Unit	Construction costs	Annual costs	Unit	Construction costs	Annual costs
Cross Mountain	$51,000,000	$414,700	Gray Canyon	$178,400,000	$1,230,300
Crystal	37,900,000	325,500	Navajo	63,000,000	251,000
Curecanti	80,400,000	378,100	Split Mountain	76,400,000	659,000
Echo Park	105,400,000	1,109,200	Whitewater	40,000,000	352,800
Flaming Gorge	82,700,000	483,000			
Glen Canyon	303,900,000	4,428,000	Total	[1] 1,139,100,000	9,732,100

[1] Does not include nonreimbursable money expended from Colorado River development fund for investigations and surveys nor costs of features in the programs recommended by cooperating agencies.

Official estimate of total project cost, Colorado River storage project, region 4

[Date of estimate, Aug. 14, 1950, prices as of December 1949]

CROSS MOUNTAIN UNIT

Class and account reference	Property and description	Previous official estimate	Detail of current estimate of project cost						Current official estimate
			Land and land rights	Labor and materials: By contractor	Labor and materials: By Government	Materials and equipment permanently installed	Construction facilities	General expenses	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	Reservoirs and dams		$1,000,000	$20,384,000		$4,436,000	$100,000	$1,984,000	$30,304,000
01.01	Cross Mountain Dam and Reservoir								
	Location: On Yampa River, 58½ miles above mouth.								
	Reservoir storage, acre-feet	5,200,000							
	Normal and maximum water storage elevation, feet	6,090							
	Type of dam: Concrete, gravity.								
	Volume of dam, cubic yards	431,000							
	Crest elevation, feet	6,095							
	Crest width, do	40							
	Crest length, do	550							
	Height of dam above stream, do	295							
	Height of dam above foundation, do	355							
	Present river elevation, do	5,800							
	Spillway capacity, square feet	45,000							
	Outlet capacity, do	5,000							
	Diversion capacity, do	10,000							
	Excavation, rock, for dam, cubic yards	80,000							
	Excavation, common, for dam, do	97,000							
11	Power plants—hydro								
11.01	Cross Mountain powerplant			4,344,000		5,259,000	50,000	1,834,000	11,487,000
	Installed capacity, kilowatts	60,000							
	Number of units	2							
	Tailwater elevation, feet	5,650							
	Mean operational head, do	400							
	Maximum static head, do	440							
	Tunnel:								
	Length, do	11,700							
	Diameter, do	17.5							

13	Transmission system: Transmissions lines, switchyards, substations, etc.			$81,000	1,944,000		4,734,000	25,000	1,296,000	8,100,000
15	General property: Town, utilities, and general service facilities				167,000		225,000	25,000	83,000	500,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc.							(200,000)		(200,000)
	Total, all classes									50,991,000 [1] 51,000,000

CRYSTAL UNIT

01	Reservoirs and dams				$16,426,000		$4,748,000	$100,000	$4,255,000	$25,529,000
01.01	Crystal Dam and reservoir									
	Location: 14 miles east of Montrose on Gunnison River.									
	Reservoir storage	acre-feet	40,000							
	Normal and maximum water storage elevation	feet	6,870							
	Type of dam: Concrete, gravity									
	Volume of dam	cubic yards	494,000							
	Crest elevation	feet	6,875							
	Crest width	do	40							
	Crest length	do	620							
	Height of dam above stream	do	305							
	Height of dam above foundation	do	355							
	Present river elevation	do	6,570							
	Spillway capacity	square feet	48,000							
	Outlet capacity	do	2,000							
	Diversion capacity	do	22,500							
	Excavation, rock, for dam	cubic yards	107,400							
	Excavation, common, for dam	do	19,700							
11	Powerplants—hydro									
11.01	Crystal powerplant				2,093,000		2,533,000	25,000	884,000	5,535,000
	Installed capacity	kilowatts	48,000							
	Number of units		3							
	Tailwater elevation	feet	6,570							
	Mean operational head	do	300							
	Maximum static head	do	300							
13	Transmission system: Transmission lines, switchyards, substations, etc			$65,000	1,555,000		3,798,000	25,000	1,037,000	6,480,000
15	General property: Town, utilities, and general service facilities				120,000		155,000	25,000	60,000	360,000
20	Construction facilities: Temporary service structures, operating tools, and equipment, operating plants, etc							(175,000)		(175,000)
	Total, all classes									37,904,000 [1] 37,900,000

[1] Rounded.

Official estimate of total project cost, Colorado River storage project, region 4—Continued

CURECANTI UNIT

Class and account reference	Property and description	Previous official estimate	Detail of current estimate of project cost						Current official estimate
			Land and land rights	Labor and materials		Materials and equipment permanently installed	Construction facilities	General expenses	
				By contractor	By Government				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	Reservoirs and dams		$680,000	$43,987,000		$11,746,000	$200,000	$10,068,000	$66,681,000
01.01	Blue Mesa Dam and Curecanti Reservoir								
	Location: 3½ miles west of Sapinero-Gunnison River								
	Reservoir storage ..... acre-feet	2,500,000							
	Normal and maximum water storage elevation ..... feet	7,535							
	Type of dam: Concrete, gravity								
	Volume of dam ..... cubic yards	1,745,000							
	Crest elevation ..... feet	7,540							
	Crest width ..... do	40							
	Crest length ..... do	1,240							
	Height of dam above stream ..... do	475							
	Height of dam above foundation ..... do	510							
	Present river elevation ..... do	7,165							
	Spillway capacity ..... square feet	48,000							
	Outlet capacity ..... do	2,000							
	Diversion capacity ..... do	22,500							
	Excavation, rock, for dam ..... cubic yards	221,700							
	Excavation, common, for dam ..... do	19,000							
11	Powerplants—hydro			2,105,000		2,548,000	25,000	842,000	5,520,000
11.01	Blue Mesa powerplant								
	Installed capacity ..... kilowatts	54,000							
	Number of units	3							
	Tailwater elevation ..... feet	7,165							
	Mean operational head ..... do	425							
	Maximum static head ..... do	470							
13	Transmission system: Transmission lines, switchyards, substations, etc.		73,000	1,750,000		4,276,000	25,000	1,166,000	7,290,000
15	General property: Town, utilities, and general service facilities			305,000		408,000	50,000	137,000	900,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc.						(300,000)		(300,000)
	Total, all classes								$80,391,000 $80,400,000

ECHO PARK UNIT

01	Reservoirs and dams			$175,000	$78,503,000		$21,668,000	$400,000	$16,091,000	$116,837,000
01.01	Echo Park Dam and Reservoir (includes access road)									
	Location: On Green River, 28 miles east of Vernal									
	Reservoir storage	acre-feet	6,460,000							
	Normal and maximum water storage elevation	feet	5,570							
	Type of dam: Concrete, curved, gravity									
	Volume of dam	cubic yards	2,680,000							
	Crest elevation	feet	5,575							
	Crest width	do	30							
	Crest length	do	920							
	Height of dam above stream	do	525							
	Height of dam above foundation	do	690							
	Present river elevation	do	5,050							
	Spillway capacity	square feet	81,560							
	Outlet capacity	do	20,000							
	Diversion capacity	do	27,500							
	Excavation, rock, for dam	cubic yards	50,000							
	Excavation, common, for dam	do	1,110,000							
11	Powerplants—hydro				7,669,000		9,274,000	100,000	2,726,000	19,769,000
11.01	Echo Park powerplant									
	Installed capacity	kilowatts	200,000							
	Number of units		4							
	Tailwater elevation	feet	5,050							
	Mean operation head	do	475							
	Maximum static head	do	520							
13	Transmission system: Transmissions lines, switchyards, substations, etc			270,000	6,480,000		15,830,000	100,000	4,320,000	27,000,000
15	General property: Town, utilities, and general service facilities				604,000		805,000	100,000	241,000	1,750,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc							(700,000)		(700,000)
	Total, all classes									{165,356,000 [1]165,400,000

[1] Rounded.

Official estimate of total project cost, Colorado River storage project, region 4—Continued

FLAMING GORGE UNIT

Class and account reference	Property and description	Previous official estimate	Detail of current estimate of project cost						Current official estimate
			Land and land rights	Labor and materials		Materials and equipment permanently installed	Construction facilities	General expenses	
				By contractor	By Government				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	Reservoirs and dams								
01.01	Ashley Dam and Flaming Gorge Reservoir		$200,000	$42,628,000		$11,525,000	$200,000	$9,784,000	$64,337,000
	Location: On Green River, 32 miles north of Vernal (airline miles).								
	Reservoir storage ..... acre-feet	3,940,000							
	Normal and maximum W. S. elevation ..... feet	6,040							
	Type of dam: Concrete, gravity								
	Volume of dam ..... cubic yards	1,725,000							
	Crest elevation ..... feet	6,045							
	Crest width ..... do	40							
	Crest length ..... do	900							
	Height of dam above stream ..... do	440							
	Height of dam above foundation ..... do	491							
	Present river elevation ..... do	5,605							
	Spillway capacity ..... square feet	85,000							
	Outlet capacity ..... do	5,000							
	Diversion capacity ..... do	20,000							
	Excavation, rock, for dam ..... cubic yards	291,000							
	Excavation, common, for dam ..... do	77,100							
11	Powerplants—hydro								
11.01	Ashley powerplant			2,940,000		3,569,000	25,000	1,176,000	7,710,000
	Installed capacity ..... kilowatts	72,000							
	Number of units	3							
	Tailwater elevation ..... feet	5,605							
	Mean operational head ..... do	395							
	Maximum static head ..... do	435							
13	Transmission system: Transmission lines, switchyards, substations, etc.		97,000	2,333,000		5,710,000	25,000	1,555,000	9,720,000
15	General property: Town, utilities, and general service facilities			305,000		458,000		137,000	900,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc.						(255,000)		(255,000)
	Total, all classes								{ 82,667,000 / 82,700,000

GLEN CANYON UNIT

01	Reservoirs and dams								
01.01	Glen Canyon Dam and Reservoir		$401,000	$120,552,000		$30,120,000	$600,000	$24,204,000	$175,877,000
	Location: On Colorado River, 15 miles upstream from Lees Ferry								
	Reservoir storage—acre-feet	26,000,000							
	Normal water storage elevation—feet	3,700							
	Maximum water storage elevation—do	3,710							
	Type of dam: Concrete, curved, gravity.								
	Volume of dam—cubic yards	5,060,000							
	Crest elevation—feet	3,715							
	Crest width—do	45							
	Crest length—do	1,400							
	Present river elevation—do	3,135							
	Height of dam above stream—do	580							
	Height of dam above foundation—do	700							
	Spillway capacity—square feet	253,000							
	Outlet capacity—do	20,000							
	Diversion capacity—do	120,000							
	Excavation rock, for dam—cubic yards	1,900,000							
	Excavation, common, for dam—do	612,000							
11	Powerplants—hydroelectric								
11.01	Glen Canyon powerplant			31,366,000		33,680,000	300,000	10,455,000	75,801,000
	Installed capacity—kilowatts	900,000							
	Number of units	7							
	Tailwater elevation—feet	3,140							
	Mean operational head—do	480							
	Maximum static head—do	560							
13	Transmission system: Transmission lines, switchyards, substations, etc.		1,080,000	25,920,000		63,420,000	300,000	17,280,000	108,000,000
15	General property: Town, utilities, and general service facilities			1,466,000		1,998,000	200,000	586,000	4,250,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc.						(1,400,000)		(1,400,000)
	Total, all classes								{363,928,000 [1]363,900,000

[1] Rounded.

Official estimate of total project cost, Colorado River storage project, region 4—Continued

GRAY CANYON UNIT

Class and account reference	Property and description	Previous official estimate	Detail of current estimate of project cost						Current official estimate
			Land and land rights	Labor and materials		Materials and equipment permanently installed	Construction facilities	General expenses	
				By contractor	By Government				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	Reservoirs and dams								
01.01	Gray Canyon Dam and Reservoir		$50,000	$84,228,000		$25,667,000	$500,000	$17,663,000	$128,108,000
	Location: On Green River, 22 miles upstream from Green River U.								
	Reservoir storage, acre-feet	2,000,000							
	Normal and maximum water storage elevation, feet	4,590							
	Type of dam: Concrete gravity								
	Volume of dam, cubic yards	3,595,000							
	Crest elevation, feet	4,595							
	Crest width, do	40							
	Crest length, do	2,100							
	Height of dam above stream, do	445							
	Height of dam above foundation, do	575							
	Present river elevation, do	4,150							
	Spillway capacity, square feet	190,000							
	Outlet capacity, do	10,000							
	Diversion capacity, do	100,000							
	Excavation, rock, for dam, cubic yards	682,000							
	Excavation, common, for dam, do	654,000							
11	Powerplants—Hydro								
11.01	Gray Canyon powerplant			7,743,000		9,363,000	100,000	2,753,000	19,959,000
	Installed capacity, kilowatts	210,000							
	Number of units	4							
	Tailwater elevation, feet	4,150							
	Mean operational head, do	400							
	Maximum static head, do	440							
13	Transmission system: Transmission lines, switchyards, substations, etc.		284,000	6,804,000		16,626,000	100,000	4,536,000	28,350,000
15	General property: Town, utilities, and general service facilities			690,000		934,000	106,000	270,000	2,000,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc.						($800,000)		($806,000)
	Total, all classes								{178,417,000 (178,400,000

NAVAHO UNIT

01	Reservoirs and dams								
01.01	Navaho Dam and Reservoir		$500,000	$33,930,000		$9,852,000	$200,000	$7,917,000	$52,399,000
	Location: 19½ miles east of Blanco, N. Mex., San Juan River.								
	Reservoir storage acre-feet	1,200,000							
	Normal and maximum water storage elevation feet	6,050							
	Type of dam: Earth fill								
	Volume of dam cubic yards	17,000,000							
	Crest elevation feet	6,060							
	Crest width do	40							
	Crest length do	3,280							
	Height of dam above stream do	335							
	Height of dam above foundation do	360							
	Present river elevation do	5,725							
	Spillway capacity square feet	175,000							
	Outlet capacity do	3,000							
	Diversion capacity do	20,000							
	Excavation, rock, for dam cubic yards	1,150							
	Excavation, common, for dam do	(600,000)							
11	Powerplant—hydro								
11.01	Navaho powerplant			2,201,000		2,665,000	25,000	979,000	5,870,000
	Installed capacity kilowatts	30,000							
	Number of units	3							
	Tailwater elevation feet	5,725							
	Mean operational head do	275							
	Maximum static head do	325							
13	Transmission system: Transmission lines, switchyards, substations, etc.		40,000	972,000		2,380,000	10,000	648,000	4,050,000
15	General property: Town, utilities, and general service facilities			237,000		316,000	40,000	107,000	700,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc.						(275,000)		(275,000)
	Total, all classes								63,019,000 [1] 63,000,000

[1] Rounded.

Official estimate of total project cost, Colorado River storage project, region 4—Continued

SPLIT MOUNTAIN UNIT

Class and account reference	Property and description	Previous official estimate	Detail of current estimate of project cost						Current official estimate
			Land and land rights	Labor and materials: By contractor	Labor and materials: By Government	Materials and equipment permanently installed	Construction facilities	General expenses	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	Reservoirs and dams								
01.01	Split Mountain Dam and Reservoir		$50,000	$22,276,000		$6,437,000	$150,000	$5,484,000	$34,397,000
	Location: On Green River, 14 miles east of Vernal								
	Reservoir storage—acre-feet	335,000							
	Normal and maximum water storage elevation—feet	5,050							
	Type of dam: Concrete gravity								
	Volume of dam—cubic yards	806,200							
	Crest elevation—feet	5,055							
	Crest width—do	40							
	Crest length—do	990							
	Height of dam above stream—do	245							
	Height of dam above foundation—do	305							
	Present river elevation—do	4,810							
	Spillway capacity—square feet	112,000							
	Outlet capacity—do	8,000							
	Diversion capacity—do	35,000							
	Excavation, rock, for dam—cubic yards	267,000							
	Excavation, common, for dam—do	185,000							
11	Powerplants—hydro								
11.01	Split Mountain powerplant			10,659,000		12,877,000	150,000	4,026,000	27,712,000
	Installed capacity—kilowatts	100,000							
	Number of units	2							
	Tailwater elevation—feet	4,735							
	Mean operational head—do	300							
	Maximum static head—do	304							
	Tunnel:								
	Length—do	11,700							
	Diameter—do	26							
13	Transmission system: Transmission lines, switchyards, substations, etc.		135,000	3,240,000		7,915,000	50,000	2,160,000	13,500,000
15	General property: Town, utilities, and general service facilities			252,000		328,000	50,000	120,000	750,000
20	Construction facilities: Temporary service structures, operating tools, and equipment, operating plants, etc.						(400,000)		(400,000)
	Total, all classes								76,359,000 76,400,000

WHITEWATER UNIT

01	Reservoir and dams								
01.01	Bridgeport Dam and Whitewater Reservoir (including 3 dikes)		$590,000	$15,608,000		$3,582,000	$100,000	$3,838,000	$23,628,000
	Location: 9½ miles southeast of Grand Junction on Gunnison River.								
	Reservoir storage—acre-feet	880,000							
	Normal and maximum water storage elevation—feet	4,880							
	Type of dam: Earth fill.								
	Volume of dam—cubic yards	6,656,000							
	Crest elevation—feet	4,890							
	Crest width—do	40							
	Crest length—do	1,830							
	Height of dam above stream—do	255							
	Height of dam above foundation—do	335							
	Present river elevation—do	4,635							
	Spillway capacity—square feet	75,000							
	Outlet capacity—do	1,500							
	Diversion capacity—do	22,700							
	Excavation, rock, for dam—cubic yards	33,000							
	Excavation, common, for dam—do	753,000							
11	Powerplants—hydro.								
11.01	Bridgeport powerplant			3,618,000		4,372,000	50,000	1,528,000	9,568,000
	Installed capacity—kilowatts	48,000							
	Number of units	3							
	Tailwater elevation—feet	4,640							
	Mean operational head—do	220							
	Maximum static head—do	240							
13	Transmission system: Transmission lines, switchyards, substations, etc		65,000	1,555,000		3,803,000	20,000	1,037,000	6,480,000
15	General property: Town, utilities, and general service facilities			133,000		180,000	20,000	67,000	400,000
20	Construction facilities: Temporary service structures, operating tools and equipment, operating plants, etc						(190,000)		(190,000)
	Total								{40,076,000 [1] 40,000,000

[1] Rounded.

CONSTRUCTION SCHEDULE

The project units are scheduled for construction over an extended period. Each unit would be brought into operation as required to meet the needs for water-consuming uses and electric energy. In scheduling construction to make certain that project units would be in operation when needed, consideration was given to cyclic shifts in runoff conditions and to the advantages that would be gained by initially filling the reservoirs while unused apportioned water is available. The Whitewater, Echo Park, Glen Canyon, Navaho, and Flaming Gorge units are scheduled for initial construction.

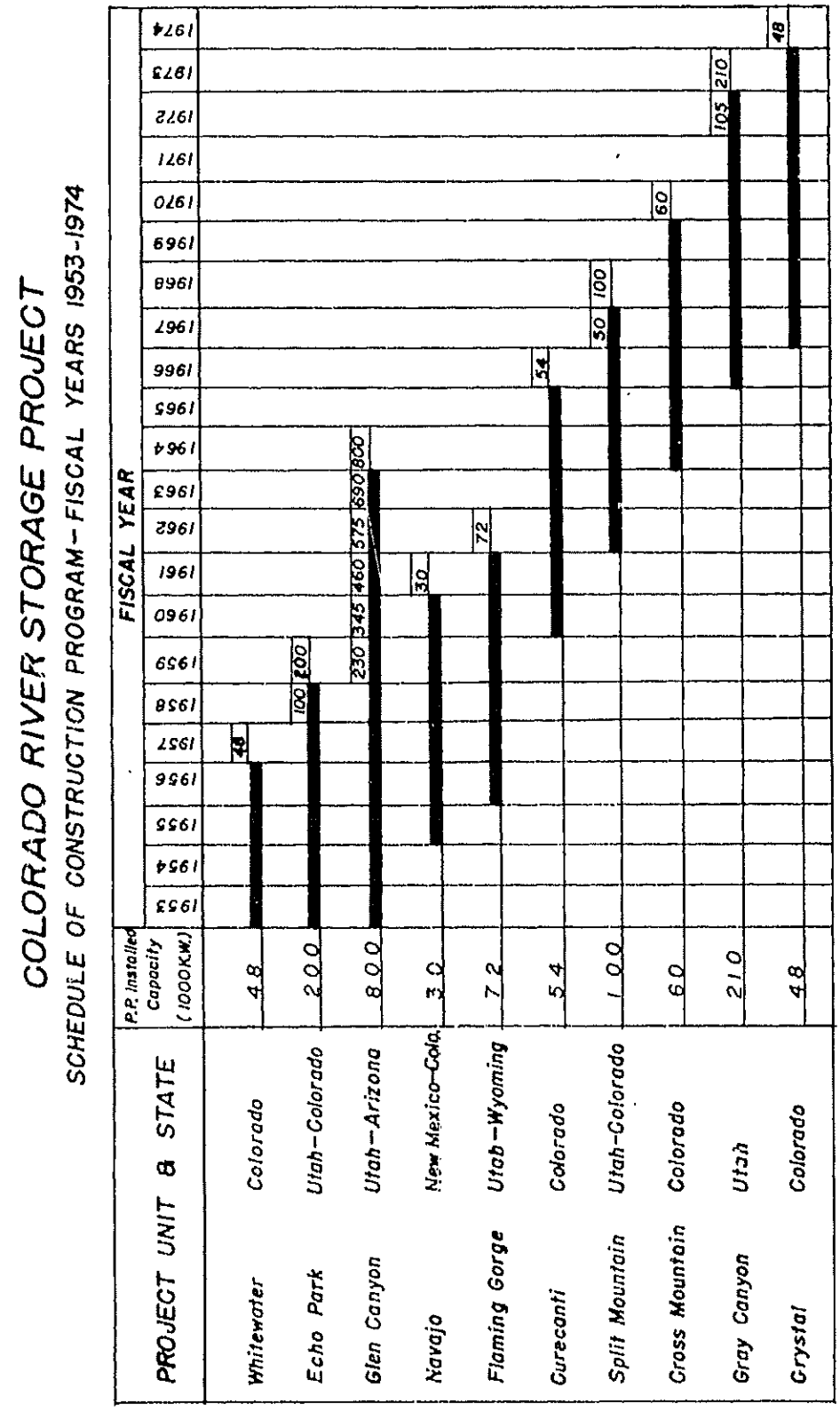
Details of the construction schedule are shown by the bar diagram following. The diagram also shows the years in which the generating units of the project powerplants are expected to be in operation.

ALTERNATIVE FEATURES

Investigations to date indicate that the system of reservoirs included in the project plan would economically obtain the greatest possible water yield and power output with minimum loss of water from evaporation. Several alternative sites for power and storage development, including the Dewey on the Colorado River, the Desolation on the Green River, and the Chinle (Bluff) on the San Juan River, have been studied and excluded from the project plan because of certain physical disadvantages. Additional attention, however, should be given other storage and power developments in the near future to assure the maximum utilization of the basin's resources.

The Desolation Dam site is located on the Green River about 50 miles upstream from the town of Green River, Utah, and within the basin of the potential Gray Canyon Reservoir. A dam rising 385 feet above the present stream bed at elevation 4,400 feet would impound a reservoir with a total storage capacity of more than 8 million acre-feet. The reservoir would have a maximum water surface area of 135,000 acres and a mean area of nearly 100,000 acres. Development of the reservoir would limit the Gray Canyon Dam to a height of 250 feet above stream bed and would limit the Gray Canyon Reservoir to a capacity of less than 500,000 acre-feet. The combination of Desolation Reservoir and a reduced Gray Canyon Reservoir, as compared to the Gray Canyon development included in the project plan, would increase active storage by about 5 million acre-feet and would increase average firm energy generation by nearly 380 million kilowatt-hours annually. The combination, however, would also result in average annual net evaporation losses of about 330,000 acre-feet annually, about 4 times the losses that would be realized at the Echo Park site for a comparable amount of active storage.

The Dewey Dam site is located on the Colorado River about 3 miles downstream from the river's confluence with the Dolores River. Here a dam 335 feet high would create a reservoir with a total storage capacity of more than 8 million acre-feet. The reservoir would have a maximum water-surface elevation of 4,410 feet and a maximum water-surface area of about 75,000 acres. A 175,000-kilowatt powerplant at the site could generate nearly a billion kilowatt-hours of firm energy annually under initial flow conditions and nearly three-fourths of a billion kilowatt-hours annually under ultimate flow conditions. Over a 200-year period the reservoir would receive nearly


COLORADO RIVER STORAGE PROJECT
SCHEDULE OF CONSTRUCTION PROGRAM - FISCAL YEARS 1953-1974
PROJECT UNIT & STATE
P.P. Installed Capacity (1000 KW.)
FISCAL YEAR
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
Whitewater Colorado 48
Echo Park Utah-Colorado 200
Glen Canyon Utah-Arizona 800
Navajo New Mexico-Colo. 30
Flaming Gorge Utah-Wyoming 72
Cureconti Colorado 54
Split Mountain Utah-Colorado 100
Cross Mountain Colorado 60
Gray Canyon Utah 210
Crystal Colorado 48
48
100
100
230
345
460
575
690
800
30
72
54
50
100
60
105
210
48
48 Operating Power Plant Capacity (1000 K.W.)

2.5 million acre-feet of sediment. Evaporation losses from the reservoir would average about 253,000 acre-feet annually. While the losses would be less than those from Desolation Reservoir, they would still be more than three times as great as those expected from Echo Park Reservoir for a comparable amount of active storage.

The Chinle (Bluff) Dam site is on the San Juan River 15 miles downstream from the town of Bluff, Utah. A dam rising 360 feet above the present stream bed at elevation 4,196 feet would impound a reservoir with a total capacity of almost 7 million acre-feet. When filled to capacity, the reservoir would extend 50 miles upstream and would cover an area of 70,000 acres. An 80,000-kilowatt plant at the site could produce nearly 500 million kilowatt-hours of energy with initial flow conditions and about 250 million kilowatt-hours with ultimate flow conditions. The next average evaporation loss from the reservoir would amount to about 170,000 acre-feet each year. The reservoir would be so located that it could control a third of all the sediment now passing Lees Ferry. The reservoir capacity would be reduced by encroaching sediment at a rate of more than 3 million acre-feet in each 100-year period. Sediment storage in a reservoir at the Chinle site would result in a corresponding reduction in the quantities of sediment deposited in the potential Glen Canyon Reservoir. Therefore, it may prove desirable to construct a temporary power and sediment storage development at the Chinle site at an early date if a practicable means can be found to minimize water losses from flood plains that would be formed by the silt beds.

Other storage and power sites are located on the Colorado River and its tributaries in the upper basin. Among these are the Blue Mountain site on the Yampa River just downstream from the confluence of the Little Snake River and the Yampa River, and the Goosenecks and Slick Horn sites on the San Juan River in the reach between the Chinle Dam site and the upstream bank of the potential Glen Canyon Reservoir. Developments at the sites mentioned could provide only limited amounts of storage and their chief function would be to produce electric energy by utilizing flows regulated upstream. Power production at the sites may be desirable at a later date since the initial energy generation at the units now included in the project plan would be materially reduced as future reclamation projects are completed.

As now planned protection is provided against sediment encroachment for about 200 years. When more complete data are assembled on sediment-contributing areas, development of reservoirs specifically for sediment control may be found desirable. Such reservoirs and improved land management and practices for reduction of erosion would increase the usefulness of the storage project by extending its life or by making available storage capacity for other purposes.

Chapter IV. Water Resources

Heaviest precipitation in the upper Colorado River drainage basin falls as winter snow in the high mountain ranges. With the rising temperatures of late spring and early summer, the snow melts rapidly, pouring torrential flows into principal runoff channels. Runoff during April, May, June, and early July comprises more than two-thirds of the annual flow at Lee Ferry. Normally the high flow subsides by late July to near the base or minimum flow, made up of spring-fed headwater contributions, return flow from irrigation, and escaping channel storage. Large land areas below the mountains contribute little to the river flow. Their limited accretions occur only during early spring snow melt or during summer rain floods of short duration.

The period of high streamflow does not coincide with the period of greatest irrigation demand. The flows of April, May, and June are practically unused, but flows during other months of the irrigation season are insufficient for present irrigation requirements.

Differences between high and low lying areas in the upper drainage basin with respect to precipitation, temperature, and evaporation are illustrated by the following chart.

WATER SUPPLY

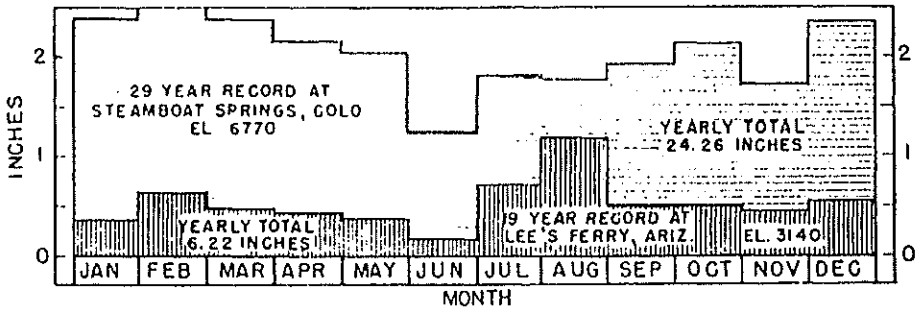
Water supply studies

Detailed water supply studies for the Colorado River storage project were made for the period 1914–47. This period of study includes the period 1914–45 used by the engineering advisory committee in its November 29, 1948, report to the Upper Colorado River Commission and was selected for two principal reasons: (1) Records of streamflow at a number of main stem and tributary stations are sufficient for that period to justify the necessary extension of many other shorter records, and (2) the period includes years of above normal flow prior to 1931 and years of drought subsequent to 1931, giving proper balance to the study.

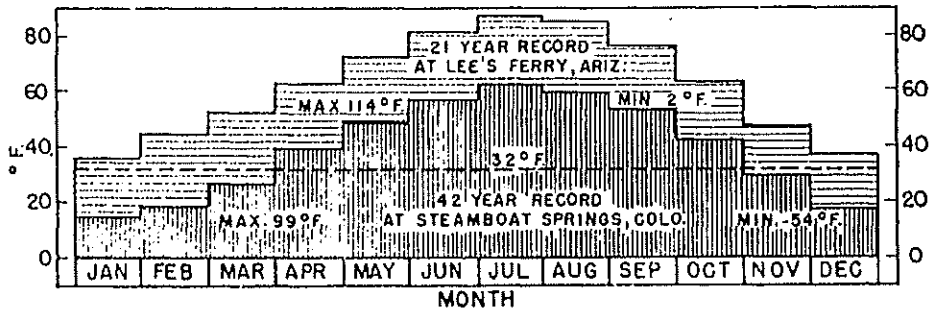
Although inaccuracies are risked with the extension of records prior to 1914, the Bureau of Reclamation made extensions to include the 1896–1947 period at Lee Ferry and the 1906–47 period at other key points on the Colorado River system. The earlier data show a rapid recovery of streamflows following the drought period ending in 1905. That drought, however, was much less severe than the drought of the 1930's.

The periods for which the records were available at key points on the river and its tributaries are shown by the following chart. Since no records were available at Lee Ferry, the dividing point between the upper and lower basins, the flow at that point was computed by adding the flow of the Paria River to the flow of the Colorado River at Lees Ferry. Lee Ferry is 1 mile below the mouth of the Paria River and about 2 miles below Lees Ferry.

45515—54——10



PRECIPITATION



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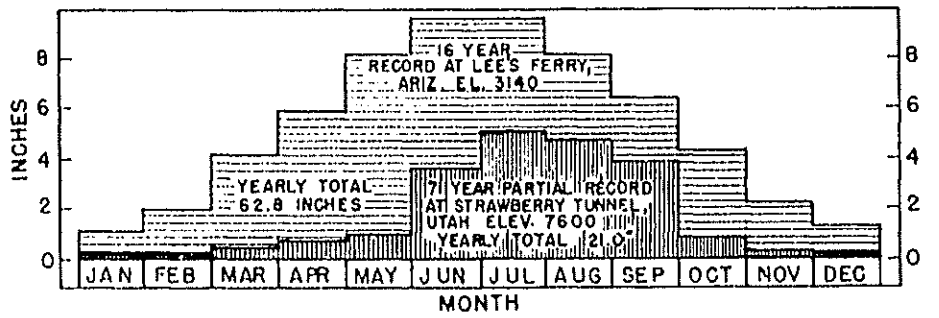


EQUIVALENT RESERVOIR EVAPORATION

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

PRECIPITATION, TEMPERATURE AND EVAPORATION

REV. CBJ JUNE 1949

DRAWN . . . H. R. S. . SUBMITTED E. B. Jackson
TRACED . . . H. R. S. . . RECOMMENDED Fred Jerman
CHECKED . . W. B. H. . . APPROVED Clinton D. Woods

SALT LAKE AREA OFFICE JAN. 1949

594-414-3

The Upper Colorado River Basin compact provides in article VI that the quantity of consumptive use of water for the upper basin and for each State of the upper basin shall be determined by the inflow-outflow method in terms of man-made depletions at Lee Ferry. This infers a partial salvage of natural losses.

Investigations by the Bureau of Reclamation have not been sufficiently detailed to justify an appraisal of channel losses below all points of diversion in the upper drainage basin. Long sections of some of the larger stream beds would be inundated by project reservoirs, however, and the resulting effect on channel losses in these sections has been estimated. The reduction of losses in the remaining sections of the stream channels, attributable to upstream depletions, is believed too small to have a marked effect on the water supply analysis. Stream depletions from upper basin development, therefore, have been estimated only at sites of use, and aggregate depletions so determined are considered representative of the depletion at Lee Ferry. Possible salvage of channel losses will be considered in future detailed studies.

Historical flow

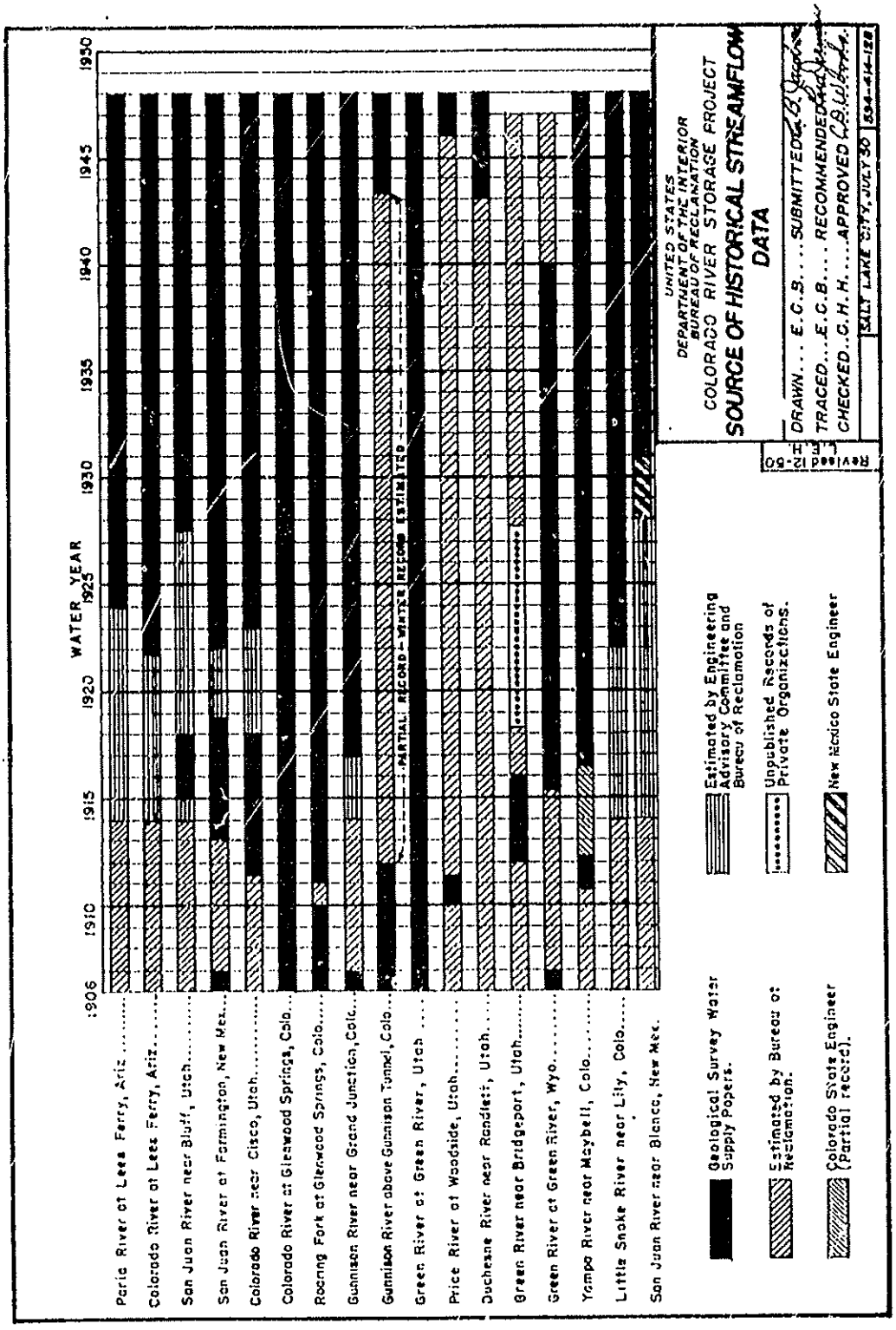
Historical flows are flows actually experienced. They reflect the total runoff of a drainage area above a gage as influenced by nature and the activities of man. Average annual historical flows at key points in the upper Colorado River system are given in the following table for the period 1914–47 and for the dry decade 1931–40.

Historical stream flows

Stream and location	Average annual flow (1,000 acre-feet)	
	1931–40 period	1914–47 period
Green River at Ashley Dam site	1,172	1,650
Yampa River at Cross Mountain Dam site	963	1,174
Green River at Echo Park Dam site	2,530	3,208
Green River at Split Mountain Dam site	2,530	3,208
Green River at Gray Canyon Dam site	3,320	4,550
Gunnison River at Blue Mesa Dam site	873	1,131
Gunnison River at Crystal Dam site	1,012	1,310
Gunnison River at Whitewater Dam site	1,467	2,020
San Juan River at Navaho Dam site	999	1,235
Colorado River at Glen Canyon Dam site	10,120	13,007
Colorado River at Lees Ferry	10,151	13,033

Past manmade depletions

The average annual manmade depletion at Lee Ferry for the 1914–45 period was estimated by the engineering advisory committee to be 1,849,800 acre-feet. This includes depletions from all causes, such as irrigation and uses incident to irrigation, water exports to areas outside of the drainage basins, domestic and industrial uses, and evaporation from storage reservoirs. The estimate allows credits for water importations and channel salvage. A summary of the committee's estimate is shown in the following table.


WATER YEAR
1906
1910
1915
1920
1925
1930
1935
1940
1945
1950
Paria River at Lees Ferry, Ariz.
Colorado River at Lees Ferry, Ariz.
San Juan River near Bluff, Utah.
San Juan River at Farmington, New Mex.
Colorado River near Cisco, Utah.
Colorado River at Glenwood Springs, Colo.
Roaring Fork at Glenwood Springs, Colo.
Gunnison River near Grand Junction, Colo.
Gunnison River above Gunnison Tunnel, Colo.
PARTIAL RECORD - WATER RECORD ESTIMATED
Green River at Green River, Utah
Price River at Woodside, Utah.
Duchesne River near Randlett, Utah.
Green River near Bridgeport, Utah.
Green River at Green River, Wyo.
Yampa River near Maybell, Colo.
Little Snake River near Lily, Colo.
San Juan River near Blanco, New Mex.
Geological Survey Water Supply Papers.
Estimated by Bureau of Reclamation.
Colorado State Engineer (Partial record).
Estimated by Engineering Advisory Committee and Bureau of Reclamation
Unpublished Records of Private Organizations.
New Mexico State Engineer
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
SOURCE OF HISTORICAL STREAMFLOW DATA
DRAWN... E.C.B.... SUBMITTED
TRACED... E.C.B.... RECOMMENDED
CHECKED... C.H.H.... APPROVED
SALT LAKE CITY, JULY 30
REVISED
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Net manmade depletions in upper basin

Nature of depletions and credits	Average annual depletion or credit 1914–45 (acre-feet)
Manmade depletions at sites of use:	
Irrigation of cropped lands	1,449,000
Water consumed on incidental areas	315,400
Transmountain diversions	122,700
Reservoir evaporation	25,900
Domestic and industrial use	14,100
Total	1,927,100
Credits from importation and channel salvage:	
Imported water	4,000
Channel salvage	73,300
Total	77,300
Net depletion at Lee Ferry	1,849,800

Similar estimates were made by the engineering advisory committee of net depletions at State boundary lines and at other key locations in the upper drainage basin. Since the estimates were based on annual averages for a 32-year period, they are not applicable to any particular year. Depletions above Lee Ferry are increasing gradually as water uses expand in the upper basin although annual variations result from fluctuations in runoff. Using basic data of the committee, the Bureau of Reclamation derived a sequence of past annual depletions at Lee Ferry for the period 1896–1947 and at potential project storag.. sites for the period 1906–47.

Virgin flow

As defined by the Upper Colorado River Basin compact, the term "virgin flow" means "the flow of any stream undepleted by the activities of man." The estimated virgin flow at Lee Ferry for the 1896–1947 period was determined by adding the estimated consumptive use in the upper basin in terms of manmade depletions at Lee Ferry to the computed historical flow at Lee Ferry. This flow and the factors considered in its computation are shown in the following table.

Computation of virgin flow at Lee Ferry

[Unit: 1,000 acre-feet]

Water year	Historical flow at Lee Ferry (includes Paria River) [1]	Irrigated areas upper drainage basin (1,000 acres)	Correction factor for variation of annual water supply [2]	Depletion rate [3] (acre-feet per acre)	Irrigation depletions upper drainage basin	Transbasin export depletions	Total depletions (column 5 plus column 6) [4]	Virgin flow Colorado River at Lee Ferry	
								Annual flow (column 1 plus column 7)	Percent of 1914–45 mean virgin flow
	1	2	3	4	5	6	7	8	9
1895									
1896	9,760	316	0.82	1.08	329		329	10,089	64
1897	17,600	370	1.08	1.38	509		509	18,009	110
1898	13,300	426	.91	1.21	515		515	13,815	88
1899	15,250	480	1.01	1.30	624		624	15,874	102
1900	12,600	530	.92	1.10	628		625	13,228	85
1901	12,900	582	.93	1.20	682		682	13,582	87
1902	8,740	635	.80	1.03	653		653	9,393	60
1903	13,950	685	.97	1.25	855	2	857	14,807	95

See footnotes at end of table, p. 146.

Computation of virgin flow at Lee Ferry—Continued

Water year	Historical flow at Lee Ferry (includes Paria River) [1]	Irrigated areas upper drainage basin (1,000 acres)	Correction factor for variation of annual water supply [2]	Depletion rate [3] (acre-feet per acre)	Irrigation depletions upper drainage basin	Transbasin export depletions	Total depletions (column 5 plus column 6) [4]	Virgin flow Colorado River at Lee Ferry	
								Annual flow (column 1 plus column 7)	Percent of 1914-45 mean virgin flow
	1	2	3	4	5	6	7	8	9
1901	14,700	732	1.00	1.29	942	3	945	15,645	160
1905	15,000	780	1.01	1.31	1,020	7	1,027	16,027	102
1906	17,961	800	1.11	1.43	1,144	13	1,157	19,121	121
1907	22,003	869	1.25	1.61	1,385	14	1,399	23,402	150
1908	11,763	920	.91	1.17	1,076	17	1,093	12,856	82
1909	21,706	970	1.24	1.60	1,552	17	1,569	23,275	149
1910	12,969	1,020	.96	1.24	1,265	14	1,279	14,248	91
1911	14,622	1,090	1.02	1.31	1,389	17	1,406	16,028	102
1912	18,880	1,090	1.16	1.49	1,624	16	1,640	20,520	131
1913	12,994	1,130	.96	1.24	1,401	78	1,479	14,473	93
1914	19,335	1,160	1.18	1.52	1,763	124	1,887	21,222	136
1915	12,500	1,200	.95	1.22	1,464	63	1,527	14,027	90
1916	17,325	1,230	1.12	1.44	1,771	105	1,876	19,201	123
1917	21,893	1,260	1.27	1.63	2,054	90	2,144	24,037	154
1918	13,650	1,290	.99	1.28	1,651	63	1,714	15,364	98
1919	10,858	1,320	.90	1.16	1,531	73	1,604	12,462	80
1920	19,730	1,360	1.20	1.55	2,093	119	2,212	21,951	140
1921	20,715	1,370	1.24	1.60	2,192	108	2,300	23,015	147
1922	16,302	1,370	1.08	1.39	1,904	99	2,003	18,305	117
1923	16,261	1,370	1.08	1.39	1,904	104	2,008	18,269	117
1924	12,481	1,370	.95	1.22	1,671	49	1,720	14,201	91
1925	11,311	1,370	.92	1.19	1,630	62	1,692	13,033	83
1926	14,000	1,370	1.00	1.29	1,767	77	1,844	15,853	101
1927	16,587	1,370	1.09	1.40	1,918	111	2,029	18,616	119
1928	15,323	1,370	1.05	1.35	1,850	106	1,956	17,279	110
1929	19,223	1,370	1.19	1.53	2,096	109	2,205	21,428	137
1930	13,070	1,380	.98	1.26	1,739	76	1,815	14,885	95
1931	6,388	1,380	.75	.97	1,339	42	1,381	7,769	50
1932	15,280	1,380	1.05	1.35	1,803	91	1,957	17,213	110
1933	9,715	1,380	.86	1.11	1,532	70	1,611	11,356	73
1934	4,306	1,380	.68	.88	1,214	30	1,244	5,640	36
1935	9,912	1,380	.87	1.12	1,546	91	1,637	11,549	74
1936	11,970	1,380	.91	1.21	1,670	160	1,830	13,800	88
1937	11,897	1,380	.94	1.21	1,670	173	1,843	13,740	88
1938	15,440	1,380	1.06	1.37	1,891	214	2,105	17,545	112
1939	9,394	1,386	.86	1.11	1,532	153	1,685	11,075	71
1940	7,082	1,380	.78	1.00	1,380	139	1,519	8,601	55
1941	16,052	1,386	1.08	1.39	1,918	178	2,096	18,148	116
1942	17,029	1,380	1.11	1.43	1,973	123	2,096	19,125	122
1943	11,263	1,380	.92	1.19	1,642	198	1,840	13,103	84
1944	13,221	1,380	.99	1.28	1,766	167	1,933	15,154	97
1945	11,545	1,380	.93	1.20	1,656	209	1,865	13,410	86
1946	8,745	1,385	.81	1.08	1,490	191	1,681	10,426	67
1947	13,516	1,385	1.00	1.29	1,780	177	1,957	15,473	99
Means:									
1914-45	13,789	1,351	1.00	1.29	1,737	112	1,849	15,638	100
1931-40	10,151	1,390			1,564	117	1,681	11,832	76
1926-47	14,200	1,282			1,659	99	1,758	15,958	102
1896-1947	14,040	1,142			1,470	95	1,550	15,590	100

[1] Flows of 1896-1923 period for Paria River and 1896-1921 period for Colorado River were estimated by correlation with upstream gaged records.

[2] Correction factor = ½ $\left(1+\frac{\text{Annual virgin flow}}{\text{1914-45 mean annual virgin flow}}\right)$. Successive approximations of virgin flow were made in order to compute the figures in column 3. First approximation was made using annual mean and historical flow.

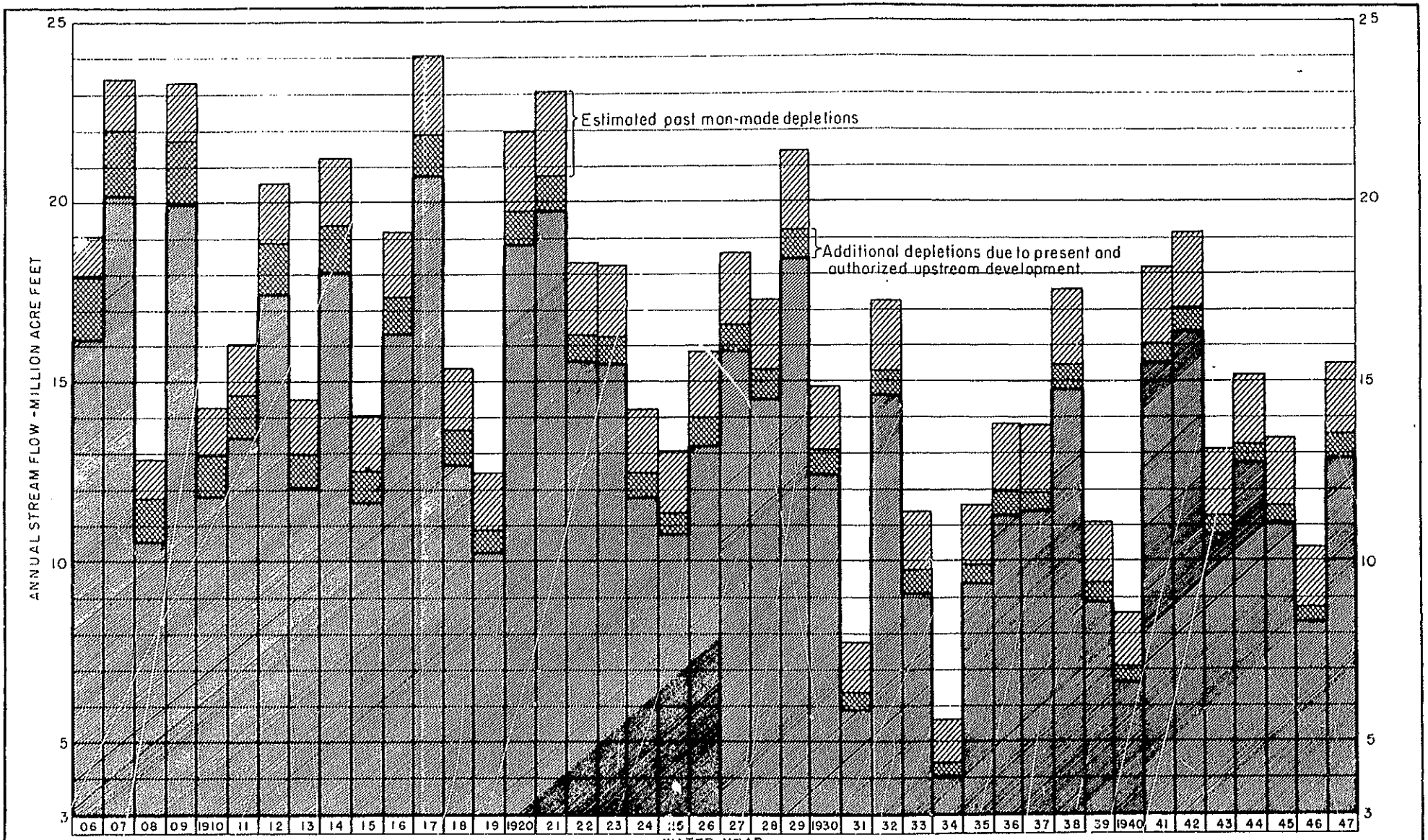
[3] Depletion rate: Column 3×1.287.

$$\left(1.287=\frac{\text{1914-45 mean annual depletion exclusive of transbasin exports}}{\text{1914-45 mean annual irrigated acreage}}\right).$$

[4] Depletions from past domestic and industrial use in upper basin are considered negligible.

Present modified flow

The present modified flow is the flow expected at any point with all upstream existing and authorized projects in operation. It was estimated at various sites by assuming a recurrence of past water supply



STREAM FLOW AVERAGES

	1931-1940	1914-1945	1906-1947	
Virgin flow at Lee Ferry	11,832,000	15,638,000	15,958,000	Acre feet.
Historical flow at Lee Ferry	10,151,000	13,789,000	14,200,000	Acre feet.
Present flow, modified to reflect existing and authorized upstream development.	9,618,000	13,090,000	13,374,000	Acre feet

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER STORAGE PROJECT

RIVER FLOW AT LEE FERRY

DRAWN. . . HRS. . SUBMITTED F. M. Harnick.
TRACED. . . HRS. . RECOMMENDED Lud Derman.
CHECKED. . SmR. . APPROVED C. D. Woods.

REVISED DEC. 1949 R.S.H.

SALT LAKE AREA OFFICE MAR 1949

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conditions and by deducting from historical flows for each year the depletions that would have resulted from the operation of all upstream projects constructed or authorized since that year.

Average annual present modified flows at key points in the upper drainage basin for the period 1914–47 and for the dry decade 1931–40 are shown in the following table. The next table shows a derivation of present modified flows of the Colorado River at Lee Ferry for each year from 1906–47. The chart following that table compares the present modified flow at Lee Ferry with the virgin and historical flows.

Average present modified flow at key points

Site	Average annual present modified flow (1,000 acre-feet)	
	1931–40 period	1914–47 period
Green River at Ashley Dam site	1,166	1,635
Yampa River at Cross Mountain Dam site	963	1,174
Green River at Echo Park Dam site	2,523	3,274
Green River at Gray Canyon Dam site	3,279	4,471
Gunnison River at Blue Mesa Dam site	876	1,131
Gunnison River at Crystal Dam site	1,016	1,309
Gunnison River at Whitewater Dam site	1,452	2,005
San Juan R[illegible] at Navajo Dam site	978	1,193
Colorado [illegible]r at Glen Canyon Dam site	9,593	12,918
Colorado [illegible]r at Lee Ferry	9,618	12,944

Annual present modified flow—Colorado River at Lee Ferry

Water year	Computed historical flow at Lee Ferry	Estimated depletion from upstream projects constructed or authorized after year indicated	Present modified flow at Lee Ferry	Water year	Computed historical flow at Lee Ferry	Estimated depletion from upstream projects constructed or authorized after year indicated	Present modified flow at Lee Ferry
	1,000 acre-feet	*1,000 acre-feet*	*1,000 acre-feet*		*1,000 acre-feet*	*1,000 acre-feet*	*1,000 acre-feet*
1906	17,964	1,789	16,175	1929	19,223	801	18,422
1907	22,003	1,845	20,158	1930	13,070	650	12,420
1908	11,763	1,182	10,581	1931	6,388	447	5,941
1909	21,706	1,734	19,972	1932	15,286	668	14,618
1910	12,969	1,163	11,806	1933	9,745	634	9,111
1911	14,022	1,195	13,427	1934	4,396	374	4,022
1912	18,880	1,425	17,455	1935	9,912	545	9,367
1913	12,904	935	12,059	1936	11,970	685	11,285
1914	19,336	1,207	18,038	1937	11,807	488	11,409
1915	12,500	880	11,620	1938	15,440	650	14,790
1916	17,325	970	16,346	1939	9,394	464	8,930
1917	21,893	1,135	20,758	1940	7,082	375	6,707
1918	13,650	972	12,678	1941	10,052	531	15,521
1919	10,858	633	10,225	1942	17,029	615	16,414
1920	19,739	901	18,838	1943	11,203	494	10,769
1921	20,715	970	19,745	1944	13,221	474	12,747
1922	16,362	737	15,565	1945	11,545	485	11,060
1923	16,261	803	15,458	1946	8,745	401	8,344
1924	12,481	686	11,795	1947	13,516	638	12,878
1925	11,341	580	10,761	Means:			
1926	14,009	829	13,180	1914–45	13,789	699	13,090
1927	16,587	751	15,836	1906–47	14,200	826	13,374
1928	15,323	827	14,496	1931–40	10,151	533	9,618

WATER AVAILABLE FOR FUTURE DEVELOPMENT

With completion of authorized projects, water-consuming uses would deplete the flow of the Colorado River at Lee Ferry by an estimated 2,548,000 acre-feet annually. Thus, there would remain for future development 4,952,000 acre-feet of the 7,500,000 acre-feet apportioned the upper basin by the Colorado River compact. Present and authorized consumptive use and the use remaining for future development are shown by States in the following table. Consumptive use is estimated in terms of long-time average manmade depletions in the river flow at Lee Ferry.

Present and future consumptive use, upper basin

State	Annual apportioned use (acre-feet)	Annual, present and authorized use (acre-feet)	Annual use remaining for future development (acre-feet)
Arizona	50,000	11,000	39,000
Colorado	3,855,000	1,591,000	2,264,000
New Mexico	838,000	79,000	759,000
Utah	1,714,000	628,000	1,086,000
Wyoming	1,043,000	239,000	804,000
Total	7,500,000	2,548,000	4,952,000

Limitations on future development

Without long-time regulatory storage, the upper basin could plan to utilize only a part of the 7,500,000 acre-feet apportioned it by the Colorado River compact since in protracted dry periods less than the compact-apportioned water would be available after the required Lee Ferry flows were provided. In the period 1931–40, the most severe drought decade of record, the estimated total virgin flow of the Colorado River amounted to 118,320,000 acre-feet. Thus, after meeting the 75 million acre-feet Lee Ferry flow obligation provided in the compact, the upper basin would have had available for use in this 10-year period a total of only 43,320,000 acre-feet or an average of 4,332,000 acre-feet annually. Permissible consumptive use in the upper basin would have been less than this theoretical average. The quantity of water available in any 10-year period would not be known until the end of the period. In the meantime, safe operation would require that deliveries at Lee Ferry be maintained ahead of the average schedule to insure against drought-caused shortages in the last years of the period. Upper basin use also would be curtailed in dry years by water shortages at points of diversion on tributary streams. Particularly severe shortages would have occurred in the extremely low runoff years of 1931, 1934, and 1940, as indicated graphically on the following chart. If the upper basin is required to release water to Mexico during dry periods, corresponding reductions in upper basin use would be required.

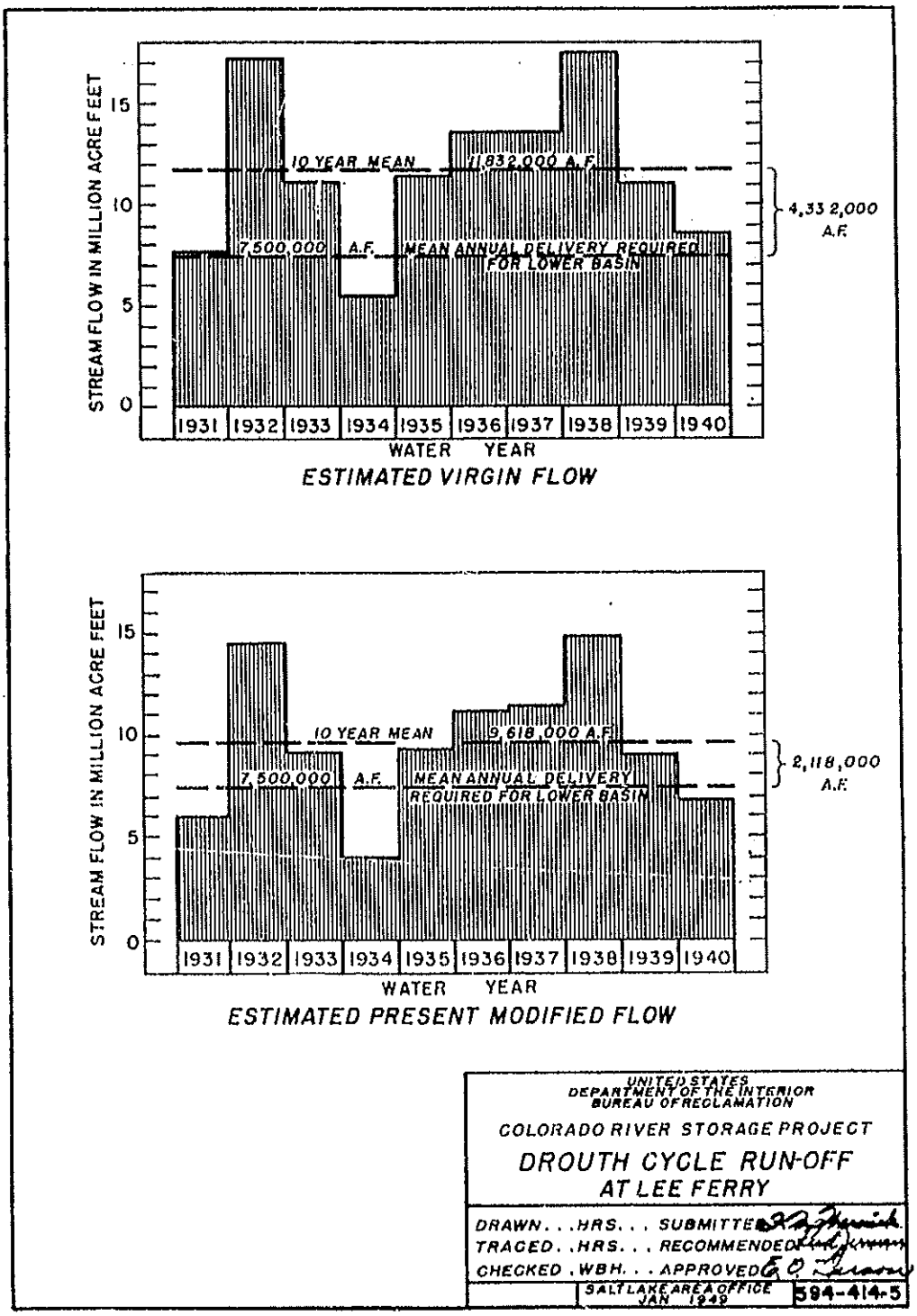
Unless future droughts are much more severe than that of 1931–40 no curtailment of present water uses in the upper basin will be re-

quired to meet the 10-year Lee Ferry flow obligation even without regulatory storage. As upper basin use increases, however, the need for regulatory storage will arise and become progressively greater. The point in upper basin development at which regulatory storage will become necessary will be determined by future runoff quantities. Through the upper Colorado River Basin compact, approved April 6, 1949, the States of the upper basin agreed on a division of their apportioned water and on their respective obligations with respect to the delivery of water at Lee Ferry. This made possible the formulation of a plan for basinwide development in which all potential projects are correlated. Therefore, in the analysis of this report all projects that would consume water of the upper Colorado River system, authorized subsequent to approval of the upper basin compact, are considered to be dependent on system regulatory storage for an assured water supply.

Evaporation

Increased evaporation resulting from manmade reservoirs is recognized by the upper basin States as consumptive use chargeable against the basin's water apportionment. Evaporation losses will vary from year to year, depending largely on the amount of storage provided in the basin. Estimated evaporation losses from reservoirs of the storage project are shown in the tables on reservoir operation in Chapter VI, Project Operations.

Only a few evaporation measuring pans are located in the upper Colorado River Basin and these do not provide data directly applicable to the remote sites at which reservoirs of the Colorado River storage project would be located. In estimating evaporation losses the Bureau used the available pan data as a base and established relationships with recorded meteorologic data. From these relationships curves were projected to indicate the gross evaporation to be expected from free water surfaces at various elevations on the Colorado River and its tributaries in the upper basin. The engineering advisory committee to the upper Colorado River Compact Commission adopted the Bureau's analysis of gross reservoir water surface evaporation. The Bureau, in computing net evaporation losses, allowed a credit for present river channel losses and other natural consumptive uses in areas to be inundated. For example, the gross evaporation rate from the free water surface of Glen Canyon Reservoir is expected to be 63 inches a year. With adjustments for present channel losses and natural consumptive uses within the reservoir area the net rate of evaporation at the maximum water surface level is estimated at 54 inches a year.


STREAM FLOW IN MILLION ACRE FEET
15
10
5
0
10 YEAR MEAN
11,832,000 A.F.
7,500,000 A.F.
MEAN ANNUAL DELIVERY REQUIRED FOR LOWER BASIN
4,332,000 A.F.
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
WATER YEAR
ESTIMATED VIRGIN FLOW
STREAM FLOW IN MILLION ACRE FEET
15
10
5
0
10 YEAR MEAN
9,618,000 A.F.
7,500,000 A.F.
MEAN ANNUAL DELIVERY REQUIRED FOR LOWER BASIN
2,118,000 A.F.
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
WATER YEAR
ESTIMATED PRESENT MODIFIED FLOW
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
DROUTH CYCLE RUN-OFF
AT LEE FERRY
DRAWN . . . HRS. . . SUBMITTED
TRACED . . HRS. . . RECOMMENDED
CHECKED . WBH. . . APPROVED
SALT LAKE AREA OFFICE
JAN 1949
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STORAGE REQUIREMENTS—COLORADO RIVER STORAGE PROJECT

The location within the upper basin of present and potential water-consuming uses should be considered in planning project reservoirs and electric-power facilities. Therefore, a distribution of apportioned consumptive use in various areas of each upper-basin State was assumed. Potential uses were estimated from data on individual projects where available, and otherwise from general studies of tributaries or sub-basins. Adjustments in the estimates may become necessary as future detailed project investigations are made. No substantial variation is anticipated, however, in the assumed effect at Lee Ferry or in the overall operation of the regulatory reservoir system.

An assumption was made as to the rate at which the remaining unused apportioned water in the upper basin would be developed. Projects now under construction or authorized for construction were considered to be in full operation by 1956, the year preceding operation year 1, resulting in stream-flow depletions previously described under present modified flow conditions. It was assumed that 80 percent of the remaining apportioned water use would be developed by 2006 (operation year 50), and that 100 percent would be developed by 2031 (operation year 75).

Storage capacity required for river regulation

If the upper basin were to attain ultimate development of its apportioned water without regard to its compact obligations to the lower basin, the resulting flow at Lee Ferry would vary widely from year to year and the 10-year average would frequently be less than 75 million acre-feet. An analysis of the flow at Lee Ferry under this condition indicates the magnitude of the storage capacity required to regulate the river for compact fulfillment. Such an analysis is shown by the table following.

The estimated ultimate use of apportioned water in the upper basin, shown in column 2 of the table, averages 7,500,000 acre-feet annually over the period 1914–45. The use would vary considerably from year to year, however, being influenced by variations in available flows at points of diversion. Column 4 shows the average flow at Lee Ferry for each 10-year period ending in the year indicated and column 5 compares the 10-year flow with the compact-required 75 million acre-feet.

The greatest 10-year flow deficiency at Lee Ferry is shown in the table as 20,800,000 acre-feet for the period ending in 1940. More detailed studies based on monthly data rather than on the annual data used in the table indicate a deficiency of 23 million acre-feet for the 1931–40 decade, showing a need for that amount of storage capacity for river regulation.

Determination of active storage requirement to permit full utilization of apportioned consumptive use

[Unit: 1,000 acre-feet]

Water year	Virgin flow of Colorado River at Lee Ferry (1)	Ultimate use of upper basin apportionment [1] (2)	Ultimate depleted unregulated flow at Lee Ferry (col. 1 minus col. 2) (3)	10-year moving total flow at Lee Ferry (4)	10-year variation from 75 million acre-feet (5)
1914	21,220	9,030	12,190		
1915	14,030	6,910	7,120		
1916	19,200	8,860	10,340		
1917	24,040	9,530	14,510		
1918	15,360	7,920	7,440		
1919	12,460	6,560	5,900		
1920	21,950	9,370	12,580		
1921	23,020	9,470	13,550		
1922	18,310	8,180	10,130	[1]	
1923	18,270	8,450	9,820	103,830	+28,830
1924	14,200	7,340	6,860	98,250	+23,250
1925	13,030	6,860	6,170	97,300	+22,300
1926	15,850	7,770	8,080	95,040	+20,040
1927	18,020	8,630	9,990	90,520	+15,520
1928	17,280	8,390	8,890	91,970	+16,970
1929	21,430	8,670	12,760	98,830	+23,830
1930	14,890	7,590	7,300	93,550	+18,550
1931	7,770	5,330	2,440	82,440	+7,440
1932	17,240	7,950	9,290	81,600	+6,600
1933	11,360	6,500	4,860	76,640	+1,640
1934	5,040	4,480	1,160	70,940	−4,060
1935	11,550	6,450	5,100	69,870	−5,130
1936	13,800	7,480	6,320	68,110	−6,890
1937	13,740	6,710	7,030	65,150	−9,850
1938	17,550	7,840	9,710	65,970	−9,030
1939	11,080	6,260	4,820	58,030	−16,970
1940	8,600	5,130	3,470	54,200	−20,800
1941	18,150	7,700	10,450	62,210	−12,790
1942	19,120	7,830	11,290	64,210	−10,790
1943	13,100	7,070	6,030	65,380	−9,620
1944	15,150	6,980	8,170	72,390	−2,610
1945	13,410	6,740	6,670	73,960	−1,040
1946	10,420	5,950	4,470	72,110	−2,890
1947	15,470	7,510	7,960	73,040	−1,960
Means:					
1931–40	11,830	6,410	5,420		
1914–45	15,640	7,500	8,140		

[1] Use apportioned by Colorado River compact, measured in terms of manmade depletions at Lee Ferry.

Sediment storage requirements

Samples of suspended sediment transported by the Colorado River and its primary upper basin tributaries have been obtained by the Geological Survey at the stations and for the periods indicated below

Sediment sampling station	*Period of sampling*
Colorado River near Grand Canyon, Ariz	1926 to 1948, inclusive.
Colorado River at Lees Ferry, Ariz	1929–33, 1943, 1944, and 1948.
Colorado River near Cisco, Utah	1930 to 1948, inclusive.
San Juan River near Bluff, Utah	Do.
Green River at Green River, Utah	Do.

From these basic records estimates were made of sediment quantities originating above each reservoir in the Colorado River storage project for the period 1930–48. Eight years of simultaneous sampling at the Grand Canyon and Lees Ferry stations provided an excellent base for extending the Lees Ferry record. This record is particularly significant because it shows approximately the total amount of sediment that would be retained in all reservoirs of the Colorado River

storage project. Drainage areas above each reservoir were compared and surface geology maps studied in estimating sediment at the various storage sites.

The 1930–48 period included a preponderance of drought years and therefore is not representative of average streamflow and sediment conditions in the upper basin. By use of streamflow-sediment-suspension relationships, however, the average sediment carried over a longtime period was estimated. Sediment loads so determined were increased 15 percent for unmeasured bed loads. At a density of 85 pounds per cubic foot for compacted sediment the longtime average sediment deposition at Lees Ferry would approximate 100,000 acre-feet annually.

Estimated sediment deposits in each project reservoir during a 200-year period, with construction progressing as scheduled, are here tabulated and illustrated graphically.

Flood-control storage requirements

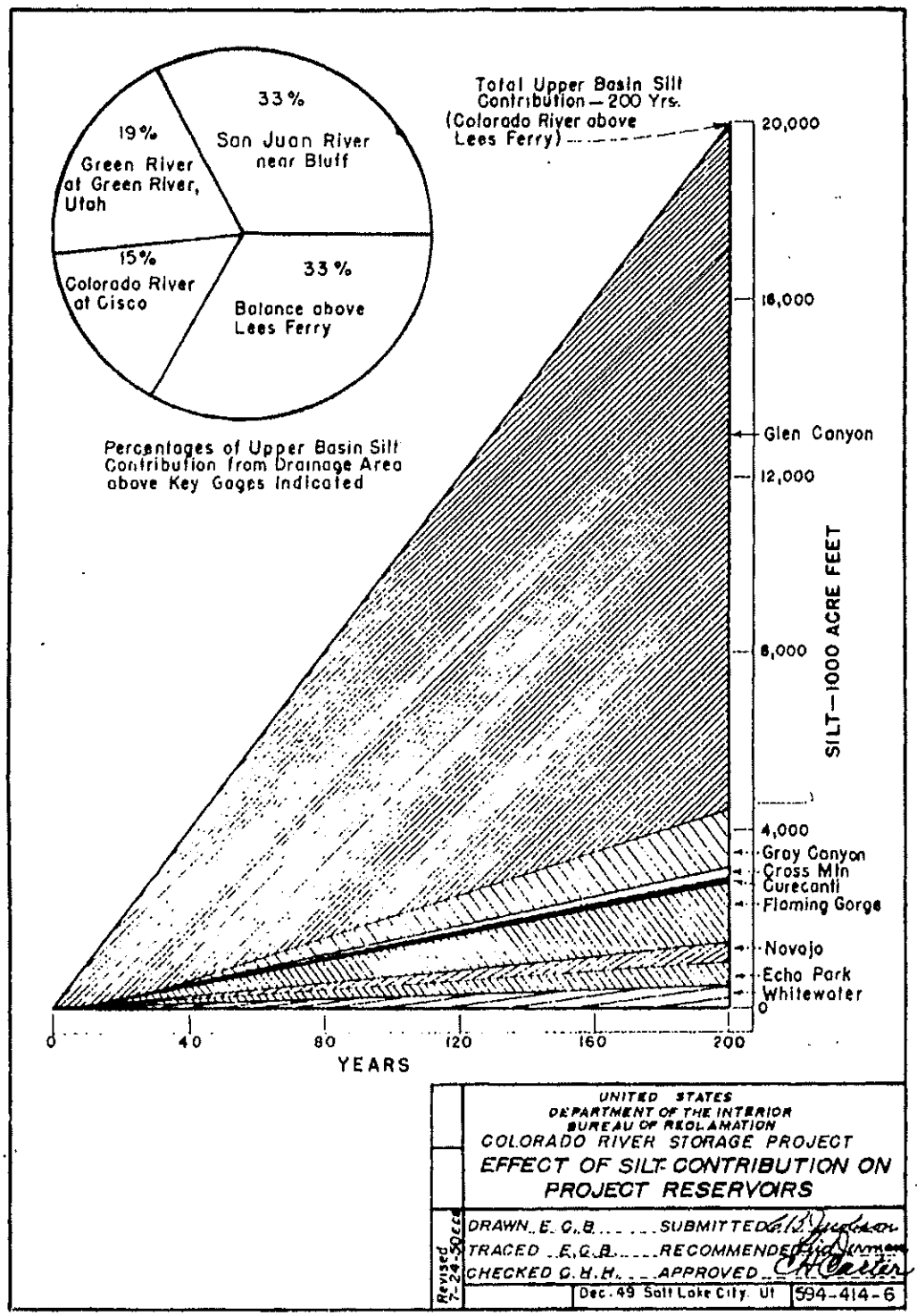
Floods on the upper Colorado River system generally result from the rapid melting of snow in the late spring, augmented at times by heavy rains over wide tributary areas. Local flood damage frequently occurs along tributary streams but the lower reaches of the river and its major tributaries are generally confined in deep and barren canyons where floods do no damage. Most of the potential reservoir sites of the Colorado River storage project are situated in these lower canyons so that their flood control value is limited.

Sediment encroachment in project reservoirs (sediment volumes at end of indicated year)

[Unit: 1,000 acre-feet]

Year of study [1]	Whitewater	Echo Park	Glen Canyon	Navaho	Flaming Gorge	Curecanti	Cross Mountain	Gray Canyon	Split Mountain and Crystal
0	2.0								
1	5.2	11.0	80.4						
2	7.8	22.0	172.8						
3	10.4	33.0	259.2						
4	13.0	37.0	343.4	2.2	7.0				(2)
5	15.6	41.0	427.6	4.4	14.0				
6	18.2	45.0	511.8	6.6	21.0				
7	20.8	49.0	596.0	8.8	28.0				
8	23.1	53.0	680.2	11.0	35.0	0.3			
9	25.4	57.0	764.4	13.2	42.0	.6			
10	27.7	61.0	848.6	15.4	49.0	.9			
11	30.0	65.0	932.8	17.6	56.0	1.2			
12	32.3	67.5	1,017.0	19.8	63.0	1.5	1.5		
13	34.6	70.0	1,101.2	22.0	70.0	1.8	3.0		
14	36.9	72.5	1,185.4	24.2	77.0	2.1	4.5		
15	39.2	75.0	1,269.6	26.4	84.0	2.4	6.0	7.0	
16	41.5	77.5	1,353.8	28.6	91.0	2.7	7.5	14.0	
17	43.8	80.0	1,417.0	30.8	98.0	3.0	9.0	21.0	
18	46.1	82.5	1,494.2	33.0	105.0	3.3	10.5	28.0	
19	48.4	85.0	1,571.4	35.2	112.0	3.6	12.0	35.0	
20	50.7	87.5	1,648.6	37.4	119.0	3.9	13.5	42.0	
75	177.0	225.0	5,895.0	158.0	504.0	20.0	96.0	427.0	
100	235.0	288.0	7,825.0	213.0	679.0	28.0	133.5	602.0	
200	465.0	538.0	15,545.0	433.0	1,379.0	58.0	283.0	1,302.0	

[1] Year of study refers to 1956 as year 0.
[2] Negligible.


33 %
San Juan River near Bluff
19%
Green River at Green River, Utah
15%
Colorado River at Cisco
33 %
Balance above Lees Ferry
Percentages of Upper Basin Silt Contribution from Drainage Area above Key Gages Indicated
Total Upper Basin Silt Contribution — 200 Yrs. (Colorado River above Lees Ferry)
20,000
16,000
Glen Canyon
12,000
8,000
4,000
Gray Canyon
Cross Mtn
Curecanti
Flaming Gorge
Navajo
Echo Park
Whitewater
0
SILT—1000 ACRE FEET
0
40
80
120
160
200
YEARS
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
EFFECT OF SILT CONTRIBUTION ON PROJECT RESERVOIRS
DRAWN E. C. B.
TRACED E. C. B.
CHECKED C. H. H.
SUBMITTED
RECOMMENDED
APPROVED
Revised 7-24-50 EEE
Dec. 49 Salt Lake City, Ut
594-414-6

A few areas in the upper drainage basin would benefit from flood control at project reservoirs. Protection to farmlands adjacent to the Green River near Leota and Greenriver, Utah, would result from storage at Echo Park and Gray Canyon, respectively. Reduction of peak flows of the Gunnison River by the Curecanti and Whitewater Reservoirs would reduce flood damage in areas near Delta and Grand Junction, Colo. The Navaho Reservoir on the San Juan River would provide some flood protection to areas near Bloomfield, Farmington, and Shiprock, N. Mex.

Prior to the formation of Lake Mead by the construction of Hoover Dam, damaging floods in the lower reaches of the Colorado River were almost an annual occurrence. Of the lake's total capacity of 32 million acre-feet, the top 9,500,000 acre-feet is reserved for flood control. Operation of the Colorado River storage project, including the large reservoir at Glen Canyon, will materially reduce the flood inflows into Lake Mead, justifying a smaller flood space reserve in Lake Mead and in turn permitting increased power production at Hoover Dam through higher head operation.

The extent of flood damage in the upper basin and the advisability of including flood control space in the project reservoirs will be investigated cooperatively with the Corps of Engineers.

Storage requirements for water use in upper basin

Future projects contemplating uses of water in the upper basin would require a fairly uniform annual delivery of water. Shortages of material consequence could be tolerated only under conditions of extreme drouth. Because of seasonal variations in streamflow, storage reservoirs would be necessary to make the water available when needed. The upper basin compact gives preference in the use of reservoirs or reservoir sites to storage for consumptive use in the upper basin over storage to assure deliveries at Lee Ferry. Consistent with this provision storage capacities required for direct use of water in the upper basin will be determined and allocated to individual projects as detailed data are obtained.

WATER RIGHTS

Necessary water rights for the units of the Colorado River storage project would be available to the United States. The use of water and the operation of these various project units would be consistent with the Colorado River compact, the Mexican Water Treaty, and the upper Colorado River Basin compact.

Water for the various participating irrigation projects would be appropriated in accordance with the law of the State in which the point of diversion of water for each such project is located. Although the water laws of all upper basin States are fundamentally the same, the procedures for the acquisition of water rights differ in minor details from State to State. In all of the upper basin States the doctrine of appropriation obtains and riparian rights are not recognized. Water is considered the property of the public and rights to its use can be acquired only by beneficial use. The priority of a right is ordinarily determined by the date of its initiation and "first in time is first in right." Limitations upon rights acquired in accordance with State law include (*a*) the paramount right of the United States to control navigation under the commerce clause of the Constitution of the United States, (*b*) limitations imposed by treaties, and (*c*) limitations imposed by compacts.

Chapter V. Power

The market area for most of the power generated by the Colorado River storage project is shown on the map following. Its principal portion includes major parts of the Upper Colorado River drainage basin and the adjoining Bonneville Basin on the west. This portion, which is divided into seven divisions as shown on the map, lies within the boundaries of the Bureau of Reclamation's region 4. The market area also includes three fringe areas in the States of Wyoming, Colorado, and New Mexico that are outside the Colorado River drainage basin. The fringe areas are included in the Bureau of Reclamation's regions 1, 5, 6, and 7.

Studies of the market area, made by region 4, were based on information compiled by the Federal Power Commission and information obtained from other regions of the Bureau. Results of the studies are presented in a report, entitled "Power Market Survey—Colorado River Storage Project," dated February 1949. Information from that report is included in this chapter.

Present development

Present power resources

Power resources available to the market area as of December 31, 1947, the most recent date for which such complete data are available, are summarized below:

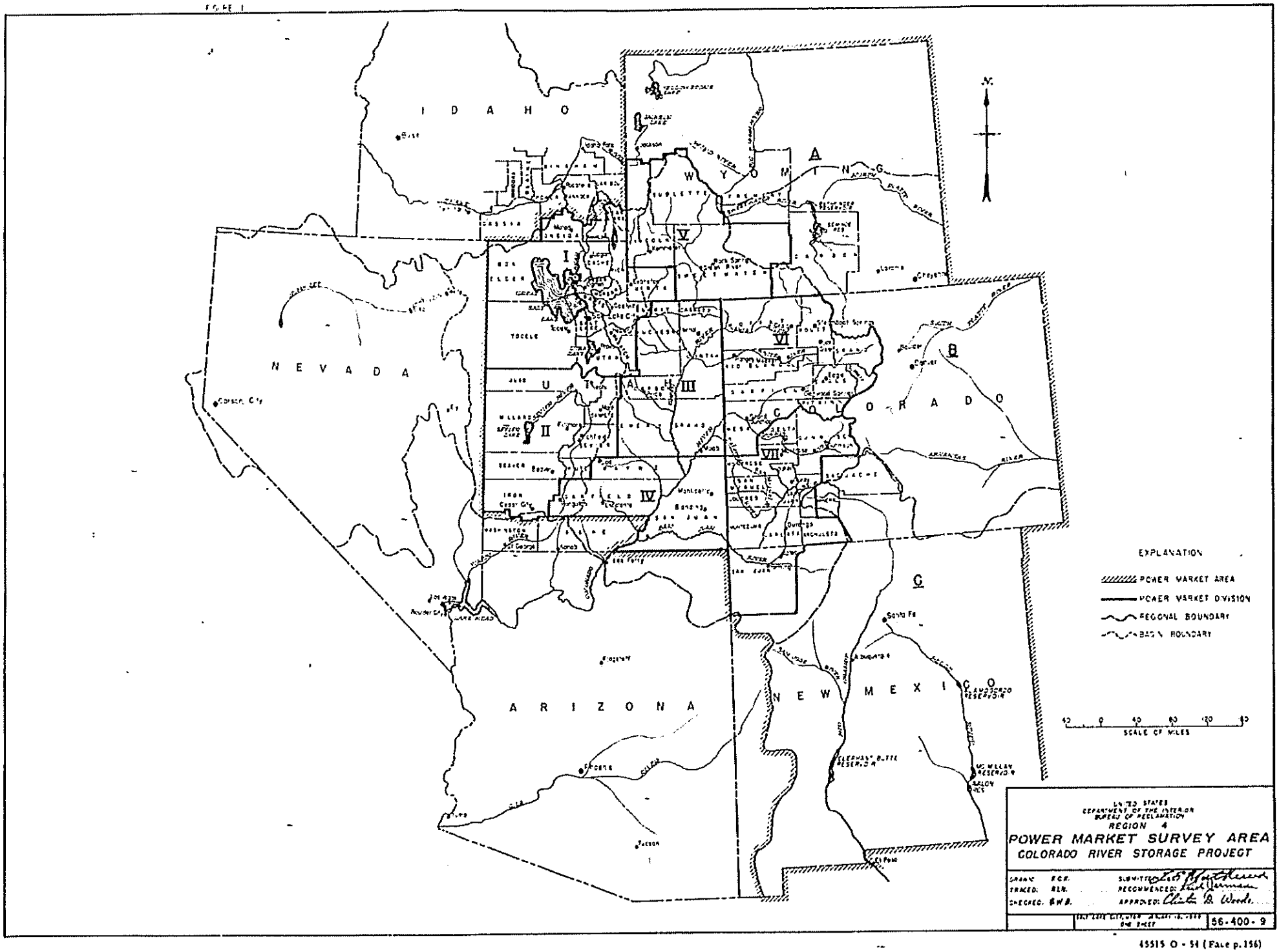
Net assured capacity, 1947

Area	Kilowatts
Region 4:	
Division I	329, 679
Division II	6, 485
Division III	3, 920
Division IV	1, 315
Division V	18, 055
Division VI	41, 346
Division VII	18, 573
Subtotal	419, 373
Fringe areas:	
A—Wyoming	85, 000
B—Colorado	247, 000
C—New Mexico	214, 000
Subtotal	546, 000
Total	965, 373

Some of the energy presently available to the northern part of the Bonneville Basin is imported from systems in Montana and Idaho which in turn are interconnected with other power systems of the Pacific Northwest. Agencies operating in the Pacific Northwest estimate that power demands there will increase so rapidly that continuation of energy exports to the Bonneville Basin cannot be assured.

Present energy requirements

Energy requirements in the market area for the year 1947 were as shown below.


IDAHO
WYOMING
NEVADA
UTAH
COLORADO
ARIZONA
NEW MEXICO
A
B
C
I
II
III
IV
V
VI
VII
EXPLANATION
POWER MARKET AREA
POWER MARKET DIVISION
REGIONAL BOUNDARY
BASIN BOUNDARY
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
POWER MARKET SURVEY AREA
COLORADO RIVER STORAGE PROJECT
56-400-9

Energy requirements, 1947

Area:	Millions of kilowatt-hours
Region 4:	
Division I	1,699
Division II	67
Division III	108
Division IV	5
Division V	75
Division VI	105
Division VII	85
Subtotal	2,144
Fringe areas:	
A—Wyoming	354
B—Colorado	1,206
C—New Mexico	901
Subtotal	2,461
Total	4,605

Future energy requirements

Energy requirements are rapidly increasing throughout the market area. The growing industrialization of the West, the accelerated development of natural resources, both mineral and agricultural, and increasing population are resulting in such an increased use of electric energy that existing generating facilities are taxed to capacity. Practically every electric utility in the market area has plans to increase its generating capacity to meet the requirements of the immediate future.

Estimated energy requirements for the years 1950, 1960, 1970, 1980, and 1990, as given in the Power Market Survey, are summarized in the following tabulation.

Estimated annual energy requirements

[Millions of kilowatt-hours]

Area	1950	1960	1970	1980	1990
Region 4:					
Division I	1,025	3,113	4,450	5,607	6,837
Division II	80	156	239	280	350
Division III	124	356	710	1,075	1,430
Division IV	9	17	28	50	75
Division V	84	235	403	590	710
Division VI	93	174	243	310	390
Division VII	88	155	220	300	370
Subtotal	2,403	4,206	6,293	8,242	10,162
Fringe area:					
A—Wyoming	499	1,289	2,448	3,734	5,075
B—Colorado	1,690	3,253	5,095	6,949	8,940
C—New Mexico	1,015	1,620	2,630	3,810	4,875
Subtotal	3,204	6,162	10,173	14,493	18,890
Total	5,607	10,368	16,466	22,735	29,052

Additional power and energy needed

Estimates were made of the additional amounts of power and energy needed from Bureau of Reclamation plants in region 4 to supplement all present and known scheduled power installations in satisfying the requirements of the power market area. These estimates are shown in the following table. Scheduled installations considered included probable Bureau of Reclamation installations in the fringe areas outside of region 4. Consideration was also given to reductions in capabilities that would result from the aging and retirement of equipment and from reductions in power importations.

Estimates of the power and energy required from the Colorado River storage project were made by deducting from the total requirements from Bureau plants in region 4 the capabilities of all other Bureau plants scheduled for construction in the region. Estimates made for 10-year intervals are shown in the following tabulation:

Year	Power needed (kilowatts)	Energy needed (millions of kilowatt-hours annually)
1950	0	0
1960	218,600	555
1970	1,110,300	5,051
1980	2,008,300	10,077
1990	3,308,300	16,820

Additional power and energy needed from Bureau of Reclamation plants in region 4 for project power market area

Year	Region 4 market area		Fringe area A (Wyoming)		Fringe area B (Colorado)	
	Power needed (kilowatts)	Energy needed (millions of kilowatt-hours annually)	Power needed (kilowatts)	Energy needed (millions of kilowatt-hours annually)	Power needed (kilowatts)	Energy needed (millions of kilowatt-hours annually)
1947	44,473	60	0	0	21,774	0
1950	43,878	3	0	51	24,670	290
1960	215,310	558	0	205	9,490	0
1970	730,353	3,331	124,000	1,180	140,590	429
1980	1,130,510	5,279	287,300	2,155	510,890	2,283
1990	1,538,510	7,199	521,000	3,492	903,890	4,274

Year	Fringe area C (New Mexico)		Total—project market area	
	Power needed (kilowatts)	Energy needed (millions of kilowatt-hours annually)	Power needed (kilowatts)	Energy needed (millions of kilowatt-hours annually)
1947	17,000	22	83,247	78
1950	0	0	68,548	344
1960	0	0	254,839	763
1970	220,000	805	1,220,943	5,811
1980	446,000	2,125	2,383,739	11,842
1990	720,000	3,620	3,681,039	18,585

PROJECT POWER DEVELOPMENT

Project capacities and capabilities

The Colorado River storage project would have a total installed capacity of 1,622,000 kilowatts. Capacities of the various units are listed below.

Unit	*Installed capacity (kilowatts)*	*Unit*	*Installed capacity (kilowatts)*
Cross Mountain	60,000	Gray Canyon	210,000
Crystal	48,000	Navaho	30,000
Curecanti	54,000	Split Mountain	100,000
Echo Park	200,000	Whitewater	48,000
Flaming Gorge	72,000		
Glen Canyon	800,000	Total	1,622,000

With ultimate upstream depletions and with all units in coordinated operation, the project could produce an estimated 6 billion kilowatt-hours of firm energy annually. The generation of each unit, however, would vary from year to year depending on the water supply available and the number of other units in operation. The following table shows the estimated firm generation of all units for each year of the assumed construction period; for year 20, the first year all units would be in coordinated operation; and for year 75, the year when all upstream water-consuming projects would be in operation. Estimates of the units' potential output are based on an assumed recurrence of water supply conditions of the 1914–47 period, with appropriate adjustments made to reflect upstream depletions for the various stages of upper basin development.

Estimates have been made only of potential firm generation. Some secondary energy also may be generated in certain years of actual project operation depending on the water supply available. The potential secondary generation cannot be determined from investigations to date as the reservoir operation studies have been based on the storage of all water not required to meet Lee Ferry flow obligations until project reservoirs are filled.

Estimated annual firm energy generation by project units

[Millions of kilowatt-hours]

Development year	Water year [1]	Project unit										Total
		Whitewater	Echo Park	Glen Canyon	Navaho	Flaming Gorge	Curecanti	Split Mountain	Cross Mountain	Gray Canyon	Crystal	
0	1956	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
1	1957	274	.....	.....	.....	.....	.....	.....	.....	.....	.....	274
2	1958	274	557	.....	.....	.....	.....	.....	.....	.....	.....	831
3	1959	274	608	1,710	.....	.....	.....	.....	.....	.....	.....	2,592
4	1960	274	866	2,570	.....	.....	.....	.....	.....	.....	.....	3,710
5	1961	274	865	3,420	171	.....	.....	.....	.....	.....	.....	4,730
6	1962	274	1,099	3,680	171	340	.....	.....	.....	.....	.....	5,564
7	1963	274	1,092	4,110	171	348	.....	.....	.....	.....	.....	5,995
8	1964	252	1,084	4,155	171	353	.....	.....	.....	.....	.....	6,015
9	1965	259	1,077	4,175	171	358	.....	.....	.....	.....	.....	6,040
10	1966	259	1,069	4,190	171	362	263	.....	.....	.....	.....	6,314
11	1967	258	816	4,200	171	387	275	372	.....	.....	.....	6,479
12	1968	257	808	4,185	171	381	304	473	.....	.....	.....	6,579
13	1969	256	800	4,220	171	376	308	470	.....	.....	.....	6,601
14	1970	255	790	4,205	171	370	308	465	73	.....	.....	6,637
15	1971	254	890	4,220	171	365	308	459	78	.....	.....	6,745
16	1972	253	880	4,220	169	359	308	516	164	600	.....	7,469
17	1973	252	880	4,245	166	354	306	511	169	1,128	.....	8,011
18	1974	251	871	4,285	163	348	304	506	175	1,118	216	8,267
19	1975	250	1,002	4,300	160	343	302	626	331	1,290	245	8,849
20	1976	249	995	4,337	157	337	300	710	330	1,303	244	8,962
75	2031	187	677	2,992	32	105	227	441	310	826	206	6,003

[1] Year ending Sept. 30 of year shown; based on assumed construction schedule.

Fuel-electric generating plants may be desirable to supplement hydroelectric plants of the Colorado River storage project, particularly when the project output is reduced through upstream depletion. Energy for construction of some of the storage project features may be obtained from fuel-electric plants.

Utilization and distribution of project power

The two following charts compare the amounts of project power and energy anticipated with the estimated amounts required by the States of the upper division comprising the project market area.

As shown by the charts, the estimated capabilities of the storage project plants in 1975 would just meet the market demands on the project in that year. By 1980 estimated energy requirements would greatly exceed the output of all production facilities.

Some project energy would be generated in advance of the market for firm energy. This energy would be produced while new generating units were being tested and while contract negotiations were in progress for the sale of firm energy. This temporary supply of energy would be salable at a secondary rate and is expected to be readily absorbed in the States of the upper division and adjacent areas for fuel replacements and for use by industries having secondary energy needs.

Seasonal energy produced by other reclamation projects in the upper basin is expected to more than meet pumping requirements for these projects. Irrigation pumping energy, if any, required from the storage project would be only a small portion of the total energy output of the project. Sale of such a small amount of energy at low pumping rates would not materially affect project repayment.

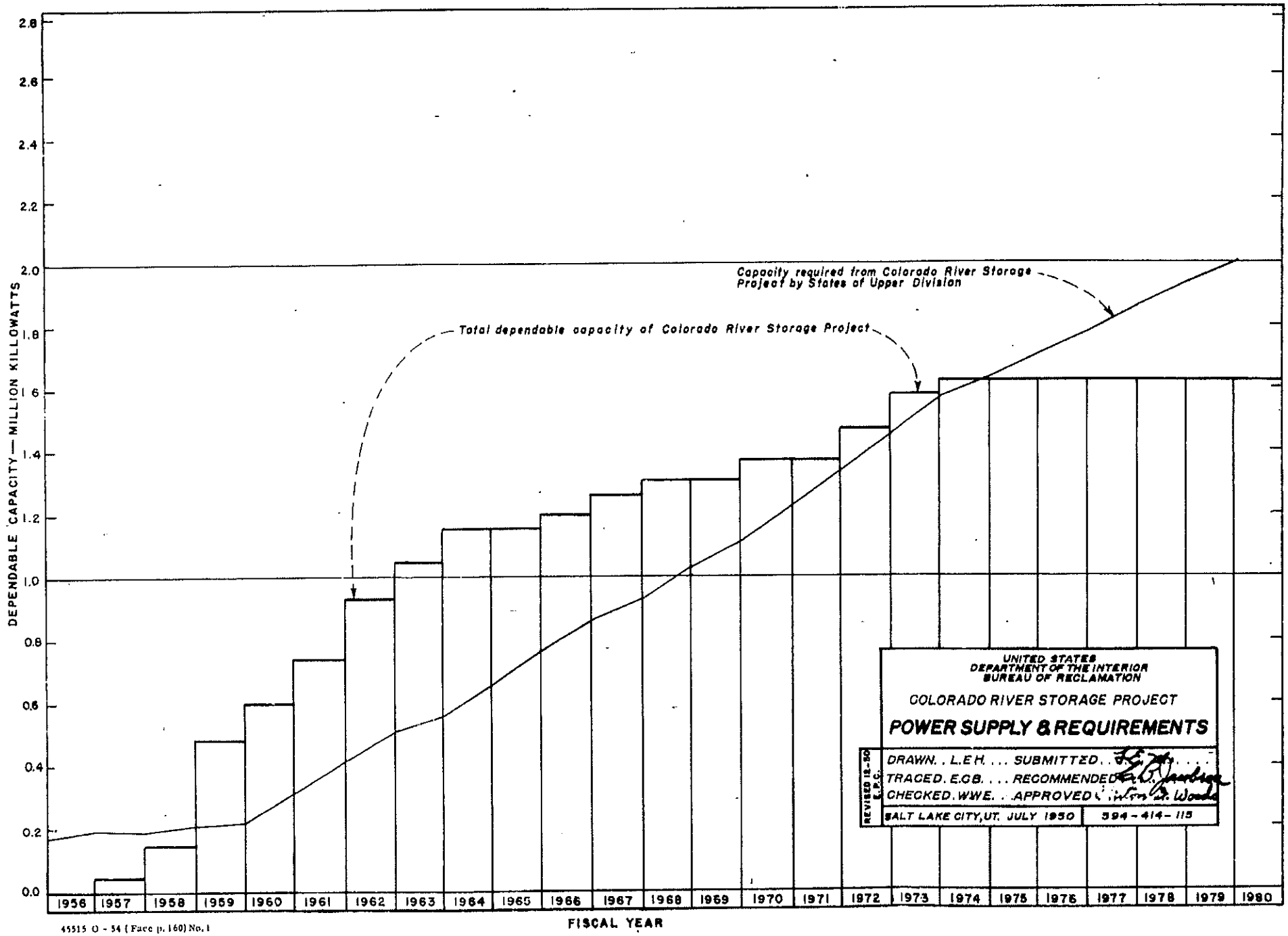
The Glen Canyon powerplant would provide a source of power which could be used to meet deficiencies which might arise due to use of water for reservoir filling if drought conditions should curtail power generation at other points. Any power losses below Lee Ferry caused by the project would be temporary, since the project, by regulating the river flow, would increase potential downstream power generation.

Power from the initial Echo Park unit would be used to meet demands in northwestern Colorado, southwestern Wyoming, and northern Utah. This area also would absorb power from the Flaming Gorge unit which is included in the initial program to permit early coordinated operation with the Echo Park unit. Energy from the Whitewater and Navaho units, also included in the initial program, would be required at an early date in western Colorado and northwestern New Mexico. As subsequent units are constructed, their power output would be absorbed in various sections of the market area.

All units of the project would be operated on a coordinated basis. The plants would be interconnected to provide optimum service to the entire market area, including firming up of other power systems where needed. A backbone high-voltage system, as shown on the following map, is tentatively planned to interconnect project powerplants and other power installations in region 4. Other lines are planned to permit energy from region 4 to be interchanged with energy produced by Bureau projects in other regions in Arizona, California, Colorado, Idaho, Nevada, New Mexico, Utah, and Wyoming. Possible locations of lines to the other regions are indicated on the map by the direction of lines approaching the regional boundary. The number of lines needed for complete development and the final routing of the lines will be determined as detailed studies are completed.

Power revenues

Ninety-three percent of the project energy is considered salable, seven percent being allowed for transmission losses. The firm energy would be sold at an average rate of 5.5 mills a kilowatt-hour and the firm energy produced in advance of market needs would be sold at an average rate of 3 mills a kilowatt-hour.



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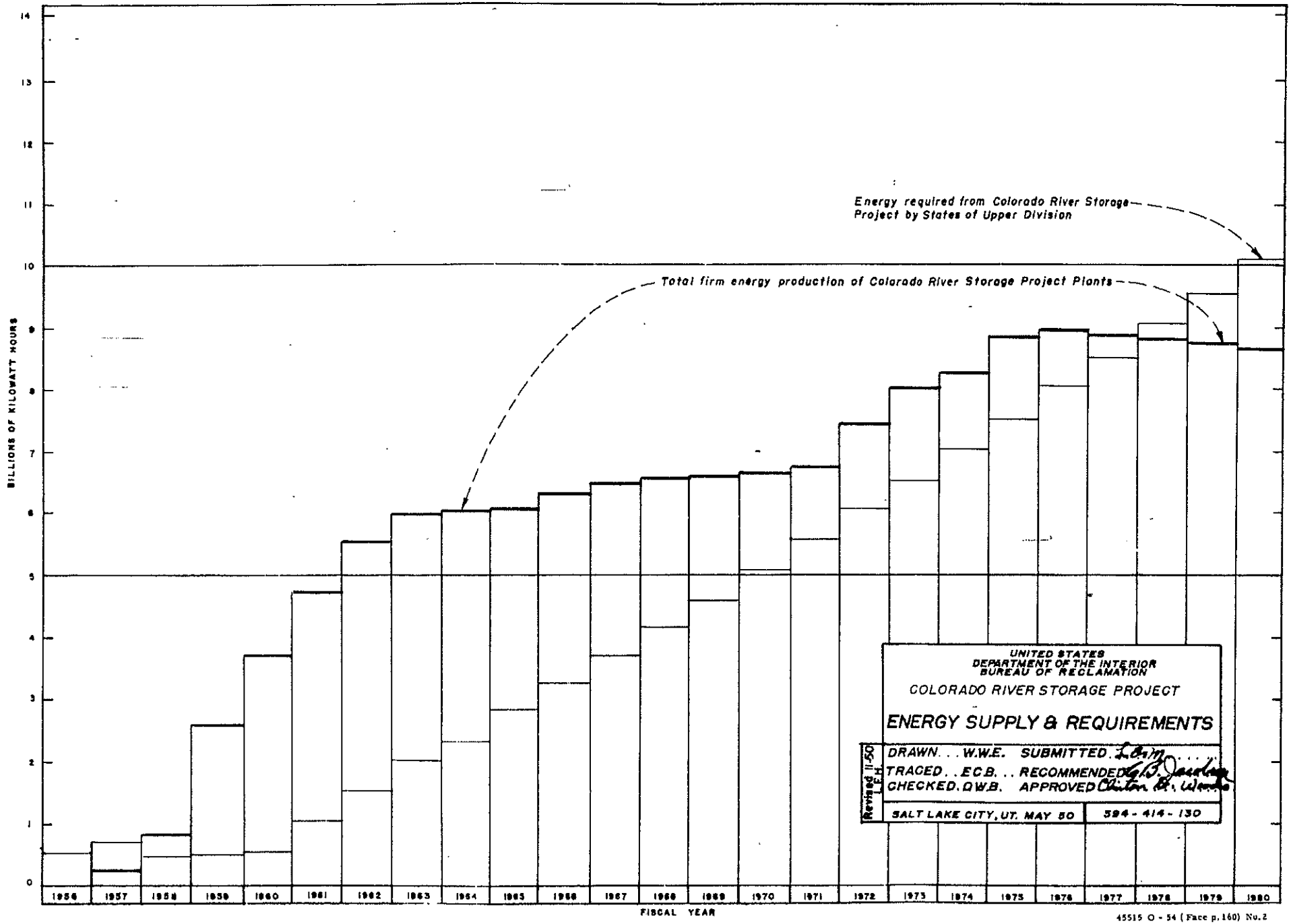

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The revenues obtained would be sufficient to pay all operation, maintenance, and replacement costs of the storage project and to retire the total project costs within 50 years after the last generating unit was placed in operation. Power revenues would include an interest charge of 3 percent on the power investment. A continuing fund in the amount of $1 million is proposed to be set up from the annual operation and maintenance provisions to defray emergency expenses and to insure continuous operation of the project. Power revenues, including revenues from interest payments, that are in excess of all project costs could be used to assist in the payment of irrigation costs of participating projects. A summarized account of the estimated distribution of project revenues is given in the following tabulation and a detailed account is given in the chapter, Financial Analysis.

Total net power revenues for first 70 years	$1, 814, 006, 800
Distribution of revenues:	
Repayment of power investment	806, 150, 000
Repayment of irrigation investment	332, 950, 000
Excess power revenues:	
Interest component	360, 331, 094
Earned surplus	314, 575, 706
Total	1, 814, 006, 800

Value of energy

The value of electric energy was estimated from the cost of producing energy at steam-electric, coal-burning plants at the principal load centers in each division of the project market area in region 4. If it is assumed that new steam-electric plants constructed in each division of the market area would be similar in capacity to recent or planned installations in the division, the cost of energy at the high voltage side of the plant stepup substation at 60 percent plant factor would be as shown in the following tabulation:

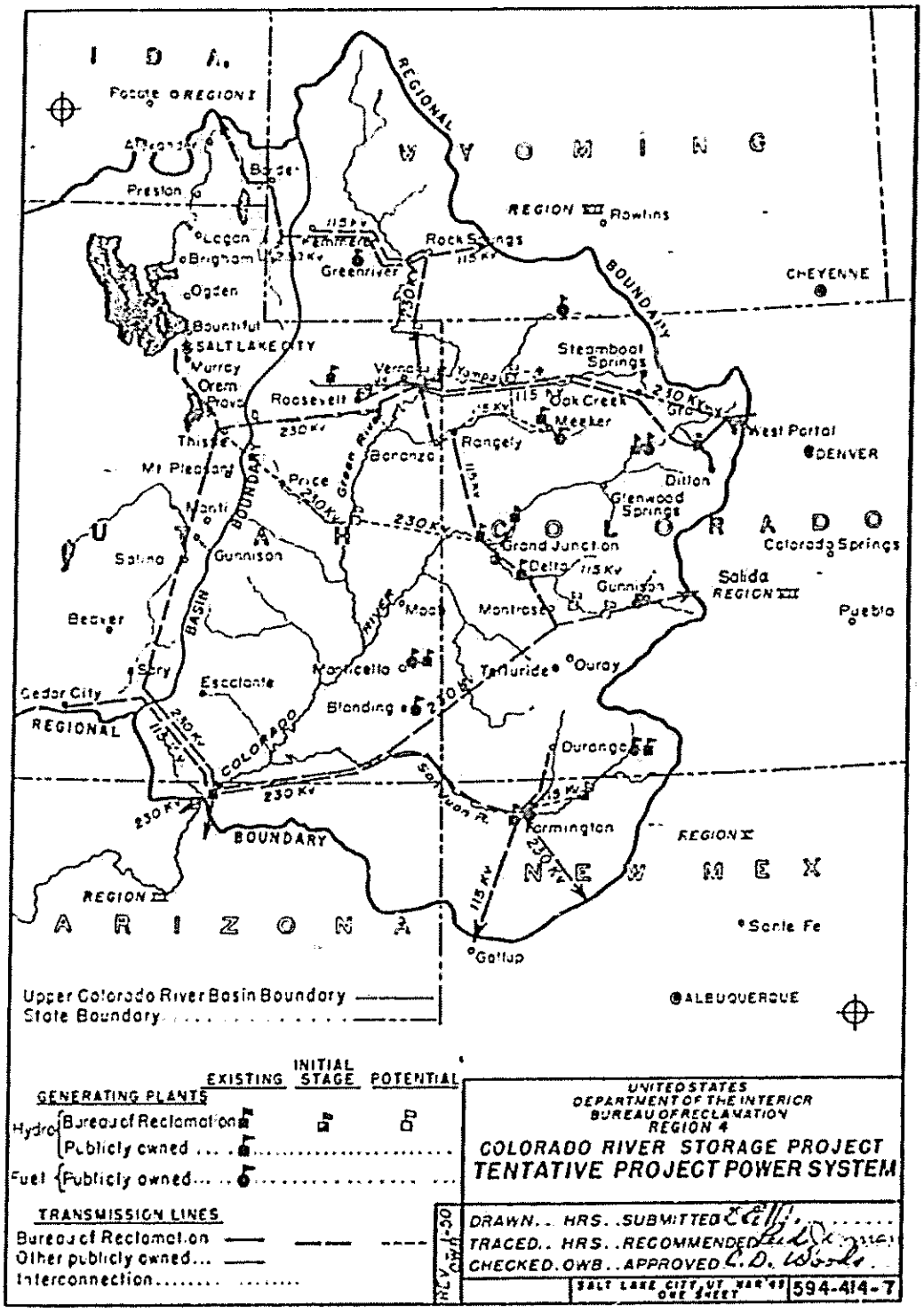
	Plant capacity (kilowatts)	Energy cost (mills per kilowatt-hours)
Divisions I and III	60,000	6.61
Division II	10,000	7.56
Division IV	2,500	10.83
Division V	5,000	8.41
Division VI	10,000	7.71
Division VII	10,000	7.06

With the anticipated powerload growth in the years ahead it is reasonable to assume that generating units installed in the future will be larger than those recently installed or planned. Installations at important load centers such as Salt Lake City in division I and at Denver and Albuquerque in the fringe areas may be as large as 100,000 kilowatts. Estimates based on July 1, 1948, prices for units of this size, with annual generation at 60 percent plant factor, indicate an average rate of approximately 6 mills a kilowatt-hour at the high voltage side of the powerplant. This cost may reasonably be considered the value of power supplied from the cheapest alternative source in the market area.

Conservation of mineral fuels

World reserves of mineral fuels, notably coal, oil, and gas, exist in fixed and limited quantities. The enormous present rates of consumption are rapidly depleting known supplies. These fuels can be preserved in their natural depositories until taken up for man's use. If little is used in this generation, more will be available for the next. The flowing water of the Colorado River cannot be preserved in this sense. Any water that flows unused to the sea today is lost forever to useful purpose.

The electric energy that could be generated in 70 years by water dropping through potential powerplants of the storage project would be equivalent to that produced by burning either 225 million tons of coal, 856 million barrels of oil, or 5.6 trillion cubic feet of natural gas. These fuels if not so consumed, could be preserved for other vital needs.



I D A
Pocatello
REGION I
Alexander
Preston
Border
Logan
Brigham
Ogden
Bountiful
SALT LAKE CITY
Murray
Orem
Provo
Thistle
Mt Pleasant
Manti
Salina
Gunnison
Beaver
Sary
Cedar City
REGIONAL
BOUNDARY
BASIN
Escalante
Monticello
Blanding
Moab
Green River
Roosevelt
Vernal
Yampa
Rangely
Bonanza
Price
Greenriver
Rock Springs
Kemmerer
Rawlins
REGION VII
REGIONAL
BOUNDARY
W Y O M I N G
CHEYENNE
Steamboat Springs
Oak Creek
Meeker
West Portal
DENVER
Dillon
Glenwood Springs
Grand Junction
Delta
Montrose
Gunnison
Salida
REGION VIII
Colorado Springs
Pueblo
Telluride
Ouray
Durango
Farmington
REGION X
Santa Fe
Gallup
ALBUQUERQUE
U T A H
C O L O R A D O
N E W M E X
A R I Z O N A
REGION IX
COLORADO
RIVER
San Juan R.
230 Kv
115 Kv
Upper Colorado River Basin Boundary
State Boundary
EXISTING
INITIAL STAGE
POTENTIAL
GENERATING PLANTS
Hydro
Bureau of Reclamation
Publicly owned
Fuel
Publicly owned
TRANSMISSION LINES
Bureau of Reclamation
Other publicly owned
Interconnection
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
COLORADO RIVER STORAGE PROJECT
TENTATIVE PROJECT POWER SYSTEM
DRAWN.. HRS..SUBMITTED
TRACED.. HRS..RECOMMENDED
CHECKED.OWB..APPROVED
SALT LAKE CITY, UT MAR '43
ONE SHEET
594-414-7

Reservoirs of the Colorado River storage project would have sufficient active capacity to regulate the flow of the river to meet the Lee Ferry flow obligation even after 200 years of sediment encroachment. About 23 million acre-feet of active reservoir capacity is reserved for this purpose. In addition, about 11,589,000 acre-feet of active capacity designed for sediment retention would be usable until occupied by sediment. This reservoir capacity, distributed among 8 project reservoirs, would permit flexibility in storage and power operations and increased energy generation for the first 200 years of project operation.

The full utilization of water apportioned the upper basin is not expected for about 75 years. In the meantime, any water that is neither consumed in the upper basin nor required for the initial filling of project reservoirs will flow through project powerplants en route to Lee Ferry. These unused flows could be regulated in project reservoirs as desired for maximum firm-power generation.

Project operation studies are based on runoff conditions that occurred in the 34-year period, 1914 to 1947, inclusive. This period provides the most recent and probably the most accurate stream flow records available and it is believed to be representative of long-time conditions of runoff. The period includes a well defined cycle of precipitation with above normal runoff occurring generally in the 17-year period, 1914 to 1930, and below normal runoff occurring generally in an equal period, 1931 to 1947. It includes the driest 10-year period of record, 1931–40, which is significant since flow obligations at Lee Ferry are based on 10-year averages. The sediment load of the river was assumed to continue at its present magnitude. Use of water apportioned the upper basin was assumed to progress uniformly in each of the 2 stages with 80 percent of the future development being accomplished in the first 50 years and the remaining 20 percent in the last 25 years.

Project reservoir operation studies were made on a "closed-cycle" basis, meaning that water from the active regulatory capacity of all reservoirs was released as required and the capacity was refilled during the 34-year period. The regulatory capacity of the reservoirs would have been nearly full at the beginning of water year 1931 and nearly empty at the end of water year 1940 with full utilization of water apportioned the upper basin. From 1941 to 1947 partial refilling would have occurred but the period was too short to demonstrate complete refilling. The period 1914 to 1930 was used to demonstrate that the reservoirs could be completely filled under project operation.

Initial filling of project reservoirs

Under the planned construction schedule and with average runoff, all project reservoirs would be constructed and filled to their aggregate capacity of 48,555,000 acre-feet within a 20-year period. During this period the system would be operated to facilitate rapid filling of the reservoirs. Water releases would be limited to those necessary to

meet power market requirements and to satisfy the rights of downstream water users.

The following table is a summary of the operation of all project reservoirs during a 20-year period of construction and initial filling. The table shows the manner in which the reservoirs would be filled, the annual growth in firm energy generation, and the residual flows at Lee Ferry. Since variations in annual stream flows during this 20-year period cannot be foretold, average flows were assumed each year. The flows used were the averages for the 1914–45 period, corrected for the effect of progressive development of water-consuming uses above the reservoirs and for upstream storage regulation. Sediment encroachment on reservoir capacity was considered negligible during this short period. The occurrence of protracted subnormal flows during the initial filling period would require temporary adjustments in project operation and the correlation of power operations in the upper and lower basins.

Data shown for year 20 in the initial filling tabulation differ in some aspects from those for an average year 20 in a closed-cycle operation study. In a closed-cycle study the reservoirs would not have remained full at all times so that the average evaporation would be only 810,000 acre-feet annually, compared to 1,045,000 acre-feet from full reservoirs. With less reservoir evaporation and no average annual increase in reservoir content during a closed-cycle operation the residual flow at Lee Ferry would be increased accordingly.

Project operation during construction and initial filling of reservoirs

Development year	Water year [1]	Total system firm energy generation (million kilowatt-hours)	Annual water utilization in upper basin (1,000 acre-feet)				Residual annual flow at Lee Ferry (1,000 acre-feet)
			Depletion exclusive of project reservoir evaporation	Project reservoir evaporation	Storage gain in project reservoirs	Total	
0	1956	0	2,548	17	880	3,445	12,193
1	1957	274	2,614	136	5,388	8,138	7,500
2	1958	831	2,679	217	5,238	8,134	7,504
3	1959	2,592	2,745	307	5,081	8,133	7,505
4	1960	3,710	2,811	462	4,874	8,147	7,491
5	1961	4,730	2,876	539	2,989	6,404	9,234
6	1962	5,564	2,942	599	2,612	6,153	9,485
7	1963	5,995	3,007	647	1,726	5,380	10,258
8	1964	6,015	3,073	689	1,711	5,473	10,165
9	1965	6,040	3,139	721	1,688	5,548	10,090
10	1966	6,314	3,204	758	1,702	5,664	9,974
11	1967	6,479	3,270	796	1,749	5,815	9,823
12	1968	6,579	3,336	844	1,762	5,942	9,696
13	1969	6,601	3,401	867	1,672	5,940	9,698
14	1970	6,637	3,467	899	1,673	6,039	9,599
15	1971	6,745	3,532	929	1,501	5,962	9,676
16	1972	7,469	3,598	944	1,303	5,905	9,733
17	1973	8,011	3,664	970	1,332	5,966	9,672
18	1974	8,267	3,729	1,007	1,234	5,970	9,668
19	1975	8,849	3,795	1,017	1,215	6,027	9,611
20	1976	8,962	3,861	1,045	1,165	6,071	9,567
Total					48,555		

[1] Year ending Sept. 30 of year shown; based on assumed construction schedule.

Initial operation of completed project, year 20

By year 20 all units of the Colorado River storage project would be operated as an integrated system with final control of the river flow at the Glen Canyon Reservoir. Depletions at Lee Ferry from

upstream uses and reservoir evaportation would then amount to about 62 percent of the use apportioned the upper basin. The maximum annual firm electric energy output for the project, estimated at 8,962 million kilowatt-hours, would be attained in year 20. Thereafter the annual generation would decrease with increased upstream water depletions and with reduced reservoir capacity for the regulation of power water due to sedimentation and increasing storage requirements for river regulation. Operation of the system under conditions prevailing in year 20 to provide maximum firm-energy generation would require large withdrawals from storage to supplement the below-average flows of the 1931–40 period. The regulatory capacity of the reservoirs would not have been completely emptied, however. The annual closed-cycle project operation as of year 20 at the Glen Canyon Reservoir and the resulting flows at Lee Ferry are shown by the following table.

Initial operation of completed project, year 20—Final point of control at Glen Canyon Reservoir

[Unit, 1,000 acre-feet]

Water year	Inflow to Glen Canyon Reservoir [1]	Net evaporation from Glen Canyon Reservoir	Controlled release from Glen Canyon Reservoir	Reservoir content end of year [2]	Inflow below reservoir (Paria River)	Regulated flow Colorado River at Lee Ferry	
						Annual	10-year moving total
1914	14,080	440	10,870	16,660	30	10,900	----------
1915	11,290	470	10,720	16,760	10	10,730	----------
1916	13,210	500	10,830	18,640	40	10,870	----------
1917	15,630	560	11,570	22,140	30	11,600	----------
1918	10,880	590	11,080	21,350	30	11,110	----------
1919	8,930	530	13,680	16,070	20	13,700	----------
1920	13,650	440	14,500	14,780	20	14,520	----------
1921	15,210	480	10,400	19,110	20	10,420	----------
1922	12,560	540	11,110	20,020	30	11,140	----------
1923	11,940	550	11,730	19,680	20	11,750	116,740
1924	10,400	530	11,600	17,950	20	11,620	117,460
1925	9,940	530	11,550	15,810	30	11,580	118,310
1926	11,710	450	11,570	15,500	30	11,600	119,040
1927	13,200	470	10,330	17,900	50	10,380	117,820
1928	12,760	530	10,350	19,800	20	10,350	117,060
1929	15,680	600	10,560	24,320	30	10,590	113,950
1930	11,410	660	10,760	24,310	20	10,780	110,210
1931	7,850	630	8,790	22,740	10	8,800	108,590
1932	10,360	560	12,390	20,150	40	12,430	109,880
1933	8,910	530	9,730	18,800	20	9,750	107,880
1934	7,000	500	8,570	16,730	20	8,590	104,850
1935	9,160	430	9,780	15,680	20	9,800	103,070
1936	10,360	440	9,990	15,610	30	10,020	101,490
1937	10,710	460	9,090	16,770	30	9,120	100,230
1938	12,810	510	8,740	20,330	30	8,770	98,650
1939	10,000	590	7,470	22,270	30	7,500	95,560
1940	8,230	550	11,400	18,550	30	11,430	96,210
1941	13,070	520	11,430	19,670	30	11,460	98,870
1942	13,850	580	11,100	21,840	20	11,120	97,560
1943	9,700	570	10,290	20,680	20	10,310	98,120
1944	11,140	560	10,280	20,980	20	10,300	99,830
1945	9,770	550	10,670	19,530	20	10,690	100,720
1946	8,200	480	11,900	15,350	20	11,920	102,620
1947	10,730	400	11,770	13,910	20	11,790	105,290
Mean	11,300	520	10,780	----------	30	10,810	----------

[1] Partially regulated by upstream project reservoirs.
[2] Glen Canyon Reservoir capacity reduced by 1,650,000 acre-feet of sediment accumulation in 20 years.

Ultimate project operation, year 75

Another closed-cycle operation study was made for year 75, when it is assumed that water uses in the upper basin, including reservoir evaporation, will result in an average annual depletion of 7,500,000 acre-feet in the flow of the Colorado River at Lee Ferry. At this stage in upper-basin development the reservoir system would be operated primarily to satisfy the 10-year Lee Ferry flow obligation. The 23 million acre-feet of regulatory capacity in the reservoirs would be required for that purpose. Firm electric energy generation, limited to storage releases for stream regulation, would average about 6 million kilowatt-hours annually.

The maintenance of uniform annual flows at Lee Ferry would not be economical nor necessary to satisfy the compact requirements which are based on 10-year moving total flows. Fairly uniform annual deliveries would be made but some variations would be caused by spills beyond control of project reservoirs. With a near-constant release from the Glen Canyon Reservoir the energy generation at the Glen Canyon powerplant would vary in relation to the hydrostatic head as determined by the reservoir water-surface elevation. Through coordinated operation, however, generation at upstream powerplants could be increased while the head at Glen Canyon is low, thus maintaining firm power production for the system.

The estimated long-time average annual evaporation from project reservoirs under conditions as of year 75 is shown below.

Average annual evaporation

Reservoir:	*Acre-feet*	Reservoir—Continued	*Acre-feet*
Whitewater	21,000	Split Mountain	8,000
Echo Park	87,000	Cross Mountain	70,000
Glen Canyon	526,000	Gray Canyon	30,000
Navaho	16,000	Crystal	negligible
Flaming Gorge	56,000		
Curecanti	32,000	Total	846,000

Annual project operation at year 75 is summarized in the following table.

Project operation similar to that of year 75 would be continued after that year under the present apportionment of water to the upper basin. After year 200, however, sediment at the present rate of erosion would encroach on the reservoir capacity required for river regulation. Without other measures to control sediment, the effectiveness of the project in providing necessary river regulation would then gradually diminish.

Ultimate project operation, year 75—Final point of control at Glen Canyon Reservoir

[Unit, 1,000 acre-feet]

Water year	Inflow to Glen Canyon Reservoir [1]	Net evaporation from Glen Canyon Reservoir	Controlled release from Glen Canyon Reservoir	Reservoir content end of year [2]	Inflow below reservoir (Paria River)	Regulated flow Colorado River at Lee Ferry	
						Annual	10-year moving total
1914	10,450	460	7,470	14,130	30	7,500	----------
1915	7,950	500	7,490	14,090	10	7,500	----------
1916	9,780	510	7,460	15,900	40	7,500	----------
1917	11,910	590	7,470	19,760	30	7,500	----------
1918	7,510	620	7,470	19,170	30	7,500	----------
1919	7,060	600	7,480	18,150	20	7,500	----------
1920	12,200	620	9,810	19,920	20	9,830	----------
1921	12,620	630	11,840	20,070	20	11,860	----------
1922	10,600	640	9,960	20,070	30	9,990	----------
1923	9,520	630	8,890	20,070	20	8,910	85,590
1924	7,820	650	7,480	19,760	20	7,500	85,590
1925	7,000	610	7,470	18,680	30	7,500	85,590
1926	8,730	620	7,470	19,320	30	7,500	85,590
1927	9,510	620	8,150	20,060	50	8,200	86,200
1928	9,820	640	9,280	19,960	20	9,300	88,090
1929	12,500	630	11,760	20,070	30	11,790	92,380
1930	8,330	640	7,690	20,070	20	7,710	90,260
1931	4,870	600	7,490	16,850	10	7,500	85,900
1932	8,440	570	7,460	17,260	40	7,500	83,410
1933	5,970	540	7,480	15,210	20	7,500	82,000
1934	4,640	480	7,480	11,890	20	7,500	82,000
1935	6,360	400	7,480	10,370	20	7,500	82,000
1936	7,250	380	7,470	9,770	30	7,500	82,000
1937	7,720	380	7,470	9,640	30	7,500	81,300
1938	9,560	400	7,470	11,330	30	7,500	79,500
1939	6,500	400	7,470	9,960	30	7,500	75,210
1940	6,180	360	7,470	8,310	30	7,500	75,000
1941	10,590	380	7,470	11,050	30	7,500	75,000
1942	11,120	480	7,480	14,210	20	7,500	75,000
1943	6,970	480	7,480	13,220	20	7,500	75,000
1944	8,350	480	7,480	13,610	20	7,500	75,000
1945	7,440	480	7,480	13,090	20	7,500	75,000
1946	6,050	440	7,480	11,220	20	7,500	75,000
1947	8,290	420	7,480	11,610	20	7,500	75,000
Mean	8,520	530	7,990	----------	30	8,020	----------

[1] Partially regulated by upstream project reservoirs.
[2] Glen Canyon Reservoir capacity reduced by 5,895,000 acre-feet of sediment accumulation in 75 years.

Chapter VII. Financial Analysis

ANNUAL BENEFITS AND COSTS

The degree to which the Colorado River storage project would be economically justified was determined by comparing the project's national benefits and costs. For the comparison both benefits and costs were converted to average annual equivalent values. These values were computed at an interest rate of 2.5 prcent over a 100-year period beginning with the first year of project operation. Costs were based on December 1949 prices, which are essentially the same as current prices, while benefits were based on the average prices expected to prevail over the next 50 to 60 years.

ANNUAL BENEFITS

Tangible benefits anticipated from the Colorado River storage project include river regulation for irrigation and other water-consuming uses, power generation, sediment retention, flood control, fish and wildlife conservation, recreation, and possibly the development of mineral resources. While all of the benefits are measurable in monetary terms, only the benefits from irrigation and power production in the upper basin were considered in the comparison. The other benefits will be evaluated as investigations progress and as additional information on the effects of the project is provided.

Irrigation benefits

The Colorado River storage project, by regulating water releases to the lower basin, would make possible completion of the development for irrigation and other purposes of water apportioned the upper basin. Certain project reservoirs also could provide water for direct irrigation use in the upper basin. Irrigation benefits from the storage project would be realized only with the construction of dependent irrigation projects. Dependent projects that would use water supplied directly from the reservoirs have not been investigated in sufficient detail to justify an appraisal of the benefit value of the reservoirs as a direct source of irrigation water. This benefit value, therefore, has not been included in the present analysis. It will be considered in the future as investigations progress on direct-use irrigation projects.

Before irrigation benefits resulting from flow regulation at Lee Ferry may be definitely evaluated, determination must be made as to which irrigation projects will benefit from river regulation. It has been shown that on the basis of past stream flows presently constructed or authorized projects using water in the upper basin are protected against curtailment to meet Lee Ferry obligations even without system regulation. These projects, therefore, would not benefit from the regulation provided by the storage project. It has also been shown that the stage in upper basin development at which regulatory storage will become necessary to prevent curtailment of water use is

approaching, the exact time being determined by runoff conditions of the future.

The upper Colorado River Basin compact, approved April 6, 1949, is an important milestone in upper basin development. By defining the rights and obligations of each upper basin State with respect to the use of water in the Colorado River system, it made possible a correlated plan of development in the upper basin. Potential projects are correlated both as to water supply and finances in the plan presented in this report. It is with good reason, therefore, that all irrigation projects using water from the upper Colorado River system authorized subsequent to approval of the upper basin compact are considered dependent on the storage project. The irrigation benefits of such projects are attributable in part to the storage project. These benefits will not be credited to the storage project in the benefit-cost analysis. Rather, and with the same effect, an appropriate part of the cost of the storage project will be assigned as a cost of the dependent projects.

Fish and wildlife benefits

A considerable net benefit to fish and wildlife is expected to result from project development although an exact appraisal has not yet been made by the Fish and Wildlife Service. Preliminary studies by the Service indicate that the project will cause some damage to fish and wildlife at all the reservoir sites. The loss is expected to be offset by gains, however, particularly at the Echo Park, Glen Canyon, Cross Mountain, Flaming Gorge, and Gray Canyon Reservoir sites. Only at the Curecanti site are the monetary losses expected to be greater than the gains. Facilities for the conservation and propagation of fish and wildlife that are found justified in future investigations of the Fish and Wildlife Service would be provided as a part of project development.

Sediment retention benefits

Benefits from sediment retention would accrue to existing and potential facilities in the lower basin. Data required for an evaluation of these benefits, however, are not yet available.

Recreation benefits

New recreational values are expected to result from the artificial lakes, access roads, and waterways that would be developed in the rugged canyons of the Green, Yampa, and Colorado Rivers. Sufficient studies, however, have not been conducted to permit an estimate of the costs of recreational facilities and an appraisal of recreational benefits. Recreational aspects of the project are now being investigated in detail by the National Park Service, and its findings will be considered in a future benefit-cost analysis.

Flood-control benefits

Minor benefits from flood control are expected in both the upper and lower basins. The most significant benefits in the upper basin are expected in developed areas adjacent to stream channels below project reservoirs. Capacity reserved for flood control in Lake Mead and other potential reservoirs farther upstream in the lower basin could be reduced after construction of the Colorado River storage project.

Thus, production of hydroelectric energy would be increased because of greater hydrostatic heads at the powerplants. An appraisal of flood-control benefits has not been made for either the upper or lower basin but may be found desirable in the future.

Mineral-development benefits

The storage project may create benefits by making water available for processing of minerals, particularly the production of oil from oil shale which is found in vast deposits in the upper drainage basin. The benefits realized would depend largely on the method selected for processing the oil shale. Some methods now being investigated require large quantities of water. Studies of the project's effect on mineral resources are being made by the Bureau of Mines.

Power benefits

The project is expected to result in power benefits in the upper basin of $59,084,000 annually, including $35,359,000 in direct benefits and $23,725,000 in indirect benefits. Allowances were made in the estimates for expected streamflow depletions and transmission losses.

The direct benefits were measured by the gross revenues expected from the sale of usable energy that would be produced and delivered to load centers in the power market area. Anticipated power revenues are:

Sale of firm energy (6,346,000,000 kilowatt-hours at 5.5 mills)	$34, 903, 000
Sale of secondary energy (152,000,000 kilowatt-hours at 3 mills)	456, 000
Total, annual direct power benefits	35, 359, 000

The indirect benefits were measured by savings in cost and by increased values that would result from the distribution and utilization of electric energy generated by the project. These benefits were estimated from production costs and studies of past use of electric energy in the potential power market area. The elements considered in determining the benefits are itemized below.

The saving in production cost realized by utilities purchasing project power for resale (assumed to be passed on to the consumer)	$3, 554, 000
A proportionate share of the retailing benefits arising from resale of project power to the consumer at higher rates	17, 844, 000
A proportionate share in the increased value of goods and services produced by utilization of project power	2, 327, 000
Total, annual indirect power benefits	23, 725, 000

Summary

Benefits of various kinds are anticipated from the Colorado River storage project. Only part of the tangible benefits from irrigation and those from power have been evaluated for the benefit-cost comparison. The irrigation benefits are contingent on the construction of dependent projects and will be credited to those projects. These benefits, therefore, are not included as benefits of the storage project. They influence the benefit-cost ratio, however, since an appropriate cost of the storage project will be borne by dependent projects in benefit-cost analyses. Only power benefits, therefore, are evaluated directly for the storage project. The evaluated project benefits are estimated at $59,084,000 annually.

ANNUAL EQUIVALENT COSTS

Federal project costs were used in computing annual equivalent costs for comparison with the benefits. Annual costs include the present worth of the estimated construction cost amortized at 2½ percent interest over the 100-year period of analysis plus the annual cost of operation, maintenance, and replacements adjusted for a 100-year period. Adjustments were made in the construction costs for interest during construction and for the present worth of the salvage value of project features at the end of the 100-year period.

Cost assigned to dependent projects

In the benefit-cost analysis a part of the storage project cost is properly assignable to dependent projects that will benefit from the river regulation provided by storage project reservoirs. It was found appropriate at the present stage of investigations of dependent projects to distribute this cost among the projects in proportion to the increase in stream depletion that would result from the construction of each project. As the first step in this distribution, the utilization of water in the upper basin with and without the Colorado River storage project was estimated as follows:

Average annual consumptive use

	Acre-feet
Without Colorado River storage project: Present and authorized uses	2, 548, 000
Additional development with Colorado River storage project:	
Dependent projects	4, 106, 000
Regulatory evaporation	846, 000
Subtotal	4, 952, 000
Total development	7, 500, 000

The lowest cost single-purpose alternative storage system that would provide holdover storage in an amount equivalent to that provided by the multiple-purpose project is a combination consisting of Cross Mountain, Echo Park, and Glen Canyon, with capacities and estimated costs as shown in the following table.

Lowest cost single purpose regulatory system

Reservoir	Storage capacity (1,000 acre-feet)			Estimated construction cost	Estimated annual operation, maintenance and replacement cost
	Gross	Sediment 200 years	Active		
				Thousands	*Thousands*
Cross Mountain	6, 540	300	6, 240	$34, 300	$36. 2
Echo Park	6, 460	1, 900	4, 560	118, 300	52. 9
Glen Canyon	30, 000	17, 800	12, 200	184, 900	100. 1
Total	43, 000	20, 000	23, 000	337, 500	189. 2

The alternative average annual equivalent cost, which is the minimum annual cost assignable to dependent projects, is estimated at $9,671,000. Distributed on a basis of 4,106,000 acre-feet of increased annual consumptive use, the cost amounts to approximately $2.35 an acre-foot of increased annual consumptive use of water. The alter-

native average annual equivalent cost includes an allowance for amortization of the construction cost of the cheapest alternative at 2½ percent interest over a 100-year period and includes annual operation, maintenance, and replacement costs of that alternative. Allowances were made in the estimates for interest during construction and salvage value.

Storage project costs

Items considered in determining the annual costs of the Colorado River storage project are shown below.

Cost item	Total cost	Annual equivalent cost
Construction cost	$1,139,100,000	
Interest during construction	74,200,000	
Gross project investment	1,213,300,000	
Less present worth of terminal salvage value	32,125,000	
Net project investment	1,181,267,000	$32,262,600
Operation, maintenance, and replacement cost		9,732,100
Gross annual equivalent in Federal cost		41,994,700
Less annual costs assigned to dependent projects		9,671,000
Net annual equivalent Federal cost		32,323,700

BENEFIT-COST RATIO

Annual evaluated benefits from the Colorado River storage project ($59,084,000) would compare with the annual costs ($32,323,700) in a ratio of 1.8 to 1.0.

COST ALLOCATIONS

All costs of the Colorado River storage project, including costs of construction, operation, maintenance, and replacements, have been allocated either to irrigation and other water-consuming uses or to power production in the upper basin. Costs of features useful for only one purpose have been allocated to that purpose as specific costs. Costs of features useful for more than one purpose have been considered joint costs and tentatively divided between irrigation and other water-consuming uses and power. Certain project reservoirs may provide some water directly to dependent projects, but pending further investigations no cost allocations have been made on this basis. No part of the project cost has been assigned to dependent projects for repayment. No allocations have been made to power production in the lower basin, silt retention, flood control, fish and wildlife conservation, or recreation. Allocations to these and other purposes may be found desirable and justified as studies are continued.

ALLOCATION OF CONSTRUCTION COSTS

Specific construction costs, amounting to $468,900,000, have been allocated to power. Joint-construction costs, amounting to $670,200,000, have been tentatively allocated to irrigation and other water-consuming uses and to power by averaging the results of the priority-of-use and alternative-justifiable-expenditure methods. This

basis for distributing the project's joint costs was selected as the most suitable after a study of several methods of allocation. Tentative allocations are shown in the following table.

Allocation of construction costs

Purpose	Specific cost	Joint costs			Total allocation
		Alternative-justifiable-expenditure method	Priority-of-use method	Average of 2 methods	
Irrigation and other water-consuming uses		$328,400,000	$337,500,000	$332,950,000	$332,950,000
Power	$408,900,000	341,800,000	332,700,000	337,250,000	806,150,000
Total	408,900,000	670,200,000	670,200,000	670,200,000	1,139,100,000

Under these tentative allocations, each project purpose would be charged no more than the capitalized value of its tangible benefits and less than the cost of its cheapest single-purpose alternative development.

Since the project units would be undertaken at different times, total allocations were distributed to the various units to facilitate payment studies during the construction period. Specific costs at each unit were first identified with the purpose served. Remaining joint costs of the total project were then distributed to the various units. Separate preliminary distributions of joint costs were made in proportion to the regulatory reservoir capacity and installed generating capacity, respectively, at each unit, except that in no instance was the distribution greater than the actual joint cost of the unit. The two distributions were then averaged for the adopted cost allocation by units which is shown in the following table. This distribution by units would not be further considered after completion of the project.

Distribution of allocated construction costs by project units

Unit	Total construction cost	Irrigation and other water-consuming uses	Power
Cross Mountain	$51,000,000	$24,400,000	$26,600,000
Crystal	37,900,000		37,900,000
Curecanti	80,400,000	41,090,000	39,310,000
Echo Park	165,400,000	71,550,000	93,850,000
Flaming Gorge	82,700,000	41,730,000	40,970,000
Glen Canyon	363,900,000	71,920,000	291,980,000
Gray Canyon	178,400,000	45,310,000	133,090,000
Navaho	63,000,000	28,270,000	34,730,000
Split Mountain	76,400,000		76,400,000
Whitewater	40,000,000	8,680,000	31,320,000
Total	1,139,100,000	332,950,000	806,150,000

Allocation of operation, maintenance, and replacement costs

Specific operation, maintenance, and replacement costs of $9,407,000 annually have been allocated to power. Joint costs have been allocated to irrigation and other water-consuming uses and to power in the same proportion as the construction costs. These allocations are shown in the following table.

Allocation of annual operation, maintenance, and replacement costs

Purpose	Specific costs	Joint costs	Total allocation
Irrigation and other water-consuming uses		$167,700	$167,700
Power	$9,407,000	157,400	9,564,400
Total	9,407,000	325,100	9,732,100

Operation, maintenance, and replacement costs have been distributed to units for payment studies over the construction periods on the same basis as the construction costs. These distributions are shown in the following table.

Distribution of allocated annual operation, maintenance, and replacement costs by project units

Unit	Total cost	Irrigation and other water-consuming uses	Power
Cross Mountain	$414,700	$24,600	$390,100
Crystal	325,500		325,500
Curecanti	378,100	10,900	359,200
Echo Park	1,199,200	31,900	1,167,300
Flaming Gorge	483,900	22,600	461,300
Glen Canyon	4,428,600	37,300	4,391,300
Gray Canyon	1,239,300	14,800	1,224,500
Navaho	251,000	12,300	238,700
Split Mountain	659,000		659,000
Whitewater	352,800	5,300	347,500
Total	9,732,100	167,700	9,564,400

REPAYMENT

As tentatively allocated, the entire construction cost is reimbursable. The irrigation allocation would be repayable without interest while the power allocation would be repayable on the basis of a 3 percent interest rate.

Both irrigation and power allocations would be repaid from power revenues of the storage project. The project would not directly receive revenues from irrigation or other water-consuming uses. Irrigation revenues available to participating projects would be insufficient to pay the irrigation allocations of these projects. The power revenues of the storage project would be sufficient to pay operation and maintenance costs of the entire project and retire all construction costs within 50 years after completion of the last project unit.

A detailed schedule of project repayment, based on an analysis of the annual project revenues over a 50-year period of full project operations, appears in the accompanying table.

UPPER COLORADO RIVER ACCOUNT

All scheduled power revenues from units of the Colorado River storage project and from participating projects located within the upper drainage basin, and all scheduled net power revenues derived from the central Utah project (initial phase) subsequent to complete reimbursement of the reimbursable costs of that project, would be credited to an account to be known as the upper Colorado River

COLORADO RIVER STORAGE PROJECT

POWER SYSTEM

FINANCIAL DYNAMETRIC STUDY FOR DETERMINATION OF AVERAGE RATE

AS REQUESTED BY SECRETARY FROM POWER REVENUES

November 30,1950

Year of Study	Fiscal Year	Firm	Firm in excess of prior years	Total (Col.2+3)	Operating Revenues: Sales of Electric Power: Firm (Col.2 x Rate)	Firm Excess (Col.3 x Rate)	Total (Col.5+6)	Other Revenues	Power Expenditures: Operation, Maintenance and Overhead (Schedule)	Provision for Replacements	Total (Col.9+10)	Net Operating Revenues (Col.7-Col.12)	Income Deductions: Repayment of Investment: Interest (2% of Col.)	Principal (Col.13-Col.14)	Investment Repayment from Power Revenues: Interest Bearing: Electric Plant	Balance to be Repaid	Interest Free: Irrigation Plant	Balance to be Repaid	Allowable Unpaid Balance: Electric Plant	Irrigation Plant	Upper Colorado River Account: Calculated Aggregate Project Charges: Power	Irrigation	Total	Total Calculated Aggregate Project Credits	Accumulated Net Credits	Year of Study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
0																										0
1	1951	255		255	3,472,500		3,472,500		163,600	352,800	516,400	2,956,100	939,600	119,100	31,320,000	31,320,000	8,680,000	8,680,000	31,320,000	8,680,000	110,100	173,600	283,700	1,049,700	766,000	1
2	1952	255	153	408	3,472,500	1,041,900	4,514,400		165,900	429,900	595,800	3,918,600	3,186,792	(851,992)	106,970,000	106,159,900	80,330,000	89,010,000	106,270,000	89,010,000	(741,100)	1,604,600	863,500	1,913,200	1,049,700	2
3	1953	1,674	537	2,211	22,791,750	3,656,700	26,448,450		1,336,200	1,336,200	2,672,400	23,776,050	9,240,717	(543,357)	333,010,000	331,733,236	152,150,000	147,328,800	330,950,000	152,150,000	1,059,236	3,013,000	4,072,236	5,985,436	2,913,200	3
4	1954	2,436	934	3,370	33,178,500	6,359,400	39,537,900		1,596,500	4,067,800	5,664,300	33,873,600	13,568,992	1,096,008	464,599,000	463,503,992	222,150,000	210,477,600	464,599,000	222,150,000	4,740,798	3,408,600	8,149,398	16,110,000	7,960,602	4
5	1955	3,164	1,214	4,378	43,113,000	8,268,200	51,381,200		1,937,500	4,997,000	6,934,500	44,446,700	16,309,000	1,625,822	611,150,000	609,033,632	222,150,000	206,216,400	611,150,000	222,150,000	6,435,822	4,443,000	10,878,822	19,745,900	8,867,078	5
6	1956	3,892	1,493	5,385	53,058,000	10,172,600	63,230,600		2,130,000	5,799,100	7,929,100	55,301,500	19,705,000	2,604,822	758,150,000	756,428,810	222,150,000	201,711,600	758,150,000	222,150,000	7,432,197	4,443,000	11,875,197	21,203,200	9,328,003	6
7	1957	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	7
8	1958	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	8
9	1959	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	9
10	1960	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	10
11	1961	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	11
12	1962	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	12
13	1963	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	13
14	1964	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	14
15	1965	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	15
16	1966	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	16
17	1967	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	17
18	1968	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	18
19	1969	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	19
20	1970	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	20
21	1971	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	21
22	1972	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	22
23	1973	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	23
24	1974	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	24
25	1975	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	25
26	1976	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	26
27	1977	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	27
28	1978	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	28
29	1979	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	29
30	1980	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	30
31	1981	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	31
32	1982	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	32
33	1983	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	33
34	1984	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	34
35	1985	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	35
36	1986	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	36
37	1987	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	37
38	1988	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	38
39	1989	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	39
40	1990	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	40
41	1991	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	41
42	1992	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	42
43	1993	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	43
44	1994	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	44
45	2003	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	45
46	2004	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	46
47	2005	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	47
48	2006	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	48
49	2007	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	49
50	2008	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	50
51	2009	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	51
52	2010	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	52
53	2011	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	53
54	2012	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	54
55	2013	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	55
56	2014	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	56
57	2015	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	57
58	2016	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	58
59	2017	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	59
60	2018	4,291	1,571	5,862	58,502,250	10,703,400	69,205,650		2,242,200	6,217,300	8,459,500	60,746,150	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	60
61	2019	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	61
62	2020	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	62
63	2021	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	63
64	2022	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	64
65	2023	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	65
66	2024	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	66
67	2025	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	67
68	2026	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	68
69	2027	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	69
70	2028	4,936		4,936	54,196,000		54,196,000		2,242,200	6,217,300	8,459,500	45,736,500	21,833,250	3,772,197	843,650,000	843,351,225	222,150,000	197,939,400	843,650,000	222,150,000	8,432,197	4,443,000	12,875,197	21,203,200	8,328,003	70
Totals		424,253	35,215	459,468	2,328,391,550	45,645,900	2,434,036,550	1,000,000	109,200	366,021,500	629,929,700	1,804,106,850	693,291,394	806,150,700	806,150,700	0	332,930,000	0	0	0	806,150,000	332,930,000	1,139,100,000	1,814,006,800	674,906,800	Totals

Operation, Maintenance and Overhead (Annual)

Reservoirs & Dams	212,800
Power Plants	2,272,600
Transmission System	2,054,300
Total	5,539,700

Annual Provision for Replacement

	169,200
	332,400
	191,400
	1,724,400
	134,200
	45,200
	24,454,400
Total	2,191,400

ALLOCATION OF COSTS

	Power	Irrigation	Total
Dams and Reservoirs	$337,350,700	$332,950,000	$670,300,700
Power Facilities	249,950,300		249,950,300
Transmission System	219,220,000		219,220,000
Total	$806,150,000	$332,950,000	$1,139,100,000

REPAYMENT SUMMARY (FIRST 70 YEARS)

Gross Revenue		$2,434,036,500
Operation, Maintenance and Overhead	$554,000,000	
Provision for Replacement	366,021,500	620,929,700
Net Project Revenue		1,814,006,800
Repayment of Project Construction Costs		
Power Investment	806,150,000	
Irrigation Investment	332,950,000	1,139,100,000
Net Credits Upper Colorado River Account		$674,906,800

Notes:

1. Column 4. The non-firm energy considered in this column represents that energy that is not salable as "firm" under the estimated load curve at time of production. This results from the planned installation of generating units in advance of market requirements.

2. Column 9. A continuing fund subject to expenditure by the Secretary to defray emergency expenses and to insure continuous operation of the project.

3. Column 16. Interest at 2% on power investment for determination of average firm energy rate.

4. Column 20. Each unit of power investment considered to be repaid within 50 years after that unit is placed in operation.

5. Column 21. Each item of investment considered to be repaid within 50 years after the investment is made.

account. The account would be charged with all scheduled payments on the construction, operation, maintenance, and replacement costs of the Colorado River storage project and participating projects located within the upper drainage basin which costs are allocated to power purposes or assigned to be returned from power revenues. The account would also be charged with scheduled payments on that portion of the construction cost of each participating project allocated to irrigation which is required to be so paid in order to show full reimbursement of the irrigation allocation within 50 years following a suitable development period for that project.

Under the plan sufficient charges would be made against the account to retire the total construction cost of the storage project. The power allocation would be retired within 50 years following installation of the last generating unit.

Credits to the upper Colorado River account from the revenues of the Colorado River storage project are expected to exceed charges against the account by the storage project in cumulative amounts shown below.

Net credit from Colorado River storage project

Year		Year	
10	$70, 600, 000	50	$382, 600, 000
20	196, 800, 000	60	454, 300, 000
30	310, 600, 000	70	674, 900, 000
40	374, 200, 000		

PARTICIPATING PROJECTS

Criteria, listed below, have been established for consideration in the selection of projects to participate in the upper Colorado River account. Under these criteria financial assistance would be given only to practicable irrigation projects. Assistance is required by nearly all potential projects in the upper basin since projects already constructed have utilized the least expensive sites and most convenient water supplies.

(*a*) A project, unit, or phase thereof may be eligible to participate only when and to the extent that all sources of estimated revenue directly available to said project, unit, or phase are insufficient to return its reimbursable costs during its payout period as hereafter specified in (*d*).

(*b*) It shall be a project for the use in one or more of the States designated in article III of the upper Colorado River Basin compact, of water of the upper Colorado River system, as that system is defined in such compact, the consumptive use of which is apportioned to those States by that article.

(*c*) Its total benefits shall exceed its total costs, including, but without limitation, any costs attributable to its direct use of the facilities of the Colorado River storage project or any other project, and an appropriate share of the costs of the Colorado River storage project.

(*d*) With anticipated revenues from irrigation, based on the irrigators' ability to pay, it shall be able to pay the operation, maintenance, and replacement costs allocated to irrigation and to pay in a period of 50 years following a suitable development period at least part of the construction costs allocated to irrigation.

(*e*) There shall be available to aid such participating project, or group of participating projects, an appropriate district, preferably of the water conservancy type, which shall be satisfactory to the Secretary of the Interior, one purpose of which shall be to provide revenues for the project over and above those paid by irrigators to assist in repayment of construction costs allocated to irrigation.

(*f*) It shall not require assistance from the upper Colorado River account in an amount, which, taking into consideration the prior obligations of the account and the anticipated revenues from its existing and authorized units, will leave the account in a deficit position at the end of the payout period for the participating project as specified in (*d*) above or will require an increase in the general level of Colorado River storage project power rates.

(*g*) Charges to the upper Colorado River account for the benefit of a project commingling water specified in (*b*) with other water shall not exceed an appropriate share of the construction cost of the works required by that project to use water specified in (*b*).

(*h*) Pertinent data sufficient to determine its probable engineering and economic justification and feasibility shall be available.

The criteria outlined are suggested for all participating projects, except the Eden project in Wyoming and the Paonia project in Colorado, which have previously been authorized. The act of June 18, 1949 (Public Law 132, 81st Cong., 1st sess.), which authorized the completion of the Eden project, provides: "That construction costs of the irrigation features of the project which are not hereby made reimbursable by the water users shall be set aside in a special account against which net revenues derived from the sale of power generated at the hydroelectric plants of the Colorado River storage project in the upper basin shall be charged when such plants are constructed." The Paonia project was authorized by the act of June 25, 1947 (Public Law 117, 80th Cong., 1st sess.). Enlargement of the Fire Mountain Canal is in progress under that act. After authorization it was determined that it would not be feasible to construct the Spring Creek Dam at the site described in the project report and that the cost would greatly exceed the estimate. A bill (H. R. 9244, 81st Cong., 2d sess.) to amend the authorizing act is now before Congress. The bill provides that the plan of development be revised and that net revenues derived from the sale of power generated at the hydroelectric plants of the Colorado River storage project be used to pay reimbursable construction costs that could not be paid by the water users within the repayment period of 68 years specified in the act of June 25, 1947.

Special consideration would be required for projects planned for irrigation of Indian lands. Such projects, however, would be evaluated by the same criteria as the non-Indian projects in order to determine the extent to which they would be assisted by the upper Colorado River account. Any additional assistance required by Indian irrigators would have to be provided by means other than the upper Colorado River account.

Water available to the upper basin is inadequate for all potential projects. Considerable study will be required of the many potentialities before a complete group of dependent projects may be chosen that have water requirements compatible with the apportionments.

of the respective States of the upper basin and that are in the best interests of the individual States and the Nation as a whole. Sufficient investigations have been completed, however, to permit selection of a few projects for initial construction and participation in the upper Colorado River account. Other participating projects will be selected on the completion of further investigations.

Several projects have been recommended cooperatively by the States of the upper Colorado River Basin for initial participation in the upper Colorado River account. Each of these projects is discussed in a supplemental report.

STATEMENTS AND PROGRAMS OF COOPERATING FEDERAL AGENCIES

GEOLOGICAL SURVEY

The Geological Survey is responsible for the collection and analysis of basic data concerning water resources, mineral resources, and general geologic conditions affecting dam and reservoir sites. It makes topographic maps of varying detail appropriate to the several planning purposes for which they are needed. It also classifies Federal lands as to their mineral, waterpower and water-storage values, and in cooperation with the Bureau of Land Management supervises the development of the resources of those public lands.

Although much information on water resources of the upper Colorado River Basin already has been collected, available records fall far short of presenting the complete understanding of water resources which will be needed for purposes of the storage plan outlined in this report, and for full utilization of the waters allocated to the respective States under the terms of the upper Colorado River Basin compact. Detailed geologic maps and data for the upper Colorado River Basin are inadequate, and in large areas they are entirely lacking. The topographic mapping essential for inventory of both water resources and mineral resources is likewise far from adequate. Only 11 percent of the basin is adequately mapped, and mapping is in progress in an additional 2 percent of the area.

For the purposes of this statement, the requirements for basic data are grouped as (1) data required for the Colorado River storage project and for participating and dependent projects; and (2) data required for general basin development.

Basic data requirements for the Colorado River storage project and for participating and dependent projects

The Colorado River storage project and its dependent projects require a great variety of basic data, some of which is within the special fields of research of the Geological Survey, and some within the provinces of other agencies of the Department of Interior, and of other Federal agencies. The basic data for which the Geological Survey is normally assigned responsibility are discussed in following paragraphs.

Operation of stream-gaging stations required by interstate compacts.—The terms of the Colorado River compact, the LaPlata River compact, and the upper Colorado River Basin compact require the operation and maintenance of nearly a hundred stream-gaging stations in the upper basin, of which 80 have been installed. Several of these have been in operation for 20 years or more, and have provided much of the basic data upon which the Colorado River storage project is founded. This is a continuing program, to be carried on throughout the construction and operation phases of the storage project. These

compact stations will provide for the collection of factual data at index inflow stations and at outflow stations in order to determine manmade depletions of the water supply for the upper basin as measured at Lee Ferry.

Other stream gaging.—Records of stream-flow are currently being obtained at more than 200 gaging stations in Federal-State cooperative programs. It is proposed that the number of these stations be increased to about 340. Some of these basic data are essential to the Colorado River storage project, but most are required for participating and dependent projects in which the individual States are vitally interested. Basic information secured at these stations will also be required for the determination of consumptive use of water by the different States in the upper basin, as provided in the percentage allotments and in the stipulation that the measurement of use will be by the inflow-outflow method.

Special erosion and sedimentation studies.—The Colorado River has always been outstanding in sediment transportation, and has been cited as a horrible example of land erosion and soil wastage by many writers. The sediment has been a vexing problem in the preparation of the storage project. A long-term average sediment load has been computed as 100,000 acre-feet where the river leaves the upper basin, and appropriate allowances for sediment deposition have been made at each proposed reservoir site. Refinements in basic data as to sediment transport can be expected on the basis of records collected or proposed at numerous compact gaging stations.

But such records give no assurance that the rates of erosion and of sedimentation will not increase over the years, nor do we know that we can do nothing about reducing those rates. Far more research is needed before reliable predictions can be made as to sedimentation in the future, and before evaluation can be made of proposed preventive measures. The upper basin provides many excellent field laboratories for such research, and studies are proposed especially in the San Rafael River Basin, and perhaps in several minor drainage basins. Detailed geologic and hydrologic data are fundamental to any study of erosion and sedimentation. A complete analysis of the problem will involve study also of meteorological aspects, as well as soils and vegetative cover—that is, coordination of effort among the Geological Survey, the Weather Bureau, and agencies of the Department of Agriculture.

Special water-loss studies.—Increased evaporation resulting from manmade reservoirs is recognized by the upper basin States as consumptive use chargeable against the basin's water apportionment. Thus the chargeable losses are less than the actual evaporation from a reservoir, for they are reduced by the amount of natural loss from the stream prior to reservoir construction. In the case of Glen Canyon, it has been estimated that evaporation losses would average about 63 inches annually, of which 54 inches would be chargeable to the basin. These estimates are based on very meager data as to evaporation from free water surfaces, and transfers of data from remote areas in the case of natural losses from the stream. Detailed investigations have not been made of evaporation from streams in the basin under varying conditions of turbulence, or of evapo-transpiration from riparian vegetation or from flood plains bordering the streams.

The proposed hydrologic study of Browns Park, Colo., is pertinent because it covers an extensive area of phreatophytes that will be inundated by Echo Park Reservoir. It is also a problem area, for there are losses in the flood flows of the Green River between Linwood and Jensen, Utah, which are not yet understood.

The Browns Park area appears to be one of the best in the upper basin for developing the techniques required for the inflow-outflow method of measuring stream depletions, and for making quantitative determinations of losses by evapo-transpiration and gains by ground-water inflow. The Green River and Vermillion Creek enter Browns Park via canyons where the inflow can be determined with reasonable accuracy, and the total outflow can be determined near the Gate of Lodore. Complete hydrologic mapping of Browns Park will probably yield definitive information on all hydrologic factors, which may prove useful in analyzing other areas where the individual factors cannot be segregated.

Unexplained losses of water have been reported also in the San Juan River Basin. The proposed study in the vicinity of the Navaho Reservoir is for the purpose of evaluating this loss, and determining the quantities that are lost by evaporation and transpiration.

Five reservoirs in the Green River Basin, Wyo., Utah, and Colo.—The purpose of the topographic and geologic mapping in the vicinities of the proposed reservoirs is to provide data essential to the construction and subsequent operation of the reservoirs, and to the development of resources in the vicinity. These maps would contain data pertinent to construction of roads and other facilities, and would show such features as landslides, faults, thickness, and distribution of surficial deposits, sources of construction materials, and weathering, strength, and other physical characteristics of rock formations. Most of these areas are now covered only by reconnaissance topographic and geologic maps at small scales which are unsuited to present needs. Topographic mapping of 735 square miles is in progress in the Echo Park and Flaming Gorge Reservoir areas.

The proposed ground-water studies are concerned principally with the Madison limestone and to a lesser extent the overlying Morgan formation. The Madison is cavernous in many places and gives rise to large springs in the Uinta Range. Both formations crop out in the reservoir sites of the Echo Park unit and Split Mountain unit, and warm springs rise from the Madison in the floor of Split Mountain Canyon of the Green River. In view of its generally high permeability, thorough investigation should be made of the formation throughout a broad region, in order to determine whether there is possibility of significant losses from either reservoir by seepage.

Glen Canyon Reservoir and vicinity, Arizona and Utah.—Topographic mapping of more than 2,600 square miles has a high priority for the Glen Canyon project. Geologic mapping of a slightly smaller area along the Colorado and San Juan Rivers is proposed. The rocks cropping out in the reservoir area are predominantly sandstones, as shown by geologic reconnaissance. It is known that structural basins lie northwest of the reservoir site under the Kaiparowitz Plateau and also under the Henry Mountains. Ground-water studies are proposed for the purpose of determining the position of the regional water table. There is also the question whether the Kaiparowitz and Henry Mountains structural basins contain significant amounts of unsatur-

ated strata in positions where they might draw water from the Glen Canyon Reservoir.

Several wells drilled in the region for oil indicate that the regional water table is at great depth below the plateaus. In the Mexican Hat field along the San Juan River, small quantities of oil were encountered in a synclinal structure, an exceptional occurrence which has been explained as due to the lack of ground water in the area. Ground-water studies are proposed for the purpose of determining the position of the regional water table. There is also the question whether the Kaiparowitz and Henry Mountains structural basins contain significant amount of unsaturated strata in positions where they might draw water from the Glen Canyon Reservoir. Drilling tests at the proposed dam site indicate that the sandstones are relatively impermeable. This impermeability would insure that seepage from the reservoir must be slow, but the question remains as to what losses might be expected during a century or more of reservoir operation. An annual loss of 100,000 acre-feet could be inconsequential in the first year of operation, but might become significant as the Colorado River waters become fully appropriated.

The Glen Canyon Reservoir will extend upstream into Cataract Canyon, where gypsum and salt of the Paradox formation crop out near river level in several places. The possible effect of these rocks upon the quality of water in the reservoir should be investigated. The situation may be parallel to that at Lake Mead, where soluble rocks in the reservoir area (particularly in Las Vegas Wash) are being progressively dissolved as the reservoir alternately inundates and exposes them. The content of dissolved solids in water flowing out of Lake Mead is appreciably greater than in the entering water.

Navaho Reservoir and vicinity, New Mexico.—This includes an area of the San Juan River Basin that is largely unmapped. Topographic and geologic mapping of an area of about 600 square miles is proposed. A major part of the topographic mapping is already underway. Groundwater studies are proposed in the area downstream from this reservoir, including the areas near Farmington where the water is used for irrigation.

Reservoirs in the Gunnison River Basin, Colo.—Topographic and geologic mapping of an area of about 1,100 square miles is proposed. A major part of the topographic mapping is underway. This would include the areas of the Whitewater, Crystal, and Curecanti units. Ground-water studies are proposed in the Delta-Montrose area and in other small areas in the basin where there appear to be possibilities of ground-water development.

Ground water in the Uinta Basin.—The Uinta Basin is believed to be the most important ground-water area in the upper Colorado River Basin. It is the principal area of ground-water inflow to the main-stem canyons in Utah, and is probably the largest contributor of ground water in the entire basin. It is also an area of large evapotranspiration losses. The water so lost obviously does not contribute to the flow of the river at Lee Ferry; any beneficial use that can be made of it is therefore not chargeable against the State's quota of upper basin water supplies.

Studies are needed to determine the quantity stored in the groundwater reservoir of the Uinta Basin, the sources and amounts of annual replenishment, and the quantity and quality of water dis-

charged from that reservoir. These studies are not directly related to the storage project, but are important in the development and utilization of water in an area which will be dependent in part upon that storage.

Classification of Federal lands for water development.—The Geological Survey is responsible for classification of Federal lands as to their water-storage and water-power values. These values are dependent in part upon the upper basin's ability to furnish water to the lower basin as required by compact, and dependent therefore upon the Colorado River storage project. Many of the streams in the basin are not adequately mapped, and geological investigations of possible dam sites must precede any classification as to their water-power or water-storage value. The topographic maps resulting from this program will be used in the classification of the public lands for power or reservoir purposes. Topographic surveys along the rivers only will be made in areas not covered by the quadrangle mapping.

Additional geologic mapping.—As a result of the gathering of general geologic data, studies will be made of areas which may contain valuable mineral resources including metals, nonmetals and fuels (both solid and liquid). These studies may be needed in some places to determine that valuable mineral resources are not made inaccessible by flooding and to plan water and hydroelectric developments so that water and power will be available where needed for the mineral industries.

As these studies cannot be planned in advance of the general geologic mapping program additional funds will be needed to support them as the general program develops, and the need becomes apparent.

Many other activities listed in the following table are also part of a continuing program, which will extend beyond the 3-year period indicated in the following tabulation.

Estimated cost of basic-data program of Geological Survey—Colorado River storage project and dependent projects

Program	1st year	2d year	3d year
Operation of compact gaging stations:			
Installation of 16 new stations	$56,000		
Rehabilitation of existing stations	45,000	$20,000	
Operation of 96 gaging stations	80,000	87,000	$86,000
Analysis of dissolved and suspended load	63,000	63,000	63,000
Other stream gaging:			
Installation of 125 new stations	188,000	125,000	
Operation of about 340 stations	240,000	270,000	270,000
Special erosion and sedimentation studies:			
Topographic mapping 1,600 square miles	120,000	160,000	110,000
General geologic mapping	20,000	57,000	82,000
Hydrologic studies	20,000	12,000	12,000
Sediment gaging	35,000	27,000	27,000
Dissolved-load analysis	6,000	6,000	6,000
Special water-loss studies:			
Browns Park	50,000	40,000	40,000
Shiprock and/or Glen Canyon	50,000	40,000	40,000
5 reservoirs in the Green River Basin:			
Topographic mapping 2,200 square miles (700 square miles at Echo Park in progress)	165,000	210,000	150,000
Geologic mapping 2,200 square miles	34,000	76,000	82,000
Ground-water hydrology of about 1,300 square miles	6,000	14,000	18,000
Glen Canyon Reservoir and vicinity:			
Topographic mapping 2,600 square miles	195,000	250,000	180,000
Geologic mapping 1,700 square miles	41,000	84,000	89,000
Ground-water hydrology	10,000	30,000	20,000
Water quality in Cataract Canyon	5,000	5,000	5,000

Estimated cost of basic-data program of Geological Survey—Colorado River storage project and dependent projects—Continued

Program	1st year	2d year	3d year
Navaho Reservoir and vicinity:			
Topographic mapping 600 square miles	$45,000	$55,000	$40,000
Geologic mapping 600 square miles	23,000	38,000	42,000
Ground-water hydrology	10,000	15,000	15,000
Reservoirs in Gunnison River Basin:			
Topographic mapping 1,100 square miles (470 square miles in progress)	80,000	105,000	75,000
Geologic mapping 1,100 square miles	31,000	55,000	62,000
Ground-water hydrology	10,000	15,000	10,000
Ground water in Uinta Basin:			
Topographic mapping	150,000	190,000	140,000
Ground-water studies	25,000	15,000	15,000
Classification of Federal lands:			
Tributary river surveys	100,000	300,000	300,000
Geologic investigations		100,000	100,000

Basic-data requirements for general basin development

The upper Colorado River Basin is rich in natural resources whose development is not necessarily an integral part of the Colorado River storage project, although unquestionably the developments are likely to be related. Mineral-resource development may be contingent upon the water or hydroelectric power made available by the storage project. Conversely the Nation's need for certain minerals (especially those of strategic and critical importance) may be so urgent as to give marked impetus to the completion of certain phases of the Colorado River storage project.

With respect to topographic mapping, the need for early completion of mapping of the entire Nation is generally recognized and has been approved in principle by the Nation's leaders. It has been proposed that the national topographic mapping program be expedited and brought to completion within 20 years. If the national program is so expedited by appropriations sufficient to provide the necessary facilities, the mapping of the entire basin of the upper Colorado would be completed within that time.

Under the national program for geologic mapping, most if not all of the upper Colorado River Basin will be mapped within 30 years. The mineral resources of the region include especially the mineral fuels (coal, petroleum, natural gas, and oil shale), base metals (copper, lead, and zinc), ferroalloys (tungsten, molybdenum, vanadium, manganese) and uranium, plus several other metallic and nonmetallic minerals. In the national program priority is given to the areas most promising for the development of these resources.

Most of the water resources of the basin are intimately related to the Colorado River storage project. However, large areas are remote from the major streams and from the water facilities that will result from the storage project. In some of these areas ground water may be available for development. Very few important aquifers are known in the upper basin, and there are few wells of moderate to large yield. However, there is practically no detailed information as to the occurrence of ground water throughout the basin. A program of progressive appraisal of all ground water resources is an essential part of the general basic-data program for the upper Colorado River

Basin. The program should include investigations of sites for stock wells on public lands, in order to extend grazing into areas that are not now accessible to stock.

Estimated cost of general basic-data program of the Geological Survey in the Colorado River Basin

Program	1st year	2d year	3d year
Topographic mapping	[1] $1,500,000	[1] $1,750,000	[1] $1,750,000
Mineral deposits	[1] 258,000	[1] 405,000	[1] 628,000
Fuels	[1] 432,000	[1] 1,285,000	[1] 1,583,000
Ground water	[2] 75,000	[2] 75,000	[2] 75,000
Classification of Federal lands	50,000	100,000	100,000
Supervision of mineral recovery on Federal lands	[3]	[3]	[3]

[1] Part of comprehensive national program. Also these figures are for the entire basin.
[2] Upper Colorado River Basin only.
[3] Dependent on private activity; income from leases is far greater than the cost of supervisory program.

National Park Service

The functions of the National Park Service are an integral part of a program of land use of the Department of the Interior. The primary function of the Service is the administration of the national park and monument system. The Service seeks to preserve and render available to the public outstanding scenic, scientific, historic, and prehistoric areas of national importance. The Park, Parkway, and Recreational Area Study Act of June 23, 1936, authorized and directed the Secretary of the Interior—

> to cause the National Park Service to make a comprehensive study, other than on lands under the jurisdiction of the Department of Agriculture, of the public park, parkway, and recreational area programs of the United States, and of the several States and political subdivisions thereof, and of the lands throughout the United States which are or may be chiefly valuable as such areas * * *. The said study shall be such as, in the judgment of the Secretary, will provide data helpful in developing a plan for coordinated and adequate public park, parkway, and recreational area facilities for people of the United States.

With this responsibility and the fact that several areas of the national park and monument system would be directly affected by certain water-control possibilities being considered by the Bureau of Reclamation, it was determined that the National Park Service should investigate and furnish the Bureau with essential facts basic to the establishment of departmental policy regarding the classification, development, and administration of possible water-control projects and related areas in the basin, in which recreation is or will become an important dominant or collateral resource. On January 27, 1941, Secretary Ickes approved the proposal of the National Park Service and the Bureau for including a basinwide recreational survey as part of the studies and investigations for the formulation of a comprehensive plan of utilization of waters of the entire Colorado River system.

The importance of recreational resources in the basin being recognized by the Bureau of Reclamation in planning for water-conservation projects, the National Park Service, through a cooperative agreement with that agency, carried on a general survey of the recreational resources of the Colorado River Basin for the Bureau. The results of these investigations have now been published by the National Park Service in A Survey of the Recreational Resources of the Colorado River Basin.[1]

Subsequent to the above general survey, cooperation between the National Park Service and the Bureau has continued under a program of river basin studies financed by funds transferred by the Bureau and later by funds appropriated by the Congress for the purpose. Under the program it has been possible to make additional recreational studies of many of the water-conservation projects being actively considered by the Bureau for development. This has included many important units in the Upper Colorado River Basin. Some of these

[1] United States Government Printing Office, Washington 1950. For sale by the Superintendent of Documents, Washington, D. C. Price $3.25.

units have now been authorized, and it is anticipated that National Park Service cooperation will include planning of recreational developments to the extent deemed appropriate in each case. Continuation of this interbureau cooperation in the field of recreational resources and their development is now covered by a memorandum of agreement between the Bureau of Reclamation and the National Park Service approved by the Secretary of the Interior on July 28, 1950.

Departmental policy is to retain control over and, through the National Park Service, develop and manage the recreational resources of those reservoirs of Bureau of Reclamation projects with recreational potentials of such magnitude that they are determined to be of national interest; and through agreements on long-term lease or by outright transfer of title to lands, provide for the management, by State or other appropriate local agencies, of the recreational resources on reservoirs of less than national importance following initial development with Federal funds. There is need for appropriate legislation to effectuate this policy, as well as authorization to allocate to recreational benefits a portion of the costs of water-controlled projects. Legislation is also needed to authorize acquisition of lands essential to the recreational development and use of the resources in addition to lands acquired for the primary purposes of the project.

Where reservoirs are within or adjacent to national forests, an agreement has been effected whereby the subsequent administration, operation and maintenance of recreational developments will be assumed by the United States Forest Service as part of the National Forest recreational program.

It is a function of the National Park Service, to the extent of available resources, to conduct surveys and salvage of archeological remains endangered by water conservation projects. Cooperation of the Smithsonian Institution and State universities and other local organizations is also enlisted. As yet, comparatively little work of this nature has been done in the upper Colorado River Basin.

Appropriations available to the National Park Service have been insufficient for the Service's functions in water resources development to keep pace with the progress of primary agency investigations, planning and development.

Basic data relating to recreational needs generally would be of great value in appraising recreational benefits and preparing well-considered, coordinated development programs for water-control projects. The preparation of reports by the National Park Service under the authority of the Park, Parkway, and Recreational Area Study Act terminated shortly before World War II and the reports prepared prior to that time are now largely out-of-date.

Evaluation of recreational benefits of reservoirs

Under the terms of the interbureau agreement approved July 28, 1950, it is the responsibility of the National Park Service to prepare for the Bureau monetary evaluations of potential recreational benefits. These monetary benefits may be used by the Bureau in computing the share of the joint costs of reservoir projects allocable to recreation and in justifying Bureau of Reclamation requests for funds for both specific and joint costs allocable to recreation, when such procedure shall be authorized.

The evaluations are based on analysis of all factors involved in the suitability of an area for recreational uses, type and probable

extent of use, and developments and facilities which will be appropriate and adequate to accommodate such use. Basically, and provided no loss or destruction of existing recreational values is involved, it is held that benefits arising specifically from development of recreational facilities will be equivalent to total annual costs, capitalized over the anticipated useful life of the project. Similarly it is estimated that additional benefits accruing from joint use of a reservoir, for recreational purposes, will be equal to those arising from the development of facilities. The sum of these figures represents the total estimated monetary recreational benefits.

This amount, then, represents the judgment of the National Park Service as to a reasonable and conservative valuation of the recreational benefits accruing to the public as a result of a reservoir. It is necessarily conjectural, as the appraisal deals with many intangibles that are difficult to evaluate and involves an attempt to foresee conditions that may or may not materialize.

Upper Colorado River Basin water utilization program and its effect on recreation

The report, A Survey of the Recreational Resources of the Colorado River Basin, emphasizes the magnitude of outstanding scenic, scientific and other geographic and historical features of the basin.

From Gannet Peak in the Wind River Mountains, highest point in Wyoming, elevation 13,785 feet above sea level, Milner Pass in Rocky Mountain National Park, and the 14,000-foot mountain peaks in southwest Colorado to the 3,100-foot elevation of the river at Lee Ferry, marking the lower end of the upper basin, lies a great region of forests, deserts, plains, mountains, canyons, and plateaus. In common with the whole basin, the upper Colorado Basin is one of the most outstanding recreational sections of the United States, because of great variety of natural scenery, climatic conditions, and areas and objects of scientific interest, its early romantic history, archeological background, and present Indian and Anglo cultures.

In this nationally significant recreational region the entire gamut of outdoor recreational activities may be enjoyed, including hunting, fishing, photography, nature study, snow sports, boating, swimming, horseback riding, camping, mountain climbing, and exploration. Two national parks, in whole or in part, and nine national monuments have been established within the basin to preserve some of the most outstanding natural, scientific, and cultural features. Large sections have been included in national forests, wildlife refuges, wilderness areas, grazing districts, and to some extent, Indian reservations. Much of the basin is in public ownership, a natural corollary of a small and thinly scattered population.

It is only natural in a region so endowed that recreation should become one of the major industries. Agriculture is restricted largely to irrigated sections. Mining, lumbering, and the raising of cattle and sheep first attracted settlers to the basin, but the recreational features are now attracting many more; and as the various sections of the basin become better known and more accessible to the densely populated regions of the United States through improved highways and air transportation, catering to the recreational business should become a major industry. To foster this industry, it must be recognized that recreational use of land may in certain places be the highest

or best use for the general welfare of the people in the basin, and in great sections of the basin should be on an equal basis with other uses, such as grazing or production of timber. One of the most important recreational aspects of the basin is the great stretches of open range, unobstructed by buildings, fences, transmission lines, and other signs of modern civilization. As other sections of the United States become more and more highly developed, this one feature of the Colorado River country, if preserved, will have unusual appeal. Such preservation, at least in large measure, should not be difficult in the vast and wild region traversed by the Colorado River in the lower reaches of the upper basin. Here in dramatic contrast to the great forested mountain ranges along the Continental Divide where headwaters of the Colorado and the Green rise is desert and semiarid country slashed by deep and colorful gorges and canyons.

In the development of water resources which are so vital to the basin, recreational use should be considered along with other uses, such as irrigation, power, municipal and industrial water supply. In the mountains and high plateau sections of the basin the clear, cold streams and lakes offer excellent fishing amid delightful surroundings. In some instances the recreational value of these streams and lakes may be such as to make this their most important use. The Green River Lakes, New Fork, Willow, Fremont, Half Moon and Burnt Lakes, within Bridger National Forest, along the slopes of the Wind River Range are natural lakes which are held to be unmistakably in this category. On the other hand, the original scenic values of Boulder Lake in the same area have been impaired by developments and would not be seriously affected by further utilization. The western slopes of the range in which these lakes are located include a mountain area of such exceptional scenic quality and recreational value as to be clearly of national importance.

In other sections, the creation of reservoirs for irrigation, important holdover functions for compact obligations, or power will frequently create new water areas of recreational importance. There are instances where the raising of water in impoundments would submerge natural areas of recreational, scenic, and scientific value or archeological importance. In such cases, it must be decided whether a reservoir in the location justifies the sacrifice of these existing values.

In cases where important archeological features would be inundated by the reservoirs, there should be a thorough survey and excavation for recovery of artifacts and data, so that knowledge of the archeological material will not be lost forever. In the larger reservoir areas, surveys should also be made of flora and fauna and records kept of the original biota.

In varying degrees the recreational potentialities of many of the proposed Upper Colorado River Basin reservoirs have been studied by the National Park Service. These include, notably, the units included in the Colorado River storage project and reservoir units of the proposed participating projects. Some reservoirs outside this group have also been surveyed and initial reports prepared on the findings for the Bureau. As project plans are further developed and construction is authorized, more comprehensive and detailed studies will be required in order to assure properly coordinated recreational developments that are commensurate with established needs, and in the general public interest.

As other projects in the basin are brought into the picture, additional investigations will be necessary. In this category are many possible units under various degrees of consideration in the Yampa, Upper Colorado, Gunnison, Dolores, San Juan, and other tributary drainages. Some of these will involve diversion of water from the Colorado Basin.

The adverse effects certain reservoir units of the Colorado River storage project would have on areas of the National Park System has been a matter of the gravest concern to the Service. The Glen Canyon Reservoir could impair the scenic value and even the stability of the Rainbow Bridge, the largest and most beautiful of all known natural bridges. However, it appears that measures to protect this national monument could and would be included as appropriate features of project development.

The Curecanti and Crystal Reservoir units of the project would regulate river flows through the Black Canyon of the Gunnison National Monument. While such river regulation involves changes in natural conditions that are held to be very undesirable, nevertheless it is recognized that the effects of flow regulation would not be sufficiently adverse to override the economic advantage to be gained thereby in the public interest.

Of the greatest concern to the National Park Service has been the inclusion in project plans of two reservoirs on the Green and Yampa Rivers within Dinosaur National Monument, where nationally significant scenic, scientific and other recreational values would be irreparably damaged or lost altogether by dam construction, related works and by inundation. However, after carefully weighing all factors and values involved, it has been determined by the Secretary of the Interior that the conservation and multiple use of these waters is more in the interest of the people of the West and of the whole Nation than the preservation of existing values.

The foregoing problems are more fully covered in the National Park Service reconnaissance report dated November 1950 on the recreational values of the Colorado River storage project. The purpose of that report was to consider, in only a very broad and preliminary manner, possible recreational aspects of the project reservoirs, with due regard to existing conservation and recreational values. The scope of the report, based on the limited reservoir data and operational information currently available, in most cases, does not permit of analysis of economic factors involved, including consideration of possible recreational benefits or values on a monetary basis. It is contemplated that more detailed studies on certain of the project reservoirs and others similarly involved in the Upper Colorado River Basin water utilization and control plan will follow, in line with schedules of studies and developments.

In the event that any of the project reservoirs are to be created, the report recommends that arrangements be made for adequate archeological surveys, and, so far as judged necessary, for excavations and salvage of scientific artifacts and information.

It further recommends:

That the recreational resources inherent in the reservoirs receive consideration commensurate with their importance during all stages of project planning and development.

Land-acquisition programs receive careful consideration where areas suitable and necessary for recreational uses and development are involved, whether by purchase or by arrangements with Federal agencies where applicable.

Arrangements be made to assure, in each case, adequate administration, operation, and maintenance of recreational developments by some qualified agency prior to final planning and provision of developments with Federal funds.

Excerpts from the report concerning the 10 reservoir units of the Colorado River storage project are given in the following sections.

GLEN CANYON RESERVOIR

The site now under consideration for the Glen Canyon Dam is located near river mile 15 (i. e., above Lees Ferry, Ariz.) in the Glen Canyon section of the main Colorado River. According to information furnished by the sponsor, it would be possible to construct a dam at this site to impound 34 million acre-feet of water which would correspond to a maximum surface elevation of 3,750 feet mean sea level. While the desired capacity has not been determined, physical data for a tentative capacity of 26 million acre-feet have been furnished by the sponsor for use pending the completion of the present studies. These are given below:

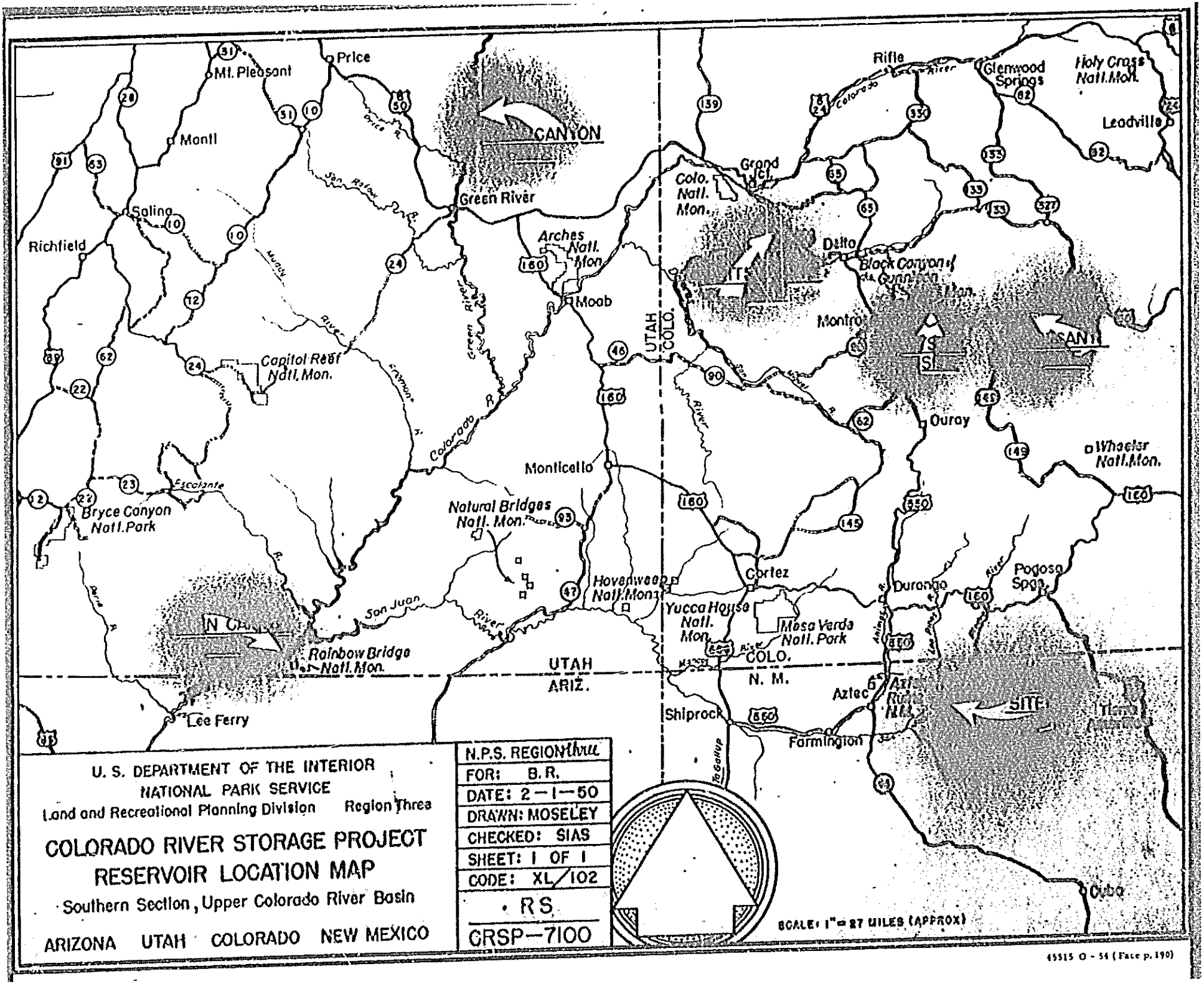
Planned capacity	26,000,000 acre-feet.
Corresponding dead-storage capacity	6,000,000 acre-feet.
Maximum water surface elevation	3,710.
Minimum water surface elevation	3,510.
Maximum reservoir area	153,000 acres.
Minimum reservoir area	56,000 acres.
Maximum reservoir length	186 miles to river mile 201.
Minimum reservoir length (approximately)	168 miles to river mile 183.
Present river elevation	3,135 feet.
Dam height	580 feet above present river.

The Glen Canyon Reservoir would offer the last opportunity for control of upper basin residual water flows for meeting compact deliveries to the lower basin at Lee Ferry. Provision for power production would be made. Regarding operation of the reservoir, the following information has been furnished:

> Probable operation would pattern other main-stem reservoirs. During normal or above normal years of runoff, the reservoir drawdown would be less than 30 feet with storage used only for seasonal regulation of power releases. Extensive drawdown would result only during a protracted dry cycle with maximum drawdown the result of a cycle as severe as the 1931–40 period. The reservoir would be refilled by storing the surplus flows of subsequent high years.

Description of the site

The narrow, vertical-walled, red sandstone gorge of the Colorado River at the 15-mile dam site is approximately 700 feet deep. Through a great deal of its length the reservoir will be similarly restricted with occasional extensive basins such as will occur at the State line where Wahweep and Warm Creek Canyons empty into the Colorado—the former a mile and a half above the dam site and the latter at the State line. Similar basin enlargements would occur shortly above the State line at the confluences of Cottonwood Canyon on the north and West Canyon Creek on the south. Between these creeks lies the historic Crossing of the Fathers area, which would be entirely inun-



U. S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Land and Recreational Planning Division Region Three

COLORADO RIVER STORAGE PROJECT
RESERVOIR LOCATION MAP

Southern Section, Upper Colorado River Basin

ARIZONA UTAH COLORADO NEW MEXICO

N.P.S. REGION	Three
FOR:	B. R.
DATE:	2-1-50
DRAWN:	MOSELEY
CHECKED:	SIAS
SHEET:	1 OF 1
CODE:	XL/102
	RS
	CRSP-7100

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dated. A little more than 40 miles above the confluence with the San Juan River, where Bullfrog and Hall Creeks flow into the canyon from the north, another important reservoir enlargement would occur. More often, however, canyons and side draws drain into the river on comparatively steep gradients, and reservoir extensions into the draws would, for the most part, be limited. At elevation 3,710 the reservoir would apparently extend up the San Juan River 70 miles or more. The upper reaches of the reservoir would lie in the restricted confines of Cataract Canyon of the Colorado, nearly 20 miles above the mouth of Dark Canyon.

Glen Canyon Reservoir area lies in the heart of the so-called Escalanta country, or canyon lands, of southeast Utah, one of the most rugged, roadless, and inaccessible regions of the United States. In the National Park Service survey of the recreational resources of the Colorado River Basin, this part of the basin is described as a—

> wild and fantastically eroded land of winding gorges and sandstone mesas whose vast expanses are punctuated at irregular intervals by the isolated, steeply upthrust masses of the Henry, Abajo, and Navaho Mountains. With the exception of the mountain summits, which are cool and moist, the greater portion of the area receives but little snowfall in winter and is characterized by a long, warm summer season. Average temperatures are higher than those of valleys to the north, in conformity with the decrease in latitude, but lower than those of deserts to the south. The annual precipitation ranges from about 6 to 14 inches with the greatest amount coming from thunderstorms during July and August. Into this desolate but spectacularly scenic sandstone area, through a deep, meandering gorge, flows the turbid San Juan River from the east, draining a far-reaching area, including La Plata Mountains, the San Juan Mountains, and other lesser ranges on the Continental Divide, the Chuska Mountains, and enormous areas of mesaland in the interior of the basin. From the Wasatch and Aquarius Plateaus on the west come other but lesser, silt-laden streams, all carving the deep, winding canyons which have given this country its name.

Owing to very difficult access, and the extremely limited local population, probably numbering a hundred or less all told in the area, present recreational use must be negligible, although the Fish and Wildlife Service reports that there are some catfish and Colorado whitefish. The most notable recreational use of the area probably consists of the occasional floats or boat trips which are made down the river, notably down the San Juan and Colorado to Lees Ferry and sometimes beyond, even through the Grand Canyon to Lake Mead.

There is ample evidence that the reservoir area is rich in archeological material, as yet very incompletely surveyed. A reconnaissance of archeological sites in the Colorado River canyons between the Fremont River and Lees Ferry was made by boat in 1932. This covered in large part the main reaches of the river that would be flooded by the Glen Canyon Reservoir. The survey was made by Dr. Julian Steward, then of the University of Utah (later staff member, Bureau of American Ethnology, Smithsonian Institution, and presently on the faculty of Columbia University). Some 27 sites were located on the sides of the main canyon. It is probable that many other sites occur in side canyons often, however, above reaches that will be inundated by the reservoir. No known archeological remains presently within a National Park Service area are involved.

No study of historical values associated with this reservoir area has been made in connection with the report but what is probably the most interesting feature in this respect, namely, the Crossing of the Fathers, has been mentioned.

Effect of Glen Canyon Reservoir on National Park Service areas

1. *Rainbow Bridge National Monument.*—This choice, unique and highly significant national monument is located in Rainbow Bridge Canyon shortly above its confluence with Aztec Creek which in turn drains into the Colorado River a little above river mile 68, or approximately 53 river miles above the dam. It comprises 1 quarter section or 160 acres. From United States Geodetic Survey topographic maps, it is estimated that the Rainbow Bridge National Monument is approximately 4 canyon miles from the main river. Grade surveys made by the Bureau of Reclamation indicate a canyon elevation of approximately 3,570 at the west monument boundary and that the bottom of the canyon under the bridge is at elevation 3,654.10.

The maximum water elevation now proposed would, at the site of the bridge, rise approximately 56 feet within the restricted channel, would not overflow the channel and would be more than 11 feet below the lower of the two abutments.

Frequency data have not been provided. There is, therefore, no indication as to how often the contemplated maximum elevation would be reached or how long retained. Both factors have a direct bearing on the effects of the proposed reservoir on the bridge.

Water backing up Rainbow Bridge Creek under the Rainbow Bridge would leave unsightly deposits of flotsam, as well as staining the walls of the gorge. However, by far the most serious effect of floodwaters reaching the bottom of the watercourse beneath the span would be the danger of undermining the buttresses of the bridge itself. Standing water would dissolve cementing materials in the rock causing the sides of the water to slough off, thus rapidly narrowing the supports beneath the ends of the bridge. It is conceivable that with water backing up no farther than to cause standing water in the watercourse beneath the bridge, softening and sloughing of the banks of the watercourse could be, in a relatively few years, sufficient to cause the weakening of the ledges beneath the ends of the bridge and the collapse of the bridge itself.

The Rainbow Bridge is considered by some to be the world's greatest known natural bridge. Certainly it is an outstanding and world famous natural feature, with the protection and preservation of which the National Park Service is entrusted. It is held that no potential recreational values which could otherwise be determined to be inherent in the reservoir could compensate for the loss of this irreplaceable natural feature to the public for all time to come. The National Park Service would be opposed to the Glen Canyon Reservoir on any basis or plan of operation which threatened the stability or natural scenic value of this national monument.

Analysis of the conditions attending the relation of Rainbow Bridge National Monument to the proposed Glen Canyon Reservoir, so far as they can at this time be determined, indicates that some modification of the reservoir and its operational plan might be possible, to an extent which would eliminate dangers of any adverse effect on the monument without jeopardizing unduly the value of the reservoir for primary purposes. A reduction in maximum water level from the proposed 3,710 feet to 3,650 would accomplish this end.

The National Park Service is not, of course, in a position to express a valid opinion as to how seriously such a change in plan would curtail

the value of the reservoir for primary purposes. It is, nevertheless, recalled that at one time a tentative spillway level at 3,528 feet was considered in connection with the alternate 4-mile site shortly above Lees Ferry. It is broadly estimated from area capacity curves furnished by the sponsor that lowering the maximum surface 60 feet would mean a sacrifice of storage capacity of between 8 and 9 million acre-feet. To what extent compensating increases in storage in other reservoirs above Glen Canyon could be accommodated has not as yet, apparently, been determined. These are possibilities which should be fully explored in advancing studies for the Colorado River storage project.

Another method of protecting monument values is under active consideration. This would involve a cutoff dam in the canyon below the monument, which, with appurtenant works, including a bypass pumping plant, would protect the monument with completely negligible loss of Glen Canyon Reservoir storage capacity.

The sponsor has given assurance that adequate protective measures will be included in plans for project development.

2. *Grand Canyon National Park and National Monument.*—This outstanding national park (with the monument) has been mentioned as an area which could be affected by a reservoir above a Glen Canyon Dam. To the extent this would be true would involve almost any plan of reservoir operation. The tributary San Juan River is a heavy silt bearer, and the creation of a river barrier below the mouth of that river would materially reduce the silt content of the Colorado River through the Grand Canyon. Scientifically, this is an important element in the overall Grand Canyon National Park picture. However, since there are considerable contributions to Colorado River silt below the San Juan, changes in the appearance of the river could, possibly, be comparatively slight.

Conceivably of greater significance would be regulation of stream flows through the park, which now vary from minimum flows to the great rushing torrents which result from the melting snows in the high Rocky Mountain sources of the river.

It is not possible to determine exactly, at this time, how extensive effects on Grand Canyon National Park would be. However, on the basis of maintaining the natural conditions of National Park Service areas, any alteration of silt content or stream flow could be considered as an adverse effect.

Nevertheless, certain other elements in the possible effects of the Glen Canyon Reservoir on Grand Canyon National Park (and its related monument) are noted. These involve the probable reduced fluctuations in the proposed Bridge Canyon Reservoir, presently under serious consideration on the Colorado River below Grand Canyon National Park. Reduction in fluctuations in the Bridge Canyon Reservoir would be most apparent in the upper reaches, where both Grand Canyon National Park and Grand Canyon National Monument would be directly involved. In the latter connection, too, reduction in silt and river debris which would occur as a result of the Glen Canyon Dam would likewise reduce the unsightly effects of fluctuation in the lower reservoir.

Potential recreational use

In the event that it is possible to realize a Glen Canyon Reservoir which would not jeopardize irreplaceable natural values in Rainbow

Bridge National Monument, rather striking advantages could result from the creation of an extensive reservoir in this scenic area.

In the National Park Service section of the interim report on the Colorado River (July 1947) it was noted that—

> much of the country bordering the Colorado and Green Rivers through this section of Utah is of high recreational value. It is a region of great colorful spaces, mountains, plateaus, canyons, desert, forest and weird formations, probably the greatest display of erosional effects in the United States, other than the Grand Canyon, and equally grand, though different in character.

Such a reservoir could warrant developments commensurate with estimated recreational use. High among potential values would be the advantages of waterborne access to remote corners of this wild canyon country, including the vicinity of the Rainbow Bridge National Monument. At present, difficulty of access to this natural wonder has limited public enjoyment to the hardy and privileged few who can afford the time, cost and effort of reaching it over a pack trail.

The character of Glen Canyon at the dam site would make access to the reservoir difficult, although the general area would be reached over project construction roads. The situation would be somewhat similar to that at Hoover Dam and Lake Mead, where actual access to the reservoir for general recreational purposes is not in the gorge at the dam, but at various points above the dam where short areas are suitable for access and related developments. At this reservoir the great bay formed where Wahweep and War Creek Valleys enter the Colorado could function in this way. Construction of roads into this area from the dam site would be rather difficult and costly, but, it is believed, not prohibitive. There are indications that it would also be possible to reach this area by road from Kanab, Utah.

It may be feasible to approach the reservoir at some point on the west side near the base of the Kaiparowitz Plateau, and again in the vicinity of Hite, where possibilities of constructing a main highway bridge across the river shortly below the mouth of Fremont (Dirty Devil) River are under consideration. Such a bridge would service an important thoroughfare across the wild country of southeast Utah. The nature of this area indicates that this through road approximately midway between present highway crossings at Moab, Utah, and near Lee Ferry, Ariz., would very probably be the only trans-Escalante County highway for many years to come. It could afford interesting access to the upper reaches of a Glen Canyon Reservoir.

A more comprehensive study of recreational possibilities which may be inherent in the Glen Canyon Reservoir may be undertaken shortly. Consideration of potential recreational use can be more appropriately discussed in such a report than in this preliminary review of the Colorado River storage project as a whole. In general, however, it has been noted in earlier comments on the proposed Glen Canyon Reservoir that the Wahweep and Warm Creeks area appears to be a logical and desirable place for recreational boating and housing facilities, and for headquarters for boating operations and parties wishing to explore this section of Glen Canyon by land or water.

It is emphasized that earlier studies of this project were based on plans of reservoir operation which could not involve such irreplaceable natural values as those which current plans could critically jeopardize at Rainbow Bridge National Monument.

Recommendations

The primary recommendation concerns adequate protection of the nationally significant values in Rainbow Bridge National Monument.

It is especially important that arrangements should be made to fully explore archeological sites in the Glen Canyon Reservoir area and to effect salvage operations so far as justified to prevent loss of artifacts and scientific information.

WHITEWATER RESERVOIR

The Whitewater Dam site of the Whitewater unit is on the Gunnison River shortly above the confluence with the main Colorado River, in west central Colorado. It is about 2 miles south of the small town of Whitewater (on United States Highway 50), and 9½ miles southeast of Grand Junction, most important center of population in this part of Colorado.

The following information has been provided regarding the operation of the reservoir:

> The Whitewater unit of the Colorado River storage project has several potential purposes, some of which are dependent upon decisions which have not been made at this time. For the purpose of present studies, the best estimate is that the reservoir will furnish replacement water (51,400 acre-feet) to Orchard Mesa lands, presently served from the Colorado River. The remaining capacity will be used for regulation for the generation of firm energy. Actually by operating the reservoir as described above, the reservoir can be credited with providing considerable holdover storage for delivery to the lower Colorado River Basin during periods of low runoff.
>
> The above method of operation will be altered when additional storage is provided upstream on the Gunnison River or if future depletions on the upper Colorado River and its tributaries make replacements to the Grand Valley canals necessary.

Analysis of the chart showing monthly reservoir stages through period of operation (1921 to 40, inclusive) and the related table giving pool surface elevations at the end of each month for the same period (both furnished by the sponsor) reveals that operation of the reservoir would be singularly favorable for recreational uses. In common with other impoundments in the main Colorado system, minimum pools would occur late in the winter or early spring—quite consistently about the end of March. With equal consistency, heavy flows from melting high mountain snows would fill the pool to normal capacity by the end of May. Fluctuations during the most important recreation-use seasons would tend to be very nominal, reservoir spills from overflows occurring generally during the summer months, and only by late summer and fall would the long gradual drawdown to late winter lows begin to be noticeable.

The Bureau of Reclamation has furnished the following pertinent information in connection with this reservoir, which is under consideration for irrigation, power, holdover, and replacement for transmountain diversion:

Planned capacity	acre-feet	880, 000
Maximum water surface elevation	feet	4, 880
Minimum water surface elevation	do	4, 756
Maximum water surface area	acres	10, 250
Minimum water surface area	do	2, 700
Present stream bed elevation at dam site	feet	4, 630
Length of reservoir at maximum	river-miles	35
Length of reservoir at minimum (approximate)	do	18
Dam height	feet	255

At extreme high water, the reservoir would extend to a point 4 miles west of Delta.

Description of the site

Located entirely within the lower reaches of the Gunnison River, the reservoir basin lies in rather gently rolling, unspectacular valley lands which intervene between the massive, 10,000 feet high Grand Mesa on the northeast and the similarly forested height of the Uncompahgre Plateau on the southwest. Vegetation is generally sparse, involving some cottonwoods, sycamores, etc., along the river bottom and some juniper along semiarid bordering ridges and hills. For the greater part of its length, the Bridgeport Reservoir would be confined to the rather restricted inner valley which has been eroded through the broader valley. The most notable escape from this narrow course would occur at the confluence with Kannah Creek shortly above the dam site. The lower Kannah Creek tributary drainage empties into the Gunnison through a narrow opening in the bordering ridge. Immediately above this narrow passage, which would assume the character of a gut with the formation of the reservoir, would be a considerable bay surrounded by comparatively gentle slopes and rolling land which would, in 2 or 3 places, require dikes to prevent high water overflows into a secondary valley drainage which roughly parallels the main river and empties into it below the dam site.

The reservoir will be more or less directly accessible practically throughout its entire length from important United States 50 which parallels the river course within a few miles along the northeast side. This highway crosses Kannah Creek where some relocation is indicated. Minor roads, including some county roads, extend into and in some cases across the valley from the main highway, affording access to the farms and cultivated areas that occur in the fertile river bottom. One such road extends into the basin approximately midway in the overall reservoir, to farms at and near the old Denver and Rio Grande Western Railroad station of Broughton (an old line of the railroad traversing the river bottom throughout the length of the reservoir). A county road also crosses the valley at Escalante Creek well up the reservoir basin, above the minimum reservoir pool indicated at elevation 4,756. Although U. S. 50 rather closely parallels the river, the topography is such with generally low, intervening ridges that views of the reservoir from the highway will be comparatively rare and restricted, other than at the Kannah Creek Bay. The prevailing impression on the reservoir would be one of greater remoteness than will actually be the case.

Although the scenery in the vicinity of the reservoir has little to recommend it in a state like Colorado, nevertheless distant views are impressive, in some cases spectacular. The former involve the dominating massives of the Grand and Uncompahgre Plateaus, while the latter include somewhat more distant views of the great Alpine uplifts of the main San Juan ranges to the south which will probably be seen even from the reservoir in the upper reaches of high pools, where bordering hills are reduced and more open valleys extend southward to Montrose and afford views of the towering mountains beyond. To the east lie the impressive West Elk and related outlying mountain ranges of the main Continental Divide Rockies.

The upper reaches of the Gunnison River, including the Black Canyon of the Gunnison National Monument, are spectacular and

offer some of the best trout fishing in this part of the country. However, the Fish and Wildlife Service, in a preliminary report, has indicated that fish in the lower Gunnison River where the Bridgeport Reservoir would be located "consist primarily of catfish and Colorado white fish, with a few largemouth black bass and many species of rough or forage fishes. Existing use is of minor importance." That agency also mentions Gambel quail habitat along the Colorado and Gunnison Rivers in the vicinity of Grand Junction and Delta, Colo. It is believed that present recreational use of the reservoir site is largely, if not wholly, restricted to minor fishing and some small game hunting. It does not appear that recreational values of any importance would be destroyed by the creation of the reservoir.

Very little is presently of record with the National Park Service regarding possible archeological or historic investigations in the Bridgeport Reservoir area. These matters should be sufficiently checked prior to project development to avoid losses of scientific artifacts and information.

No National Park Service area or interest, or any State park area will be affected by the Bridgeport Reservoir or its operation.

Potential recreational use

Even in the absence of immediate scenic values of note, this reservoir should assume appreciable significance for recreation. Plans of operation currently being considered are very favorable to such use. It seems probable that minimum pools would very rarely occur, that normal low pools would be in late winter and that fluctuations in relation to power pool operation (for firm power so far as possible) would tend to be nominal.

The reservoir would be long and winding, with somewhat varied shore lines. It should lend itself to a considerable variety of boating, being somewhat safer in this respect than larger, more open and exposed bodies of water.

In summing up their report, the Fish and Wildlife Service indicated that the Bridgeport Reservoir would be particularly desirable (but admittedly "not so much for any values created by it, but as an alternate site for the Ruedi Reservoir on Frying Pan River, which would cause major losses in irreplaceable fish and wildlife resources").

It is possible that during the warmest summer months there could be considerable appeal for swimming—a form of recreation unlikely to be in much demand, for instance, on the Grand Mesa and similar areas nine and ten thousand feet above sea level.

In appraising the potential recreational values and opportunities believed to be inherent in this considerable reservoir, due consideration should be given to the outstanding recreational appeals generally exercised in southwestern Colorado, many of which assume regional and even national importance. The high, cool, heavily forested areas on nearby Grand Mesa, with its many glaciated lakes is a typical example of such appeal. Nevertheless, there is reason to believe that such outstanding recreational areas can be complemented to an appreciable extent by the Bridgeport Reservoir, very largely because of its much lower altitude, being under 5,000 feet. The recreational season will be much longer at the lower altitude, high mountain areas often remaining closed until late in the spring, and being similarly closed by early snows and cold in the autumn.

The relation of important U. S. 50 to the reservoir has been noted, this highway being one of the main, east-west routes through central Colorado between Colorado Springs and Pueblo to Grand Junction and on to Salt Lake City.

While some recreational use of the reservoir could be derived from travelers along this route, a great deal in this respect would depend on the scope and character of facilities provided for the public, notably in the way of accommodations. Also, the bulk of summer tourist travel over this, as well as other routes through Colorado, will continue to have the pick of higher, cooler, and far more scenic areas (often including lakes or reservoirs) in this spectacular State than could ever be associated with this reservoir, regardless of developments. It is, therefore, believed that the bulk of recreational use made of the reservoir will be derived from visitors from local communities such as Montrose, Delta, and notably Grand Junction, with related communities in that important section of the Colorado River Valley.

It is concluded that the recreational significance of the reservoir, while considerable, would nevertheless be primarily local.

Possible recreational development sites occur on the reservoir, notably in relation to the Kannah Creek Bay area, directly accessible from U. S. 50. Here, too, shore areas will be fairly gentle and topography well suited for a general recreational development area, with provision for boating, swimming, picnicking, campgrounds, possibly a lodge and appurtenances. As elsewhere on this reservoir, considerable tree planting will be required to assure the full appeal inherent in the site.

Other areas which can be considered as suitable for potential developments would occur near Broughton and near the present Escalante road crossing—but the latter depending on frequency of drawdowns that might leave the area above accessible water. Apparently only once would this condition have occurred during the period of study, and then only for late spring months.

The preliminary right-of-way map furnished by the sponsor indicates that most of the privately owned land in the main river bottom will be acquired by purchase. In large measure, these private holdings appear to be flanked by public domain which should reduce land-acquisition problems, for well considered recreational developments, to one of suitable agreement with the public agency involved. It is quite possible, however, that in large measure lands around the Kannah Creek area are in private ownership and considerable care will be necessary to assure acquisition suitable and adequate for all phases of reservoir operation and utilization, including recreation.

Recreational facilities planned for the reservoir should be considered primarily for the largely local day use that can be anticipated, with allowance for concessioner enterprises, including possible accommodations for the traveling public on U. S. 50.

GRAY CANYON RESERVOIR

The Gray Canyon Reservoir dam site is on the Green River, Utah, 22 river miles above Green River and some 4 miles above the confluence with the Price River. It is between Grand and Emery Counties. The site is in the steep-sided, sometimes precipitous canyon which traverses the plateaus out of which the main Tavaputs Plateau rises shortly to the north and which drop abruptly into the valley below

the dam area to form the Book Cliffs. The head of the reservoir, 53 river miles above the dam, will be shortly below Minnie Maude Creek which drains the northerly slopes of West Tavaputs Plateau and 53 river miles below Ouray near confluences with the Duchesne River which drains east slopes of the Wasatch Mountains to the west and the south slopes of the Uintas on the north, and the White River on the east which heads in Colorado.

It has been indicated that the primary purpose of the reservoir would be for power, with winter drawdowns to maintain firm energy generation with rapid refilling in the following spring. It is possible the reservoir could have some value for sediment control, and an allocation of 641,000 acre-feet is indicated for holdover storage in connection with this important phase of the Colorado River storage project. Recent studies, however, appear to emphasize the importance of power output, with as constant a maximum head as possible maintained for this purpose. On this basis, current information furnished by the sponsor is as follows:

> Studies of the Gray Canyon Reservoir indicate that maximum energy generation can be expected if the reservoir is maintained at or near its maximum capacity of 2 million acre-feet. Prior to the need for extensive holdover demands (in 150 to 200 years based on present estimates of sediment encroachment into the system of reservoirs) on Gray Canyon storage, the water-surface fluctuations would be limited to a maximum drawndown of about 40 feet during the winter months with refilling expected each year by May or early June.

The following data have been furnished by the Bureau of Reclamation or estimated from related information similarly provided:

Planned capacity	acre-feet	2, 000, 000
Maximum water surface elevation, mean sea level	feet	4, 590
Minimum water surface elevation (approximate) (based on inactive storage of 500,000 acre-feet)	feet	4, 400
Maximum water surface area	acres	10. 750
Minimum water surface area (approximate)	do	5, 200
Length of reservoir at maximum	miles	53
Length of reservoir at minimum (approximate)	do	28
Present stream bed elevation at dam site	feet	4, 150
Height of dam	do	445

Description of the site

The lower end of the reservoir, for approximately 10 miles above the dam, traverses the steep barren gorge through the southerly outlying mesas of the Tavaputs Plateau. These "steps" range in elevation between 5,000 and 6,000 feet but are in turn dominated by the massives of the east and west Tavaputs uplifts ranging up to 9,000 feet and more and between which the Green River has cut its way through the Gray Canyon from which the reservoir takes its name. The rise to these higher plateaus is abrupt on the south, forming the Roan or Brown Cliffs which extend easterly into Colorado. Beyond Gray Canyon which appears, from the air at least, to be in effect more truly canyon-like in character than a gorge, the reservoir will continue through the narrow passages of the northerly outlying table lands and mesas of the central Tavaputs plateaus. These reaches of the river traverse so-called Desolation Canyon which appears to be appropriately descriptive of this barren, isolated section of the country.

From the limited map data available, it is estimated that throughout its length the reservoir will be almost entirely restricted to a

narrow body of water. The 10,750 surface acres noted for the full pool of a 53-mile-long reservoir strengthens this impression.

Vegetation ranges from scattered juniper and minor range vegetation on the lower steppes to pinion country on the higher plateau areas.

While definitely rugged in a desolate sense, in this generally highly scenic part of the country the Gray Canyon Reservoir site can by no means be characterized as noteworthy in this respect. Gray Canyon appears to be especially appropriately named. The rich colorings which occur in such variety and abundance in lower reaches of the Green and Colorado Rivers through the Escalante country to the south and on through the Grand Canyon of the Colorado, are notably lacking here. Nor, from the reservoir itself, lost in narrow gorges and canyons, would there be the inspiring views of the Wasatch Mountains to the west, the Henry and distant Blue Mountains to the south, or the alpine peaks of La Sal Mountains to the southeast.

Access will have to be provided for dam-construction purposes, but otherwise the reservoir area will be singularly inaccessible, except for the occasional ranch trails which may penetrate the barren lands of this part of Utah. Nor, in the foreseeable future, does it appear at all likely that this general inaccessibility is likely to be altered. Access to the dam area will be from U. S. 6 and 50, either at Green River or down the Price River from Woodside on the west.

Perhaps largely due to inaccessibility, coupled with the rugged and barren aspect of the country, it seems highly improbable that the proposed reservoir area can offer much, if anything, in the way of present recreational values. There may be some hunting in the area and, in the comparatively more accessible reaches of the river between the dam site and Green River, Utah, some fishing. These are values which, to the extent they occur, will undoubtedly be adequately considered by the United States Fish and Wildlife Service. It seems reasonable to assume that no recreational values of importance will be destroyed by the development of the Gray Canyon Reservoir.

National Park Service archeologists have no record of archeological investigations having been made in the barren reaches of the Green River which would be inundated. It is believed very unlikely that archeological sites which may occur would assume much if any importance.

Potential recreational use

The reservoir operation plans, involving only nominal drawdowns during the winter, nonrecreational-use season, and quite constant summer water levels could be indicative of conditions rather unusually favorable to recreational uses. However, the local population which could most readily be drawn to the reservoir is extremely small and scattered. The population of the town of Green River in 1940 was only 470, and there is little indication that it has changed much since the last census. The barren and uncolorful aspect of the reservoir area seems unlikely to attract tourists from U. S. 6–50, except to the extent of the minor detour necessary to see the dam itself, which, rising 445 feet above the river in the narrow gorge, could have some sightseeing appeal.

The reservoir would offer fine opportunities for boating on its own merits, and this form of recreation could be stimulated if fishing proves to be good. A fairly constant water level encourages the belief that

this could be the case, but this phase of reservoir utilization can best be appraised by the Fish and Wildlife Service. Recalling the rather remarkable trout fishing which has developed in the Colorado River from the cold water released through Hoover Dam, at a much lower altitude, it seems highly probable that a similar situation would be created below the Gray Canyon Dam where the Green River would be comparatively easy of access, at least in reaches below the canyon which opens through the Book Cliffs above the main highway.

No detailed recreational survey of the reservoir area has yet been made, but air reconnaissance leads to the belief that in short stretches along the extended shoreline (well above a hundred miles) places would occur in side draws and bays, even in this rugged country, where boats could be beached for camping. Such recreational use of the reservoir as noted above will probably be very limited due to the very small local population which could be most directly served by the reservoir and general lack of scenic and other appeal for tourists traveling United States Highway 6–50. Probably only a widespread and justified reputation for exceptionally good fishing would be likely to materially alter this situation.

Consideration of possible recreational developments for the reservoir should be weighed in the light of the probably very limited use which can be anticipated. Some facilities can possibly be arranged by means of which boating could be handled, although undoubtedly considerable ingenuity would be necessary in this regard, especially if provision for this activity were to be made at or near the dam. This location would normally be the most accessible over construction roads and closest to centers of population and the main highway. But it will be seriously complicated by topography.

It is very unlikely that provision for overnight visitors would be warranted. Development of accommodations on a sound business basis will probably be stimulated at Green River both during dam construction and subsequently for tourists—especially if river fishing below the dam assumes importance. If construction access should be from Woodside via the Price River route, a similar impetus for accommodations would undoutedly occur in that small community.

Recommendations

While the potential value of the Gray Canyon Reservoir for boating and related recreational activities appears to be substantial, the limited use that can reasonably be anticipated because of location, small local population, difficult access and lack of scenic appeal should be recognized. However, it is recommended that ways and means of accommodating boating activities receive careful and early consideration. This should be done at the time dam construction plans are in progress in an effort to provide suitable reservoir access so far as possible to reduce subsequent difficulties and greater costs which might otherwise be involved.

NAVAHO RESERVOIR

Present plans call for locating the Navaho Dam on the San Juan River shortly below the confluence with Pine River (Los Pinos). More generally the dam would be in northeastern San Juan County and northwestern Rio Arriba County where the San Juan River forms the boundary between these two counties in northwestern New Mexico.

The Pine River arm of the reservoir will extend almost to the Colorado State line and the main San Juan will extend about 3 miles or so into Colorado at high water elevation.

The dam site is approximately 45 miles east of Farmington, N. Mex., and about 35 miles southeast from Aztec. Durango, Colo., is 45 miles northwest of the San Juan arm of the reservoir and about 40 miles from the Pine River arm. The latter is not immediately accessible by road, but Bureau of Reclamation plans contemplate location of the construction road south from Ignacio, Colo., which would provide direct access to the dam area and to points along the Pine River.

According to the preliminary plans advanced by the Bureau of Reclamation, the storage in the Navaho Reservoir would be used both for energy generation and holdover storage with the maximum elevation at 6,050 mean sea level and maximum drawdown to 6,010 except during years of extremely low runoff when it could become necessary, under the plan of ultimate development, to reduce water levels to dead storage elevation. It appears that operation could be compatible with general recreational use of the reservoir.

Total reservoir capacity	acre-feet	1,200,000
Maximum water surface elevation	feet	6,050
Minimum water surface elevation	do	6,010
Maximum water surface area	acres	10,800
Minimum water surface area (approximately)	do	6,800
Length of reservoir at maximum (approximately)	miles	33
Present stream-bed elevation at damsite	feet	5,725
Dam height	do	335

According to the 8-year period of study provided by the sponsor, fluctuations will be nominal, with the reservoir at full pool by the end of May something like 5 years out of 8. The lowest elevation which would have been reached during the study period was 6,010, only 40 feet below full pool, and that would have occurred in late November. The recreational use season low would have been at elevation 6,030, late in October. At no time during the 8-year fluctuation study would operation have seriously interfered with recreational use of the reservoir.

At maximum elevation of 6,050, the reservoir would extend approximately 30 miles up the San Juan River reaching widths of a quarter to one and a half miles. The Pine River arm would reach some 10 miles varying in width from one quarter to three quarters of a mile. The La Jara canyon would be inundated for some 5 or 6 miles. There would also be other inlets and bays of smaller note but of considerable recreational interest for boating and fishing.

Description of the site

Rising in Colorado, the San Juan River is the largest stream flowing into or through New Mexico. It flows through the northwest section of New Mexico for a distance of 100 miles. The surrounding topography in the vicinity of the reservoir is the characteristic mesa land with the San Juan River flowing often several hundred feet below the top mesas. Occasional lower benches intervene between the larger tablelands and the river channel bringing available recreational use space within accessible reach of the proposed lake levels.

The flat mesas above the reservoir area are sparsely vegetated with scattered pinion and juniper. There is a notable lack of larger trees for shade. This lack could be altered, however, in the vicinity of recreational development sites by spotting cottonwoods or other shade trees when water becomes available.

The open character of the land permits wide panoramic views that hold considerable interest. However, in conforming to the usual open aspect of the New Mexico landscape, the scenic value surrounding the Navaho site fails to impress one with any individuality worthy of special consideration.

Archeologically, there is known to be much of significance in the San Juan River Basin. Although little or no search has been made in the area of the Navaho Reservoir site, the Smithsonian Institution should be kept informed of the status of the project in order to allow ample time for proper investigation and clearance.

Potential recreational use

Existing recreational values along the San Juan River are very minor in the vicinity of the Navaho Reservoir area. Such use appears to be limited almost exclusively to fishing on which there is no great value at present. In fact the United States Fish and Wildlife Service believes that actual fishery values could be increased by impoundment of the reservoir.

The opportunity for general recreational use will also be enhanced by the reservoir and could include boating, fishing, picnicking, and perhaps some camping. Swimming could become a minor function, but suitable space for a beach appears, at present, only at the upper end of the reservoir and would not be sufficiently well related to population to draw day-use visitors for that purpose. The limiting factor to general development seems to be population. Not only is the immediate area rather sparsely populated, but there will be complications concerning fishing licenses for residents of Colorado who wish to fish in the New Mexico portion of the reservoir. To a lesser extent the reverse may also be true although the Colorado section of the reservoir will be quite small compared to the New Mexico portion. If a reciprocal license could be arranged to accommodate both New Mexico and Colorado fishermen, the recreational use potential of the reservoir would be considerably enhanced.

Comparing the relative areas of population influence in Colorado and New Mexico on a county basis discloses that San Juan (17,115) and Rio Arriba (25,352) counties in New Mexico had a combined population in 1940 of 42,467, whereas La Plata (15,494) and Archuleta (3,806) counties in Colorado had combined population of only 29,300. Since many of the Colorado residents will be attracted to the Vallecito Reservoir on the Pine River well above the tail waters of the Pine River arm of the Navaho Reservoir, the potential drawing power from Colorado would be further reduced.

Appraising the expected recreational use at the Navaho Reservoir on a strictly local basis, it is expected that most of the patronage will come from residents of New Mexico and more particularly from the area around Farmington (1940 population 2,161) and Aztec (1940

population 756) both of which have increased in population since that time. Because of recent oil and gas developments in the area, it is also probable that future population increases will considerably surpass those of the past decade. There is a local need for water-type recreation in this area, and it is anticipated that these local values appraised will be the probable extent of the recreational benefits resulting from the impoundment.

Recommendations

It is recommended that the Navaho Reservoir, as presently proposed by the Bureau of Reclamation, be considered for recreational development fundamentally for local use. Such development could include limited general development in the vicinity of the dam where it would be conveniently accessible via the construction road. Access from the Farmington and Aztec areas should be provided as directly as possible and might include justification for a road from the floor of the canyon to the top of the mesa area on the north side of the reservoir.

Depending upon the degree of success in arranging for a reciprocal fishing license for residents of Colorado to fish in the New Mexico part of the reservoir, it may become feasible to develop a recreational area at the upper end of the reservoir near the Colorado stateline. Suitable and well-related space is located on a low bench on the north side of the reservoir near the maximum water level just south of the stateline. This bench extends northward across the line into Colorado so that if licensing arrangements do not result in a mutually satisfactory solution for residents of both States, it would be possible to develop a small area in Colorado from which direct access could attract quite a few visitors. While early consideration should be given to the development of the sites recommended, it does not seem feasible to recommend actual land acquisitions or specific development until later studies introduce more definite information on actual operation, definite location of the construction road, and the feasibility of arriving at an agreement for providing reciprocal fishing licenses.

Archeological investigation is an important factor in clearing the way for any impoundment in the San Juan Basin. Early clearance should be sought to allow ample time for excavation and removal of valuable material believed to exist in the area.

CURECANTI RESERVOIR

The Curecanti Reservoir will be impounded behind a high (475 feet) dam at the Blue Mesa Dam site on the Gunnison River in the upper reaches of the Black Canyon, shortly below the mouth of Lake Fork and 3½ miles below Sapinero. The whole reservoir area is in Gunnison County, Colo. The dam site is some 13 miles or more above the Black Canyon of the Gunnison National Monument.

Earlier studies made by the Bureau of Reclamation for impoundments at the Blue Mesa site involved a very much smaller reservoir. The present plan calls for an impoundment that will extend up the river nearly to the town of Gunnison an estimated overall distance of something like 30 miles. It is estimated from limited, small scale,

USGS topographic sheets available for this area that the large basin shortly above the gorge in which the dam would be located would be as much as a mile and a half to 2 miles in width.

Information furnished by the sponsor indicates that the primary purposes of the reservoir are for holdover storage in connection with the Colorado River storage project, of which it is one of the units, and for power production. Utilized for these functions, it appears that a high degree of river regulation would be achieved, 2 million acre-feet out of a total of 2,500,000 acre-feet being indicated for holdover storage.

The following data have been furnished by the sponsor, or estimated from related available information:

Planned capacity	acre-feet	2, 500, 000
Maximum water surface elevation	feet	7, 635
Minimum water surface elevation	do	7, 455
(500,000 acre-feet inactive storage from water surface fluctuation chart.)		
Maximum water surface area	acres	18, 200
Minimum water surface area	do	5, 200
(Estimated from area capacity curves at 500,000 acre-feet inactive storage.)		
Length of reservoir at maximum	miles	30
Length of reservoir at inactive storage, estimate	do	17
Dam height	feet	475

The following statement regarding reservoir operation has been provided by the sponsor as follows:

> Reservoir fluctuation will normally follow the drawdown pattern shown for the period 1927–30. Somewhat greater drawdown will result in years of extremely low runoff such as 1931–34. Under conditions of ultimate development, which is expected in about 75 years, it is anticipated that irrigation requirements during years of extreme drought might necessitate the evacuation of the reservoir to the dead storage level for short periods.

Subsequently more extended period of study data for the reservoir have been made available, involving a 34 year period, 1914–47. From this extended table it is possible to make somewhat more sound deductions regarding future probabilities, especially since the period included the years of historically low flows beginning in the early thirties. According to about the first 20 years of the study period, which it is believed represents within close limits a normal cycle of runoff, the reservoir would be filled to capacity about 5 years out of 34 and would approach full pool within 5 feet on 3 other times.

Under ultimate flow conditions, only once during the 32-year period of study provided would the reservoir have filled to within 2 feet of maximum elevation, and frequently would fall far short of full pool. This indicates virtually complete river regulation.

Analysis of capacity tables in relation to area, capacity, elevation curves which have been provided by the sponsor, is summarized in the following table:

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Curecanti Reservoir water elevations, normal and abnormal

FLUCTUATIONS WITH PRESENT MODIFIED FLOWS

(*a*) Under normal cycle conditions:	
Maximum pool (full pool) elevation	7, 635
Minimum, end of August approximate elevation	7, 545
Average, end of June (20 years) elevation	7, 608
Average, end of August (20 years) elevation	7, 608
(*b*) Under dry cycle conditions:	
Maximum pool, approximate elevation	7, 568
Minimum, end of August approximate elevation	7, 495
Average, end of June (14 years) elevation	7, 527
Average, end of August (14 years) elevation	7, 517

FLUCTUATIONS WITH ULTIMATE FLOWS

(*a*) Under normal cycle conditions:	
Maximum pool, approximate elevation	7, 633
Minimum pool, end of August approximate elevation	7, 558
Average pool, end of June (21 years)	7, 617
Average pool, end of August (21 years)	7, 612
(*b*) Under dry cycle conditions:	
Maximum pool, approximate elevation	7, 585
Minimum pool, end of August approximate elevation [1]	7, 505
Average pool, end of June (11 years) elevation	7, 568
Average pool, end of August (11 years) elevation	7, 566

[1] Evacuation to the dead-storage level referred to in the sponsor's statement would rarely, if ever, occur during the summer recreational use season. Capacity table data indicate that such exhaustion of active storage would have been closely approached once during the period of study, late in April.

In the above table, present modified flows are adjusted to account for the depleting effect of all existing and authorized developments in operation. Ultimate flows are adjusted to account for the depleting effect of the system operating under ultimate development.

The above tabulation reveals that while the reservoir would seldom completely fill under ultimate flow conditions, nevertheless average summer pools could actually be somewhat higher than initially and that average recreational use-season fluctuations would be quite comparable. In the light of present studies, therefore, it is believed that changing conditions resulting from ultimate Upper Colorado River Basin developments would not materially affect potential recreational values inherent in the reservoir. Nevertheless, it must be recognized that the effects of fluctuations on fishery will have, in either case, a direct bearing on general recreational importance.

Description of the site

The upper portions of the Black Canyon in which the dam would be located are less deep and, aside from a much reduced inner gorge, less precipitous and spectacular than the reaches embraced by the Black Canyon of the Gunnison National Monument a few miles below. The dam area, and gorge sections of the adjacent reservoir are not lacking, however, in notable scenic appeal, dominated as they are by rugged canyon country with quite spectacular buttes, darkly crowned with coniferous evergreens along the rim. Sapinero, Blue, and Pine Creek Mesas flank the portals of the canyon where it opens into the broader valley bordered by more gentle, rolling, open mesa terrain. This basin extends for some 15 miles and will provide the most significant mass storage section of the reservoir.

Immediately above the small hamlet of Elkhorn, the valley again becomes restricted into a minor gorge a few miles in length, opening

finally into the broader, comparatively flat-bottomed valley in which the town of Gunnison is located. On the basis of limited observation and in the absence of map material, it is very broadly estimated that the upper reservoir pool which would occupy the lower portions of this valley at high water would be some two or three thousand acres in extent. It would reach to within a few miles of Gunnison, and would be surrounded by low, gently rolling hills and mesa rangelands.

The general setting of the reservoir, in addition to immediate scenic values of considerable note at and above the dam, is superb. To the north lies the impressive West Elk Range, to the south the great San Juan uplift, and shortly to the east occurs the great Continental Divide, spectacular with alpine peaks often ranging over 14,000 feet in height. Many of these varying views, except in restricted gorge sections, would be visible from the reservoir itself.

Recreational values

The Gunnison River has long enjoyed a national reputation as an outstanding fishing stream. Anglers in great numbers are attracted to it annually, often from distant parts of the country. This recreational use must contribute appreciably to the economic stability of the valley above the Black Canyon of the Gunnison National Monument, and noteworthy investments have been made for guest and tourist accommodations. Many such camps have been developed along the banks of the river which would be flooded by the Curecanti Reservoir. One disadvantage resulting from these developments, so far as the general public is concerned, has been the posting of many stretches of privately controlled stream banks.

Potential recreational use

Fluctuations in the reservoir during recreation use seasons except during drought periods will not, it is believed, be unfavorable for recreation. The area is located adjacent to United States 50, is near the spectacular Black Canyon of the Gunnison National Monument, and is surrounded by great Rocky Mountain areas which themselves offer recreational opportunities of a very high order. It appears reasonable to assume that the importance of the reservoir, as a complement to other advantages offered by the region, would assume a considerable degree of State significance, meeting a much wider range of recreational needs than presently exist in this comparatively thinly populated part of the State.

The extent to which lake fishing can be developed in lieu of the notable stream fishing which is now enjoyed will have considerable bearing on the popularity of the reservoir. Fluctuations which, because of seasonal occurrence, would not seriously impair general recreational values may complicate the maintenance of quality fishing, a phase of use which can best be analyzed by the Fish and Wildlife Service. In this connection, perhaps mention could be made of a suggestion which has been advanced regarding the possible construction of a large weir shortly below the upper basin by means of which a constant water level could be maintained in the large reservoir section near Gunnison. Should such an arrangement prove feasible, it would maintain an impressive pool under conditions which would be ideal for recreational use and presumably equally so for fish reproduction. This would greatly improve the basic values of

the Curecanti Reservoir, even though at periods of low water, there would be two rather than one body of water. Because of seasonal occurrence this would not be a particularly unfavorable situation.

Even with moderately good lake fishing, the reservoir should encourage day, overnight, and weekend use, and because of the location in relation to various mountain recreational areas, even vacation use should assume importance. As a natural concomitant to these types of visitor use, would be demands for summer home sites, probably group camp areas and notably for boating facilities. Early consideration should be given to planning the reservoir area, especially in connection with land acquisition, to meet various visitor needs in an orderly and well organized manner. It seems highly probable, as a result of the preliminary reconnaissance, that many areas suitable for the various types of development will occur in satisfactory relation to reservoir shores around both the central and upper basins.

Effect on Black Canyon of the Gunnison National Monument

No State park area will be affected by the reservoir. The interests of the National Park Service, however, will be adversely affected in the monument by regulation of river flows. How completely river regulation can be achieved by the Curecanti Reservoir is not, as yet, known but it seems quite probable that it will reach a high degree and that only in comparatively rare years of excessive runoff would there be spills which would course through the canyon in addition to normal regulated flows.

This regulation will drastically alter the historic flows through the monument. These have already been somewhat changed by diversion to the Uncompahgre River Basin by means of a tunnel taking off from the Gunnison River very shortly above the east monument boundary. The degree of regulation resulting from this diversion does not appear to have drastically changed the character of flows through the monument, with great rushing spring torrents, followed by minimum summer flows that are comparatively unimpressive. There are years of record, although very rare, when flow has practically ceased, leaving only scattered pools along the canyon bottom.

It is the historic flows which, over hundreds of millions of years, have carved the spectacular gorge down through the basic, precambrian geological formation to depths ranging from 1,730 feet to as much as 2,425 feet, creating a great earth gash which is, in places, deeper than the width from rim to rim. Other natural weathering forces have combined with the river to create this natural wonder. Spalls, chips, and gravels falling unhindered to the canyon bottom are annually swept away by the great spring tidal flushes of the river.

Evidently with the flow of the river regulated and equalized by the Curecanti Dam this annual spring flushing would no longer take place unless the dam could be operated in such a way as to release large volumes of water during flood periods. The National Park Service would, of course, be concerned with any development which would alter natural conditions in the monument.

National Park Service archeologists are of the opinion that only minor hunting and camp sites of archeological interest are likely to have been found in the basin, and not necessarily prehistoric.

Recommendations

The potential recreational value of the Curecanti Reservoir indicates that appropriate attention should be given to land acquisitions where public domain is not involved, in order to make adequate provision for the various recreational uses which can be anticipated.

Closely related to land acquisition problems will be routes selected for the relocation of U. S. 50 which will be necessitated by reservoir development. There is some indication that the south side will be followed by the new route. On either side, however, it is recommended that consideration be given to areas of potential recreational-use value, both to assure, so far as feasible, suitable access thereto from the highway and, of equal importance, to avoid undesirable relationship to such areas in a way to reduce their subsequent value. This will require early reservoir planning and close cooperation with the State highway authorities.

It is especially recommended that consideration be given to possibilities of providing the weir in the narrow gorge between the lower and upper reservoir basins, by means of which a constant, or nearly constant water level could be maintained in the latter.

CRYSTAL RESERVOIR

The dam site for the Crystal Reservoir is located on the main Gunnison River, about 1 mile below the narrow Crystal Creek side draw which empties into the gorge from the north. The site is only a short distance above the east boundary of the Black Canyon of the Gunnison National Monument, Montrose County, Colo.

The small Crystal Reservoir would function as an after-bay, reregulatory impoundment for the very much larger Curecanti Reservoir, a few miles upstream. It would provide the means of developing important electrical energy, for which it is being considered. It would have no holdover storage function.

The following data is provided for this reservoir:

Planned capacity	acre-feet	40,000
Maximum water surface elevation	feet	6,870
Minimum water surface elevation	do	6,860
Normal water surface area	acres	550
Length of reservoir (estimated)	miles	8
Present stream bed elevation at dam site	feet	6,570
Dam height	do	305

The sponsor has given assurance that operational plans for the reservoir contemplate a practically constant water level at full pool, power spills from the Curecanti unit being reused here for additional energy production. The capacity would be used only to provide power head and for daily regulation with drawdown limited to a maximum of less than 10 feet.

Description of the site

The reservoir area is entirely within the Black Canyon. Viewed from the air it lacks the sheer, precipitous character of the national monument section which begins very shortly below the dam. The reservoir section, while yet extremely rugged, gives the impression of being a deep, very steep-sided V-shaped canyon. It is still 1,500 to 2,000 feet deep.

In addition to dam area access over construction and maintenance roads there will be one other point where limited access to the reservoir

will occur. At elevation 6,870, the impoundment will extend a short distance up the Cimarron Creek side canyon, to within a few hundred yards or possibly a half a mile of U. S. 50. It was through this draw that the old Denver and Rio Grande Western Railroad from the west entered the Black Canyon. A bench mark elevation at the upper end of this draw is given as 6,893, only 23 feet above normal reservoir, clearly indicating the feasibility of water access at this point.

Potential recreational use

At present the some 8 miles of the Gunnison River which would be inundated by the reservoir must have a high value for stream fishing, especially in view of the ready access to this part of the river noted above.

Lake fishing in the reservoir may reasonably compensate for the loss of stream fishing. The constant water level below several miles of the open stream between the Blue Mesa Dam which would impound the Curecanti Reservoir and the headwaters of the Crystal may be factors which are favorable in this regard.

The reservoir should be interesting for boating—an interest which will be enhanced by fishing if it can be established and maintained. Even on its own merit, boating should have considerable appeal affording as it will views of the upper reaches of the scenic Black Canyon. Also, from near the dam, there may be glimpses into the more startling, precipitous sections of the gorge in the national monument below the reservoir. It is anticipated that facilities for boating, including sightseeing excursions, can be developed in the draw at Cimarron where the reservoir will closely approach United States Highway 50.

The extremely steep, rugged nature of the canyon would probably preclude other forms of recreational use and development on the shores of the reservoir, forms of recreational outlets that can be more appropriately and conveniently developed on the great Curecanti Reservoir shortly upstream.

Effect on Black Canyon of the Gunnison National Monument

The monument and its primary values have been described by the National Park Service as follows:

> Black Canyon is notable for its narrowness, depth, ruggedness, great expanses of sheer walls, and interesting gorge formation. The rims of the gorge are only 1,300 feet apart at their nearest approach, yet the gorge ranges from 1,630 to 2,125 feet in depth within the monument. At one location the channel of the Gunnison River narrows to only 40 feet in width. For many millions of years this river has been furiously carving its channel deeper and deeper through this probable Archean complex at a greater speed than all combined natural processes can widen it. The tools which the river uses are the sand and gravel that it carries, mainly in periods of flood. The hardness of its rock formation and the joint, or fracture, system account for the sharp, ragged sheerness of the canyon walls. The rolling hills, which rise above the canyon rim and which formerly entrenched the flow of the Gunnison River, are carved from sedimentary rocks. These rocks are so much younger than those of the gorge itself, which immediately underlies them, that during this gap of time life developed from the single plant cell to the monstrous dinosaur. This tremendous break in the record of geological time is as significant to the imagination as the chasm of Black Canyon is to the sight.

It is true that regulated flows of the Gunnison River through the monument below the existing irrigation diversion tunnel have, for comparatively brief periods, been reduced to hardly more than

scattered pools. But, without exception, these periods have been followed within the space of a few months with the great, furious spring torrents with their scouring effects that have, in the main, been responsible both for creating the spectacular gorge and deepening it. Regulation will have an adverse effect on this natural process.

With the Crystal Reservoir operated as a re-regulatory afterbay for the Curecanti Reservoir, additional effects on river flows through the monument should be negligible. On this basis it can be assumed that it will be the Curecanti which will affect the monument in this respect rather than the Crystal unit. Such changes in natural conditions, while very undesirable, are nevertheless not sufficiently adverse to offset the economic advantages to be gained by river regulation in the public interest.

Recommendations

In the event the Crystal Reservoir is developed, it is recommended that consideration be given to making suitable provision for boating facilities for the reservoir. This should include adequate land acquisition in the restricted area near Cimarron where the reservoir will be primarily accessible for such recreational activities.

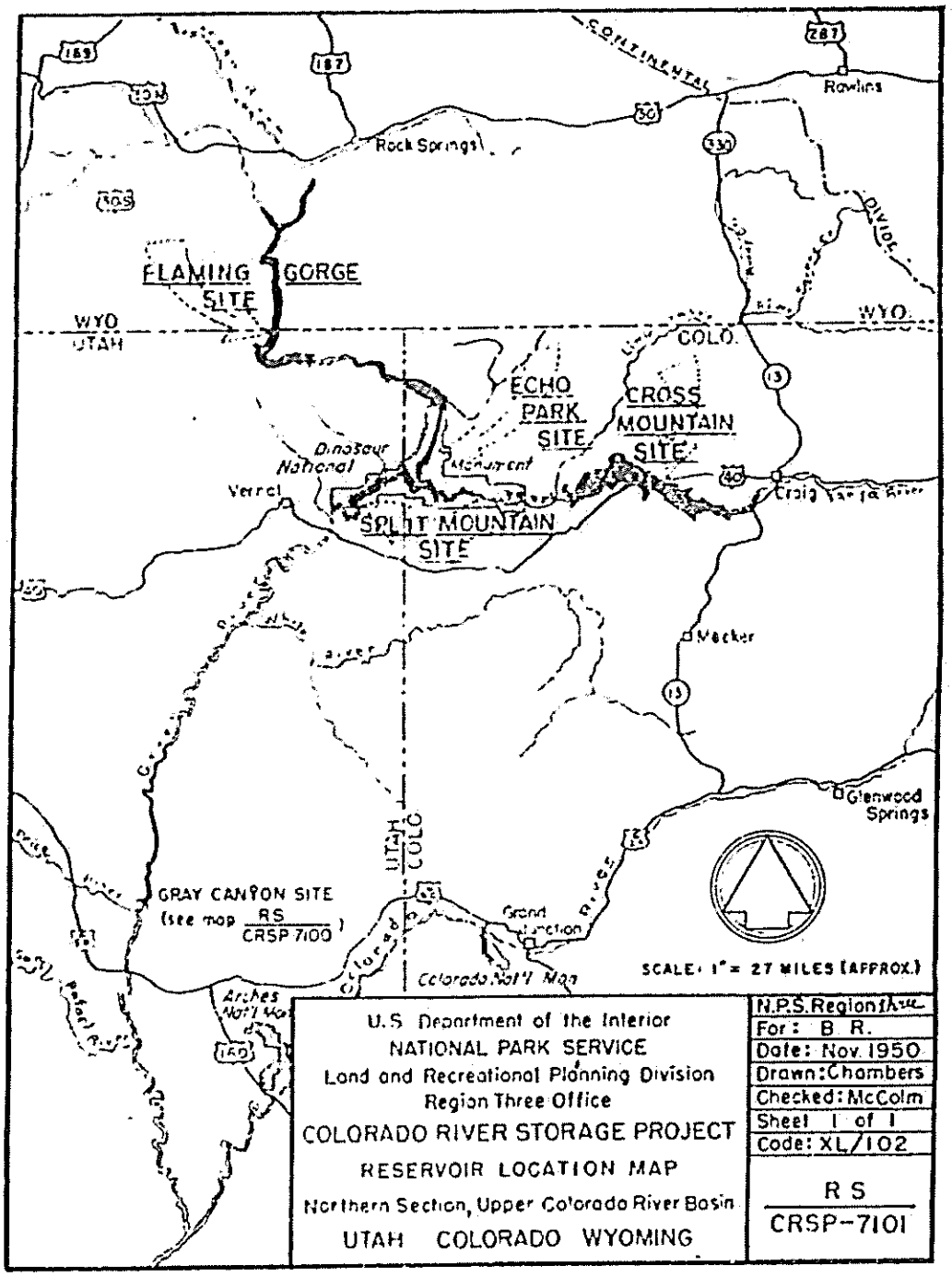
FLAMING GORGE RESERVOIR

The proposed Ashley Dam of the Flaming Gorge unit would be located in Red Canyon at a point on the Green River about 32 river miles downstream from the Utah-Wyoming State line. It would rise 440 feet above the river and impound a reservoir having, when filled to capacity, a surface area of 40,800 acres and extending 91 miles upstream through Hideout Canyon, Kingfisher Canyon, Horseshoe Canyon, Flaming Gorge, and the rolling plains of southern Wyoming to a point within 3 or 4 miles of the city of Green River, Wyo. The lower portion of the site lies in the Ashley National Forest on the northeastern flank of the Uinta Mountain Range. No primitive, wild, or wilderness area is involved.

Except for its area of origin in the Green River Lakes, the section of the Green River from Flaming Gorge to Red Canyon, inclusive, is the first highly scenic portion of the river in its course to its junction with the Colorado River. Farther downstream it plunges into the much more spectacular canyons of Dinosaur National Monument.

From Red Canyon upstream to Flaming Gorge is a nearly continuous series of canyons, of which the two named are the more scenic. Many portions of Red Canyon are narrow, precipitous, and colorful, its colors being reminiscent of the reds, grays, and purples found in the Canyon of Lodore in Dinosaur National Monument. It attains a depth of 1,500 feet or possibly more. The slopes are partly forested while the rims are more heavily wooded.

Flaming Gorge is notable for the intense reddish and orange shades of its cliffs which rise abruptly several hundred feet above the river. The colorful cliff on the right bank continues in a southwesterly direction and merges with the northerly slopes of the Canyon of Sheep Creek, a tributary. The cliff forms a finely colored setting for the Green River where, after leaving Horseshoe Canyon, it makes a sharp bend in Nielson Flat before entering Kingfisher Canyon.


FLAMING GORGE SITE
ECHO PARK SITE
CROSS MOUNTAIN SITE
SPLIT MOUNTAIN SITE
GRAY CANYON SITE
(see map RS / CRSP 7100)
WYO
UTAH
COLO.
Rock Springs
Rawlins
Vernal
Dinosaur National Monument
Craig
Meeker
Glenwood Springs
Grand Junction
Colorado Nat'l Mon
Arches Nat'l Mon
SCALE: 1" = 27 MILES (APPROX.)
U.S. Department of the Interior
NATIONAL PARK SERVICE
Land and Recreational Planning Division
Region Three Office
COLORADO RIVER STORAGE PROJECT
RESERVOIR LOCATION MAP
Northern Section, Upper Colorado River Basin
UTAH COLORADO WYOMING
N.P.S. Region Three
For: B. R.
Date: Nov. 1950
Drawn: Chambers
Checked: McColm
Sheet 1 of 1
Code: XL/102
RS
CRSP-7101

The canyons are locally well known for their scenic values, and as features of interest to visitors to the Uinta Mountains. Utah State Highway No. 44 runs from Vernal to a point a few miles from the dam site. Unimproved roads lead southward from Green River, Wyo., to join this road. A side road leads to the rim of the canyon where a small resort has operated for a number of years, and where the Forest Service has provided overlooks. Flaming Gorge and Horseshoe Canyon also are accessible by a side road. The Forest Service has provided a road and campground in Hideout Canyon.

It is doubtful that the reservoir site receives recreational use other than for some hunting and fishing.

It is not known whether an archeological survey of the site has been made. It seems reasonable to assume, however, that evidences of prehistoric occupation exist.

Construction of the Flaming Gorge unit would cause material changes in the scenic characteristics of the site. The visible height of canyon walls from Red Canyon to Flaming Gorge, inclusive, would be reduced and a long still lake substituted for the much narrower river that flows through hilly plains in southern Wyoming and the canyons in northeastern Utah. Vegetation in the river bottoms and up the river slopes would be inundated and habitat for several species of mammals and birds would be lost, including some winter range for deer. The Forest Service campground and road in Hideout Canyon would be covered by the reservoir.

It is surmised that impoundment of the reservoir and possibly construction activities would destroy or damage a number of archeological remains.

Construction operations would also result in impairment to scenic values. Construction roads would involve some scarring of the landscape. Power lines, tunnel adits, construction buildings, and other features would also have adverse effects.

However, some scenic values would remain and a new recreational element would be introduced in the form of a lake. Drawdowns, if amounting to more than a few feet during the recreation season, would, of course, have adverse effects upon both scenic and recreational values. In general, the adverse effects of drawdowns would be more pronounced in portions of the reservoir site where shores are flattest.

It would be advantageous to recreational use if the water level could be kept relatively constant during the recreation season. In this event it is believed that the reservoir area, if suitably planned and developed for recreational purposes, would have local recreational value extending into southern Wyoming and northeast Utah.

Pending more detailed studies, it appears that this reservoir area should be suitable for picknicking, boating, fishing, camping, riding, and hiking. Development of recreational facilities might be limited in many cases by the rugged and steep topography of canyon sections of the area. Recreational planning for Flaming Gorge Reservoir should, however, take into consideration the competitive effects of the Echo Park and Split Mountain Reservoirs, as well as the many existing and potential attractions in the adjacent Uinta Mountains, the more distant Wind River Mountains in Wyoming, and the Wasatch Front near Salt Lake City.

CROSS MOUNTAIN UNIT

The proposed dam, which would be located at the head of Cross Mountain Canyon on the Yampa River 58.5 river miles upstream from its confluence with the Green River, would rise 295 feet above the river, and impound a reservoir having, when filled to capacity, a surface area of 52,200 acres and extending 76 miles nearly to the city of Craig, Colo. The reservoir would inundate the broad and indented valley of the Yampa River to the vicinity of the village of Maybell. Here it would be constricted somewhat; from this point it would extend easterly through Juniper Mountain Canyon, then widen again.

The reservoir site offers little, if anything, in the way of special scenic value. It consists of the river course with bordering deciduous vegetation, adjoining meadows and some irrigated lands, and flanking, semiarid rough grasslands sparsely dotted with cedar and pine. The river itself is fairly clear.

It has been reported that some of the last known resting places of Canada geese in Colorado may be along some of the bars and banks of the Yampa. The reservoir would apparently inundate some of these. An undetermined amount of winter range for deer would also be flooded.

The river is used to some extent for sport fishing, and there may be hunting values in adjacent lands. Although, pending further study, no conclusive statements as to fishing and hunting can be made at this time, it does not appear that there are any recreational values of great importance that the reservoir would destroy or seriously impair.

A brief preliminary archeological survey of the Juniper Mountain portion of the reservoir site in 1942 revealed at least five rather extensive prehistoric Indian campsites, and several others were noted along the river in the vicinity of Maybell. There are, no doubt, other archeological values in the remainder of the reservoir area. However, an intensive survey, together with limited testing, will be necessary to determine the probable extent and scientific importance of the prehistoric occupation of the reservoir area as a whole.

Because of the monotonous character of the terrain through which the reservoir would extend, this artificial lake would have minor scenic value. A long, somewhat broad lake of irregular shoreline in a semiarid setting would add a note of variety and interest to the landscape in normal or above-normal runoff cycles. If, during low runoff cycles, use of the active storage were to result in considerable drawdowns, these would adversely affect scenic values and this effect would progress with the reduction in storage. Large expanses of barren shores would probably be exposed, leaving mud flats and rough cobble beaches. Drawdowns would impair recreational values of the reservoir, the degree of impairment dependent on the extent of drawdown.

In years of normal or above-normal runoff, the reservoir can be expected to offer possibilities for recreation, such as picnicking, boating, camping, and perhaps hunting and fishing. It may provide opportunities for local day use by residents of Craig, Colo., and vicinity. More thorough study would be required to conclude as to probable use from more distant population areas, such as Denver and

Grand Junction, Colo.; Salt Lake City and Vernal, Utah, Rock Springs, Rawlins, and Laramie, Wyo. Recreational planning for this reservoir should take into consideration the competitive effects of other reservoir areas such as Echo Park, Split Mountain, Flaming Gorge, and Pathfinder-Seminoe in Wyoming, as well as mountain areas in this general part of Colorado-Wyoming-Utah region.

ECHO PARK AND SPLIT MOUNTAIN UNITS

Dinosaur National Monument was established by proclamation of President Wilson on October 4, 1915, under authority of the Antiquities Act for the primary purpose of preserving a rich deposit of fossilized dinosaur bones which had been found here in an excellent state of preservation. By President Roosevelt's proclamation of July 14, 1938, the monument was enlarged to include other resources of geological, archeological, and wilderness values. The extension included the Canyon of the Yampa River and the Canyon of Lodore, Whirlpool Canyon, and Split Mountain Canyon on the Green River. Of the total gross area of 209,744 acres, about 70 percent is in Colorado and about 30 percent in Utah.

The enlarged monument is essentially a canyon-plateau area along the most spectacular and scientifically interesting parts of the drainage of the Green River and its major tributary, the Yampa. The dynamic processes of river erosion have produced a colorful, rugged wilderness of deep canyons, dissected erosional benches, and bold promontories. The geological features have been given the place of outstanding importance. Second to these are the scenic features which form an inseparable combination with those of geology.

Functionally, Dinosaur National Monument consists of two sections referred to as the quarry section and the canyon section.

The quarry section comprises a comparatively small area in the vicinity of the dinosaur beds and includes the original monument. The canyon section, consisting of the remainder of the present monument, is over 200,000 acres in extent.

The geologic formations of the quarry section are of scientific importance and of distinct scenic value, but the major significance of this section is considered to be in the dinosaur beds. The principal deposits of fossilized dinosaur bones are found in the coarse sandstones of the Morrison (Jurassic) formation which underlies the shales and sandstones of the Cretaceous and is underlain by other strata of the Jurassic.

The canyon section is characterized by a notable combination of geological, scenic, archeological, and biological values and by its wilderness quality. Its most spectacular features are the canyons of the Green and Yampa Rivers, where interesting geological formations and impressive landscapes are displayed in great variety. One of the exceptional attributes of this section consists of contrasts of these two canyons in their geological formation and scenic character. Echo Park, at the confluence of the Green and Yampa Rivers, is especially notable because of the high, knife-ridge of sandstone known as Steamboat Rock, which rises vertically about 750 feet above the junction of the Green and Yampa Rivers.

In addition to the predominant geologic and wilderness values of the canyon section, there are noteworthy archeological features.

Evidences of prehistoric Indian life have been found in many areas and include campsites, rock shelters, petroglyphs, burials, and caves that were inhabited or used for storage. The archeology of the region is not yet fully known nor have all sites been adequately investigated and recorded.

Likewise, the many interesting historical aspects of the area have not been adequately chronicled.

In addition, there are distinct biological interests. Deer are abundant in some sections, and there have been reports of mountain sheep. There are also many plant associations which are correlated with geological structure and interesting biotic units whose origins are related to the development of the canyons and the local mountain structures on the flank of the Uinta Mountains. Forms of animal and plant life reveal influences of the hardy climate and are evidences that much of interest might be revealed by a careful biologic survey.

The proclamation of July 14, 1938, enlarging the monument, stated that—

> The Director of the National Park Service, under the direction of the Secretary of the Interior, shall have the supervision, management, and control of this monument as provided in the act of Congress entitled "An act to establish a National Park Service, and for other purposes," approved August 25, 1916, Thirty-ninth United States Statutes at Large, page 535 (U. S. C., title 16, secs. 1 and 2) and acts supplementary thereto or amendatory thereof, except that this reservation shall not affect the operation of the Federal Water Power Act of June 10, 1920 (41 Stat. 1063), as amended, and the administration of the monument shall be subject to the reclamation withdrawal of October 17, 1904, for the Brown's Park Reservoir site in connection with the Green River project.

In accordance with the act of 1916, it has been and is the responsibility of the National Park Service to conserve the scenery and the natural and historic objects and wildlife within the areas in the national park system, and to provide for the enjoyment of them in such manner and by such means as will leave them unimpaired for future generations. Accordingly the major aims of the National Park Service in its administration of the Dinosaur National Monument have been:

1. Protection of unimpaired resources and, through elimination of factors that have modified other natural conditions, the restoration of those other conditions to their original state. The modifying factors principally involved are agricultural pursuits which consist largely of grazing, and the presence of non-Federal lands within the exterior boundaries of the area.
2. Protection and preservation of archeological features.
3. Provision of facilities necessary to enable visitors to study and enjoy the features of paleontological, geological, archeological, wilderness, and related interests, and required for proper recreational use and administration of the area.

In accordance with those objectives, the National Park Service prepared a master plan for Dinosaur National Monument. The developments shown thereon were for the purposes of making the noteworthy features of the area accessible and providing facilities and accommodations for visitors, as well as administering the area and protecting its superb natural and archeological values. The general theme of development was centered around the paleontology of the quarry section and the wilderness character of the canyon section. Proposed facilities included a modern road system, an expanded trail system, several tourist centers, and a headquarters area.

In connection with investigations of the Colorado River Basin under authority of the Federal reclamation laws and acts amendatory thereof or supplementary thereto, particularly the Boulder Canyon Project Adjustment Act of July 19, 1940 (54 Stat. 744), the Bureau of Reclamation has studied for several years the water storage and hydroelectric power possibilities of the upper Colorado River Basin including the area included within Dinosaur National Monument. The Bureau arrived at the conclusion that utilization of two storage-power sites within the national monument, referred to as the Echo Park and Split Mountain sites, was necessary for the best development of the water resources of the Colorado River Basin and that suitable alternate sites outside the boundaries of the monument could not be found.

In its role, under congressional mandate, as custodian of the areas of the national park system, of which Dinosaur National Monument is one, the National Park Service believes and, therefore, maintained that the proposed Echo Park and Split Mountain units of the upper Colorado River storage project would seriously and adversely affect numerous splendid natural and archeological values of the extensive canyon portions of the national monument, although they would not physically affect the small area in which the famous dinosaur beds are found. On pages 244 and 245 of the departmental report of July 1947, entitled "The Colorado River," and in the National Park Service report entitled "A Survey of the Recreational Resources of the Colorado River Basin," compiled in 1946 and published in 1950, it is asserted that the effects of the proposed Echo Park and Split Mountain units upon irreplaceable geological, wilderness, and related values of national significance would be deplorable.

The former report also stated that some geological and scenic values would remain, that new scenic and recreational values would result from the impoundment of reservoirs, and that, even though they would not compensate in kind for the losses described in the report, they would be of real importance.

Both reports pointed out that the policy of the National Park Service as the administrative agency responsible for the national monument has been to make the protection of the natural and archeological values of the area the controlling factor in administering it. They also expressed the view that the question of whether this policy is to be changed to permit development for water-control would require for its solution a review of all probable advantages and disadvantages by authorities superior to either the National Park Service or the Bureau of Reclamation, and that, before changes in the status of the canyon section are authorized in order to recognize water control as the principal consideration in administering the unit, it should have been clearly and certainly shown that it would be in the greater national interest to develop the area for such use than to retain it in its natural state for its geologic, scenic and associated values and for the enjoyment of them by the Nation.

The proposal to construct the Echo Park and Split Mountain Dams within Dinosaur National Monument resulted in a controversy of nationwide scope. There were numerous conservation groups and individuals on the one hand who believed that the effects of these projects upon the canyon areas of the national monument would be so disastrous as greatly to impair and even destroy natural values of

the highest order and that suitable alternate sites could be found outside the monument to save the area from despoilation. There were also many groups and individuals on the other hand who believed that utilization of the two sites in question was necessary for the fullest development of the power resources of the Colorado River and that satisfactory alternate sites outside the monument did not exist. The controversy became so intense that the Secretary of the Interior decided to hold a public hearing in Washington, D. C., on April 3, 1950, to afford both sides an opportunity to state their views. After thorough study of the arguments of opponents and proponents of the projects, the Secretary on June 27, 1950, issued a memorandum to the Commissioner, Bureau of Reclamation, and the Director, National Park Service, as follows:

THE SECRETARY OF THE INTERIOR,
Washington, D. C., June 27, 1950.

Memorandum.
To: Commissioner, Bureau of Reclamation, Director, National Park Service
From: The Secretary
Subject: Construction of Dams in the Dinosaur National Monument

The preparation of a comprehensive report for the development of the upper Colorado River Basin has posed the question of whether Echo Park (immediately) and Split Mountain (eventually) Dams should be built in the canyon sections of Dinosaur National Monument. I will not have the final say, but I must determine whether, as Secretary of the Interior, I shall approve and recommend to the Congress a plan that includes these dams.

The history of the issue is well known to you and is well documented in the transcript of proceedings of the hearing I held on April 3, 1950. I shall not review it here.

I am impressed with the fact that the waters of the Colorado River constitute a resource of paramount importance to the region and that in view of the arid nature of the area, my approved plan for the development of the upper basin must make every practicable provision for the conservation and multiple use of these waters in the interest of the people of the West and of the whole Nation.

I am not unmindful of the public interest in the inviolability of our national parks, and in the status, only a little less austere, of the national monuments. By no precedent of mine would I wish to endanger these places.

Weighing all the evidence in thoughtful consideration, I am impelled in the interest of the greatest public good to approve the completion of the Upper Colorado River Basin report, including the construction of the dams in question, because:

(*a*) I am convinced that the plan is the most economical of water in a desert river basin and, therefore, is in the highest public interest; and

(*b*) The order establishing the extension of the monument in the canyons in which the dams would be placed contemplated use of the monument for a water project, and my action, therefore, will not provide a precedent dangerous to other reserved areas.

I note that the fossils are not in the areas of the monument proposed to be flooded and that the creation of the lakes will aid the public in gaining access to scenic sections of the Green and Yampa River Canyons. Much superb wilderness within the monument will not be affected, excepting through increased accessibility.

The importance to the growth and development of the West of a sound upper Colorado River Basin program can scarcely be overemphasized. I hope that this decision on my part will promote quick solution of all other problems connected with this matter so that we may proceed with such a program.

I ask the National Park Service and the Bureau of Reclamation to cooperate fully in making plans that will insure the most appropriate recreational use of the Dinosaur National Monument, under the circumstances.

OSCAR L. CHAPMAN,
Secretary of the Interior.

Accordingly, the National Park Service is making a restudy of the values of the area in line with the Secretary's decision to recommend

to Congress the construction of the Echo Park and Split Mountain units. The objective of the restudy will be the replanning of proposed development, especially of the canyon section, to make the best possible recreational use of the Echo Park and Split Mountain Reservoir areas, in the event the dams are authorized, as well as to protect and make accessible remaining features of natural and archeological interest.

Recreational planning for the Echo Park and Split Mountain Reservoir areas will be based on the assumption that the Congress will approve and provide funds for them and will be focused on the potential values of these two artificial lakes and adjoining lands for such activities as boating, fishing, swimming, hiking, and riding. These will require roads and trails to points of access on the reservoirs and to overlook or view points. Consideration will also be given to needs for overnight facilities including campgrounds. Moreover, planning for the administration of the area will receive careful study. This will include studies for the safety of visitors and the protection of the area itself against soil erosion and fire, as well as plans for an administrative, protective, and interpretive staff and headquarters.

Prior to filling the reservoirs, it is contemplated that more thorough studies of the archeology, paleontology, geology, and wildlife of the area will be made, particularly for the purpose of recording and/or salvaging important scientific data which would be submerged by the reservoirs. The information gained by these studies will be of great value in future interpretive programs for the recreational areas.

The National Park Service will cooperate with the Bureau of Reclamation with regard to the location and layout of the Bureau's permenent and temporary facilities, such as construction camps, roads, tunnels, powerlines, and administrative developments, so that the objectives of the two agencies may be most harmoniously realized. Such cooperative planning should also result in the ultimate combined use of some facilities, such as roads, for both administrative and recreational purposes.

Estimates of cost

Recreational development of the canyon section of Dinosaur National Monument has been impossible because of inadequate funds or other obstacles. Necessarily such developments were deferred during the war period and there has been no opportunity thus far during the postwar period to proceed with logical and needed development. The canyon section is, therefore, inaccessible to the great majority of visitors. Trips into this section have been made almost solely by local residents and a few others who are sufficiently familiar with this type of rough canyon-plateau country to venture into it over very rough roads and trails.

It is believed, however, that there will be considerable demand to develop the canyon section for recreational purposes. Its location between two heavily used transcontinental highways, U. S. 30 and U. S. 40, and possibilities for making it accessible by good roads from both lead to the conclusion that this area, if suitably developed, will receive a good deal of use, not only by residents of nearby portions of Colorado, Utah, and Wyoming, but also from more distant and more

heavily populated districts. While the small number of potential visitors living within the immediate vicinity do not require extensive developments, the number of visitors from more distant sections may be expected to be large and a considerable recreational development will therefore be necessary.

In order to reach final conclusions as to the probable annual number of visitors to the area under adequate recreational development, it is essential to undertake a study involving not only these two reservoirs but also the recreational, scenic, and related resources, existing and potential, of the general region in which these reservoir areas lie. This region includes at least southwestern Wyoming, northwestern Colorado, and northeastern Utah. A regional study is imperative before it can be fully determined how much and what kinds of recreational use will be made of the two reservoir areas, and therefore, the amount and types of recreational facilities that should be provided.

Among the important resources of the region to be fully studied are the existing attractions of the nearby Uinta Mountains including forest recreation in the scenic Ashley and Wasatch National Forests with their natural lakes and streams and good fishing, as well as the cooler summer climate of the Uintas. Also, to be seriously considered is the potential recreational value of the Flaming Gorge reservoir area, particularly in view of its close relationship with the Uinta Mountains and their forests and natural waters. If, as seems contemplated by the Bureau of Reclamation, a good road may be constructed between United States Highway 40 at a point near Vernal, Utah, to United States Highway 30 in the vicinity of Green River or Rock Springs, Wyo., by way of the Ashley Dam of the Flaming Gorge Reservoir, a large and important mountain recreational district including this reservoir will apparently be made readily accessible.

Also to be considered is the Cross Mountain reservoir area, particularly if the fishing proves good.

This regional study has been initiated by the National Park Service, and it is expected that its findings will be made and its conclusions reached within a few months. These will have a direct bearing upon final recreational planning of the Echo Park and Split Mountain Reservoir areas. Pending the completion of this study, the National Park Service has prepared preliminary estimates of cost for Echo Park and Split Mountain, recognizing the possibility, however, that material alterations may have to be made in them when the regional study has been finished. The current estimates follow:

1. PRELIMINARY PLANNING

For study of boundary problems, selection of sites and preliminary sketches for development, soil conservation studies for watershed protection, collaborating with Bureau of Reclamation personnel on location of construction roads, camps, stockpiles, borrow pits, powerlines, and architectural design of structures, etc., preparation of the master plan which includes the development outline and all pertinent drawings as called for in vol. 12 of the National Park Service Administrative Manual, travel, per diem, and incidental expense	$100,000

2. RECREATIONAL PLANNING AND CONSTRUCTION COSTS

Roads: Approximately 85 miles of road construction which will include the approach road from U. S. Highway 40 to proposed developed areas such as Harpers Corner, Buena Vista Peak or Round Top, and Pats Hole	$6, 000, 000
Trails: Approximately 200 miles of trails which include walks within developed areas and nature trails and bridle trails to overlook points and to features and points of scenic, recreational, and related interest throughout the area	800, 000
Campgrounds: It is contemplated to provide 6 areas of varying capacity to accommodate approximately 4,000 camping groups, including such points as Island Park, Pats Hole, and the vicinity of Zenobia Peak	3, 600, 000
Picnic areas: 3 picnic areas are contemplated to accommodate approximately 2,000 picnic groups	1, 600, 000
Beaches: 7 beach developments are contemplated to accommodate the camping, picnicking, and lodge visitors. Among areas tentatively considered for beach development are Island Park and Pats Hole	230, 000
Lodge: Lodging for 400 guests, restaurants, shops, and employee quarters, and motor service. This development is being considered at a location on the Yampa Bench near the lagoon in the Pats Hole area	1, 250, 000
Marinas: 1 large marina in the vicinity of the lodge and 6 smaller ones adjacent to the camping areas	180, 000
Interpretative facilities: It is proposed to have 1 main museum and 8 secondary or wayside museums at other important public use areas to exhibit excavated materials and tell the archeological and geological story of the area	340, 000
Headquarters: This development will include administrative offices, repair shops, equipment storage buildings, and 7 employees' residences. Current studies indicate that the logical place for such development may be on U. S. Highway 40 at a point where the proposed main approach road will lead from the highway to the interior of the canyon section. Related to administrative headquarters will be several ranger stations throughout the area for services to visitors and protection of the area itself against fire	1, 800, 000
Construction cost	15, 800, 000
Construction plans, specifications, and estimates: Planning and supervision of construction average approximately 12 percent of construction cost	1, 896, 000
Grand total, planning and construction	17, 796, 000

3. WILDLIFE PROGRAM

(*a*) To survey the existing terrestrial animal life of the area to be flooded and the adjoining habitats which will be affected and to plan for subsequent management and interpretation_p. a	17, 000
(*b*) To survey the existing fishery resources and to plan for management and public use of the fishery in the future impoundments_p. a	10, 000
(*c*) To survey the existing plant life of the areas to be flooded and affected by flooding, and to plan for subsequent management, use by wildlife and interpretation to the public_p. a	10, 000
A minimum of 3 years will be required for the necessary field investigations and writing reports. Total amount required	111, 000

4. GEOLOGICAL PROGRAM

(*a*) To excavate two important fossil sites in Echo Park and Split Mountain respectively; recovery, preservation, and storage of the fossils and plan for subsequent public exhibit---p. a--	$25,000
(*b*) To survey geologic values of area, prepare geologic maps, and develop future interpretive programs----------p. a--	10,000
A minimum of 2 years will be required for the necessary field investigations, writing and printing reports. Total amount required---	70,000

5. ARCHEOLOGICAL PROGRAM

(*a*) Intensive survey of Yampa and Green River Canyons and testing of new sites as located----------	50,000
(*b*) Complete excavation of Hells Midden----------	20,000
(*c*) Complete excavation of Mantle's Cave----------	8,000
(*d*) Intensive testing of 33 other sites of the total 58 at approximately $3,000 per site----------	99,000
(*e*) Archeological excavation under (*a*) and (*d*) after survey and testing are completed----------	200,000
Total----------	377,000
A minimum of three years should be allowed for adequate completion of this project.	
Grand total----------	18,354,000

Program of estimated planning, construction, and related costs, by fiscal years, Echo Park and Split Mountain units, Colorado River storage project, involving Dinosaur National Monument [1]

	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	Total
PLANS AND INVESTIGATIONS											
Preproject recreational investigations and studies, archeological, geological, wildlife, and soil and moisture studies; master plan preparation, detail construction drawings and estimates and related work	$212,000	$399,000	$443,000	$300,000	$400,000	$300,000	$300,000	$200,000	----------	----------	$2,554,000
CONSTRUCTION AND LAND ACQUISITION											
Roads and trails, buildings and utilities, etc. including acquisition of land needed for recreational use and development	----------	----------	1,000,000	2,200,000	3,500,000	3,140,000	1,900,000	1,650,000	$1,310,000	$1,100,000	15,800,000
Total	212,000	399,000	1,443,000	2,500,000	3,900,000	3,440,000	2,200,000	1,850,000	1,310,000	1,100,000	18,354,000

[1] Prepared by River Basin Recreation Survey, Region 2, Nov. 14, 1950.

Bureau of Land Management

The Bureau of Land Management is charged with responsibility for managing, developing, protecting, and disposing of the surface and subsurface resources of the vacant, unappropriated public-domain lands of the United States, as well as the mineral resources of public lands withdrawn for other agencies. It has the exclusive responsibility for cadastral surveys on the public lands. It acts as custodian and handles applications for all mineral resources, not only on all public lands, but also upon privately owned lands where mineral rights are retained by the United States. The Bureau is the office of record of all transactions involving the public lands of the United States. It processes withdrawals of the public-domain lands for administration by other Federal agencies, and it classifies the remaining lands for their highest use, and administers them according to such classification. The Bureau rules on all applications to enter the public land under the agricultural land laws and, when proper, issues patents to the land. The Bureau handles the grazing responsibilities of the former Grazing Service under the Taylor Grazing Act of 1934, regulating grazing on the Federal range within the grazing districts and on lands leased for grazing outside of the grazing districts.

From the above general statement of the responsibilities and activities of the Bureau of Land Management in the Upper Colorado River Basin it is apparent that any changes in the general economy and land pattern of the area will have a strong influence on the program of the Bureau of Land Management. The Colorado River storage project and subsequent irrigation projects will have far-reaching beneficial effects on the local economy, making it necessary to make substantial adjustments in public-land programs for the basin.

There remains in the upper Colorado River Basin approximately 29 million acres of public domain, most of which is included in established grazing districts. Approximately 41 percent of the gross area of the basin is administered by the Bureau of Land Management. The acreages of public domain are distributed by State about as follows:

	Acres
Arizona	156, 000
Colorado	6, 610, 000
New Mexico	1, 749, 000
Utah	13, 904, 000
Wyoming	6, 582, 000
Total	29, 001, 000

The public domain consists of remnants of a land-disposal program which has continued for almost a century. These lands are, therefore, the least productive and those which are located in arid regions where crops cannot be produced without extensive investment in irrigation. While these lands have been considered mainly valuable for grazing, industrial development and irrigation have created a demand for lands which were formerly considered as having no value. Their

disposal to individuals and to public programs continues to take place. In addition to those being withdrawn for reclamation purposes, numerous applications are filed each year for homesteads, isolated tract sales, home, cabin and business sites, and various other special uses. Public lands are exchanged for State and privately owned lands where such exchanges are in the public interest. Those lands which have natural recreational or scenic value, or acquire these values through construction of artificial dams, may be reserved for use by State, municipal, or Federal agencies dedicated to the management and development of land for these uses.

The principal use of the public domain at the present time is grazing. These same grazing areas are subjected to multiple uses, including production of forest and woodland products and big game. Another important value attaching to the public domain is its watershed value. The public domain lands are not the principal water-producing lands, but they do contribute the major portion of the sediment deposited in the Colorado River. An analysis of the sediment records available on the Colorado River shows that approximately 60 percent of the sediment entering the stream originates in the area located below the confluence of the Green and Colorado Rivers and above the Grand Canyon. Another 22 percent originates in the San Juan River drainage above the Bluff gaging station. The total water contribution from these two areas is about 25 percent of that passing the Grand Canyon. In these two areas we have a situation where 80 percent of the sediment is contributed by 25 percent of the water; 75 to 80 percent of the land in these 2 areas is federally owned.

With the development of the upper Colorado River it is imperative that broad studies be made which will provide information to determine the proper use of land and water resources as a basis for determining disposal programs and adjustments in land control between Federal agencies. Such studies would form the basis for developing an integrated land-use program which would have as its objective a balance between the various phases of agricultural pursuits as well as mineral development and other industries. These studies should be on an area basis to insure proper consideration of the present and potential uses of land and water in advance of action programs. For example, livestock raising is one of the most important industries in the upper Colorado River Basin and is successful only where there is a proper balance between feed produced on irrigated land and on the open range. Advance area studies are needed to avoid a situation where this balance is not maintained thereby causing overgrazing and accelerated erosion.

The effect of the upper Colorado River storage and participating projects on the program of the Bureau of Land Management is specifically outlined below under the various functions of the Bureau.

Minerals and resource disposal

There are in the public domain lands extensive deposits of coal, oil and gas, and numerous other minerals. Notable examples are the coalfields throughout the basin and oil and gas deposits in the San Juan and Uinta basins and in northwestern Colorado near Rangely.

The Bureau of Land Management is charged with the responsibility of processing applications for leases of oil, gas, coal, phosphate,

potash, and so forth, under the Mineral Leasing Act of February 25, 1920, as amended, and applications for mineral entries; of determining whether the public land is mineral or nonmineral in character, as well as making investigations of mining claims to determine the validity of such claims. The hydroelectric power made available as the result of the Colorado River storage project will greatly stimulate the development of mineral resources, making it necessary for the Bureau of Land Management to adjust its operation to meet changing programs. The number of mineral applications is expected to increase manyfold. The added work connected with investigating and determining the validity of existing mining claims in connection with the construction program will be one of the immediate jobs of the Bureau of Land Management. There will also be a large amount of appraisal work of valid mining claims on lands which will be inundated as a basis for determining damage to claimants. The costs of this accelerated program resulting from the upper Colorado storage project are reflected in the attached budget estimates under "Mineral examination."

Land classification and resource inventory

Prior to designating public land for certain uses or acting upon applications seeking to acquire part of the public land, the law requires that the land be classified according to its suitability for the purpose intended. This includes determining that the lands are proper for withdrawals for national forests, parks, wildlife refuges, and reclamation. Coincident with and a part of the land classification responsibilities of the Bureau of Land Management is the determination of which lands the public interest requires be retained in public ownership, and the planning of a unified management program which encourages the most productive use of these lands from a public viewpoint. Proper management encompasses policies dealing with multiple-land uses such as forestry, grazing, mining, watershed protection, and recreation. Land classification also encompasses economic studies as a basis for determining the relationship between land pattern, public improvements, private improvements, the different phases of agricultural pursuits, and potential and existing industrial development.

The classification of the public lands in the Colorado River Basin has been carried out on a basis of relatively small areas, chiefly those on which land-disposal cases are pending. The initiation of the Colorado River storage project, with the subsequent development of the participating projects, will make it imperative that the program of the Bureau of Land Management on land classification and resource inventories be stepped up manyfold if errors are to be avoided in the overall land-use program of the upper Colorado River Basin.

The character of the public domain is known in a general way, but sufficient information is not available on which to base sound land-management plans or to determine the overall land-use adjustments needed. Detailed physical and economic information is needed to determine the suitability of public lands for such uses as watershed, forestry, grazing, crop production, industrial, recreational, and other special uses. A general resource inventory is needed, which would include the segregation of the lands according to their physical-use capabilities as limited primarily by soil, topography, and climate.

Such a study would appraise the erosion situation as to extent and degree and would include an inventory of the forage and timber resources as to quantity and quality to serve as a basis for stocking the range and determining allowable cut of timber and woodland stands. The data collected in such an area study would serve not only as a basis for planning conservation and watershed protection, but would permit an analysis as to which lands, in the public interest, should be retained and which lands should more properly be managed by other Federal agencies or under private ownership. It will permit a complete analysis of interrelated land values. When analyzed in connection with expected agricultural and industrial development as a result of the development of the upper Colorado River Basin, such a survey will indicate what adjustments will be needed for a balanced economy in the basin.

Such a broad area classification and resource inventory should be initiated at an early date, as the data developed should be available in advance of completion of construction phases. The estimated cost of an area classification and resource inventory is reflected in the attached schedule.

Basic land records

The Bureau of Land Management is charged with the responsibility of keeping the basic land records for the public lands of the United States. This activity is carried on through the Bureau's various land offices. In these offices are recorded all applications for entry upon public lands for any purpose except grazing permits within established grazing districts. Among other kinds of entries, these include homestead entries, desert-land entries, small tracts, isolated tracts, exchanges, special-use, State selections, grazing leases, mineral and gas and oil leases. Records must be maintained on the final disposition of all of the above enumerated applications, including patents issued and patented lands on which the minerals are reserved to the United States. The combined record of all of these entries is the only means of determining current status of the land. Records are also kept of all lands withdrawn for use by other Federal agencies, as well as rights-of-way over public lands. Records of revocation of various orders withdrawing lands are also maintained as a basis for determining the availability of land for other uses.

The development of the water resources of the upper Colorado River and the resulting rapid industrial development through the upper Colorado River storage project and participating projects, will greatly increase the demand for public lands in the basin. The increased number of land transactions will increase the volume of work in the land offices beyond the capacity of the present facilities and personnel, and the present record-keeping system. Lands involved in both the storage project, and the lands which will be irrigated under participating projects, will have to be cleared of all other obligations against the land. This will require a review of all existing withdrawals, including those which overlap, and the mineral claims on the lands affected. Since mineral claims are not filed in the land office until patent is applied for, this will require extensive checks in the various county offices as well as the Federal land offices. The estimated cost of this project is shown in the attached tabulation giving the estimate of funds needed.

Cadastral surveys

The Bureau of Land Management is the only agency authorized to conduct surveys fixing township and section corners in accordance with the rectangular system of surveys. These surveys form the basis of all legal descriptions of land and are necessary in establishing the location for rights-of-way, and in fact establishing ownership or control of land. Accurate locations are necessary in all planning and land classification programs. They form the basis for the mapping of basic resources and the condition and character of the land. Accurate locations in the construction phases of the upper Colorado River storage project will be necessary in the acquisition of rights-of-way and the determination of adverse claims on the lands affected. They will be needed in the laying out of farm units and settlements as the participating projects enter into the overall program.

In the upper Colorado River Basin there is a gross area of some 73,577,000 acres of land divided cadastrally as follows:

Unsurveyed	16,377,000 acres.
Old surveys	32,752,000 acres.
Iron post surveys	24,448,000 acres considered as sufficiently surveyed for most purposes.

With some exceptions the unsurveyed areas should all eventually be resurveyed cadastrally so that the land can all carry a legal description and known area. The exceptions are the very rough canyon areas and such permanent reservations as national parks and monuments where no land transactions normally take place.

The old surveys, those executed before 1910, should all be resurveyed with perhaps the following exceptions:

1. Highly developed suburban areas that have been adequately shown on local plats of record.
2. Incorporated areas, such as cities and towns.
3. Areas within permanent reservations such as national parks and monuments, where cadastral resurveys may be limited to boundary surveys and to surveys within the reservations sufficient to define private property limits.
4. Areas of sold private ownership in counties that have kept good local records of survey monuments and of cadastral activities of local county surveyors and other local engineers.

The cost estimates as shown in the accompanying program are based on a survey of 75 percent of the unsurveyed acreage, and a resurvey of 60 percent of the area of old surveys.

Resource management, protection, and rehabilitation

(*a*) *Grazing.*—The Taylor Grazing Act of June 28, 1934, authorizes the Secretary of the Interior to establish grazing districts upon the public domain. The primary objectives of this act are:

1. To stop injury to the public grazing lands by preventing overgrazing and soil deterioration.
2. To provide for their orderly use, improvement, and development.
3. To stabilize the livestock industry dependent upon the public range.

Almost all the public domain in the upper Colorado River Basin is located within 18 established grazing districts. These districts and the acreage in each are listed below.

Grazing district:	Acres
Colorado No. 1	1,727,000
Colorado No. 2	336,000
Colorado No. 3	1,143,000
Colorado No. 4	1,045,000
Colorado No. 6	858,000
Colorado No. 7	1,336,000
Total	6,445,000
Wyoming No. 3	909,000
Wyoming No. 4	4,400,000
Wyoming No. 5	1,212,000
Total	6,521,000

Grazing district—Con.	Acres
Utah No. 5	2,170,000
Utah No. 6	2,466,000
Utah No. 7	3,127,000
Utah No. 8	1,782,000
Utah No. 9	1,708,000
Utah No. 11	2,528,000
Total	13,781,000
Arizona No. 1	156,000
New Mexico No. 1	872,000
New Mexico No. 7	867,000
Total	1,739,000

The total of lands within grazing districts: 28,642,000 acres.

Livestock raising is the principal agricultural pursuit in the Colorado River Basin. Because of the vastness of the public domain it constitutes an important part of the livestock operations. This industry, being one of the important pursuits, exercises a strong influence on the prosperity of the basin as a whole. The Bureau of Land Management is charged with the responsibility for the stabilization of this industry insofar as use of the public domain is concerned, and at the same time conserving and developing the resources on the public land.

The Taylor Grazing Act authorizes the Secretary of the Interior to issue, or cause to be issued, permits to graze livestock on the grazing district lands, to bona fide residents, settlers, and other livestock owners. Permits have been issued to approximately 4,700 operators to graze a total of approximately 2,237,000 head of livestock. The number of permittees and numbers of livestock permitted to use the grazing district land is shown in the following table.

State and district	Number of permittees	Number of permitted livestock				
		Cattle	Horses	Sheep	Goats	Total
Colorado No. 1	163	22,000	560	127,000	----	149,560
Colorado No. 2	252	48,000	940	41,000	----	69,940
Colorado No. 3	396	36,000	930	117,000	----	153,930
Colorado No. 4	269	17,000	90	90,000	50	107,140
Colorado No. 6	88	4,000	190	92,000	----	96,190
Colorado No. 7	555	38,000	620	80,000	----	118,620
Total	1,723	145,000	3,330	547,000	50	695,380
Utah No. 5	308	20,000	310	49,000	----	69,310
Utah No. 6	103	14,000	190	77,000	----	91,190
Utah No. 7	438	23,000	920	88,000	----	111,920
Utah No. 8	220	12,000	350	177,000	----	189,350
Utah No. 9	92	7,000	80	109,000	----	116,080
Utah No. 11	364	19,000	560	28,000	----	47,560
Total	1,525	95,000	2,410	528,000	----	625,410
Wyoming No. 3	79	6,000	300	115,000	----	121,300
Wyoming No. 4	307	27,800	1,200	430,000	----	459,000
Wyoming No. 5	174	44,200	2,500	105,000	----	151,700
Total	560	78,000	4,000	650,000	----	732,000
Arizona No. 1	13	2,000	----	----	----	2,000
New Mexico No. 1	392	8,000	900	90,000	3,000	101,900
New Mexico No. 7	564	3,600	3,200	66,000	8,000	80,800
Total	956	11,600	4,100	156,000	11,000	182,700
Grand total	4,777	331,600	13,840	1,881,000	11,050	2,237,490

Prior to the passage of the Taylor Grazing Act, there was no control of the use made of these lands and each individual had to be the first one on the lands with his livestock in order to protect his interests. Range livestock operations were conducted with a minimum of overhead. Before the days of reclamation a minimum of cultivated forage crops were produced. The livestock were permitted to graze upon the public range during all seasons of the year, including those seasons when grazing on the range is most destructive. As a result of this condition, when grazing districts were first established a large part of the public domain was in a seriously depleted condition.

Under the Taylor Grazing Act and the rules and regulations promulgated thereunder, the public-domain lands are administered in accordance with accepted range management practices giving appropriate consideration to the effect of such administration on the local economy. Because of the character of the land, proper management requires the application of many scientific principles. The grazing district lands, for the most part, are located in the most arid portions of the basin and there exists a delicate balance between soil conditions, natural vegetative cover, and climate. Under these circumstances natural balances are easily distrubed.

In management of the public ranges four cardinal principles of range management are recognized and applied. These are (1) proper numbers of livestock, (2) proper seasons of use, (3) proper distribution of use, and (4) proper class of livestock. The number of livestock using the range is controlled by the permits issued. Proper seasonal use is accomplished by the construction of drift fences, stock water holes, and other range improvements designed to control or encourage livestock to use the range according to the season for which it has been classified. This practice is, however, influenced to a large degree by the production of cultivated forage on privately-owned land to supplement range forage during periods when the range cannot be properly grazed. The distribution of livestock on the range is accomplished through construction and use of range improvements and such accepted range practices as herding and salting. Class of livestock grazed is ideally governed by the dominant type of range forage. It is often necessary, however, to modify this practice according to the prevailing type of agriculture on the irrigated lands.

The livestock industry is dependent upon the production of hay and other feed crops for their livestock when range forage is not available or cannot be properly used. Experience has also shown that ample supplies are the best insurance against drought and severe winters. A stable livestock economy is dependent upon a proper balance between cultivated feed crops produced and the available seasonal forage production on the range. The increased hay production resulting from the development of the upper Colorado River Basin will complement the range forage and ultimately result in increased total livestock production. However, careful planning will be required to avoid an adverse effect. Most of the ranges are already fully stocked and if the additional production resulting from new irrigation merely permits the introduction of more livestock into the basin without adjustments in seasons of use and feeding periods, there will be increased pressure for more stock on the range for the same periods of time. By advance planning for readjustments in management plans, the increased production on irrigated lands can

relieve the pressure on overgrazed ranges while they are being rehabilitated to produce more forage than they now produce.

The interrelationship between production on privately owned or controlled land is further emphasized by the methods of adjudicating grazing privileges under the Taylor Grazing Act and the Federal Range Code. These rules and regulations under the act provide that preference will be given to livestock owners who own or control land or water used in connection with the public range. With the exception of the grazing districts in Arizona and New Mexico, grazing privileges in the upper Colorado River Basin have been apportioned to livestock operators on the basis of ownership or control of land. It is required that the operator possess sufficient land to feed his livestock for a given period of time. The development of additional feed on irrigated land will make it necessary to make substantial adjustments in range apportionments and livestock operations in the basin.

The upper Colorado River storage project will result in some ranch properties with grazing privileges attached to them being inundated by water. The public land on which some operators have grazing privileges will be cultivated or otherwise needed in connection with the project. In those cases where the operators lose their base properties they should have an opportunity to transfer their grazing privileges to other properties which can be used in connection with the public range. A study of the operations of those whose range allotments are needed in connection with the project should be made with a view to rounding out their operations on other lands or by use of new feed supplies resulting from increased irrigation. This will involve a revision in management plans for the units involved as well as the processing of appropriate transfers of grazing privileges.

The estimated funds required to make the necessary studies, reapportionment and transfer of grazing privileges as a result of the expected expansion of the livestock industry, are reflected in the attached program schedule under "Adjustment in range management plans and apportionment of grazing privileges."

(*b*) *Soil and moisture conservation.*—The President's Reorganization Plan No. 4 of April 11, 1940, transferred the responsibility for soil and moisture conservation operations on lands administered by the Department of the Interior from the Secretary of Agriculture to the Secretary of the Interior. Special funds are made available to the Department of the Interior and to the Bureau of Land Management to carry out this responsibility.

Bureau of Land Management conservation operations are organized by project areas. The project area is a unit of land on which rehabilitation and conservation practices are essential for the prevention of critical soil erosion and the wastage of water resources. These are areas that have been seriously impaired by wind or water erosion, or both, as a result of improper use by man or his animals, drought, or damage by fire or floods to such an extent that they require remedial action. Bureau of Land Management activities are carried out on the public lands within approved soil and moisture project areas. Lands in other ownership, the rehabilitation of which would vitally affect adjacent or nearby public domain lands, also may be included in the soil and moisture conservation program through cooperative agreement and contributed funds.

First priority for soil and moisture conservation operations is given to those lands described as being in the severe-to-critical stage of man-induced erosion, where such erosion is endangering other lands or public facilities such as irrigation projects. Soil and moisture operations may be carried out on lands in less serious condition when their treatment is necessary for success on lands in the first category. Funds made available for soil and moisture conservation are used to carry out proven erosion control practices designed to protect the soil and hold it in place. These practices include reseeding, construction of small detention and check dams, contour furrowing, water-spreading devices, and construction of livestock control fences and stock-water development to insure uniform utilization of native forage.

It is estimated that between 50 and 60 percent of the lands under the administration of the Bureau of Land Management in the upper Colorado River Basin is in severe to critical erosion condition, and it is known that the public domain lands are the principal contributors of sediment to the Colorado River system. This erosion is attributed to a combination of features, including topography, geology, soil, climate, and land use. The situation in the Colorado River Basin with respect to the first four features mentioned naturally results in an unusually high rate of erosion. The public lands in the upper Colorado River Basin are, however, characterized by broad alluvial filled tributary valleys. These are the most productive of the public lands. Because they were originally the best grazing lands, they were the most seriously misused. This misuse is responsible in a great measure for the present extensive gully system which is characteristic of the most critical erosion in the basin. These gullied valleys are the greatest potential source of sediment for transportation into the main system of the Colorado River. Because of the more favorable soil conditions, they are also the areas on which effective treatment has been demonstrated. To obtain optimum benefit of the flow of the Colorado River and to provide maximum benefit for existing and contemplated structures on the river, as well as to prevent excessive destruction of the watershed itself, a conservation program for erosion abatement is essential.

While a number of conservation measures and erosion-control measures have proved effective on a small scale and under given conditions, there is urgent need for extensive studies in erosion control and sediment abatement on a larger scale and over a greater sample of geologic formations, soils, and climatic conditions. For the protection of the upper Colorado River storage project and participating projects, these studies should be undertaken at an early date.

(c) *Timber and woodland management.*—The public domain lands have not been considered important for their production of forest and woodland resources. However, these areas do support unknown quantities of sawtimber and extensive stands of pinon and juniper. Prior to the passage of the act of July 31, 1947 (6 Stat. 681, 43 U. S. C., sec. 1185), commonly called Public Law 291, there was no authority for the orderly management and sale of timber and woodland products from the public lands, except under wartime emergency provisions.

Disposal of these products was by free-use permits for woodland materials such as posts, poles, and cordwood for use by local residents. The Secretary of the Interior is now authorized to sell woodland products and a small amount of money has been appropriated for the administration of this law. The amount appropriated does not allow the inventorying of the woodland areas and providing for supervision to abate trespass and to develop orderly management plans. The total volume of forest and woodland products on the public lands is not known. In addition to the value of the resource for the product itself in the economy of the basin, the protection from erosion afforded by the forest and woodland cover is an important factor. This is especially true because many of the forest and woodland types are found on steep slopes.

The anticipated increase in rural population resulting from the Colorado River storage project and participating projects will create an additional demand for forest and woodland materials. These will consist largely of posts and poles for fencing and other farm improvements. The attached budget schedule for the upper Colorado River Basin reflects the cost of forest and woodland inventories. .. These will consist of detailed inventories to determine total volume and allowable cut in areas where it is anticipated that the demand will be greatest.

(*d*) *Fire control.*—In connection with its public-land management and protection program, the Bureau of Land Management is charged with the responsibility of fire protection. Investments in conservation must be protected from forest and range fires which can cause damages requiring years to correct.

Fire is historically one of the destructive agents of western watersheds and has been the cause of serious erosion problems in some areas. With expected improvement of the Colorado River watersheds through more intensive management, it is reasonable to assume that the fire hazard will become more acute, requiring a greater investment in fire presuppression and suppression.

(*e*) *Wildlife (game management).*—The public domain lands provide part of the yearlong habitat of the big-game population of the basin. Because the lands administered by the Bureau of Land Management are located in medium and lower elevations, they provide a substantial part of the winter grazing for game animals. While the Fish and Wildlife Service and the State game commissions are the agencies responsible for the technical game-management programs, the land-management agencies must consider the use of the land made by game and provide for their use in their management plans, as well as resolve conflicts resulting from competition between wildlife and domestic livestock for range forage. Experience has shown that failure to recognize this dual use has resulted in serious erosion problems. Increases in population in the basin will create a need for recreational opportunities, including hunting and fishing.

Proposed program, Bureau of Land Management, Upper Colorado River Basin

Program element or function	Funds required by fiscal year—						Total estimated cost, 6 years 1952–57	Funds required after fiscal year 1957
	1952	1953	1954	1955	1956	1957		
Adjustments in range-management plans and apportionment of grazing privileges	$10,000	$65,000	$65,000	$65,000	$65,000	$65,000	$335,000	[1] $65,000
Cadastral surveys	169,000	217,000	207,000	363,000	324,000	324,000	1,604,000	[2] 8,000,000
Land classification and resources inventories	130,000	195,000	243,000	244,000	241,000	241,000	1,300,000	1,500,000
Mineral examination	8,000	10,000	10,000	8,000	8,000	5,000	52,000	----------
Basic land records	10,000	15,000	15,000	10,000	10,000	-------	60,000	----------
Watershed and sedimentation studies	10,000	50,000	50,000	50,000	50,000	10,000	220,000	[1] 10,000
Forest and woodland inventories	-------	12,000	12,000	12,000	12,000	6,000	54,000	6,000
Total	337,000	564,000	662,000	752,000	713,000	657,000	3,685,000	9,581,000

[1] Continuing.
[2] Based on resurvey of 60 percent of old surveys (not iron posts) and 75 percent of unsurveyed area. By end of first 6-year period it may be determined that the degree of coverage will need to be revised.

Bureau of Mines

INTRODUCTION

The upper Colorado River Basin is entirely within region IV of the Bureau of Mines, administered from Denver, Colo. The only establishments of the Bureau of Mines within the basin are the Oil-Shale Demonstration Mine and Plant at Rifle, Colo., and a standby helium recovery plant at Shiprock, N. Mex. However, all of the personnel and facilities within the region and some outside are concerned with the many diverse mineral problems in the basin.

The development and conservation of the mineral resources of the upper Colorado River Basin area within the States of Arizona, New Mexico, Colorado, Utah, and Wyoming are directly and indirectly affected by the development of the water resources and power. Without either, the other is impaired.

The national requirements for minerals are increasing, while, on the other hand, the rate of discovery of many high-grade critical and essential minerals, including oil and gas, is on the decline. In order to keep abreast of the increasing national demand, it is necessary to provide measures to step up the rate of discovery of new reserves, reduce the cost of mining and handling ores by improvements in techniques, improve methods of recovery and separation, and develop better usage of the minerals and metals.

This Nation produces and consumes roughly one-half of the aggregate of all the mineral wealth in the world today. It is self-sufficient in many minerals, particularly bituminous coal and lignite, anthracite, natural gas, phosphate rock, and potash; and it is virtually self-sufficient for the immediate future in a number of other metals such as copper, iron, molybdenum, and vanadium. Although many of these minerals in the eastern and central part of the United States are being rapidly depleted, large undeveloped or underdeveloped reserves exist in the upper Colorado River Basin area.

The Nation is dependent on the West for most of its copper, lead, zinc, gold, silver, vanadium, and petroleum. This area contributes a substantial part of these minerals and to a very great extent, the continued welfare of the Nation depends upon maintaining a healthy mineral industry within the upper Colorado River Basin area.

MINERAL PRODUCTION AND EXTENT

The total production of minerals from the upper Colorado River Basin, as shown in table 1, amounts to over $2½ billion based on the value of the raw material at the mine or well. Commercially the most important have been coal and petroleum. Coal represents over half the aggregate value of all minerals produced. Although the statistics of production are not available, the area is the principal source of uranium and vanadium in the Nation. The principal reserves of molybdenum in the Nation occur in the upper basin. Silver,

TABLE 1.—*Production of gold, silver, copper, lead, zinc, coal, petroleum, natural gas, and other minerals in the upper Colorado River Basin area to 1948 (except uranium and vanadium)* [1]

	Colorado	New Mexico	Utah	Wyoming	Total
Gold:					
Ounces	8,905,764				8,905,764
Value	3,397,513			(2)	$108,397,513
Silver:					
Ounces	335,801,274				335,801,274
Value	$248,140,450			(2)	$248,140,450
Copper:					
Pounds	331,212,771				331,212,771
Value	$41,418,335			(2)	$41,418,335
Lead:					
Pounds	2,178,021,871				2,178,021,871
Value	$118,530,742			(2)	$118,530,742
Zinc:					
Pounds	1,250,022,668				1,250,022,668
Value	$110,360,048				$110,360,048
Other metallic: Value	[3] $200,000,000	(2)		(2)	[3] $200,000,000
Coal:					
Tons	141,600,000	28,887,000	190,772,000	265,657,000	616,916,000
Value	$320,000,000	$70,953,000	$473,944,000	$474,316,000	$1,315,212,000
Petroleum:					
Barrels	74,000,000	6,318,000		229,843,000	310,161,000
Value	$146,000,000	$7,992,000	(2)	$245,019,958	$399,002,000
Natural gas:					
Million cubic feet	61,500			133,745	198,245
Value	$2,080,000	(2)	(2)	$5,555,462	$8,535,462
Other nonmetallic: Value	$10,000,000	$2,500,000		(2)	$12,500,000
Grand total, value (approximate)	$1,401,827,000	$81,435,000	$473,944,000	$724,890,000	$2,682,097,000

[1] Compiled from Geological Survey "Mineral Resources," Bureau of Mines "Minerals Yearbook," and statistics furnished by various Bureau of Mines statistic and economic offices.
[2] None or minor.
[3] Includes 355 million pounds of molybdenum valued at $150 million.

gold, lead, and zinc are commercially important, and metals of minor interest include copper, manganese, bismuth, and antimony. Potash and magnesium, although undeveloped, occur in large partly proven reserves, and phosphate rock is found in thick, medium-grade beds in Utah and Wyoming. The largest reserves of oil shale in the United States occur in northern Colorado and Utah and southern Wyoming within the basin. The search for petroleum and natural gas is being expanded rapidly and production continues to increase.

Mineral fuels and other hydrocarbons

Coal.—The upper basin contains enormous reserves of coal, mostly of bituminous and subbituminous grade. Reserves here are much larger than those in any other section of comparable size in the world and amount to approximately one-third of all of the coal deposits in the United States and one-sixth of those in the entire world. Some of this coal is below present mineable depths, but mineable reserves alone are nearly one-fourth of the Nation's total deposits. Coal reserves within the upper basin are roughly estimated at 400 billion tons.

The importance of these vast reserves is enhanced by the almost complete absence of any coal deposits in the States west of this region. The only exception of any consequence is the coal deposits of the State of Washington, but this coal is inferior in quality and more difficult to mine than the coals of the upper basin. Large quantities of coal from the upper basin are now shipped west, north, and sometimes east. These coals can be mined more cheaply than those in most other regions and may provide the basis for much of the future industrial development of the western part of the United States.

Mine entries above ground level are possible for a large portion of the deposits. Thick beds, ranging from 8 feet to a maximum of 90 feet and virtually horizontal, can be mined with comparative ease.

Bituminous coals from the upper basin are considered the highest quality bituminous coals on the western market. They are low in ash and moisture, extremely low in sulphur and highly volatile with a high heat value. Largest coal mines in the upper basin are in the Rock Springs and Kemmerer districts in Wyoming, served by the Union Pacific Railroad, and near Price, Utah, on the Denver & Rio Grande Western Railroad. Most of the coal mined in the Colorado area is bituminous but some good grade anthracite is mined in Gunnison County.

Coal production in the upper basin increased more than 50 percent in the period 1940–43. Part of the increase was in coking coals mined near Sunnyside, Utah, for new steel plants at Geneva, Utah, and Fontana, Calif. The new completely mechanized mine located near Sunnyside has a capacity to produce 8,000 tons of coking coal per day. Other important deposits of coking coal are located near Crested Butte, Durango, and Norwood, Colo. Coal in the Willow Creek area, Wyoming, was found recently to be suitable for blending with other coal in the manufacture of metallurgical coke.

Coal production from the upper Colorado River Basin has declined since World War II, due to extreme competition from petroleum and natural gas. However, it is indicated from fuel and population trends on the west coast that large quantities of coal will be needed in the near future. The increasing use of coal in this market will be accelerated due to probable decline in petroleum and gas production. Already large gas lines are being extended from the upper basin to west coast points.

Petroleum and natural gas.—Oil and gas have been discovered in over 40 widely separated fields in the upper basin. Most of the fields are located in northwest Colorado, southwest Colorado, and northwest New Mexico. It is reported that between 15 and 20 wells are in production in the newly discovered Ashley Valley field near Vernal, Utah.

The 1948 estimate of proven petroleum reserve in New Mexico, Colorado, and Wyoming was over 1½ million barrels. The reserve strictly within the upper basin is not segregated. The estimated reserves of natural gas in New Mexico, Colorado, and Wyoming, mostly within the basin in millions of cubic feet, was about 9 million at the end of 1948.

Oil shale.—The upper basin contains the largest deposits of oil shale in the United States. These beds of oil shale occur in Colorado, Utah, and southern Wyoming. Next to coal, they are potentially the most important mineral resource of the upper basin. The estimated oil-shale resources in northwestern Colorado, calculated from all the information obtained through 1950, indicate a total of nearly 500 billion barrels of oil in an average thickness of 500 feet of shale. The reserves in Utah and Wyoming probably are not as large as those in Colorado nor as readily mined.

Bituminous sandstone and rare hydrocarbons.—Another oil-bearing material of great potential importance is bituminous sandstone. At the present time it is being used as a road-surfacing material. Large

deposits are worked near Vernal and Sunnyside, Utah. The Vernal deposit contains about 2 billion tons averaging between 8 and 15 percent bitumen by weight, but most of it can be recovered only by underground mining. The deposit near Sunnyside is also very large; a sample of it averaged 11 percent bitumen by weight.

The only known deposits of gilsonite, elaterite, wurtzilite, and ozocerite are in the upper basin. In normal times these materials are mined from veins and shipped to all parts of the world for use in the manufacture of roofing, insulating materials, and such articles as ink and switch handles.

The gilsonite deposits occur mainly in the Uinta Basin in Utah.

Production of gilsonite in northeastern Utah amounted to 67,165 short tons valued at $1,746,228 in 1947 and 52,122 short tons valued at $1,390,000 in 1948.

Reserves have been estimated at 25 million tons. The annual output of ozocerite and wurtzilite in Utah amounts to only a few hundred tons.

This array of mineral fuels and carbonaceous materials is not approached by any region in any other part of the world. The extent to which these materials may provide the basis for future mining and mineral processing within the basin and in contiguous areas cannot be foretold definitely, but it is certain that their effect on future industrial development will be important.

Nonferrous metals

The upper basin has contributed 8,900,000 ounces of gold, 336 million ounces of silver, 1 million tons of lead, 625,000 tons of zinc, and 165,000 tons of copper to the total mineral production of the Nation. Virtually all of this production came from Colorado, primarily from the San Juan region in San Juan and San Miguel Counties and from Eagle, Pitkin, and Summit Counties. Geologic conditions are favorable for increased production from these areas and other minor areas, providing sufficient incentive is offered.

Ferro-alloy metals

The Climax molybdenum district is the largest molybdenum district in the world and contains the largest single metal mine in Colorado. The district is situated on the Continental Divide in Lake County. The district has produced nearly 350 million pounds of molybdenum, and the reserves are estimated to be 500 million tons containing 2 billion pounds of recoverable molybdenum. Byproducts produced from molybdenum treatment comprise tungsten, pyrite, tin, monazite, and topaz.

The Plateau area of Colorado, Utah, Arizona, and New Mexico is the principal source of uranium and vanadium in the United States. Deposits of manganese in the San Juan Mountains and in Eagle County within the upper basin and at Leadville, just outside the basin, may prove to be extremely important to the Nation during an emergency. These ores are mixed with lead, zinc, and silver and are generally refractory and difficult to treat in order to separate the constituents. They represent one of the major metallurgical problems in the upper basin.

Nonmetallic minerals

Although there has been no production, potentially phosphate rock and magnesium and potash salts constitute some of the most important

mineral resources of the upper basin. Phosphate rock occurs in medium-grade thick beds in the Phosphoria formation along the southern flank of the Uintah Mountains in Utah. Reports indicate the reserves are enormous. Recent exploration by the Bureau of Mines and Geological Survey near Thompson, Utah, has proven the presence of extensive deposits of carnallite, a chemical combination of potassium chloride and magnesium chloride, and of other potash-bearing minerals. Associated beds of salt were found to be up to 2,000 feet thick.

When other more economically situated deposits approach exhaustion, these deposits of phosphate rock and potash will doubtless become important sources of mineral fertilizer.

DEVELOPMENT AND CONSERVATION PROGRAMS

The program of the Bureau of Mines in the Upper Colorado River Basin has as an objective the development and conservation of the mineral resources of the area and the promotion of accident prevention and health of the people working in the mineral industries. Development and conservation is being accomplished by providing means of (1) increasing the rate of discovery of new reserves; (2) reducing the cost of mining and handling ores by improvements in techniques; (3) improving methods of recovery and separation of minerals and metals; and (4) developing better usage of the minerals and metals.

Mineral mining (except oil and gas)

Mineral mining as used here includes the extension or discovery of mineral reserves, extraction of ores from the ground, and related problems. The functions of the Mining Division covering all problems involved in mining broadly comprise: (1) Actual physical development to extend known reserves and discover new ones, (2) collecting information on mining practices at specific operations and actual research on specific mineral deposits, (3) studies of mining and related problems within natural mineral areas or other geographic subdivisions, (4) studies of mineral resources as they relate to other resources within basin areas, and (5) dissemination of the information through publication. All of these functions have as their primary purpose the conservation of mineral resources.

Mining development and research.—Mining development and research include the field of activity wherein (1) work is done to extend reserves of minerals in specific deposits or to discover new ones, and (2) research conducted on specific deposits, usually submarginal in grade, to develop methods of mining and better equipment. This field of endeavor has covered the entire upper Colorado River Basin area and includes many of the metals and nonmetallics found in the area. A current list of pending development and research projects is maintained from which are selected those that best meet the national need as funds become available. Examinations and studies are being made constantly and the list revised to fit changing economic and technical conditions in the Nation and the world at large. Examples of this field of activity are illustrated by the following description of several active and proposed projects.

Coal mining methods and reduction of losses.—The purpose of this project is to conduct research in mining thick beds of coal to increase the extraction as a conservation measure. The overall extraction of

coal in thick beds ranges from 30 to 70 percent. The loss represents a national extravagance that may prove very costly for future generations.

Ferrous metals and alloys.—Large reserves of mixed manganese-lead-zinc ores and refractory manganese silicate are known to exist at Leadville, Gilman, and Silverton, Colo. Nationally, manganese, as well as lead and zinc, are in critically short supply. The higher grade manganese, low in lead and zinc content, has been virtually exhausted, and many of the mines are largely caved and inaccessible. Most of the remaining manganese is marginal or submarginal in grade according to present standards, intimately mixed with lead and zinc, or otherwise refractory, and the metals cannot be separated economically by known methods. The solution of the problems relating to mining and metallurgical recovery would make available an important source of these scarce metals.

Nonferrous metals.—The upper Colorado River Basin area has been the source of a considerable quantity of many of the most important nonferrous metals, particularly copper, lead, zinc, and many minor metals recovered as byproducts from smelter and refining plants. These metals are on the critical list, and most of the mining development and research in the area is devoted to problems relating to increasing reserves by extension of known deposits and discovery of new ones.

It is proposed to conduct experimental mining on narrow lead-zinc-bearing veins that are found in many places throughout the area. The veins contain large quantities of metal that are uneconomic to mine under present standards. The object of this project is to investigate and develop less costly and more efficient methods of mining, to test equipment to determine that which is more adaptable, and establish better practices that will reduce the cost of mining. Successful solution of the problems involved in mining narrow veins will increase the known reserves materially.

Projects designed purely to develop or extend reserves of minerals by examination, comprising mapping and sampling, diamond drilling, trenching, and underground excavation, are selected each year from a list of requests for work from owners of prospects, examinations by Bureau of Mines engineers, and recommendations from the Geological Survey. These projects cover the entire area of the upper basin.

The gravels in many of the streams that have their source in the mountains on the western slope of the Rocky Mountains in Colorado contain gold. Considerable placer mining has been done along these streams. The extent of these gold-bearing gravels and the gold content has never been determined. Before any large reservoirs are established that might cover these potentially valuable gravels, a thorough job of sampling and testing should be done to determine the metal content. Other valuable minerals may also be found.

Consideration should be given to providing sluice boxes to trap gold and other heavy valuable minerals on all Government projects or contracts where aggregates from stream beds are to be mined for construction purposes.

Nonmetallic minerals.—Development and research on nonmetallic mineral deposits are becoming increasingly important as new uses for the minerals are discovered. Steadily increasing demand for these minerals has prompted the Bureau of Mines to expand investigations.

Pegmatite dikes are scattered through the large granitic mountain masses in Colorado and New Mexico within the upper basin. These are the source of many uncommon nonmetallics, such as beryl, mica, lithium minerals, columbite-tantalite, feldspar, and numerous undifferentiated rare earth minerals.

Usually the dikes are mined in a haphazard and expensive manner by individuals or small groups to recover 1 or 2 of the constituent minerals and the remainder is wasted. This results in operations that are uneconomic and the minerals are not available when emergency needs arise. The prices therefore are too high for general use in special processes and industries where they would improve the process or product.

Several projects are being considered to determine the extent and mineral content of selected individual dikes, conduct research to determine the most economical methods of mining the commercial minerals, conduct tests at the mine and in laboratories to effect separation and recovery of the various constituents, and make economic studies to determine the best combined methods of obtaining production from the dikes in case of economic need and emergencies.

Mineral research unclassified.—Mineral surveys are conducted on a district or county basis. These surveys comprise studies of past and present activities in the production of minerals, methods, and practices employed in mining, treatment, and related mineral industry activities. The information is compiled, analyzed, and published.

Mineral-mining methods and cost surveys are made on individual privately operated mines throughout the upper basin. These studies are published and made available to the mining industry. They have proven helpful to the industry in solving many operational problems.

The proposed park tunnel, to drain the mines in the Park City district, Utah, is outside the upper Colorado River Basin; however, it is presented here because any water drained from the mining areas probably will have to be renewed through water exchange which ultimately will have to be supplied from the upper basin.

The great need for additional water in the Salt Lake Valley has prompted studies of the justification and feasibility of a tunnel through the Wasatch Range, serving the purposes of water diversion from the Provo River and drainage of the Park City and Alta mines. The water-diversion aspects of the tunnel now appear to be more economically accomplished by other methods; however, the need for draining the mines is still a virtual necessity to enable the mines to operate over any long period of time.

The important mines are within a 3-mile radius of Park City. Production has been continuous since the first mineral discovery in 1868, and for the years 1870 to 1948, inclusive, the recorded value of recovered gold, silver, copper, lead, and zinc has been $385 million. A group of smaller mines surrounding Alta have produced over $34 million in gold, silver, copper, lead, and zinc.

Water has been the greatest difficulty in developing the Park City mines. As mining has continued to greater depth, tunnels have been driven at progressively lower levels to drain mine areas. At present, the Ontario No. 2 is the lowest drainage tunnel in the Park City area and it drains about 6,000 gallons per minute from 1 section of the area. Mines in this section have been developed 450 feet below the tunnel, but mining below the tunnel has been impossible for some

years because of the excessive cost of pumping that would be involved. The Spiro tunnel drains another section of the area and normally collects about 6,000 gallons a minute, of which 4,500 gallons per minute are pumped from 700 feet below tunnel level. Mines in this latter section have recently been closed and expect to request some Government subsidy to permit them to cover the extra cost of pumping.

It has been estimated that the proposed park tunnel, 1,000 feet lower than present water level, would make accessible for mining 6,500,000 tons of ore above the tunnel and 3,250,000 tons below the proposed tunnel, having an aggregate value of half a billion dollars.

Without the water-diversion features originally considered, it is tentatively estimated, that the tunnel can be driven for twenty to twenty-five million dollars and completed in 7 to 10 years.

Metallurgical research

Today, virtually no mineral resources other than some fuels go directly from the mine to the ultimate consumer. Our mineral economy is based largely upon the economic effort required to convert naturally occurring deposits of raw materials into beneficiated and purified products which will fit into established use patterns. Although billions of tons of important metals such as manganese, aluminum, and iron exist in the United States, we are greatly concerned about shortages, because it is not now feasible, economically and technologically, to convert many of these very low-grade and often refractory resources to materials which are suitable for the production of ferromanganese alloys, aluminum ingots, or pig iron. It is this field of translating mineral resources into terms of useful products that is the concern of the Metallurgical Division.

The metallurgists by employing advances in the sciences and improvements in technology are finding it feasible to beneficiate, smelt, and refine consecutively lower grade and more refractory ores, thereby increasing our mineral wealth in terms of utility. The metallurgist also devises means of recovering and producing new materials demanded by advances in related fields for rare elements such as thallium, zirconium, beryllium, and uranium. Conversely, metallurgical research is concerned with providing new materials from minerals which occur in abundance but have been neglected. For example, research by the Bureau of Mines recently demonstrated that titanium, one of the most plentiful elements in the earth's crust, can be fabricated as a metal in ductile form having the strength of steel and only one-half the weight, and military demands already far exceed production even at prices higher than $10 per pound.

Ferrous metals and alloys.—The proposed metallurgical program in ferrous metals and alloys as it may apply to the upper Colorado River Basin includes investigation of the recovery of titanium, vanadium, and iron from titaniferous magnetite; ferrograde manganese from low-grade ores; silicomanganese from rhodonite ore; and manganese, zinc, and lead by amalgam metallurgy from low-grade complex ores. A few typical proposed investigations are more fully described in the succeeding paragraphs.

Domestic manganese ores in most instances are too low in grade to be used directly by the steel industry and require beneficiation for the production of ferrograde manganese. At present, the steel industry is dependent upon foreign sources of manganese; and in the case of a

global crisis, it is improbable that shipping lanes can be maintained to meet the needs of a wartime economy. It is proposed to develop processes to treat the low-grade ores in the region and to obtain engineering data from pilot-plant operations. The mineral beneficiation and processing by hydrometallurgical and electrometallurgical means would be investigated to demonstrate efficient methods of converting low-grade ore to products acceptable to the ferroalloy industries.

Deposits of rhodonite, a silicate of manganese, and rhodonitic-type ores are a potential source of manganese for the steel industry. The deposits in Colorado represent a considerable tonnage and have been ignored previously because the ores contain excess silica and are unadaptable to the production of ferromanganese. It is reported that in 1949 the steel industry was ready to use as much as 230,000 tons per year of silicomanganese in lieu of ferromanganese and ferrosilicon. It is proposed to investigate the production of silicomanganese from rhodonite.

The I. G. Farbenindustrie of Germany has developed a new metallurgical process called "amalgam metallurgy" based on the cyclic use of mercury as a reagent. Among the accomplishments claimed for this process are (1) production of high-purity zinc, manganese, and other metals from impure electrolytes; (2) direct electrolytic production of alloys of virtually any desired composition; (3) electrolytic production of powdered metals and alloys; and (4) ability to produce 99.999 percent zinc, lead, and other metals from low-grade and complex ores. The process may be applicable to many deposits of low-grade ores in the region such as the manganese-zinc-lead-silver ores of the Leadville and Gilman districts, Colorado. It is proposed to study all available information concerning the process, to conduct investigations on laboratory scale, and if the results are sufficiently encouraging, to try it in a pilot plant treating typical ores.

Pyrometallurgical research proposes to study the development of processes for treating strategic domestic ores such as those of chromium and manganese by pyrometallurgy and by electrometallurgy. This study will develop more economical methods for producing ferroalloys acceptable for use in industry. It will also develop methods for the simultaneous recovery of silver, lead and zinc from low-grade manganese ores. Technologic studies, already complete, indicate the feasibility of developing and improving such processes and the final step in producing metal always involves a process in pyrometallurgy, electrometallurgy or by electrolysis.

The production of manganese by electrodeposition from chloride electrolytes prepared from low-grade domestic ores appears to be economically feasible. Laboratory work has indicated that leaching low-grade manganese ores with hydrochloric acid and ammonium chloride followed by electrolytic deposition of manganese can be adapted to commercial production. This project proposes to study the factors involved in converting the present laboratory process into a commercial process by erecting and operating a production pilot plant that will produce 1,000 pounds of pure manganese metal per day.

Nonferrous metals.—Copper, lead, zinc, antimony, gold, and silver deposits represent the chief nonferrous mineral resources and the suggested metallurgical program includes investigations directed toward the solution of major problems confronting industry for the

more efficient utilization of these resources. In addition to the more common nonferrous metals, the area is the only important source of uranium and vanadium. Programs for these particular metals are given as are descriptions of investigations dealing with the production of such rare metals and elements as hafnium, gallium, germanium, selenium, tellurium, beryllium, titanium, and zirconium by special processes. The following paragraphs discuss the significance and scope of a few typical suggested metallurgical investigations.

Uranium.—The area encompasses virtually all the known producers of uranium ore in the United States. The uranium occurs in many types of minerals which are in general low grade. As the mining and processing of uranium ores become more declassified and are taken over more by industry, the need for technologic data will be critical. It is proposed to investigate processes for beneficiating low-grade ores and for the treatment of many off-grade types to permit the widest production of this important element. The information sought would be that which could be generally disseminated without jeopardizing national security.

Many major problems face the western mineral industry in meeting the demands for ever-increasing amounts of lead and zinc. These problems can be attributed to the exhaustion of high-grade ores, with the consequence that lower grade and more complex ores must be worked, and to the increased cost of obtaining the metals from more remote and smaller deposits. In seeking a technologic solution of these problems, it is proposed to make a comprehensive study in two directions as follows:

Unitized small smelting plants.—The success of large integrated smelters in acting as custom buyers for ore has to a large extent discouraged investigation into the feasibility of building and operating small-scale smelters suitable for treating complex lead ores. However, existing smelters were originally located close to large mining districts, which have now been exhausted; and with the increased cost of hauling ore to these smelters many remotely located complex ore deposits cannot now be profitably exploited. One possible solution is to devise a simplified smelting process using a minimum of equipment to make the capital cost low and so unitized as to be readily moved to a new location.

Volatilization processes.—Another attack on the same problem of treating complex ores, particularly partially oxidized ores of lead and zinc, is the possibility of developing a volatilization process for treatment of this type of ore. The Waelz process, as employed on very low-grade and complex ores in European countries, has not been adequately tried in the United States; and it is proposed to determine what modifications of the basic process are needed to make it applicable to treating domestic ores.

Nonmetallic minerals.—The nonmetallic mineral program of the area is headed by the vital problem of investigation, the utilization of the low-grade western phosphate ores by mineral beneficiation, furnace treatment, and chemical processing. The program also includes the beneficiation and preparation of clays for irrigation ditch linings, catalysts, and various other uses; the recovery of economic and rare, strategic minerals from pegmatite dikes; and the evaluation of the rare earth content of placers, dikes, and disseminated deposits in the area.

The reserves of western phosphate rock are tremendous, but most of the phosphate beds are not high in grade. Utilization of these low-grade deposits will be essential in the future economy of the area. Before any large-scale use can be made of the phosphate ore and shales, a technology must be developed for the low-cost beneficiation, and furnace or chemical treatment, of the low-grade ores and shales that are minable by large-scale and inexpensive methods. Laboratory and small pilot-scale studies would comprise the major part of the initial proposed mineral beneficiation work, and the emphasis would be on the use of low-cost gravity, flotation, and dry methods to produce acceptable feed material for the more expensive chemical or furnace treatment. The pioneering studies would be supplemented by larger scale demonstration units to further prove the processes and provide data using commercial-size equipment. It is further proposed to study the feasibility of treating the beneficiated phosphate material by various alternative chemical and furnace methods to recover superphosphates, elemental phosphorus, byproduct vanadium, and defluorinated products.

In the conservation of water resources, the prevention of seepage losses from water ponds and irrigation ditches is becoming increasingly important. As much as 25 percent of the irrigation water in secondary and tertiary canals and ditches may be lost by seepage. A small amount of a swelling-type bentonite mulched into the porous and sandy soil forms an impervious coating that reduces water seepage and thereby conserves the limited supply for useful irrigation purposes. A number of bentonitic clay deposits are known to occur in the river system areas. Although some of the Wyoming and South Dakota bentonites are high-grade swelling types, the Colorado and Utah deposits are generally of the nonswelling type that would require physical beneficiation and chemical processing to increase their gelling and swelling properties to make them useful as a lining material. It is proposed that a laboratory investigation be initiated to study the beneficiation and base exchange methods for converting the readily available nonswelling type bentonites to useful and low-cost swelling type bentonite. A further objective of the work would be the preparation of satisfactory swelling-type bentonite and activated bentonite for well-drilling muds and oil clarification to be used in oilfields and refineries.

Important areas of pegmatite dikes in the area contain economic minerals such as feldspar, mica, zircon, quartz, and lithium minerals. They also contain rare and strategic minerals such as beryl, columbium, hafnium, and thallium. Quartz, feldspar, and zircon are used in large quantities for the production of ceramics, glass, and refractories, while mica, lithium minerals, beryl, columbium and tantalum, hafnium, and thallium are all important strategically and occur rarely in the United States. It is proposed to make laboratory and pilot-plant studies of methods for the production of economic minerals from the vast dike systems.

The major portion of the metallurgical work would consist of labotory and small pilot-plant studies in mineral beneficiation aimed at the production of the principal minerals such as feldspar, mica, beryl, and lithium minerals. The project would also entail microscopic, chemical, and spectrographic studies of the rare elements and chem-

ical extraction methods if this type of research were a logical sequence of the investigation.

Coal-utilization investigations

Although coal production in the upper Colorado River Basin is relatively low, due to extreme competition of oil and natural gas, it is indicated from fuel and population trends in California that large quantities of coal will be needed in the relatively near future. At present, California uses relatively no coal but by 1955 it is indicated that about 10 million tons will be required per year to supplement oil for generation of electric power. Each year thereafter more coal will be required because the demand for electric power in California more than doubles every 10 years.

Raw coal from Utah costing $4.50 per ton at the mine can be shipped to California to compete with fuel oil at about $2.60 per barrel. Approximately the same will hold for coal from western Colorado with slight adjustments in freight rates. In 1949, the price of fuel oil rose to $2.45 per barrel, and it is indicated that by 1954 the average price of oil will be close to $2.60.

If favorable coals in the upper Colorado River Basin are distilled at low temperatures to make tar-oils and chars, it is feasible to recover up to 45 gallons of tar-oil per ton. The chars produced represent about 73 percent of the available heat in the raw coal but only about 63 percent of the weight. It is indicated that the cost of processing coal will be considerably less than the value of the tar-oils produced; therefore, the probable cost of char on a heating-value basis should be considerably less than the cost of raw coal delivered in California. If this can be proved by adequate research and development, a vast new industry and new markets for coal in the upper Colorado River Basin will be created.

Although hydropower development in the West will relieve the demand for electric power, it is pretty well proven that thermal power is necessary in some areas to sustain firm markets for hydropower. In a relatively few years, it will be necessary to install thermal power plants to supplement hydropower. Such plants should be designed to burn char for steam generation or for the gas turbine. The by-product tars produced would be the basis for new industries or raw materials for synthetic liquid-fuel plants.

Much research is needed to establish the technical and economic facts related to utilization of processed coal for power generation. The coal branch of region IV has studied this problem in connection with utilization of Texas lignites. Similar studies on testing and appraisal of upper Colorado River Basin coals should be conducted as a long-range problem to improve the western fuel picture. National fuel economy requires maximum efficiency in the use of fuel. This is especially true when considering shipments of large quantities of solid fuel to California where the freight cost exceeds the mining cost. By processing coal at the mine to remove moisture and inert constituents, the higher heating-value char can be shipped at less cost per heat unit and the savings in freight will pay a large part of the processing expense. The byproduct tar-oils have value for chemical raw materials or for the manufacture of synthetic liquid fuel.

In planning the fuel economy of the upper Colorado River Basin, multi-purpose use of coal should be considered as a conservation

measure. Solid fuel should replace liquid fuel for generation of electric power because it is not desirable to burn oil for generation of power if coal can be supplied at equal cost. The same applies to natural gas.

The following discussion gives a striking example of the great potential possibilities in the use of processed coal for generation of electric power on the west coast: The Pacific Gas & Electric Co. is just about to complete the construction of two new large power plants at Moss Landing and at Contra Costa. These plants will cost over $100 million and they are designed for use of oil, gas, or coal. Each plant will have a capacity of 300,000 kilowatts. The Pacific Gas & Electric Co. expects to construct additional plants to keep up with the constantly increasing power demand.

Such a plant will require 718,000 tons per year of high-grade Utah coal of 12,500 British thermal units per pound. It will require 2.54 million barrels of fuel oil or 16.86 billion cubic feet of natural gas per year if these higher value fuels are used. Raw coal can be shipped from Utah to compete with oil when the price of oil is about $2.60 per barrel and this may occur in the relatively near future.

If coal is upgraded at the mine to make char and tar-oils, 1 million tons of coal would be processed at the mine to produce 628,000 tons of char of 13,610 British thermal units per pound. The char thus formed will run the plant but the weight represents only 87.5 percent of the weight of raw coal needed. The freight saving will therefore be 12.5 percent or equal to 45 cents per ton of coal processed. The tar produced amounts to 45 million gallons or 1.07 million barrels per year. It is indicated that tar is worth about 11 cents per gallon and the tar value per ton of coal processed is $4.96. With the saving in freight of 45 cents per ton of coal, the potential values created to defray cost of processing amount to $5.41 per ton of raw coal. Since it is indicated that the cost of processing will be about $2 per ton, there is a substantial margin to reduce the cost of char delivered at the power plant to a point where it will compete with fuel oil.

The Coal Branch of region IV, Bureau of Mines, has developed new processes for high-speed drying and carbonization of noncoking coals at low temperatures. Due to the high capacity of plants employing the new process, the investment cost is estimated to be about $1,000 per ton of daily capacity. The process is continuous and subject to automatic control. Coal is handled pneumatically in the fluidized state, there are no moving parts except a gas compressor, and the cost of operation should be less than $2 per ton of coal handled. The development of this process on a pilot-plant scale has been done in cooperation with the Texas Power & Light Co. and it is indicated that processed lignite in Texas may soon compete with natural gas for power generation.

Research and development work on processing coals of the upper Colorado River Basin is necessary to determine the technical and economic data for a more accurate appraisal of the possibilities of treating coal for shipment to California and for use in the basin in powerplants supplementing hydropower.

Oil-shale development

Resources.—It is an accepted conclusion that liquid fuels play a major role in the economy of the United States and it is absolutely

imperative that an adequate supply of such fuels be available at all times if we are to maintain our present standard of living. In the past, these liquid fuels have been produced solely from petroleum, and since petroleum is an exhaustible resource, it is mandatory that other sources of liquid fuels be developed. Liquid fuels can be produced from such natural resources as coal and oil shale. In order that the United States will have an adequate supply of liquid fuels for an indefinite period of time, the 2d session of the 78th Congress passed the Synthetic-Liquid-Fuels Act charging the Bureau of Mines with the responsibility of developing the necessary technology to insure that the Nation would have a continuing supply at a low cost. In accordance with the provisions of this act, the Bureau of Mines established and has in operation an oil-shale demonstration plant and mine near Rifle, Colo., where work conducted to date indicates that liquid fuels can be produced from oil shale at costs not greatly exceeding the production of the same fuels from petroleum. However, in order to produce adequate supplies to augment our dwindling petroleum production at costs satisfactory to our economy, further research and development work are necessary and such research must continue as long as the natural resource is available so as to increase the quantities of liquid fuels, thus conserving the natural resource and reducing its cost so that it can be used more widely.

To date less than one-third of the vast oil-shale deposits in Colorado have been proven or blocked out. An expenditure of nearly $1 million over a period of 6 years would be necessary to block out completely a thousand square miles of probable commercial grade oil shale in northwestern Colorado. This work would include approximately 51 holes for a total length of about 91,000 feet.

Large deposits of Green River formation are known to exist in both Utah and Wyoming. However, little is known about the oil yield from the formation in these States. It is roughly estimated that with the drilling of 45 holes for a total of about 125,000 feet and the expenditure of about $1,440,000 the most important areas of these States could be located. It would take approximately 6 years to complete this preliminary program. Considerably more drilling would be necessary to determine accurately the extent of the areas located.

The term "oil shale" is a misnomer, as it is not a true shale but a marlstone and contains no free oil but an organic material which can be converted to liquid products.

The oil-shale project is composed of three distinct industrial phases; first, the rock must be mined and crushed; second, the solid organic products are converted to liquids; and third, the liquid product is converted to usable fuels. Since there was no technology available pertaining to these three phases of operation, it had to be developed by the Bureau of Mines. Although to date, as a result of experimentation and demonstration, the Bureau has been able to make marked progress in the development of this technology, a large amount of research work is yet to be done before economically feasible commercial projects can be established.

Mining.—During the period 1945–50 the Oil-Shale Mining Branch has developed the equipment, method, and procedure for one means of exploiting the 70- to 90-foot thick Mahogany Ledge of the Green River formation in western Colorado. Production rates of 148 tons

per man-shift underground labor have been demonstrated at a direct cost of 29.2 cents per ton.

It is estimated that a period of 6 years and an expenditure of about $3,200,000 are necessary to complete the present mining research program, design, and fabrication of new and more efficient mechanized equipment, and to demonstrate their use in a unit of a large-scale operation. In addition, alternate methods of mining should be investigated and the mining of thinner sections containing greater values should be demonstrated and evaluated.

Mining research that must be completed includes improvements in operating procedure and lowering of operating supply costs for percussion drilling; rotary drilling research to determine optimum drilling characteristics of the oil-shale formation and the selection of suitable rotary bits; the completion of instrumented blasting research designed to lower the cost of explosives in both heading and bench rounds; investigation of alternate loading and transportation equipment should be done to lower the cost of these phases of the operation; exhaustive studies of accurate methods for determining the stresses in the mine structure must be continued and expanded; methods for ventilating large-scale commercial mine structures must be determined and demonstrated; and the possibility of mining by means of sonic disintegration should be fully investigated.

The present mine structure must be developed to demonstrate mining the 70-foot Mahogany Ledge on two levels employing both percussion and rotary-type drilling upon the completion of suitably designed mechanized equipment. A method for mining a 25-foot-thick bed yielding about 35 to 40 gallons per ton should be determined and studies of the mine structure stresses in such a mine should be made. Suitable equipment should be designed, fabricated, and demonstrated. Efficient mining cycles should be established.

Plant.—During the period 1949–50, the Oil-Shale Demonstration Branch has conducted research on and developed several retorting and refining techniques for the extraction of oil from shale and its subsequent conversion into usable liquid fuels. Numerous processes and specially developed equipment for using these processes have been developed, and from these additional information is steadily forthcoming from which better processes and types of equipment can be developed.

Retorting.—The only way known to date of converting solid organic material to liquid products is through the application of heat, and major problems involved in the development of techniques and equipment are in reality a problem of heat transfer and material handling, and because of the complex organic material occurring in the oil shale the mechanisms of the chemical reactions for its conversion to oil must be understood in order that an adequate solution of the problem may be forthcoming. In order to solve these problems it requires the construction and operation of several stages of pilot-plant equipment to obtain the necessary thermodynamic and engineering information on which to base the design of a commercial plant.

Refining.—Since shale oil is a different chemical substance than petroleum, it cannot be converted to usable products using standard refining practices. The chemical complexity of shale oil is increased because of the presence of sulfur and nitrogen in combination with carbon and hydrogen. To solve the technical problems involved

requires the construction and operation of numerous and various sizes of pieces of pilot-plant equipment. The devising of various processes and design, construction, and operation of equipment to reduce this process to practice and analyses of the data obtained therefrom are the bases of necessary chemical, thermodynamic, and engineering information necessary to produce commercial units capable of producing high-quality, low-cost products.

Plant location survey.—In addition to the development of necessary mining, retorting, and refining technology and drilling of core holes to prove the extent of the oil-shale deposits, it is also necessary to conduct location surveys for adequate sites upon which to establish an oil-shale industry. As previously stated, the Green River oil-shale reserves occur in abundance in northwestern Colorado, northeastern Utah, and southwestern Wyoming. In this particular area the terrain is extremely mountainous and cut with numerous river valleys. Because of the terrain and the extremely isolated areas, and in order to establish industries to utilize the resources, it is imperative that the area be thoroughly surveyed and adequate, detailed plot plants and topography maps be made so that the mines, plants, and refineries could be advantageously located with respect not only to each other, but with respect to availability of water, power, transportation facilities, and existing communities.

Petroleum and natural gas research

In any planning or development program that might be undertaken relative to a river basin, the amount of the reserves of oil and gas should be known as well as the rate at which these reserves can be made available. It is necessary to know that in making these resources available, the oil and gas fields are operated so that the greatest recovery of these resources will be accomplished.

An inventory of the physical plant in its branches of production, pipeline and refinery, as well as the requirements of energy and water and the utilization of manpower, all as of the present and projected into the future are requisites.

In the upper Colorado River Basin there are undeveloped resources of materials that should be studied with the view toward the utilization of these natural resources in the economy of the area, materials such as tar, waxes, gilsonite, and the unusual natural gases.

Mineral statistics and economics

The Bureau of Mines collects production statistics of all the minerals produced in the United States. Each year these statistics and economic studies are published in the publication known as the Minerals Yearbook. This publication has a worldwide circulation and is regarded as the most authentic information available.

Within the area of the upper Colorado River Basin, petroleum and gas statistics are collected in Los Angeles and gold, silver, lead, zinc, and copper statistics are collected in Denver and Salt Lake City. The present plan is to expand this collection of statistics at these offices to include all minerals. The importance of statistics of production cannot be overestimated since it gives an index to the supply of critical minerals and metals available. A mining library is maintained in Denver and in Salt Lake City where the mining public, consulting

engineers, and others interested in mining may obtain information readily.

Accident prevention and health in the mining industry

The Bureau of Mines was organized in 1910 following a series of disastrous coal-mine explosions which resulted in the death of hundreds of miners. The basic act outlined, as one of the principal activities for the Bureau, studies to increase mine safety and the reduction of the accident rate in mines. Subsequent acts of Congress greatly expanded the activities of the Bureau of Mines, and today the Bureau of Mines has an interest in all phases of mining.

The fatality accident rate in coal mines has been reduced from 5.63 killed per million tons of coal production in 1910 to 1.24 in 1949; there has been in the same period over 50 percent reduction in fatalities in noncoal mines on an exposure basis.

All coal mines in the United States are inspected from 1 to 4 times per year by the Federal coal-mine inspectors. Some very small mines have not been inspected because of an insufficient number of inspectors. In the upper Colorado River Basin area virtually every coal mine of whatever size has been inspected at least once every year. In addition to the inspection of coal mines, the inspectors are trained in the use of oxygen-breathing apparatus and are available in case of a disaster such as a coal-mine explosion or a mine fire. There is seldom a year that the Bureau Mines is not called upon to furnish trained personnel to assist in recovery work following a fire or a mine explosion.

The Accident Prevention Branch provides technological assistance in promoting mine safety in the metal and nonmetallic branches of the mineral industry. The work includes demonstrations of the hazards in handling and use of inflammable liquids such as gasoline, the use of diesel engines underground and inspections of operating mines so that the known hazards may be pointed out to the operators. Employees in the mineral industry are given training in first aid to the injured and in the use and care of oxygen-breathing apparatus.

The work of both the Coal-Mine Inspection Branch and the Accident Prevention Branch includes much instruction of mine officials and employees through accident-prevention classes.

The Roof Control Branch studies the roof control methods practiced within the region, the use of timber and metal supports including various types of roof bolts, and the study of roof fall accidents which comprise at least 50 percent of the fatal accidents in the mineral industry. This branch is new to the Bureau of Mines, and considerable expansion is contemplated.

Mine ventilation, particularly in metal and nonmetallic mines, is generally inadequate. Most coal mines are ventilated in accordance with State laws. The Bureau of Mines furnishes technological advice to mine operators whereby the ventilation can be improved and brought to the standards set by the United States Public Health Service.

Studies are made of explosives practices in all types of mining. Explosives are one of the primary sources of serious and fatal accidents in mines. The work in testing explosives, and the study of

fast-delay detonators, double priming, and fumes from explosives should be greatly expanded.

The mechanization in coal mines, particularly, and to a lesser degree in metal mines, has introduced new hazards in mines because of electricity used for power. The hazards of the use of electricity underground are not well known in many instances. This field of study should be augmented, and more information made available to the operator.

Many millions of tons of coal are burned each year by fires which occur in the coal deposits in the Western States. The Bureau of Mines is currently controlling fires in coal beds on the public domain and this should be continued until all known fires have been controlled. The cost of controlling these fires ranges from $200,000 to $350,000 per annum.

Bureau of Indian Affairs

The whole Colorado River Great Basin is of special importance and significance to the Bureau of Indian Affairs. Within its broad boundaries live over one-fourth of the Indians of the United States totaling in numbers to approximately 101,600. Residing in that part of the Great Basin to be directly benefited by the Colorado River storage project of the upper basin are approximately 38,000 Indians. Eighty-four percent of these Indians are Navahos, while members of the Ute and Apache Tribes make up the balance. They are almost entirely dependent on the natural resources of their lands which are inadequate for their minimum needs. To them, as to their non-Indian neighbors, water is of vital importance. Historically, Indians within this arid region settled along the water courses, particularly those of the Colorado River and its tributaries. It was inevitable that conflicts over the use of water with non-Indians should develop, and many such conflicts are still unresolved. With the settlement of the West, and the encroachment of non-Indians on lands which the Indians formerly used at will, reservations were established through treaty, executive order, and congressional action. Restricted to limited areas, and increasing in population, the Indians overgrazed their land and now face with non-Indians the problems of accelerated erosion, soil depletion, and diminished resources.

Tribes within the Colorado River Great Basin have retained their aboriginal culture to a greater degree than tribes elsewhere in the United States. In many parts of the region the Indians have had only slight contact with modern technologies. Many Indians speak only their native tongue, and only a minority can read and write. There is a strong adherence to their traditional patterns of thought and behavior. The reluctance to accept modern technologies and concepts, the inability to read and speak English, and a resistance to leaving their reservations create serious problems in the economic development of the Indians of the region.

The basic responsibilities of the Bureau of Indian Affairs are twofold: To protect and develop Indian resources; and to help and encourage Indians in the slow and sometimes painful process of acculturation. The final goal is the integration of the Indians in the social, economic, and political pattern of American life. It is obvious that the work of the Bureau deviates widely from that of other Bureaus in the Department of the Interior.

INDIANS AND THEIR LAND

The Colorado River Basin is the pre-Columbian home of most Indians now living within its boundaries. They were not transplanted there from other parts of the country under the pressure of the westward movement of the white population. This has an important influence on their attitudes. They have strong emotional

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and cultural ties to their land, even though it is in many cases unproductive.

Within the upper Colorado River Basin region Indian landholdings total approximately 11 million acres located on reservations varying in size from the vast Navaho Reservation of over 8 million acres within the upper basin, while an almost equal acreage of this reservation is located within the adjacent lower basin. The greatest part of this whole area is classified as open grazing land—most of which has a very low carrying capacity. There are 360,000 acres of Indian land susceptible of irrigation in the upper basin taking into account the full development of the projects now partially irrigated.

With some notable exceptions, the land base of the Indians is grossly inadequate, and even with proper development and use cannot support them at a minimum acceptable standard of living. They are, however, peculiarly dependent on the resources of their land. Most Indians are not equipped by education, experience, or ambition to compete with non-Indians away from their reservations. Nor do they have the desire to leave the emotional security of their own environment and face insecurity and discrimination in the outside world, yet it is inevitable that many Indians must progressively seek their living away from their lands.

INDIAN RESOURCE PROBLEMS

The Bureau of Indian Affairs is responsible for the protection, development, and conservation of all lands held in trust for the Indians. In the upper Colorado River-Great Basin region these total over 11 million acres as already stated.

Certain problems faced by Indians in the development and use of their lands are common to all groups making a living from the soil of this arid region. In addition there are other problems peculiar to the Indian which intensify the difficulties of the Bureau in its administrative responsibilities.

Fundamental in consideration of Indian resource problems is the gross inadequacy of the land base, and the peculiar dependence of the Indians on their land for a livelihood. An increasing population has placed a progressively heavier burden on the land, and resulted in serious overuse of the grazing land especially. Its productivity has been drastically reduced, and in many areas accelerated erosion has taken place. The prevention of further deterioration of the soil, and the restoration of damaged areas are of major concern to the Bureau and to the entire region. The effect on Hoover Dam of the soil erosion on the Navaho Reservation has been widely publicized. There are other examples, less dramatic, throughout the region.

There are approximately 10.2 million acres of tribal land and 800,000 acres of trust allotted land in the upper Colorado River Basin region. Both types of ownership present serious problems in the efficient use of the land. On many unallotted reservations the pattern of land-use is according to tribal custom without a formalized system of land assignment. Individuals and groups have certain historical land-use rights in areas which are informally recognized by other members of the tribe, but there is rarely any clear delimitation of the area. The Bureau and the Indians face the task of creating effective land-use codes, through which individuals and groups will have clearly estab-

lished land-use rights to specific areas of land. In addition, governmental and tribal controls are needed to implement these codes and assure sound land-use practices.

Even more serious are the problems of proper land use on trust allotments. The General Allotment Act provided for the allotment of small pieces of land to individual Indians, varying in size from 10 acres of irrigated land to 160 acres of grazing land. Under the law, trust allotments cannot be alienated, but on the death of an allottee are subject to the State inheritance laws. The result over the years has been a progressive subdivision of allotments which were often uneconomic units originally. Unless the numerous heirs to an allotment could agree among themselves, the individual holdings were too small to farm, and often fell into disuse. This process is continuing and threatens paralysis of some of the most valuable Indian land in the region.

Inadequate credit has been another obstacle to the full use of Indian lands for farming and stockraising. Indians are denied the usual sources of credit because of the trust status of their land, and their lack of property to use for security. Congress has never fully recognized the importance of this, and loan funds established through congressional action have not been large enough to meet all Indian needs. This in spite of an extraordinarily fine repayment record by Indians of the funds that have been made available.

The existing and potential projects of irrigable Indian land in the upper basin have all the problems of water rights, maintenance costs, drainage, water supply, and operation which are common to all irrigation projects. In addition the Indians have special problems inherent in the transition from subsistence farming to commercial farming and use of modern farming methods. The Bureau has the task of developing potential irrigation projects to meet the pressing needs of the Indians, safeguarding Indian water rights, and assisting Indians in learning new techniques of agriculture.

IRRIGATION

General

The complete utilization of all Indian basic resources must be brought about with the utmost speed in order to prevent a continuing drain upon the Federal Treasury for Indian support and to forestall the pauperization of a large part of the Indian population. And it is here that the importance of irrigation as a part of the economy of Indian administration becomes apparent.

Agricultural development by irrigation on most of the reservations in the arid and semiarid regions constitutes the principal if not the sole means and opportunity by which the Indian may become self-supporting and make proper use of his lands. Also the continued and further development of Indian irrigation projects is essential to preserve the water rights pertinent to the reservations which have been established by treaties or other Federal enactment. This right becomes increasingly difficult to protect in the face of approaching full development of the general water resources of the country by other water users. At present the Indians are not prepared or equipped to develop their own water rights and it is the Government's duty to do so. Congress, facing the difficulties of Indian self-use of

irrigated land and realizing the subsistence character of farming operations especially in its initial stages, in 1932 passed what is commonly known as the Leavitt Act (47 Stat. 564). This legislation provides in effect that no irrigation construction assessments shall be made against Indian lands so long as the title remains in Indian ownership. It further provides that the Secretary of the Interior may adjust or cancel any unpaid operation and maintenance assessments. Both unpaid construction and operation charges constitute first liens against the land, which will be recited in any patent or instrument issued for such lands.

It accordingly will be seen that the need for and the feasibility of irrigation projects for Indians should be determined by a somewhat different formula than is commonly used in determining the feasibility of irrigation projects for the more mobile white farmers. Economically, the Indian is confined to his reservation until the time comes when he has adjusted himself to the whites' "civilized competitive environment."

A large factor in the question of economic feasibility of Indian irrigation projects is whether it will tend to increase the chances of the Indians becoming self-supporting. Consequently the justification for Indian irrigation projects should to a large extent be measured by what it would cost Federal gratuities if the irrigation projects were not constructed. Included in these gratuities are the many social and administrative costs created by the existence of a large substandard population.

Continuation of irrigation development for Indians together with the construction of works to serve such privately owned land as may be included in Indian irrigation projects should be continued by an organization directly under the control of the Indian Bureau. The success of an Indian irrigation project depends not only upon it being properly and economically constructed and operated but also upon the development of the Indian to the point where he will make use of the facilities provided. This is a human and social problem which necessarily must be worked out in company with the other elements essential to Indian advancement. The irrigation activities must dovetail into an integrated reservation program.

INDIAN IRRIGATION PROJECTS IN THE UPPER BASIN NAVAHO RESERVATION—POTENTIAL AND EXISTING

Shiprock project

The resource development which would provide for the largest number of Navaho families is the proposed Shiprock-San Juan irrigation project. It is located south of Shiprock on the San Juan River in the northwest corner of New Mexico and comprises a large area of Navaho tribal land susceptible of irrigation from the San Juan River. The possibility of developing an irrigation project in this area has been under intermittent consideration for more than 50 years. Surveys have been made by one or more State engineers of New Mexico, the Bureau of Indian Affairs, and the Bureau of Reclamation as well as by private persons. More recent studies of the Bureau of Indian Affairs in which the Bureau of Reclamation has substantially assisted have now reached the preliminary report stage. The final phases of

this report together with any further extensive investigations must necessarily await the outcome of current negotiations endeavoring to reach an agreement covering allocation of the waters of the San Juan River and its tributaries taking into account the apportionments made to the upper basin States by the upper Colorado River compact.

The net area of the Shiprock project pending the water supply determination and as assumed for preliminary report purposes is 114,000 acres, all of which could be irrigated by gravity facilities. A considerably larger gross acreage of 45,000 acres could be served by pumping with a maximum pump lift of 150 feet. In the event the Bureau of Reclamation's proposed south San Juan project is constructed as has been proposed, as much as 23,000 acres additional Indian land area could be included in that project.

Present project major structure plans are based upon participation in the power benefits and the use of the Navaho Dam and Reservoir which comprises one of the main units of the Colorado River storage project, and has long been used as the storage site for the Shiprock project. This unit of the storage project as tentatively designed will have a capacity of over 1 million acre-feet.

At least a portion of the area of the Shiprock project would be competitive for the utilization of the San Juan River water supply with the potential south San Juan project as well as with the San Juan-Chama transmountain diversion project. These two latter proposed developments have been under investigation and study by the Bureau of Reclamation for several years. Obviously the size and cost of the several proposed projects in this region will depend upon final allocations of the available water supply. No determinations have as yet been made as to allocation of construction costs to power or to flood and silt control. The assumed 114,000-acre Shiprock project would provide economically sized farm units averaging 63 acres to 1,800 families. Several times this number of nonfarming families would eventually be supported as incidental to the extensive agricultural production which would surely result from a project of this magnitude.

Navaho Animas-La Plata (potential project)

Within the proposed extension of the Animas-La Plata project of the Bureau of Reclamation there is an area of 25,000 acres of Indian land on the Navaho Reservation which is susceptible of irrigation. This land lies in the Monument Rocks area north of Shiprock and would be served by extending the Animas-La Plata canal system. The Bureau of Reclamation is currently designing this project for a total area of 110,000 acres of which about 24,000 acres of non-Indian land is now under constructed works. The enlarged project involves the construction of nine reservoirs, a hydroelectric powerplant, together with a canal and distribution system.

Navaho miscellaneous irrigation projects (present and potential)

The present irrigation development on the Navaho Reservation within the upper basin region consists of more than 40 small tracts varying in area from 20 to 4,200 acres each. The aggregate area in these units now provided with irrigation facilities is approximately 15,000 acres of which about one-half is class 1 and one-half class 2 land of 5 classes of land surveys.

These small irrigated tracts are scattered over the entire reservation and because of such dispersal fit in well with the livestock economy of the Indians. Expansion of a considerable number of these units to their ultimate irrigable area estimated at some 25,000 acres in the aggregate should be given favorable consideration. The potential work involved in completing these small projects consists of extending and improving the canal and lateral systems, the development of some additional and supplemental storage capacity and the preparation of raw land for Indian use. Construction work is now underway on the more promising of these units and the preparation of detailed plans are sufficiently advanced so that the work can be continued. Further surveys will be made as required for the development of the remaining units which will be carefully selected. Based upon the estimated productive capacity of the present irrigated area it is believed to be sufficient for the support of 300 families. With the eventual completion of the more feasible units, it is estimated that an additional 200 families will be able to obtain self-support by farming.

Uintah and Ouray (existing and potential extensions)—Utah

There are 77,000 acres under irrigated works on the Uintah Reservation in Utah, supplied by water from the Uintah, Duchesne, Lake Fork, and Whitewater Rivers; and 1,250 acres with irrigation facilities on the Uncompahgre Reservation. It is planned to increase this to 22,000 acres.

A preliminary statement of the Bureau of Reclamation on the proposed central Utah project, which is currently under investigation, the initial phase development of which has been named as one of the principal participants in the upper Colorado River account, states that this project—

> proposes to intercept water of the streams flowing down the southern slopes of the Uintah Mountains at sufficient elevation to flow by gravity into the Bonneville Basin * * *. Replacement of water thus diverted from the Uintah Basin would be accomplished under ultimate phase development by diverting water from the Flaming Gorge Reservoir on the Green River.

The Indian as well as the non-Indian landowners throughout the Uintah Basin are vitally interested in this project. The extent to which the proposed irrigation works will affect the water rights and present water supply of the Uintah Indian irrigation project is of utmost importance to the Indians and to the Bureau.

Jicarilla Reservation, N. Mex. (existing and potential)

On the Jicarilla Reservation 800 acres are now being irrigated and plans contemplate increasing this area to 5,000 acres. The water supply is secured from La Jara and Dulce Creeks. The present average annual diversion is 4,000 acre-feet and the average annual diversion requirement for the ultimate area is 25,000 acre-feet. The estimated cost of providing irrigation facilities for the additional area is $250,000.

Southern Ute and Ute Mountain Reservations, Colo. (existing and potential)

Within the upper Colorado River Basin in Colorado are two Indian projects, the Pine River and the Mancos River. The combined present irrigable area amounts to 8,600 acres and plans contemplate expanding this area to 20,350 acres. The present average annual

diversion is 43,000 acre-feet and the average annual diversion requirement for the ultimate area is estimated at 72,750 acre-feet. The two projects are described as follows:

Southern Ute-Pine River.—On the Southern Ute Reservation 8,400 acres are now supplied with irrigation facilities of which 2,400 acres are in non-Indian ownership, and plans contemplate expanding the area to 19,850 acres of which 3,700 will be non-Indian. The water supply is secured from Pine River and tributary creeks. The present average annual diversion is 42,000 acre-feet and the average annual diversion requirement for the ultimate irrigable area is estimated at 70,250 acre-feet. The tentative estimated cost to provide irrigation facilities for the additional area is $860,000.

Ute Mountain-Mancos River.—On the Ute Mountain Reservation there are 200 acres being irrigated and plans contemplate expanding the area to 500 acres. The water supply is secured from Mancos Creek. The present average annual diversion is 1,000 acre-feet and the average annual diversion requirement for the ultimate irrigable area is estimated at 2,500 acre-feet.

SOIL AND MOISTURE CONSERVATION

The approximately 10,700,000 acres of Indian land in the upper basin of the Colorado contribute the highest amount of sediment of any other equal area in the basin. They constitute about one-seventh of the area but contribute between one-fifth and one-fourth of the sediment. Two-thirds of the Indian lands are severely or critically eroded. Erosion and sediment removal are due to a combination of climate, geology, soil, topography, vegetative cover, and land use. Indian lands have been seriously depleted by wind and water erosion caused by improper use by men and livestock together with drought, fires, and torrential rains.

The Indian Bureau has successfully demonstrated that this damage can be economically checked and lands restored by water diversion, water-spreading, revegetation, streambank protection, and other related soil and moisture conservation practices. Control of erosion and restoration of Indian land resources are an integral part of the Bureau programs and policies of resource management. Indian resources in the basin are seriously inadequate for the present population. Land losses from erosion must be checked more rapidly than means to date have made possible or the Indians' extremely low standard of living will be further reduced and accelerated erosion will add progressively increasing amounts of sediment to the already excessive loads into the streams, reservoirs, and other downstream developments.

There are about 3,500,000 acres of forest and woodland on Indian reservations in the upper basin of the Colorado with an estimated stand in excess of 6 billion feet of timber. It has been estimated that within this area on about 500,000 acres of this land there are 2 billion board feet of commercial saw timber. The area and volume of timber are based on ocular estimates and not on actual forest surveys. These forest resources are important to the Indians for fuel, posts, poles, and other forest products and as a source of income from sales of timber. It is the established policy of the Bureau of Indian Affairs to manage the forest resources in accordance with the principles of sustained

yield. In the circumstances, a comprehensive survey of these resources should be made to obtain essential data for dependable management plans. Such a survey is now being made of the forest resources on the Navaho Reservation where a tribal sawmill enterprise is being conducted. Conservative development of the timber on the Jicarilla and Consolidated Ute Reservations has been primarily through sales of timber to non-Indians.

The Indian forest and woodlands in this region have been protected from fire to the extent that limited funds have been available for that purpose. The fire hazard in some parts of this area will probably increase because of the accumulation of forest litter and the dense growth of forest reproduction and other vegetation. This increase in fire hazard presents a serious problem which can be met only with increased funds for adequate organizations for fire prevention and control.

Considerable quantities of oil, gas, copper, uranium, and other minerals are believed to exist on a number of Indian reservations in the region, particularly in the Navaho-Hopi area where there have been productive oil and gas leases for many years. An obstacle to further exploitation of these resources is the lack of adequate surveys and studies. On the Hopi Reservation explorations by the major oil companies indicate the possibilities of highly productive oil deposits, and efforts have been made by them to obtain leases from the tribe. So far, however, these efforts have been unsuccessful because there is no central body among the Hopis authorized to act for the entire tribe. It should be stated with respect to the Hopi Reservation that most if not all of its area as usually designated is located just south of the dividing line between the upper and lower Colorado River Basins and accordingly cannot be considered an upper basin reservation.

BUREAU PROGRAMS

The future programs of the Bureau of Indian Affairs in the upper Colorado River Basin as elsewhere are designed to achieve the economic and social rehabilitation of the Indians through the provision of adequate education, health, and other public service facilities, the development of physical and other subsistence resources on the reservation, and assistance in obtaining stable employment or occupation off the reservation.

Long-range programs are contemplated for all reservations, and are now being prepared by Indian Bureau officials and Indian groups. The basic objectives of these programs as stated by the Commissioner of Indian Affairs are:

> The establishment of various tribes or groups of Indians on an economic level comparable to other citizens of the area; their integration into the social, economic, and political life of the Nation; and the termination at the appropriate future time, of Federal supervision and control special to Indians.

The Navaho program deals with the rehabilitation of a large and comparatively primitive Indian group, living on an unallotted reservation to which they have strong cultural ties, but which is totally inadequate to meet their minimum needs. The program includes vigorous measures to develop and protect the land through soil and water conservation, irrigation projects, and range improvement.

Additional emphasis is placed on the exploitation of minerals, and expansion of the present timber operations.

The funds available to the Bureau of Indian Affairs through annual appropriations have been insufficient to implement long-range plans such as the Navaho. Special authorization was requested for this purpose in a bill to promote the rehabilitation of the Navaho and Hopi Tribes of Indians and the better utilization of the resources of the Navaho and Hopi Indian Reservations, and for other purposes. This bill was passed by both the Senate and the House in the 81st Congress but was vetoed by the President. An amended version was passed in the second session of the 81st Congress in April 1950.

The future work of the Bureau is of course dependent on the availability of funds, and the acceptance by the Congress of the principle that it is sound economy to spend the money necessary to rehabilitate Indian groups to the point that they can become independent of special Federal services. Within the upper Colorado River Basin region, the development of Indian resources is closely related to the overall planning of the area. It must be coordinated with the work of other Bureaus of the Department of the Interior, and all other branches of the Government in this field.

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
WASHINGTON, D. C.

A PRELIMINARY REPORT ON FISH AND WILDLIFE RESOURCES IN RELATION TO THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

FIELD WORK AND REPORT BY
OFFICE OF RIVER BASIN STUDIES
ALBUQUERQUE, N. MEX.

A PRELIMINARY REPORT ON THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, UTAH, WYOMING, COLORADO, NEW MEXICO, AND ARIZONA,

1. Pursuant to Public Law 732, 79th Congress, 2d session, and a memorandum of agreement between the Fish and Wildlife Service, region 2, and the Bureau of Reclamation, region 4, dated December 5, 1949, there is furnished below a preliminary report which outlines the effect that the Colorado River storage project and its participating projects would have on fish and wildlife resources. It reflects the opinions of the Fish and Wildlife Service and the fish and game conservation agencies of the States of Utah, Colorado, Wyoming, Arizona, and New Mexico. It is planned that detailed fish and wildlife investigations and reports on individual features of the project will be prepared as promptly as possible. The objective of such investigations is to prevent damage to fish and wildlife resources which would otherwise occur as a result of the project.

2. Biological investigations, prerequisite to preparation of a preliminary evaluation report on the effect of the proposed developments on fish and wildlife resources, were begun in 1949, but due to the immensity of the individual projects, the complexity of the habitat, the shortage of time and personnel available, complicated by the inaccessibility of the areas, the information obtained was necessarily meager.

3. This preliminary report reviews available data covering the proposed Colorado River storage project and the participating projects, and describes some of the ways that fish and wildlife resources would be affected by the projects. It points to the developments that would be most detrimental, and suggests some modifications that would mitigate damages to the fish and wildlife resources.

4. The Colorado River storage project would be a multipurpose project. Some of the principal objectives are briefly described below, but not necessarily in their order of importance. One objective would be the storage and regulation of Colorado River flows sufficient to meet aggregate downstream requirements and permit upstream utilization with a reasonable assurance of adequacy during years of low streamflow.

5. Another objective would be to generate electrical power by utilizing the flows released to meet downstream commitments. Sale of this power should according to present plans, provide sufficient funds to repay construction costs and provide an interest component which could be used for a third objective, that of assisting irrigation developments in the basin which could not otherwise meet their repayment costs in the allotted period. These would be participating projects.

6. The fourth objective would be to provide water for irrigation. Some water would be delivered to presently irrigated lands in trade for established water rights so that diversions could be made at higher elevations for use in other basins, especially in connection

with the central Utah project development where transmountain diversion would be made to the Bonneville Basin and possibly in the Gunnison-Arkansas project area where diversion would be made to the Arkansas Basin.

7. The fifth and sixth objectives would be to retain silt and to level out flash-flood peaks.

8. These objectives would be accomplished by the eventual construction of the 10 Colorado River storage project reservoirs and by other coordinated developments throughout the basin which would include construction of 15 or more participating projects. The proposed Colorado River storage project reservoirs, and their purposes are shown in table 1.

TABLE 1.—*Units of Colorado River storage project*

Unit and reservoir	Name of river	Name of dam	Principal purposes to be served
Initial:			
Echo Park	Green	Echo Park	H, P, S.
Flaming Gorge	do	Ashley	I, H, P, S.
Glen Canyon	Colorado	Glen Canyon	H, P, S.
Navaho	San Juan	Navaho	I, H, P, S.
Whitewater	Gunnison	Whitewater	I, H, P, S.
Ultimate:			
Cross Mountain	Yampa	Cross Mountain	H, P.
Crystal	Gunnison	Crystal	P.
Curecanti	do	Blue Mesa	I, H, P.
Gray Canyon	Green	Gray Canyon	H, P, S.
Split Mountain	do	Split Mountain	P.

Symbols used: I—Irrigation. H—Holdover storage for new irrigation. P—Power. S—Sediment retention.

9. Initially, the participating projects would include: The central Utah project (initial phase) extending from Uinta Basin to the Bonneville Basin, Emery County project in the San Rafael Basin, Seedskadee project on Green River, La Barge project on Green River, Eden project on Big Sandy Creek, Lyman project on Blacks Fork, all affecting the Green River drainage; Florida project on Florida River, Pine River project extension on Pine River, the Hammond and Shiprock Indian projects on the San Juan River, all within the San Juan River drainage; Smith Fork project on Smith Fork and Iron Creek, Paonia project on Muddy Creek, all in the Gunnison River drainage; and the silt project in the upper Colorado River drainage. Ultimately other projects will be undertaken as participating projects, all utilizing upper Colorado River waters.

10. The Colorado River storage project and participating projects would be concerned with the possible utilization of available streamflows throughout the entire 110,000 square miles upper Colorado River Basin. Streamflows available for upstream utilization would consist of the apportioned 7.5 million acre-feet annually of Colorado River water above Lee Ferry, Ariz., a point on the Colorado River just below the Utah line. By mutual compact the States of Wyoming, Utah, Colorado, New Mexico, and Arizona have established apportioned shares of this allotment for development and utilization in their respective States.

11. Pertinent engineering data relating to the Colorado River storage project are listed in table 2.

TABLE 2
COLORADO RIVER STORAGE PROJECT
(From data supplied by Region 4, Bureau of Reclamation, November 1950)

Project Unit	River	Height of Dam (feet)	Main Streams Inundated (miles)	Drainage area (sq. mi) above dam	ELEVATIONS m.s.l. River Bed at Damsite	Water Surface at Max. Storage	Water Surface Av. Ann. Maximum	Water Surface Av. Ann. Minimum	Water Surface at Dead Storage	Approximate Av. Annual Fluctuations (feet) 1/	CAPACITY Maximum Reservoir Acre-feet	Average Annual Maximum (ac-ft)	Average Annual Minimum (ac-ft)	Dead Storage (ac-ft)	AREA Maximum Surface Acres	Acres at Average Annual Maximum	Acres at Average Annual Minimum	Dead Storage Acres	STREAM FLOWS Average Recorded Flow c.f.s. & a-f	Bureau Proposed Minimum c.f.s.
Cross Mountain	Yampa	295	Yampa 76	At Maybell 3410	5,800	6,090	6,067.6	6,053.7	5,963	13.9	5,200,000	4,116,300	3,528,200	1,000,000	52,200	44,100	39,700	17,500	At Maybell, Colo. 1,617 (1,160) 2/	705
Crystal	Gunnison	305	Gunnison 10	Below Gunnison Tunnel 3980	6,570	6,870	6,870 3/	6,870 3/	6,870	---	40,000	40,000 3/	40,000 3/	40,000 3/	560	560 3/	560 3/	560 3/	At Iola, Colorado 841 (1,323) 2/	805
Curecanti	Gunnison	475	Gunnison 30	At Iola, Colo. 2490	7,165	7,635	7,582.6	7,544.4	7,457	38.2	2,500,000	1,700,900	1,283,600	490,000	18,200	13,640	10,990	5,400	At Iola, Colorado 841 (1,142) 2/	670
Echo Park	Green	525	Green 63 Yampa 46	25,760 4/	5,050	5,570	5,530.8	5,521.2	5,362	9.6	6,460,000	4,772,800	4,445,200	1,000,000	42,800	36,250	35,000	9,800	4,100 4/ (3,288) 2/	2,160
Flaming Gorge	Green	440	Green 91	At Linwood, Utah 14,300	5,605	6,040	6,015.7	6,006.9	5,935	8.8	3,940,000	2,899,800	2,638,400	990,000	40,800	35,400	33,200	11,200	1,817 (1,636) 2/	1,020
Glen Canyon	Colorado	580	Colorado 186 San Juan 71	At Lees Ferry 107,900	3,135	3,710	3,667.5	3,647.2	3,490	20.3	27,800,000	20,134,500	17,640,500	6,000,000	153,000	133,900	122,000	49,000	At Lees Ferry 17,350 (13,763) 2/	12,200
Gray Canyon	Green	445	Green 53	At Green River, Utah 40,600	4,150	4,590	4,590	4,590	4,420	---	2,000,000	2,000,000	2,000,000	610,000	10,750	10,750	10,750	5,900	At Green River, Ut. 6,740 (4,567) 2/	2,660
Navajo	San Juan	335	San Juan 33	At Farmington, New Mex. 7,240	5,725	6,050	6,037.3	5,988.2	5,875	49.1	1,200,000	1,079,000	699,300	150,000	10,800	10,000	7,230	2,350	At Farmington, N.M. 2,498 (1,260) 2/	690
Split Mountain	Green	245	Green 21	25,760	4,810	5,050	5,050	5,050	5,050	---	335,000	335,000 3/	335,000 3/	335,000 3/	4,250	4,250 3/	4,250 3/	4,250 3/	4,100 (3,228) 2/	2,130
Whitewater	Gunnison	255	Gunnison 35	7,780	4,635	4,880	4,880	4,842.7	4,760	37.3	880,000	880,000	565,000	410,000	10,250	10,250	7,220	6,250	At Grand Jct, Colo. 2,761 (2,055) 2/	1,420

1/ Maximum average annual water elevations less minimum average annual water elevations.
2/ Modified average annual 1914-45 historical flow in 1,000 acre-foot units at damsites.
3/ Only daily or hourly fluctuations. Entire capacity is considered inactive by the Bureau of Reclamation.
4/ Computed as for a point below Split Mountain damsite.

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12. The construction of dams and reservoirs as proposed in the Colorado River storage project and participating projects would, in general, destroy all present big game, upland game, fur animal, and waterfowl habitat in the reservoir areas. The 10 Colorado River storage project reservoirs would, when filled to maximum capacity, inundate 700 miles of stream fisheries located within the 343,610 acres of reservoir area.

13. The fluctuating reservoirs would provide only poor type resting areas for ducks, unattractive shorelines for fur animals, and would expand the production of already abundant rough fish at the expense of all the above-mentioned more desirable forms of wildlife.

14. Where flows of streams are periodically reduced by reservoir storage or are otherwise diverted from the channel for irrigation or power-production purposes, there would be an additional loss to the fishery and fur animals, and to a lesser extent waterfowl and upland game, unless sufficient and properly regulated flows are maintained.

15. Where sediment loads are reduced by deposition in the reservoirs and continuous favorable releases of cool water are achieved below the dams, highly desirable sport fishing may be increased. Newly irrigated areas may favor production of pheasants, which would supplant the native upland-game populations, sometimes to the detriment of other species such as wild turkeys, sage hens, and deer.

16. The damage that would result to fish and wildlife by construction of the different projects throughout the upper Colorado River Basin would vary markedly between those reservoirs in the mountains and those such as Glen Canyon Reservoir in the arid gorge of the Colorado. In the mountains, where much of the annual precipitation occurs as snow and there are frequent summer rains, vegetation is plentiful, soil fertile, streams generally clear and cold, and fish and wildlife abundant. Along the Green River in central Utah, and along the San Juan and Colorado Rivers in southern Utah, rainfall during the growing season is insufficient to support cultivated crops, soils are dry or saline, palatable vegetative cover is sparse, and the rivers are heavily silt laden. Between these extremes are myriad combinations of slope, climate, and soil. Some combinations favor one type of game, some another, until in the relatively inaccessible canyon of the Colorado River only those animals which live in its muddy waters, or are able to subsist on the sparse vegetation among the cliffs, can maintain themselves.

17. Utilization of fish and wildlife resources produced within the upper basin varies principally with the accessibility of the area, attractiveness of the game, and distance from major centers of population. Split Mountain and Echo Park Reservoirs would lie partially within a national monument where hunting is prohibited. All of the other project areas, except possibly Gray Canyon, are accessible to hunters, but access is not adequate to permit full utilization of the fish and wildlife populations. It is expected that as roads are improved hunting and fishing pressure would increase with, however, much of the use continuing to come from persons living outside of the upper basin. In many instances the abundance of game animals has been the motivating factor in the opening of new roads. Some of the proposed reservoir sites are remote from centers of population, or may be so situated that they would compete with each other for use.

18. There are within the upper basin fewer than 25 communities

having over 1,000 population. Only 5 communities have more than 5,000 of which Grand Junction, Colo., (12,479), and Rock Springs, Wyo. (9,827), are the largest. Total population within the 110,000 square-mile basin is 286,450 with an average of 2.6 persons per square mile.

19. Highway distances from major cities outside the basin to the initial project reservoirs are shown in table 3.

TABLE 3

State and city	Population (1910 census)	Distances to reservoir areas				
		Echo Park [1]	Flaming Gorge	Curecanti	Glen Canyon	Navaho
Colorado:						
Denver	322,412	349	423	206	549	445
Pueblo	52,162	403	537	161	496	331
Colorado Springs	36,789	410	493	173	510	375
Utah:						
Salt Lake City	140,934	182	256	438	405	459
Ogden	43,688	233	307	475	445	496
Provo	18,071	160	234	395	362	416
Arizona: Phoenix	65,414	833	888	646	330	535
New Mexico: Albuquerque	35,449	613	691	398	434	194
California: Los Angeles	1,501,277	881	936	1,024	602	913

[1] Also Split Mountain and Cross Mountain Reservoirs.

20. The proposed developments are so interrelated that monetary evaluation of the damages or benefits to fish and wildlife resources caused by any one of the project units would require careful analysis to determine its relationship to all the other projects.

21. In view of the magnitude of the changes that would occur to fish and wildlife habitat due to project construction, it is believed that separate evaluation reports should be prepared on each project as sufficient engineering data becomes available to make proper biological surveys and analyses. The Fish and Wildlife Service and the State fish and game departments would thus have an opportunity to make biological investigations and recommendations based on preliminary plans of the constructing agency. They would then be in a better position to fulfill the requirements of Public Law 732 for participation in the planning of the project in order to prevent loss of and damage to wildlife resources.

Individual Units and Their Anticipated Effect on Fish and Wildlife Resources

INITIAL PHASE

22. The five reservoirs of the Colorado River storage project which are being considered for initial construction are Glen Canyon, Echo Park, Flaming Gorge, Navaho, and Whitewater.

Glen Canyon unit

23. The Glen Canyon Reservoir would be impounded by a dam, 580 feet in height, located in the narrow precipitous canyon of the Colorado River, 15 miles above the Paria River and Lees Ferry in Arizona.

24. The reservoir would inundate 153,000 acres of poor-quality wildlife habitat along the narrow gorge of the Colorado and San Juan Rivers where only meager vegetation persists. The reservoir would extend 186 miles up the Colorado River and 71 miles up the San Juan River and form a lake with but few points of access. The presence of the reservoir in Glen Canyon would make the entire area accessible by boats launched from immediately above the damsite or from either side of the reservoir where the present Blanding to Hanksville road enters the reservoir area. At present the Colorado River in the reservoir area is accessible by automobile at but one place, Hite, Utah, and then only over a partially improved road not passable during rainy weather. Other access is by one-way boat trip down the Colorado River from Moab to Lee Ferry, down the San Juan River from Mexican Hat to Lee Ferry, or by pack trails through extremely rough terrain.

25. Fishery values in the Colorado and San Juan Rivers without the project based on present harvests would be insignificant. The reservoir would provide recreational potentialities, but because of its inaccessibility and the fact that there are other fishing areas nearer the important centers of population, it is expected that the reservoir fishing would not be fully utilized. Fishery value of the reservoir and the river below the dam would depend somewhat on the public recreation facilities provided and improved access.

26. The Colorado River below Glen Canyon Dam would become an improved fishery due to the proposed minimum release of at least 10,000 cubic feet per second of clear, cool water. Access to the river, however, would be limited to about a 25-mile section of the river near Lee Ferry.

27. Wildlife habitat in the reservoir area would be destroyed, but the reservoir would open the canyon area to travel so that some of the now isolated game populations above the reservoir could be better managed.

Echo Park and Flaming Gorge units; considering Split Mountain and Cross Mountain units

28. Echo Park, Ashley (Flaming Gorge Reservoir), Cross Mountain, and Split Mountain Dams would impound a series of closely integrated

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reservoirs on the Green and Yampa Rivers near the point where Utah and Colorado meet along the Wyoming boundary. Only Echo Park and Flaming Gorge Reservoirs are being proposed for initial construction, but because the four reservoirs are so closely interrelated they are described together.

29. United States Highway 40 passes to the south of the Uinta Mountains about 25 miles from the 3 most southern reservoirs. United States Highway 30 crosses southern Wyoming north of the Uinta Mountains about 3 miles from the nearest point on the Flaming Gorge Reservoir. Access roads to the reservoir areas follow the rivers for only very short distances. These roads are open seasonally, generally graded but only occasionally graveled. The canyon areas are accessible only by boat down the rivers and from pack trails.

30. The four dams would form almost contiguous reservoirs on the Green and Yampa Rivers from Split Mountain above Jensen, Utah, to below Green River, Wyo., on the Green River and below Craig, Colo., on the Yampa River. The reservoirs would lie in the canyons and parks along the Green and Yampa Rivers where the rivers have cut through the Uinta Mountains of northeastern Utah, northwestern Colorado, and southern Wyoming.

31. Flaming Gorge Reservoir, the farthest upstream of the reservoirs in this group, would be impounded by the Ashley Dam in the Red Canyon of Utah, but most of the 40,800-acre reservoir area would lie in Wyoming, where it would receive the turbid waters of the Green River.

32. The area to be irrigated from the Flaming Gorge or Echo Park Reservoirs would be on the south side of the Uinta Mountains, where flows would be delivered from Flaming Gorge Reservoir through a tunnel or by pumping from Echo Park Reservoir. There would be some new irrigation areas developed in the Uinta Basin in connection with this reservoir development, but its principal purpose would be to trade assured flows to Uinta Basin areas for water originating in the mountains. The mountain flows could then be diverted by aqueduct to the Bonneville Basin for production of power and irrigation as part of the central Utah project.

33. Cross Mountain Dam, 295 feet in height, would be located in Cross Mountain Canyon; but the resultant 52,200-acre reservoir would inundate an open valley east of the mountains and 76 miles of the Yampa River.

34. Echo Park Dam, 525 feet in height, on the Green River would form a 42,800-acre reservoir 63 miles up the Green River through Lodore Canyon and Brown's Park to just below the Flaming Gorge damsite and for 44 miles up the Yampa to just below the Cross Mountain damsite.

35. Split Mountain Dam, 245 feet in height, would impound releases from Echo Park Reservoir in a 21-mile section of the Green River immediately below the Echo Park damsite. It would have only 4,230 surface acres at maximum water level with little seasonal fluctuation but considerable daily fluctuation.

36. Releases below Flaming Gorge and Cross Mountain Reservoirs would enter Echo Park Reservoir and flows released below Echo Park Dam would flow directly into the proposed Split Mountain Reservoir. Below Split Mountain Reservoir the Green River emerges from the mountains and flows in a southwesterly direction across the Uinta

Basin to Ouray where it is joined by the White and Duchesne Rivers. This section of the Green River, from Split Mountain to Ouray, may have a decidedly improved fishery if constant releases from the reservoirs are provided.

37. There is some sport fishing on the Green and Yampa Rivers but the area is generally rough and inaccessible, the stream habitat is poor and, at present, the type of fish taken is not highly regarded for sport fishing. The reservoirs would probably produce more rough fish than could be taken for sport, so that the principal harvest would be by commercial fishing.

38. The proposed reservoirs would inundate small farming areas which have been established in the parks along the Green and Yampa Rivers. On the steeper slopes above the farms, but within the reservoir areas, are ranges utilized by big game as well as livestock. Impounding of the reservoirs would seriously reduce the deer wintering areas, especially in Brown's Park, and it is doubtful if the remaining range could maintain the present deer herds.

39. Upland game, fur animals, and waterfowl would also be adversely affected by the project. The nesting sites of from 300 to 500 pairs of geese and of numerous ducks would be eliminated by the inundation of the "bottoms."

40. The possibility of establishing a migratory bird refuge on, or adjacent to, the Echo Park Reservoir, provisions for the protection of big game by acquisition of lands about the reservoir, the enhancement of the fishing by maintaining suitable releases to the streams, and providing access to the fisheries so improved are being considered.

Whitewater unit

41. Whitewater Dam would be located on the Gunnison River approximately 9½ miles southeast of Grand Junction, Colo. It would rise 255 feet above the stream bed to create the 10,250-acre Whitewater Reservoir that would extend 35 miles upstream to a point about 4 miles west of Delta.

42. This reservoir would not provide an outstanding sport fishery. A short stream section below the reservoir should be greatly improved by the proposed water releases. The reservoir would inundate about 10,000 acres of big-game, upland-game, and fur-animal habitat. Waterfowl would be benefited by the presence of the reservoir which would serve as a resting area during spring and fall migrations.

Navaho unit

43. The 10,800-acre Navaho Reservoir would be impounded by a dam 335 feet in height on the San Juan River above Blanco, N. Mex., and would inundate 33 miles of the San Juan River Canyon and portions of the Pine and Piedra Rivers.

44. The Bureau of Reclamation is also considering utilizing water from this reservoir for the irrigation of lands under the Shiprock, south San Juan, and possibly the Hammond projects. Water would be carried by a common canal from the Navaho Reservoir to the project lands where smaller canals would divert the water to each of the units.

45. Construction of a dam and reservoir at the Navaho site should be considered in connection with the potential San Juan-Chama diversion to the Rio Grande Basin, which could be very damaging to the upper San Juan River fishery.

46. There is some fishing along the stream segments that would be affected by the reservoir. The meager fishery below the dam would not be maintained as the stream would be shut off periodically for storage; however, the reservoir might provide a better fishery than that destroyed by inundation. The effect on the fishery caused by diverted flows through the San Juan-Chama diversion would depend on the quantity and quality of residual flows in the San Juan Basin and by the type of habitat provided or destroyed in the Rio Grande Basin.

47. Plans are being made to carry out the necessary biological investigations to determine the most desirable operations for maintenance of this fishery. Minimum flows below dams and diversions are recommended especially below the Navaho Reservoir to protect the fishery in the San Juan River.

48. The reservoir area provides winter cover for deer and wild turkey and year-round habitat for small-game animals. This wildlife habitat would be destroyed. However, there would be an increase of upland game in the areas which would be irrigated.

ULTIMATE PHASE

49. The ultimate development of the Colorado River storage project would consist of 10 major reservoirs. Five of these reservoirs would be constructed in the initial phase as already described, and five others, namely, Cross Mountain, Crystal, Gray Canyon, Curecanti, and Split Mountain, would be constructed in the ultimate phase of the project. There may be two other reservoirs, not presently considered, which would have as their principal purposes the production of power and the retention of silt. These would be Dewey Reservoir on the Colorado River and Bluff Reservoir on the San Juan River.

Cross Mountain and Split Mountain

50. Cross Mountain and Split Mountain Reservoirs were previously described with the Echo Park and Flaming Gorge Reservoirs because of their close relationship.

Crystal Reservoir

51. Crystal Reservoir (560 surface acres) on the Gunnison River would serve mainly for power production, utilizing the flows released from Curecanti Reservoir. The reservoir would inundate 10 miles of stream in the walled Black Canyon of the Gunnison River. Fishery values of the Gunnison River without the project are high, but values anticipated for the reservoir are low. The stream fishery below the reservoir as far as the Whitewater Reservoir should be good if the power releases are sufficiently constant.

Gray Canyon

52. The 10,750-acre Gray Canyon Reservoir would be located in the extremely rough and inaccessible canyon of the Green River in central Utah. It would be 440 feet deep at maximum water level and would extend 53 miles back into the canyon. The dam site would be located approximately 22 miles upstream from the town of Green River, Utah, and would flood canyon areas, none of which are of agricultural value with the exception of the McPherson ranch, comprising a small area near the mouth of Florence Creek.

53. Wildlife values in the area are low and the fishery within the reservoir area is almost nonexistent. The reservoir should produce a meager fishery, but its utilization for sport fishing would be low. Constant minimum flows below the dam should, however, improve the stream and provide several miles of fair trout stream.

Curecanti unit

54. The 18,200-acre Curecanti Reservoir would be impounded by the Blue Mesa Dam, 475 feet in height, located on the Gunnison River near Sapinero, Colo.

55. The reservoir, inundating 30 miles of the Gunnison River, would be extremely damaging to both the fish and wildlife in the area. The reservoir would inundate sections of a stream and its tributaries which have been utilized extensively for recreational purposes. The present fishing use of the Gunnison River is high and is expected to become even higher in the future. Because of its scenic location, accessibility, abundance of recreational facilities, and consistent productiveness, this stream section is of exceptional value as a fishing stream.

56. Construction of the dam at Blue Mesa would destroy the valuable established fishery and in exchange would leave a fluctuating reservoir, much less attractive and unlikely to maintain a good trout fishery.

57. Flows of the Gunnison River below the proposed reservoir may have a more dependable late season flow than at present. The reservoir on the Gunnison may make possible water diversions from its headwaters to the Arkansas Basin on the eastern slope of Colorado.

58. The Gunnison River Valley within the Curecanti Reservoir site is important as big-game and upland-game habitat. The reservoir would inundate critically needed winter range for deer. This range is already overutilized and further reduction in the amount of range available due to inundation would have an extremely harmful effect on the deerherd which is of great recreational value to the State. In view of the extremely harmful effects that construction will have on wildlife resources and lack of feasible means for mitigating these anticipated losses, this Service recommends that the investigation of alternate sites be continued, in cooperation with the State game and fish commission and the Fish and Wildlife Service in order that wildlife losses may be kept to a minimum.

59. There would be some beneficial utilization of the reservoir by waterfowl and fur animals but the overall annual loss to wildlife would be great.

PARTICIPATING PROJECTS

60. The separate projects which are presently proposed for initial participation in the Colorado River storage project plan are described briefly in the following paragraphs. The Fish and Wildlife Service, together with the appropriate State game and fish agencies, will prepare separate reports on each of these projects. One of the detailed reports (Paonia) has been completed, preliminary reports have been prepared on nine, and field work has been initiated on several others.

Eden project, Wyoming

61. The Eden project, consisting of a 40,000 acre-foot reservoir on Big Sandy Creek and an irrigation system, 35 miles north of Rock

Springs, Wyo., will provide water for 11,000 acres of new land to be irrigated and a supplemental supply for 9,000 acres of land now under irrigation.

62. The project was approved for construction by President Roosevelt in September 1940, but construction was stopped by order of the War Production Board in December 1942. Completion was reauthorized by the act of June 28, 1949.

63. Fishery values are low in the project area as the stream sections affected are often dewatered. Big Sandy Reservoir is not expected to provide an important fishery. The Eden project will eliminate valuable antelope and sage hen habitat; however, the new land to be brought under irrigation may provide habitat for pheasants.

Paonia project, Colorado

64. The Paonia project, consisting of the 18,000 acre-foot Spring Creek Reservoir and appurtenant irrigation system, is designed to provide water for the irrigation of 2,210 acres of new lands, and supplemental water for 14,830 acres of land already under irrigation adjacent to the North Fork on the Gunnison River in Delta and Gunnison Counties, Colo.

65. The proposed reservoir would not provide a valuable fishery; however, the stream fishery would be benefited under project conditions due to improved streamflows below the dam. Gains to upland game would occur principally as the result of the irrigation of new lands. There would also be small gains to both waterfowl and fur animals. The Paonia project as proposed would result in minor benefits for both fish and wildlife resources.

66. In order to further improve habitat and utilization, it is recommended that waste areas and gullies in the irrigation area be planted and maintained for the propagation of wildlife, and that turnouts or parking areas be provided about the reservoir.

Central Utah project

67. The initial phase of the proposed Central Utah project involves drainage areas of over 7,000 square miles. It would provide water for the irrigation of approximately 28,540 acres of new land and supplemental water for 131,840 acres of irrigated land in the Colorado and Bonneville Basins. In addition, 48,800 acre-feet of water would be available for municipal, industrial, and related uses. Construction of 4 powerplants would generate approximately 373 million kilowatt-hours of energy annually. Part of the power would be required for irrigation and drainage pumping.

68. The 37-mile Strawberry aqueduct would intercept the flows of Rock Creek, Hades Creek, Wolf Creek, West Fork of the Duchesne River, Currant Creek, Layout Creek, and Water Hollow and convey them to the Stawberry Reservoir. Reservoirs to regulate inflow into the aqueduct would be constructed on Rock Creek, West Fork of the Duchesne River, and Currant Creek. Strawberry Reservoir would be enlarged by the construction of Soldier Creek Dam. An enlarged outlet tunnel would permit releases of Strawberry Reservoir water for four powerplants on the western slope of the Wasatch Mountains. Monks Hollow Reservoir, Utah Lake, and an enlarged Mona Reservoir in combination with the Wasatch aqueduct, the Mona-Nephi, and the enlarged Elberta Canals would then distribute the water to the irrigation areas of the Bonneville Basin. Exchange use of Provo River

water as planned would require construction of three additional dams and related works, and include the diking and drainage of Provo Bay in Utah Lake.

69. Project works to provide water for replacement, expanded irrigation, and municipal use in the Uinta Basin would include dams on the North Fork of the Duchesne River, Strawberry River, and Brush Creek, with feeder canals into offstream reservoirs at the Upalco and Stanaker sites from Lake Fork River and Ashley Creek.

70. As a result of project construction, excellent trout streams in the Uinta and Wasatch Mountains would be destroyed or severely damaged with only partial compensation to the sport fishery expected from the proposed reservoirs. Commercial fishing in Provo Bay would be cut off. A Federal refuge would be completely inundated, and excellent waterfowl, upland-game, and fur-animal habitat destroyed. Critically needed big-game range would be further reduced

71. The project would increase the abundance of rough fish and consequently improve the commercial fisheries. It would extend the habitat suitable for pheasants and some other upland-game species.

72. The Fish and Wildlife Service in cooperation with the Utah Fish and Game Commission have been making investigations to determine satisfactory means to replace the lost fish and game habitat in kind and to mitigate unavoidable losses. The difficulty of obtaining water to assure a stream fishery is emphasized, however, by the keen competition between municipal, industrial, and agricultural interests for the water to maintain themselves in this arid region. If the fisheries are to be maintained for posterity, expensive developments will be necessary to effectively manipulate the flows to maintain suitable fish habitat.

Emery County project, Utah

73. The Emery County project, in the Colorado River Basin, would impound the flows of Cottonwood Creek, in lower Joes Valley Reservoir, for release to 3,630 acres of new land. The reservoir would provide a supplemental late season water supply to 20,450 acres of land now irrigated in the Huntingdon, Castle Dale, and Orangeville areas. The reservoir would provide sufficient storage to permit 1,000 acre-feet of water to be diverted to the Sanpete project in the Bonneville Basin.

74. The fishery would be benefited by the project as the reservoir would provide better habitat than exists in Cottonwood Creek or the streams inundated. The elk and deer herds would be adversely affected because a sizable portion of their critically needed winter range would be destroyed. The creation of habitat in the irrigation area would benefit upland game, especially pheasants, and to a lesser extent fur animals and waterfowl.

Florida project, Colorado

75. The Florida project consisting of the 472-acre Lemon Reservoir on the Florida River and an enlarged and rehabilitated distribution system, would provide supplemental irrigation water for 12,650 acres and a full supply for 6,300 acres of new lands in the Florida River Valley and on the Florida Mesa of southwestern Colorado.

76. Construction and operation of the project as proposed by the sponsor would enhance fish and wildlife resources. Deer habitat

would be decreased but upland-game habitat would be improved. The estimated fur-animal values would increase slightly, and no significant changes would occur to waterfowl. Constant releases, fish screens, and stream channel improvements are proposed to improve fishing conditions below the reservoir site.

Hammond project, New Mexico

77. The Hammond project, on the San Juan River, would consist of a low diversion dam, an irrigation system, and a pumping unit with a water lift of approximately 50 feet. The project is designed to provide irrigation water for 3,670 acres of irrigable land near Bloomfield, N. Mex.

78. The waters of the San Juan River in the Hammond project area provide only a poor fishery. They are heavily laden with silt and are warm and generally sluggish; however, Colorado squawfish, catfish, and a few brown trout are taken. Wildlife values in the project area are low. Sparse populations of scaled quail and Gambel's quail and good pheasant habitat are found near Farmington. Probably the only benefits which would accrue through project construction would be derived from increased upland-game habitat.

79. The Hammond project may be included with the Shiprock and South San Juan projects under one plan of development. Water would then be stored in the proposed Navaho Reservoir, and a large canal would carry the water to the project area where it would be used for the irrigation of between 100,000 and 125,000 acres.

Lyman project, Wyoming

80. The Lyman project would consist of a 460-acre off-stream reservoir at the Bridger site on Willow Creek and an irrigation system. The reservoir is designed to store the flows of Black's Fork and the West Fork of the Smith Fork River for supplemental irrigation of 40,600 acres of land near the town of Lyman, Wyo.

81. The proposed project would be detrimental to the fish and wildlife resources of the area. The fishery resulting from construction of Bridger Reservoir would not compensate for the reduced fishery in stream segments affected by the project. Big-game and fur-animal habitat would be damaged; however, the reservoir would create some waterfowl resting habitat. Upland game would not be significantly affected.

Pine River project extension, Colorado and New Mexico

82. The Pine River project extension is a feature of an ultimate project which would provide irrigation water for 69,000 acres of land in southwestern Colorado and northwestern New Mexico. At present, 33,200 acres are being irrigated with water assured by the Vallecito Reservoir. The proposed extension would consist of the enlargement and extension of 8 major canals and ditches and 6 minor laterals to irrigate an additional 15,150 acres of land.

83. The fishery of 42 miles of Pine River below Vallecito Reservoir would be affected by the project extension. The Fish and Wildlife Service has recommended water releases which would prevent damage to the fishery. Without these recommended releases, considerable damage would result. Rotary fish screens are being recommended for the headings of the four largest canals.

84. The project extension would cause a loss to big game through removal of the irrigation area from the present deer winter range. Upland game, in general, would be benefited by the increase in irrigated land; however, sage-hen habitat would be destroyed. The increase in the length and number of canals and ditches and the recommended stabilized and increased flows of the river would result in an increase in the population of fur animals. Waterfowl nesting and feeding habitat would be increased somewhat.

Seedskadee project, Wyoming

85. The purpose of the proposed Seedskadee project would be to irrigate 60,720 acres of sagebrush land on both sides of the Green River in Lincoln and Sweetwater Counties, Wyo. A diversion dam would turn water from the Green River into a canal where a system of pumps and siphons would deliver it to the irrigation areas.

86. The mediocre fishery of the river extending 39 miles below the diversion would be adversely affected by depleted streamflows and occasional periods of no flow during the irrigation seasons. Fish screens are planned for the main canal near the headworks.

87. The project would cause a loss to big game through a reduction in range. There would be a loss in the sage-hen population, but other species of upland game would probably increase. Fur-animal values would be slightly reduced. Some nesting and resting areas for waterfowl would be created.

La Barge project, Wyoming

88. The proposed La Barge project would consist of a wing-type diversion dam and headworks on the Green River near Big Piney, Wyo., and a 38-mile-long canal to provide water for irrigation of 7,970 acres of land along the west side of the river.

89. The La Barge project alone would not adversely affect the fishery of the Green River, but would increase the damage that would be caused by the proposed Seedskadee project. Irrigation of the sagebrush lands would decrease the range of deer and antelope, causing some loss to these species, while the presence of the canal and farm fences would partially restrict the migration of elk through the area. Establishment of open lanes through the irrigation area with means of access for the migrating animals would reduce this restriction. Habitat for upland game with the exception of sage hens, would be increased and improved by the project. Fur animals would not be unfavorably affected by the La Barge project alone; however, the adverse effects of the proposed Seedskadee project would be increased by operation of the La Barge project. Resting and nesting habitat for waterfowl would be slightly increased by the project.

Silt project, Rifle Creek, Colo.

90. The Silt project, consisting of a 300-acre reservoir and a distribution system, is designed to irrigate 1,900 acres of new land and provide supplemental water to 5,400 acres already irrigated.

91. Fish and wildlife would be benefited as a result of the project. Big game would not be affected; however, habitat of upland game, fur animals, and waterfowl would be increased. The present low quality fishery of the 7 miles of Rifle Creek below the dam would be improved if reservoir releases recommended by the Fish and Wildlife Service are made.

Smith Fork project, Colorado

92. The Smith Fork project, consisting of a 420-acre reservoir, diversion canal, and irrigation system, would furnish supplemental water to 8,160 acres and a full supply to 2,270 acres of new land in the Cottonwood Creek and Smith Fork River areas of western Colorado.

93. Little change would occur in the fish and wildlife resources of the area as a result of the project. The fishery of Smith Fork would not be materially altered by the project because of present water priorities that must be maintained. The proposed impoundment would not provide a valuable fishery because of the severe fluctuations and poor quality of the water. A small amount of mule deer winter habitat would be lost; however, upland game, especially pheasants, would be benefited by the food provided on the new land to be irrigated. Value of the project area would be slightly decreased for fur animals but increased somewhat for waterfowl.

Suggestions and Recommendations

94. The foregoing statements were based upon information developed prior to November 1, 1950. Therefore, the Fish and Wildlife Service and the appropriate State fish and game departments should be advised of changes in project plans or methods of operation, as soon as they are anticipated rather than when they become final, so that the reports being prepared may include provisions to prevent damages to fish and wildlife.

95. The Fish and Wildlife Service, the fish and game departments of the States concerned, and the construction agency should confer in the early stages of project planning to formulate a general memorandum of understanding in order to establish a plan of procedure wherein fish and wildlife problems can be effectively presented.

96. The Fish and Wildlife Service, the State fish and game departments concerned, the Bureau of Reclamation, and the irrigation districts should enter into agreements, which would cover such assistance as the Bureau and the districts can reasonably and lawfully provide, making land within each of the districts accessible for public hunting and fishing and otherwise assuring that the maximum possible benefits are realized from the fish and wildlife resources.

97. Leases of Federal land in the project areas should stipulate the right of public access for the purpose of hunting, fishing, and other uncommercialized recreational purposes.

98. Management of the fish and wildlife resources in the project areas should be vested in the States concerned.

99. The Fish and Wildlife Service, the State fish and game departments, and other appropriate State agencies concerned should be given the opportunity to participate in the early planning of auxiliary features of the projects so that adequate road and trail systems and other management developments may be constructed to facilitate public access.

100. Title to all lands within the reservoirs and for an agreed-upon distance from the perimeters at maximum pool elevations should be acquired in fee simple, or through the transfer of property, and be vested in the United States Government for the purpose of providing free public access.

101. No part of the reservoir areas or the acquired strips surrounding the reservoir areas should be leased for the exclusive benefit of any corporation, individual, or groups of individuals for any purpose which would prevent or interfere with the use of project areas for recreation, hunting, or sport fishing by the general public.

102. The Soil Conservation Service or other proper land-management agency should be consulted concerning the employment of proper soil-conservation practices on the project lands and their recommendations should be incorporated in the overall plan for enhancing fish and wildlife habitat.

103. Releases from the reservoirs and diversions below dams should be accomplished by gradual operations of the gates to avoid sudden changes in the flows below the dams and rapid changes in reservoir pool levels.

104. Minimum flows to protect the fisheries in streams affected should be guaranteed as part of the operation of the proposed project.

105. Precautions should be taken during the period of construction to prevent excessive damages to fish and wildlife.

106. In making investigations and preparing detailed reports on the fish and wildlife aspects of individual units and participating projects, recommendations will be made to protect or enhance fish and wildlife values. Following are listed recommendations expected to apply to at least some of the projects.

(*a*) All timber and heavy vegetation be cleared from specified areas of the reservoirs to permit efficient seining operations.

(*b*) Adequate facilities be developed for the protection and management of migratory fishes affected by the project and for the prevention of loss of fishes through power tunnels, pumping plants, or diversion canals.

(*c*) The State fish and game departments concerned be notified of water shutoffs in sufficient time to allow fish to be salvaged from affected stream sections.

(*d*) Provision be made for the possible development of unaffected as well as affected streams so that anticipated losses to fish and wildlife may be mitigated.

(*e*) Grazing by livestock be prohibited or controlled along the reservoir margins and about project works to permit vegetative cover to become established.

(*f*) Waste areas, such as gullies and seeps, be planted and maintained for the benefit of wildlife to offset losses in wildlife habitat occasioned by project construction.

(*g*) Project plans include provisions for the control of domestic and industrial pollution in both the reservoirs and streams of the project areas in accordance with good management practices as well as established State and Federal laws.

(*h*) Suitable lands within the flood pools be devoted to waterfowl food plantings and administered by an appropriate conservation agency.

(*i*) Migratory bird refuges, fish hatcheries, or other management areas and facilities be established, where conditions warrant, to enhance wildlife propagation based upon detailed operation and maintenance plans developed by the Fish and Wildlife Service and the State or States concerned.

JOHN C. GATLIN,
Regional Director.

PROGRAM

The Fish and Wildlife Service program for the protection, development, and utilization of fish and wildlife resources in the upper Colorado River Basin involves a wide variety of activities. The more important of these are the development of habitat and the production of game and fish. The success of these endeavors is made possible through use of techniques and information gained from biological research as to populations, requirements, and diseases of the different fish and wildlife species, and by construction and maintenance of refuges and fish hatcheries. Enforcement of wildlife conservation measures helps to protect the resource as does the cooperative control of injurious species of predators and rodents. The supervision of the Federal-aid acts to restore fish and wildlife and the coordination of fish and wildlife conservation measures on water development projects are becoming important functions of the Service.

A sizable portion of the economy of the upper Colorado River Basin is based on the sales and services involved in the harvesting of fish and game. Most of the lands in the upper basin lie in semiarid regions which have been utilized for production of domestic stock and wildlife. Increased populations, farming, irrigation, and industrial development have reduced the wildlife habitat, while the demand for game has increased tremendously. Past records give strong indication that continued increases can be expected in the pursuit of fish and wildlife for recreation. Fifteen years ago approximately 10,400,000 licenses were issued to hunt and fish in the United States. The latest figures indicate more than 26 million licenses are sold each year. This represents an increase of 150 percent, or about 10 percent annually. In less than 10 years receipts from license sales nearly tripled in both Utah and Wyoming, where each State reported annual harvests of fish and game meat in excess of 9 million pounds. The Colorado Department of Game and Fish reports the money turnover accruing directly from fish and wildlife resources in Colorado amounts to more than $50 million annually. These figures reflect the enormous value of fish and wildlife resources in the upper Colorado River Basin.

Some varieties of animal life are found on almost every acre of land or water throughout the basin. Changes in land use or water manipulation will affect these animals and consequently the fish and wildlife populations of the area. To determine the effect that project development would have on fish and wildlife and to suggest means of mitigating losses or preventing damage is the responsibility of the Office of River Basin Studies. This Office proposes to make surveys and investigations over a period of time sufficient to determine the status and trends of the resource and to determine the effect of the individual projects on the wildlife resources of the Nation.

Conservation aims and the methods of attaining them must be ever sensitive to change and must be constantly improved to meet the new demands. Since wildlife is probably the least static of all our natural resources the Service's program in the upper basin, as elsewhere, must be sufficiently flexible to permit modification to meet the inevitable but often unforeseeable changes in conditions that affect the resource.

Within the organization of the Fish and Wildlife Service are several branches which would need to adjust their programs according to the effect exerted by the upper Colorado River Basin development. The branches involved are described in the following paragraphs with specific reference to their more important functions. These functions all possess an underlying unity directed toward conserving the present populations and if possible increasing the fish and wildlife resources.

THE BRANCH OF WILDLIFE RESEARCH

The Branch of Wildlife Research plans, directs, and supervises the wildlife-research activities of the Service and is charged with the problems of conservation, restoration, and management of the wildlife resources of the Nation. The program, in part, consists of investigations on birds, mammals, and other wildlife, and includes studies of life histories, habits, and distribution. The Branch investigates damage caused by wildlife on agricultural and forest lands, and recommends methods for the reduction or elimination of such damage. It also studies the effect of insecticides and control chemicals on wildlife population.

The relative inaccessibility of many areas in the upper Colorado River Basin has not only obstructed an adequate management program for the wildlife of the area, but has retarded the research necessary for proper management. A research program to be carried out during the preconstruction and construction period seems advisable in order that probable changes might be anticipated.

The proposed Colorado River storage project reservoirs would inundate approximately one-half million acres of poor to excellent wildlife habitat displacing present populations and causing loss where ranges become overstocked, unless adequate habitat is developed.

BRANCH OF FISHERY BIOLOGY

The responsibility for fishery-research activities of the Service rests with the Branch of Fishery Biology. In addition to numerous phases of marine research, it studies the habits, ecology, and distribution of anadromous and fresh-water fishes. The effects of both commercial and sport fishing upon populations are also studied. Recommendations for conservation of fishery resources, improvement of fish-cultural methods, and prevention and control of hatchery fish diseases are made by this branch. It also approves designs, and operates fishways and fish screens to minimize losses from project works.

The Branch would be responsible for investigating the fishery potential of the various reservoirs of the upper Colorado River Basin and for determining the need and feasibility of introducing more suitable species. An integrated research program that would include study of the entire basin should be instituted so that such aspects as the correct species to be introduced into the different waters, their effect on the species already present, and the proper management techniques could be applied.

BRANCH OF WILDLIFE REFUGES

The Branch of Wildlife Refuges plans and executes an integrated wildlife program for the establishment of refuges for migratory waterfowl, big game, and other forms of wildlife. Units of the

program may vary from mere protection during breeding seasons to complex restoration or development of habitat for the preservation and propagation of many species. To expedite the program a wide range of information from extensive investigations is necessary.

Migratory waterfowl and big game refuges are the predominant types of refuges existing in the States that would be influenced by the project.

Waterfowl refuge management is dependent upon proper utilization of available water, thus any proposed water manipulations that may affect the waterfowl program is of utmost importance to the Branch of Wildlife Refuges.

Possible refuge sites within the project area would be examined by this Branch and if finally approved the resulting refuge would be administered by it or by the State game conservation department under proper agreement.

BRANCH OF GAME MANAGEMENT

The Branch of Game Management administers and enforces the Federal statutes for the protection and conservation of migratory birds, mammals, and game and food fishes involved in interstate movement. Its principal responsibility is the apprehension and prosecution of offenders of these statutes. In the enforcement of these laws, close cooperation is maintained with State conservation agencies and organized sportsmen's groups.

The Branch conducts the annual midwinter waterfowl inventory to obtain data on the continental population of these birds by species. It studies nesting conditions, conducts bag checks, collects other hunting and game kill data, and recommends administrative regulations under the Migratory Bird Treaty Act based on bird populations, hunting pressure, and other available factual information.

The Branch has the responsibility for issuance of permits to take, possess, sell, and otherwise traffic in migratory birds for scientific and propagating purposes. It works closely with the United States Customs Service in preventing the unlawful importation of wild birds and mammals. Similar cooperation is carried on with postal inspectors and Railway Express officials to obtain records of unlawful interstate shipment of wild birds, fishes, mammals, and parts thereof. The Game Management Branch with assistance from county agricultural agents investigates depredation to crops by migratory birds, develops and demonstrates methods and devices for abating such damages, and works toward the elimination of such losses. It also disseminates information to the public about game laws and practical conservation through newspapers, schools, and farmers' and sportsmen's organizations.

The Colorado River storage project would tend to increase the human population, intensify the agricultural activities in the basin and would provide new means of public access to this relatively inaccessible country. These changes would necessitate increased supervision and administration by the Branch of Game Management in conserving, protecting, and managing the wildlife resources of the basin.

THE BRANCH OF PREDATOR AND RODENT CONTROL

The Branch of Predator and Rodent Control plans and directs cooperative predator and rodent control operations throughout the United States. This work includes use of various control measures for the protection of livestock, poultry, stored foodstuffs, and agricultural crops as well as beneficial species of wildlife and native vegetation. The Branch operates with the public-health services in initiating rodent-control measures in areas where disease-carrying animals may create a health hazard. Field investigations and demonstrations facilitate control measures in these programs.

Within the upper Colorado River Basin, funds are not available to put into operation such overall control plans as are deemed necessary. Predator and rodent-control work, therefore, is confined to critical areas depending upon the season of the year and the species requiring control. Expanded agricultural activities resulting from the Colorado River storage project would necessitate further control of injurious animals, some of which now present only minor or local problems. Irrigation produces improved habitat for some rodent species.

BRANCH OF FEDERAL AID

The Branch of Federal Aid is concerned with the administration and use of federally collected funds made available to the State game departments through the Pittman-Robertson Act and the newly enacted Dingell-Johnson bill. The activities of this Branch include supervision of matters pertaining to the management of areas acquired, developed, or maintained by cooperating States under the provisions of the acts, and advising the States with regard to biological research and land-development activities for effective fish and wildlife restoration. It assists the State fish and game departments in the formulation of sound management plans and programs relating to upland game, big game, waterfowl, fur-bearing animals, and fishes.

The Colorado River storage project with its numerous water developments and resulting irrigation areas would afford numerous opportunities for the Branch of Federal Aid to cooperate with the States in planning and developing efficient fish and wildlife-management programs.

THE BRANCH OF GAME FISH AND HATCHERIES

The Branch of Game Fish and Hatcheries is concerned with two separate but closely integrated phases of fisheries conservation. First, management plans are formulated and recommended for waters under Federal jurisdiction; cooperation is given other conservation agencies and individuals in the development of management programs for public and private waters.

Second, hatcheries and rearing ponds are operated to produce and distribute, to the extent funds will allow, the fish species, sizes, and numbers which are required to fill the stocking needs as well as to furnish considerable numbers for further rearing and distribution by State conservation agencies.

Development of proposed water storage facilities in the upper Colorado River Basin will create further demands on both phases of the work carried on by the Branch of Game Fish and Hatcheries. Of particular importance will be the increased need for advanced fingerling and larger sizes of trout to maintain the fishery of high elevation impoundments, and for warm water species to stock impoundments at lower elevations. The Service at the present time furnishes virtually all of the warm-water species stocked in the area concerned.

OFFICE OF RIVER BASIN STUDIES

The Office of River Basin Studies, acting in cooperation with the State fish and game departments and the other branches of the Fish and Wildlife Service, is responsible for investigating water-resource development projects to insure proper consideration of fish and wildlife needs. The objectives of such investigations are to determine the project's effect on fish and wildlife and to prevent damage which might result from project construction, point out means of developing or rehabilitating habitat, alleviate pollution and assist in planning for propagation and refuge facilities. The work is carried on in cooperation with the project sponsor and other Government agencies, as well as the State fish and game conservation departments of the States concerned.

The development of the Colorado River storage project with its many dams, reservoirs, irrigation areas, and related works would cause changes in the present land use in the basin which would have a pronounced effect on the fish and wildlife of the area. This effect must be considered in developing sound policies for reducing losses and in making recommendations to insure maximum fish and wildlife production on project areas.

The cost of surveys made by the Office of River Basin Studies is paid by the sponsor of the project as provided in Public Law 732, 79th Congress (60 Stat. 1080) an act to promote the conservation of wildlife, fish, and game and for other purposes.

If provision is made in the final project plans to maintain fish and wildlife populations displaced from all the habitat that will be inundated, in the half million acres of proposed reservoirs, the acquisition and construction costs may well exceed $10 million with operation and maintenance costs of $250,000 per year. The costs of maintaining fish and wildlife adversely affected by the project would be in addition to the expanded program the Fish and Wildlife Service contemplates in the upper Colorado River Basin region as proposed in the following program.

Estimate of funds required by the Fish and Wildlife Service for comprehensive developments in the area influenced by the Colorado River storage project

Branch activity	Current year	Fiscal years, beginning with year of project authorization						Total for initial 6-year period
		First	Second	Third	Fourth	Fifth	Sixth	
Management of fish and wildlife resources:								
Administration of fish and game laws	$14,762	$19,600	$20,050	$20,600	$21,050	$21,600	$22,000	$124,900
Propagation and distribution of food fishes [1]	11,934	30,350	57,150	57,900	57,050	59,400	58,350	320,200
Mammal and bird reservations	20,184	41,600	44,000	45,000	42,000	42,600	42,600	257,800
Control of predatory animals and injurious rodents [1]	241,244	292,750	292,750	292,750	292,750	292,750	292,750	1,756,500
Investigations of fish and wildlife resources:								
Research on fish and fisheries		19,800	19,950	20,050	6,200	6,300	6,450	78,750
Research on birds and mammals	5,357	24,500	24,800	25,000	11,250	11,400	11,550	108,500
Construction:								
Fish facilities	39,750	86,300	137,500	68,750	5,000	7,250	7,250	312,050
National wildlife facilities	2,700	44,800	45,400	32,800	26,200	26,200	25,600	201,000
Federal aid:								
Wildlife restoration [1]	288,252	288,500	288,500	288,500	288,500	288,500	288,500	1,731,000
Sport fishing [1]	53,088	107,900	107,900	107,900	107,900	107,900	107,900	647,400
Migratory Bird Conservation Fund	1,200	1,800	4,300	5,200	11,400	16,500	21,500	60,700
River-basin studies [1]	57,140	58,600	61,200	61,750	63,350	64,900	66,500	376,300
General administration costs of Washington and regional offices for upper Colorado River Basin region	15,126	20,350	22,050	20,500	18,650	18,900	19,000	119,450
Total	750,737	1,036,850	1,125,550	1,046,700	951,300	964,200	969,950	6,094,550

[1] Includes cooperative funds.

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Public Health Aspects of the Colorado River Storage Project and Participating Projects

The Colorado River storage project and participating projects would consist of a combination of dams, reservoirs, powerplants, and other appurtenant structures on the upper Colorado River and its principal tributaries. The project would provide a means for the full development of the water resources and long time regulatory storage needed to permit States of the upper basin to meet their flow obligations at Lee Ferry, as defined by the Colorado River compact, and still utilize their apportioned share of water. Lee Ferry, in northern Arizona, is the dividing point on the river between the upper and lower Colorado River Basins. During periods of low streamflow, the States would release storage water to meet the Lee Ferry flow obligation and in exchange they would divert upstream-flow for use in the upper basin. The project would provide some water for direct use in the upper basin. In addition, the project would control sediment, abate floods, facilitate recreational development, and aid in fish and wildlife conservation. It also would permit production of a substantial amount of the electric energy needed in the upper basin and adjacent areas.

All projects authorized subsequent to approval of the upper Colorado River Basin compact that would consume water of the upper Colorado River system are considered to be dependent on the storage project for an assured water supply. Such projects have been designated as dependent projects. Benefits from irrigation, municipal, industrial, and related uses in the upper basin would be realized only with the construction of dependent projects. In this respect, the importance of the dependent projects is illustrated by the fact that the central Utah project, one of the major projects in this category, provides for 47,100 acre-feet of water annually for municipal, industrial, and related uses.

Construction Phase of Project

Public-health services in the upper Colorado River Basin are limited and the State and local health units are not adequately staffed in most cases to cope with local public-health problems. The large construction program that will be required during the development stage will be located in rural and isolated areas. The influx of construction workers into areas without proper facilities to care for their needs or to provide for their families may create acute public-health problems involving proper medical care and the provision of adequate sanitary facilities. In some cases, the construction work will be carried on in relatively remote areas and accommodations will have to be provided for the influx of workers and their families. In most cases, temporary camps will be provided for construction workers and facilities of a more permanent nature will be provided for Bureau of Reclamation employees. Problems which may be encountered will include adequate housing, development of safe and ample water

supplies, proper sewage disposal, adequate garbage and refuse disposal, insect and rodent control, proper food-handling facilities and their control, safe sources of milk and meat supplies, and adequate medical care. Sanitary surveys of proposed construction camps by representatives of the State health departments or Public Health Service would be of considerable value in revealing public-health problems that may be encountered during the construction phase of the projects. Plans of proposed sanitary installations should be forwarded to the respective State health departments for approval prior to construction so that the sanitary facilities to be provided will meet the requirements of the State health departments.

Some of the proposed impoundments will flood areas occupied by rural communities. In the relocation of these communities, precautions should be taken to remove or dispose of all wastes prior to the flooding in order to eliminate all sources of pollution. The wastes should be disposed of in accordance with the requirements of the local health authorities. Proper sanitary facilities should be provided for each community. These should include a water supply system with a safe and adequate source of supply, proper sewage disposal and treatment, and adequate garbage and refuse disposal.

In connection with industrial health hazards that may be encountered on construction projects, arrangements should be made for the prevention of health hazards and accidents and for the emergency treatment of injuries.

PROPOSED RECREATIONAL DEVELOPMENT

The impoundments that will be developed will provide opportunities for the development of recreational areas on the adjoining watersheds. Most of these areas will be accessible to the public over highways that will be provided during the construction stage of development. Under these conditions, the areas that provide opportunities for fishing, boating, bathing, hunting, and hiking may be developed for recreational purposes. The areas that are of unusual scenic interest may also be considered for development.

The development of recreational areas in the vicinity of proposed impoundments may create public health problems if local sanitary requirements are not enforced. In addition to the possible effects of these installations on the use of the impounded waters for domestic water supplies at recreational areas or for irrigation purposes, the problem of providing adequate and safe sanitary facilities for the public at recreational areas is important from a public health standpoint. These problems include a safe and ample water supply, proper sewage disposal, adequate garbage and refuse disposal, insect and rodent control, proper food handling facilities, and safe sources of milk supply. Proper design, construction, operation, and maintenance of resorts, tourist courts, private cabins, fishing camps, and boating and bathing facilities at proposed recreational areas are essential both for the protection of visitors and for the maximum benefit of subsequent water users. Sanitary requirements recommended by the State health departments or the Public Health Service should be adopted and enforced to solve the public health problems which will be encountered.

STREAM POLLUTION PROBLEMS

The upper Colorado River drainage basin is sparsely populated and according to the census, 286,450 people were residing there in 1940. The average density was 2.6 persons per square mile, compared with the national average of 44.2 persons per square mile. Grand Junction, Colo.; Rock Springs, Wyo.; Durango, Colo.; Price, Utah; Montrose, Colo.; and Delta, Colo., are the 6 largest towns in the upper drainage basin, but their combined 1950 population is only 47,600. The population in these communities ranges from 14,454 for Grand Junction to 4,077 for Delta, the largest and smallest towns respectively, in this group.

Agriculture, particularly livestock raising, and mining are the principal industries of the upper drainage basin. The processing of agricultural products on a small scale is practically the only manufacturing undertaken in this area. Three factories are available for the processing of fruits and vegetables, and two for the processing of sugar beets and the refining of sugar.

The upper drainage basin is the leading domestic source of vanadium, uranium, molybdenum, and radium ore. Zinc, lead, silver, and gold deposits there also are commercially important. Large coal fields in the upper drainage basin are being extensively worked. About 15 million tons of coal were mined in 1943. Oil and gas are produced in the San Juan River Basin, the Uinta Basin, and in northwestern Colorado. Several producing fields have been developed recently and widespread exploration is continuing. Pilot plants are being operated to determine the best methods of extracting oil from shale.

Under conditions that prevail in the Colorado River Basin at this time, stream pollution problems are considered of minor importance with the exception of a few problems of a local nature. This picture may change materially under expanded industrial development. Although untreated domestic and industrial wastes are discharged into the streams in the Colorado River Basin, the pollution problems that are encountered are confined to local areas due to the limited volume of wastes in proportion to the water available for dilution purposes. Adequate treatment of these wastes prior to disposal is considered essential when the untreated wastes are detrimental to the subsequent use of water below points of pollution.

Large-scale industrial development in the Colorado River Basin may alter the problem of stream pollution to a considerable extent. The industries that may be involved in future development and expansion include: (1) Processing of oil and oil products from vast reserves of oil shale, (2) manufacture of wood pulp and paper, (3) development of major oil fields, (4) further expansion of mining, and (5) processing of food and meat products. Untreated wastes from some of these developments some day may be responsible for pollution which could debase the quality of water to be used for irrigation and domestic purposes, development of recreational areas, and the propagation of fish and wildlife. Most of these problems can be solved by the State health authorities in requiring adequate waste treatment and by the cooperation of industry in voluntarily providing treatment facilities. However, where these wastes will not respond to conventional or known methods of treatment, studies and investigations should be made by industry and the State health authorities in order

to solve these problems. The cooperation of all interested parties is considered essential to the elimination of existing and new sources of water pollution.

Studies to determine the present and future requirements for controlling water pollution in the upper Colorado River Basin are now being made by the States of that area in cooperation with the Public Health Service.

Natural purification that will take place in the proposed impoundments by means of prolonged storage, sedimentation, aeration, and biological changes should improve the physical and bacteriological quality of the water to a marked degree. The greater part of the sediment and soil pollution that will enter all impoundments will be removed or transformed into inert material by the processes referred to. This will produce water of a quality desirable not only from a physical and bacteriological standpoint, but also for various purposes including irrigation, domestic purposes, fish and wildlife development, and recreation. These conditions will prevail if adequate treatment is provided for all domestic and industrial wastes responsible for stream pollution.

MOSQUITO CONTROL

The development of the Colorado River storage project and participating projects may increase the population of mosquito vectors of certain diseases endemic within the boundaries of the project. These increases will probably not be significant over the entire project area. However, unless proper considerations are included in the project, it is believed that in certain locations these increases will be of considerable importance. Determinations of existing conditions relative to mosquito species and densities are necessary for proper evaluation of future developments that may grow out of the project. Investigations for such purposes should be made by public health authorities and completed in sufficient time to permit action which will tend to minimize mosquito production where it is important to the public health to do so.

COMMENTS

COMMENTS, GOVERNOR OF ARIZONA

OFFICE OF THE GOVERNOR,
Phoenix, Ariz., June 19, 1951.

Mr. WESLEY R. NELSON,
Assistant Commissioner, Department of the Interior,
Bureau of Reclamation, Washington, D. C.

MY DEAR MR. NELSON: At last we have completed our study of the report on the Colorado River storage project and participating projects. We apologize for the delay in supplying the enclosed material, but there have been complications over which we had no control.

Incidentally, we appreciate this opportunity to give you the views and recommendations of the State of Arizona.

Beginning with those portions of the report dealing with the generation, transmission, and sale of electric power and energy, we submit the following:

Although the Glen Canyon unit is located above Lees Ferry and therefore wholly within the upper Colorado River Basin, the Glen Canyon Dam site and the proposed Glen Canyon powerplant are both located within northern Arizona, about 13 river miles downstream from the Utah-Arizona State line and 15 miles upstream from Lees Ferry. Despite this fact, the report makes no provision for sale and delivery of electric power and energy in Arizona, as a part of the considered power market.

The market area considered by the report for most of the power to be generated by the Colorado River storage project lies outside of the area contained within the upper Colorado River Basin. A large potential market for such power is shown in the Bonneville Basin around Salt Lake City. This area lies largely within the boundaries of region 4 of the Bureau of Reclamation, but outside and just west of the upper Colorado River Basin. An even larger potential market is shown in the report as contained in three fringe areas in the States of Wyoming, Colorado, and New Mexico. Each of these fringe areas lies largely outside of both the upper Colorado River Basin and region 4. The potential market in Arizona is not included among the so-called fringe areas, although a small part of the State lies within the upper Colorado River Basin and the State contributes within that area one of Arizona's natural resources, the Glen Canyon Dam site and powerplant. This powerplant is proposed for an installed capacity of 800,000 kilowatts, or almost one-half of the total installed capacity of 1,622,000 kilowatts proposed for the Colorado River storage project.

The tentative project power system shows proposed transmission lines throughout that portion of the market area contained within

region 4. No transmission lines are shown as proposed within the three fringe market areas of Wyoming, Colorado, and New Mexico. Transmission interconnections are shown, however, not only between the region 4 market area and the three fringe areas, but between region 4 and Arizona at Glen Canyon and between region 4 and southeastern Idaho. The statement is made that other lines are planned to permit energy from region 4 to be interchanged with energy produced by Bureau projects in other regions in Arizona, California, Colorado, Idaho, Nevada, New Mexico, Utah, and Wyoming.

The report proposes that firm energy will be sold at an average rate of 5.5 mills per kilowatt-hour, and that firm energy produced in advance of market needs would be sold at an average rate of 3 mills per kilowatt-hour. Although the point, or points, of delivery at which such average rates would apply are not set forth in the report, it could be assumed that such applicable points of delivery will be on the transmission system within the boundaries of region 4. This would mean that any energy delivered in the fringe market areas of Wyoming, Colorado, and New Mexico would have to stand a transmission charge in addition to the 5.5 or 3 mills per kilowatt-hour. This is not borne out, however, by the fact that the 5.5 mills per kilowatt hour average rate for firm energy in the market area is considered reasonable when compared with the estimated cost of generation at future steam electric installations at Salt Lake City, Denver, and Albuquerque. Such installations were assumed to include units as large as 100,000 kilowatts, and it was estimated that energy could be produced, with annual generation at 60 percent plant factor, at an average rate of approximately 6 mills per kilowatt-hour at the high voltage side of the plant. This would indicate that the average rate of 5.5 mills per kilowatt-hour was assumed to be applicable to deliveries of energy in the three fringe market areas as well as within region 4. Such a conclusion is also borne out by the fact that the report includes the potential market within the three fringe areas in determining market needs. The balance of available firm energy, considered in excess of such market needs, is to be sold at 3 mills per kilowatt-hour.

Future steam electric installations in southern Arizona, operating at 60 percent annual plant factor, are estimated to produce energy at 6 mills per kilowatt-hour or less. This means that energy will have to be delivered in southern Arizona, as well as in the three fringe areas, at the average rate of 5.5 mills per kilowatt-hour without additional transmission costs, in order to be competitive with local generation.

The Glen Canyon unit is estimated in the report to cost as follows:

Dam and reservoir	$175, 877, 000
Powerplant	75, 801, 000
Transmission system	108, 000, 000
General property	4, 250, 000
Construction facilities	1, 400, 000
Total all classes	363, 928, 000

The installed capacity is proposed for 800,000 kilowatts and the generation is estimated at 1,710 million kilowatt-hours in 1959 increasing to 4,337 million kilowatt-hours in 1976.

The annual costs of the Glen Canyon unit, including operation, maintenance, and replacement, are estimated in the report at:

Dam and reservoir	$93, 500
Powerplant	1, 602, 700
Transmission system	2, 732, 400
Total	4, 428, 600

Based on the above estimates and for the assumed conditions, energy produced at Glen Canyon would cost:

(*a*) Delivered on the transmission system charged to Glen Canyon, allowing 10 percent for losses and with the generation estimated for 1959—2.88 mills per kilowatt-hour.

(*b*) Delivered on the transmission system charged to Glen Canyon, allowing 10 percent for losses and with the generation estimated for 1976—1.13 mills per kilowatt-hour.

(*c*) Delivered at Glen Canyon without charges for transmission and with the generation estimated for 1959—0.99 mills per kilowatt-hour.

(*d*) Delivered at Glen Canyon without charges for transmission and with the generation estimated for 1976—0.39 mills per kilowatt-hour.

The early completion of construction of the Bridge Canyon project, so that operation could begin in 1956, should provide sufficient generation to meet the estimated increased power-market needs for Arizona by that time. In anticipation of such power needs, the Arizona Power Authority has filed an application with the Secretary of the Interior for the entire commercial output of the Bridge Canyon powerplant when available. Arizona must look to a portion of the output of Glen Canyon powerplant to meet its probable needs after 1957, and this need for power from Glen Canyon would be increased should Arizona not be allocated the entire commercial output of Bridge Canyon.

In view of the fact that Arizona is one of the Upper Colorado River Basin States and that the Glen Canyon Dam site and powerplant are located within and constitute a natural resource of the State of Arizona together with consideration of the estimated cost of power generation at Glen Canyon and the possible power-market needs of Arizona, it is recommended that the Secretary of the Interior be requested to include the State of Arizona in the project power market area as fringe area D (Arizona) and that energy be made available to that fringe area on the same basis as proposed for the other three fringe areas. In this connection, it would likewise seem equitable that fringe area C (New Mexico) be increased to include the western edge of that State and that the southwestern portion of Utah also be included in the project power market area.

Turning now to another aspect of the Colorado River storage and participating projects report, we would like to say that we concur in the conclusions listed on pages 20 and 21 of the report, which are as follows:

40. The Colorado River storage project would provide necessary regulatory storage by a combination of reservoirs on the Colorado River and its tributaries above Lee Ferry. All projects that would consume water of the Upper Colorado River system, authorized subsequent to approval of the Upper Colorado River Basin compact, are considered to be dependent on river regulation for an assured water supply.

41. Reservoirs of the Colorado River storage project would provide a total storage capacity of about 48,555,000 acre-feet. In 200 years at the present rate of erosion about 20 million acre-feet of the capacity would be occupied by sediment, leaving 25,941,000 acre-feet of active capacity for river regulation and direct use of water in the upper basin and 2,614,000 acre-feet of inactive capacity for creation of power heads, fish and wildlife propagation, recreation, and other purposes.

42. Releases from regulatory reservoirs would produce substantial amounts of electric energy. Power load growth trends indicate that the project power output would readily be absorbed in the power-market area.

43. The Colorado River storage project has engineering feasibility and is economically justified.

44. The initial construction program would include the Echo Park, Flaming Gorge, Glen Canyon, Navajo, and Whitewater units. These would be constructed in an orderly schedule. Construction of the Whitewater, Echo Park, and Glen Canyon units should be started immediately.

45. Revenues from the sale of electric energy generated by units of the Colorado River storage project would be more than sufficient to pay all reimbursable costs of the project within a period of 50 years after installation of the last generating unit. Project power revenues also would be available to assist irrigators in the payment of construction costs of economically justified and urgently needed participating projects. Financial assistance could best be rendered irrigators through establishment of an upper Colorado River account.

46. Development of the Colorado River storage project and participating projects is essential to the comprehensive development of the upper basin's natural resources. It would provide flexibility in the basin development and coordination of the interests of the Nation and States of the upper Colorado River Basin.

We further concur in the statement on the bottom of page 18 of the report, to the effect that the construction of the holdover reservoirs will assist the States of the upper division in meeting their obligations to make deliveries to the lower basin at Lee Ferry.

We, therefore, recommend that all assistance possible be given to the States of Colorado, New Mexico, Utah, and Wyoming, and the Bureau of Reclamation in securing the expeditious construction of the features proposed in the report, reserving the right to examine the provisions of any bill which may be offered to authorize the construction of the project, particularly Glen Canyon Dam, which is wholly within the State of Arizona.

If there are any questions concerning Arizona's reactions to your Colorado River storage and participating projects report, we would be more than happy to provide the earliest possible answers.

Sincerely,

HOWARD PYLE, *Governor.*

COMMENTS BY DIRECTOR, ARIZONA GAME AND FISH COMMISSION

ARIZONA GAME AND FISH COMMISSION,
Phoenix, Ariz., February 23, 1951.

ALBERT M. DAY,
Director, United States Fish and Wildlife Service,
Washington 25, D. C.

DEAR MR. DAY: Reference is made to your request that the State of Arizona review the report of the activities and proposed programs of the Fish and Wildlife Service as it applies to the Bureau of Reclamation's departmental report on the Colorado River storage project.

Please be advised that the State of Arizona agrees wholeheartedly with the program as submitted by the Fish and Wildlife Service. There is one item, however, which in our opinion needs clarification. It has been stated that acquisition and construction costs to maintain

fish and wildlife populations may well exceed $10 million, but no definite recommendations have been made as to which agency shall be responsible for requesting the funds and for carrying out the development program. I find no recommendation made in this regard by the Fish and Wildlife Service and likewise none has been made by the Bureau of Reclamation. Public Law 732, 79th Congress (60 Statute 1080) provides that when wildlife values are destroyed by river basin development they shall be replaced in kind. We wholeheartedly agree with the provisions of this public law, but we feel that some definite course should be recommended and outlined for carrying out the provisions of the act. In this respect we feel that no appropriation should be made for river basin development work unless at the same time appropriation is made to restore wildlife values which would be destroyed by the completion of the project. We strongly urge that this policy be adopted by the Bureau of Reclamation in conformance with the provisions of Public Law 732.

It is also noted that in the estimate of funds required by the Fish and Wildlife Service there is included an item for the administration of fish and game laws. We are wondering whether or not this is the proper title for this proposed expenditure. We have always been of the opinion that the States held the authority to administer fish and game laws, and I assume that this means the branch of game management which administers and enforces the Federal statutes for the protection and conservation of migratory birds, mammals and game and food fishes involved in interstate movement. In order to eliminate any confusion in this respect I would suggest that this item be made to conform with the Federal authority as above stated.

Yours very truly,

THOMAS L. KIMBALL,
Director, Arizona Game and Fish Commission.

Approved:

HOWARD PYLE, *Governor.*

COMMENTS, CALIFORNIA DIVISION OF PUBLIC WORKS

DEPARTMENT OF PUBLIC WORKS,
Sacramento, Calif., June 14, 1951.

Hon. OSCAR L. CHAPMAN,
Secretary of the Interior,
Washington, D. C.

MY DEAR MR. SECRETARY: Your proposed report entitled "Colorado River Storage Project and Participating Projects, Upper Colorado River Basin," dated January 26, 1951, was received on February 15, 1951, for review in accordance with the provisions of Public Law 534, 78th Congress, 2d session. On the latter date, the report was transmitted to the State engineer for review and comment thereon. The State engineer has submitted his comments, in which I concur and request that they be considered as expressing the views of the State of California on your proposed report.

Very truly yours,

C. H. PURCELL,
Director of Public Works.

STATEMENT OF THE STATE OF CALIFORNIA ON PROPOSED REPORT OF THE SECRETARY OF THE INTERIOR ENTITLED COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

INTRODUCTION

In accordance with section 1 of the Flood Control Act, approved December 22, 1944 (Public Law 534, 78th Cong., 2d sess.), on January 30, 1951, the Assistant Commissioner of Reclamation transmitted two copies of the proposed report of the Secretary of the Interior entitled, "Colorado River Storage Project and Participating Projects, Upper Colorado River Basin," to the director of public works, the official designated by Gov. Earl Warren as his representative in such matters, for his views and recommendations thereon. The report was received in the office of the director of public works on February 15, 1951, and referred on the same date to the State engineer, who is chief of the division of water resources, for review. One copy of the report was referred by the State engineer to the Colorado River Board of California on February 23, 1951, for comment of that board. Additional copies of the report and substantiating material were required for use in connection with the review of the report, and upon request, copies of the report and of reports on seven of the participating projects were transmitted on March 2, 1951, by the regional director, region 4, United States Bureau of Reclamation, to the State engineer and to the chief engineer, Colorado River Board. On April 17, 1951, copies of reports on two additional participating projects were furnished by the regional director, region 4, to the director of public works and to the chief engineer of the Colorado River Board, and on May 11, 1951, copies of two reports, which were all of the reports on participating projects prepared to date, were transmitted to the director of public works and chief engineer of the Colorado River Board.

On April 10, 1951, the State engineer addressed a letter to the Commissioner of Reclamation, as follows:

> Reference is made to letter from Mr. Wesley R. Nelson, Assistant Commissioner, United States Bureau of Reclamation, dated January 30, 1951, transmitting two copies of the Department of the Interior's proposed report on the Colorado River storage project and participating projects, to Mr. C. H. Purcell, director of public works. These reports were received in the director's office on February 15, 1951.
>
> On February 23, 1951, Mr. Purcell acknowledged receipt of the two copies of the report and stated that additional copies of the report and the substantiating material would be needed for this office and for the Colorado River Board of California. In accordance with the suggestion in Mr. Nelson's letter, a request was made to Mr. E. O. Larson, regional director at Salt Lake City, for the additional material.
>
> On March 2, 1951, Mr. Larson forwarded the additional copies of the report and supplemental reports on Florida project, silt project, Smith Fork project, and Paonia project in Colorado; Pine River project extension, Colorado-New Mexico; Hammond project, New Mexico; and Lyman project, Wyoming. This material was received on March 5, 1951. Reports on six of the recommended projects have not yet been received.
>
> In view of the delay in receiving sufficient copies of the main report on the Colorado River storage project, and the additional delay in receiving substantiating material it is anticipated that it will be necessary to ask the Secretary of the Interior to withhold transmittal of his report to the Congress until the comments of the State of California can be submitted.

By letter dated May 11, 1951, the Secretary of the Interior advised the director of public works as follows:

On January 30, 1951, copies of this Department's proposed report on the Colorado River storage project were sent to you by the Commissioner of Reclamation acting in my behalf, for the views and recommendations of the State of California in accordance with the provisions of section 1 (c) of the Flood Control Act of December 22, 1944. This act provides for a waiting period of 90 days during which the affected States may submit comments on the proposed report.

In consideration of the unanimous action taken by the Upper Colorado River Commission at its April 22, 1951, meeting, in passing a resolution urging an extension of the time for the submittal of comments and recognizing the complexities and magnitude of the project, the Department of the Interior will withhold transmittal of the report to the Congress until after June 15, 1951, in order to permit additional time for the States to comment on the report.

The Commissioner of Reclamation by letter dated May 17, 1951, advised the State engineer as follows:

Response to your letter of April 10, relative to the review of the proposed report of the Department of the Interior on the Colorado River storage project and participating projects, has been held up pending decision by the Secretary as to whether transmittal of his report to the Congress would be held up beyond the expiration of the 90-day period established by the Flood Control Act of 1944 for submittal of comments by the States on the Secretary's proposed reports

In consideration of the unanimous action of the representatives of the upper Colorado River Basin States in requesting an extension of time for submittal of comments on this report, the Secretary has decided to withhold transmittal of the report to the Congress until after June 15, 1951, so as to permit those States which require it additional time in which to submit comments. A letter to that effect has already gone forward from the Secretary to Mr. Purcell.

It is noted that at the time of writing your letter you had not received copies of the reports on six of the participating projects. By this time, you have undoubtedly received copies of the reports on central Utah and Emery County projects directly from Mr. Larson, and the LaBarge and Seedskadee project reports should be furnished you soon. These small projects in Wyoming would appear to have little, if any, effect on the State of California, and it is not expected that the delay in furnishing you with copies of the reports will affect the submittal date of comments. It is not contemplated that a participating project report will be made on the Eden project, certain features of which are, as you know, already under construction.

At the time the recommendations for the Colorado River storage project were formulated, we had expected that the report on the Shiprock project, New Mexico, would be completed before the present time. It is now clear that the report will not be completed in the immediate future; however, we are hopeful that the various interests concerned will soon reach agreement.

The proposed report of the Secretary of the Interior consists of (1) a letter, dated December 22, 1950, from the Commissioner, Bureau of Reclamation, to the Secretary of the Interior, which letter was approved on January 26, 1951, by the Secretary of the Interior; and (2) the interim report of the regional director, dated December 15, 1950, with substantiating materials. Reports on participating projects which have been received for review consist of the following:

Florida project, Colorado
Silt project, Colorado
Smith Fork project, Colorado
Paonia project, Colorado
Pine River project extension, Colorado-New Mexico
Hammond project, New Mexico
Lyman project, Wyoming
Central Utah project, Utah
Emery County project, Utah
LaBarge project, Wyoming
Seedskadee project, Wyoming

The Commissioner of Reclamation in his letter, dated December 22, 1950, to the Secretary of the Interior makes, among others, the following recommendations:

(*a*) That the plan of development of the water resources of the upper Colorado River Basin described in this report be approved.

(*b*) That authority be sought for the Secretary of the Interior acting pursuant to the Federal reclamation laws (act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto) to construct, operate, and maintain (i) the following units of the Colorado River storage project:

Echo Park	Navaho
Flaming Gorge	Whitewater
Glen Canyon	

and (ii) the following initial participating projects subject to the terms of paragraphs (*c*) or (*g*), as appropriate, of these recommendations:

Central Utah (initial phase), Utah	Pine River extension, Colorado-New Mexico
Emery County, Utah	Seedskadee, Wyo.
Florida, Colo.	Silt, Colo.
Hammond, N. Mex.	Smith Fork, Colo.
La Barge, Wyo.	Paonia, Colo.
Lyman, Wyo.	

all as described in the report of the regional director but with such modification of, omissions from, or additions to the works as the Commissioner of Reclamation, with the approval of the Secretary, may find proper; * * *

(NOTE.—Paragraphs (*c*) and (*g*) set forth qualifications to be met by the participating projects.)

In the report of the regional director, the construction cost of the entire Colorado River storage project is estimated at $1,139,100,000, and the average annual operation, maintenance, and replacement costs are estimated at $9,732,100, with full project development.

COMMENTS

The voluminous reports on the Colorado River project and on the participating projects have been reviewed and studied by the State division of water resources and the Colorado River Board of California as fully as practicable within the limited time available under circumstances existing, and as permitted under provisions of the Flood Control Act, approved December 22, 1944.

It is the policy of the State of California to favor full development of the upper basin of the Colorado River system, utilizing the water apportioned to it under the Colorado River Compact.

The primary interest of the State of California in the specific projects set forth in the report of the Commissioner of Reclamation as approved by the Secretary of the Interior on January 26, 1951, is that in the construction and operation of any of these projects, California will receive its due apportionment of the waters of the Colorado River system as provided for in the Colorado River Compact and related laws, instruments, and documents. Therefore, the State of California favors congressional authorization of the specific projects set forth in the proposed report of the Secretary of the Interior or as may be modified, and their construction with Federal funds consistent with national welfare if (a) such projects qualify under criteria, policies, and procedures of the Congress, and (b) the diversion and utilization of the waters of the Colorado River system by and through these projects will not impair the rights of the State of California or any of

its agencies to the waters of that system as defined and set forth in the Colorado River Compact and related laws and documents.

Submitted by:

A. D. EDMONSTON,
State Engineer.

Approved with the understanding that the phrase "criteria, policies, and procedures of the Congress" refers to "uniform criteria, policies, and procedures to be established by the Congress."

COLORADO RIVER BOARD OF CALIFORNIA,
By FRANKLIN THOMAS, *Chairman.*

SACRAMENTO, CALIF., *June 14, 1951.*

OFFICIAL COMMENTS AND RECOMMENDATIONS OF THE STATE OF COLORADO ON THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS REPORT, UPPER COLORADO RIVER BASIN

(Project planning report No. 4–8a.81–1, December 1950)

JUNE 12, 1951.

The SECRETARY OF THE INTERIOR.

SIR: On behalf of the State of Colorado, and pursuant to section 1 of the act of December 17, 1944 (58 Stat. 887), there are herewith transmitted the comments, views, and recommendations of the State of Colorado concerning project planning report No. 4–8a.81–1, Bureau of Reclamation, Department of the Interior, dated December 1950 and entitled Colorado River Storage Project and Participating Projects, Upper Colorado River Basin. These comments, views and recommendations are submitted by the Colorado Water Conservation Board under the authority granted to that board by chapter 265, session laws of Colorado of 1937, as amended, and in accordance with the designation of such board by the Governor of the State of Colorado as the official State agency to act in such matters.

PRELIMINARY STATEMENT

The report is vitally important to Colorado because it deals with the only remaining unused major source of water in the State. It has been well said that the Colorado River is Colorado's last waterhole.

The need for water in Colorado is ever present. Many of the important cities and towns of the State need substantial additional quantities of water if they are to grow and prosper. Denver, Grand Junction, Pueblo, Colorado Springs, Boulder, and other communities all look to the Colorado River water to sustain their growing populations. In all areas of the State more water is needed for agricultural pursuits. The livestock growers demand more irrigated pasture and meadow land. Industrial needs are rapidly increasing. Vast oil-shale and coal deposits are available for synthetic liquid-fuel production. Enormous timber reserves await development under a sane conservation program. The industrialist, the farmer, and the city dweller demand more and more hydroelectric power. The satisfaction of these demands will enhance both State and national welfare. Colo-

rado sees in the Colorado River storage project a means of expediting the attainment of the desired development.

Colorado greatly appreciates the expeditious manner in which the Secretary of the Interior and the Bureau of Reclamation have prepared and submitted the report now under consideration. It has quickly followed the consummation of the Upper Colorado River Basin compact. The Bureau of Reclamation, in full compliance with the spirit and intent of the Flood Control Act of 1944, has kept the States directly affected fully informed during the course of its investigations. The Department of the Interior and its several agencies, particularly the Bureau of Reclamation, are to be commended for the manner in which this important undertaking has been handled.

GENERAL COMMENTS

The general plan set forth in the report is acceptable to and approved by Colorado. Upper basin holdover storage must be provided to equate the Lee Ferry flows so that the upper basin may utilize the water apportioned to it by the 1922 compact without the upper division States violating their obligation not to deplete the Lee Ferry flow below the quantity required by that compact. The necessity for such storage was recognized by the negotiators of the 1922 compact and from time to time has been recognized by all basin States. Reservoirs which provide such holdover will also fill the important role of retaining silt so that the usefulness of the great lower basin reservoirs may be prolonged. It is indeed fortunate that the cost of these reservoirs may be financed through the generation and sale of hydroelectric power which is needed in ever-increasing quantities.

Colorado wholeheartedly supports the plan to use a portion of the power revenues to support irrigation projects. In this regard Colorado approves the plan of the basin account and of the participating projects. Such plan will permit the construction of many desirable consumptive use projects which, without the aid from power revenues through the basin account, might not be possible of construction. It is gratifying that this aid may be obtained and at the same time a reasonable rate be set for the sale of power.

In connection with the participating projects Colorado gives general approval of the criteria established by the report for the determination of the right of a project to qualify for aid from the revenues made available by the project. In particular instances it may be found desirable to adjust these criteria to meet unusual situations.

Included among the participating projects in the State of Utah is a project, the central Utah, which will utilize water exported from the natural basin of the Colorado River. No such exportation project in the State of Colorado is mentioned in the report. Perhaps this results from the fact that Colorado exportation projects are located in an area outside of the jurisdiction of region 4 which prepared the report. It is suggested that there should be full and complete cooperation between region 4 and region 7 to determine what, if any, Colorado exportation projects should be approved as participating projects.

To conclude these general observations Colorado says that the development in the upper division States must, so far as is possible,

move forward on an even basis. This should be possible because the plan contains a desirable flexibility which will permit the States, the Department of the Interior, and the Congress to consider from time to time the addition of worthy units and participating projects.

THE APPLICABLE LAW

With reference to particular matters Colorado agrees that the project should be constructed by the Bureau of Reclamation. This construction and the subsequent operation of the project, and of its various units and participating projects, should be in accord with the Federal reclamation laws and acts amendatory thereof or supplementary thereto, the Colorado River compact of 1922, the Upper Colorado River Basin compact of 1948, and the applicable laws of the various States. Colorado directs particular attention to the following compact provisions:

(*a*) Article V (c) of the 1948 compact which reads thus:

> In the event the commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the upper division, the storage of water for consumptive use shall be given preference. Any reservoir or reservoir capacity hereafter used to assure deliveries at Lee Ferry shall by order of the commission be used to store water for consumptive use in a State, provided the commission finds that such storage is reasonably necessary to permit such State to make the use of the water apportioned to it by this compact.

The right to convert part of the storage capacity of the project reservoirs from holdover use to storage use for consumptive purposes in an upper division State must be recognized and given full effect.

(*b*) Article IX (a) of the 1948 compact provides:

> No State shall deny the right of the United States of America and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity of any signatory State to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals, and conduits in one State for the purpose of diverting, conveying, storing, regulating, and releasing water to satisfy the provisions of the Colorado River compact relating to the obligation of the States of the upper division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing, or regulating water in an upper signatory State for consumptive use in a lower signatory State, when such use is within the apportionment to such lower State made by this compact. Such rights shall be subject to the rights of water users, in a State in which such reservoir or works are located, to receive and use water, the use of which is within the apportionment to such State by this compact.

It is plain under this provision that the rights of water users in a State in which a holdover reservoir is located to receive and use water within the apportionment of the State must be recognized.

(*c*) Article IV (b) of the 1922 compact states:

> Subject to the provisions of this compact, water of the Colorado River system may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

This provision must be considered in connection with its counterpart in the 1948 compact to which reference is next made.

(*d*) Article XV (a) of the 1948 compact reads as follows:

> Subject to the provisions of the Colorado River compact and of this compact, water of the upper Colorado River system may be impounded and used for the

generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

The last two mentioned compact provisions must be given effect. They require that the use of project water for power generation purposes is subservient to domestic and agricultural uses and that no firm rights can be secured which will preclude the use within any upper basin State of that State's apportioned share even though such use develops after the power generation use has been perfected. It is entirely correct for the report to recognize a diminishing power use as consumptive use projects come into being.

(*e*) Article XV (b) says:

The provisions of this compact shall not apply to or interfere with the right or power or any signatory State to regulate within its boundaries the appropriation, use, and control of water, the consumptive use of which is apportioned and available to such State by this compact.

This provision is tied into the comments under (*c*) and (*d*) above. Most obviously the holdover storage reservoirs will not fulfill their primary function if they are so used as to prevent the authorization and construction of junior upper basin projects which use water within the apportioned share of any State. Due regard for this important matter must be made in all priorities awarded any of the units of the project.

STORAGE PROJECT UNITS

With reference to the storage units proposed for immediate authorization and construction, Colorado has no comment as to the Flaming Gorge and Navaho units. Their positions in the overall plan seem well established.

In regard to the Echo Park unit, Colorado emphasizes the need for immediate authorization and construction. The wise decision of the Secretary of the Interior approving this unit even though it is located within the Dinosaur National Monument is to be commended. The question of access roads to the Echo Park Reservoir, and also to the Split Mountain unit, is a matter of great importance to Colorado. These roads should be of such a nature that they are useful not only during construction but also thereafter for recreational development in this remote region of unusual attractions which will be made available to the public for the first time by the construction of the proposed reservoirs. Colorado firmly believes that access roads from Colorado points will satisfy all requirements, and requests that before any final decisions are made as to road locations full opportunity be afforded Colorado to be heard on this subject.

The proposed Glen Canyon unit is recognized as an important and essential feature of the project. Colorado does not object to its inclusion as a unit for initial authorization and construction. Its capabilities for holdover storage, power generation, and silt retention are outstanding. Its location at the extreme lower end of the upper basin may possibly raise questions of interbasin relations upon which Colorado may desire to be heard in connection with the authorizing legislation.

Colorado is most vitally interested in securing the development of the Gunnison River. The report contemplates three units as a part of the storage plan on this stream. The Bridgeport is recommended

for initial authorization and construction. The Curecanti and Crystal are recommended for later action.

Colorado believes that full study has not been given to these Gunnison River potentials. Many local problems are presented. Colorado most respectfully requests that it be given opportunity at a later date to state its position with regard to the Gunnison River storage. To this end, it requests that the Bridgeport unit should not be included within the initial list and that further study and consideration should be given to the location of storage units on the Gunnison River which develop, as far as possible under all of the conditions, the full power potential of that stream, permit the early construction of participating irrigation projects, and provide holdover storage, all with the least possible disruption of the local economy. Colorado desires that a unit of the storage plan located on the Gunnison River be included in the initial authorizing legislation. It is anticipated that the restudy herein urged and further comments of the State will be made in due time so as to accomplish this purpose. Colorado pledges its full cooperation with the Bureau of Reclamation in the formulation of an acceptable Gunnison River plan.

PARTICIPATING PROJECTS

The participating projects listed in paragraph (b) of the Commissioner's letter of December 22, 1950, are all approved by Colorado. The early construction of these projects is urged.

Colorado specifically requests that the La Plata project, heretofore recommended by the State and not appearing in the list, should be included among the participating projects for initial authorization. This project is desperately needed to provide a dependable water supply for lands lying in the La Plata Valley and located in both Colorado and New Mexico. The limited and erratic water supply of the La Plata is apportioned between Colorado and New Mexico by the La Plata River compact. This compact was recognized and approved by the Upper Colorado River Basin compact. The La Plata project is of relatively small cost and does not materially or adversely affect other proposed developments, or materially disturb the economic feasibility of the entire basin development. At the request of the States of Colorado and New Mexico, the Bureau of Reclamation commenced investigation of the La Plata project many years ago. At least two reports have been issued by the Bureau. The Colorado landowners have organized a district under the Colorado Conservancy District Act. The La Plata water users have expended considerable money and put forth every effort to obtain a project only to be faced with years of delay and disappointment. Fair treatment of the La Plata farmers requires the inclusion of the La Plata project for initial authorization as a participating project under the Colorado River storage project plan.

Attention is directed to the fact that the Paonia project, which is included in the list of participating projects recommended for initial authorization, has twice been authorized by Congress. The increase in construction costs, the addition of certain acreage, and the relocation of the proposed storage reservoir have resulted in substantially increasing the project cost. This necessitates either reauthorization or amended authorization. The report on the revised project plan

has been pending before the Bureau of the Budget for some time. A bill has been introduced in the Congress for amended authorization. This legislation provides that the Paonia project shall become a participating project under the Colorado River storage plan. Colorado expresses its intent to proceed with the legislation for amended authorization of the Paonia project in advance of the approval of the Colorado River storage project in order that there may be no cessation of construction activities.

Paragraph (d) of the Commissioner's letter of December 22, 1950, makes reference to the Shiprock Indian project. This is of vital concern to both Colorado and New Mexico in view of the provisions of article XIV of the upper Colorado River Basin compact and particularly paragraph (c) thereof providing for curtailment of uses of San Juan River water in times of water shortages. Colorado has not been provided with a planning report on the proposed Shiprock Indian project. It is not advised as to its cost, size, the water users' ability to return operation and maintenance costs, or any other essential data. The extent of the Indian land proposed to be irrigated under the project, the amount of water required for such irrigation, and the relationship of the use of such water to other proposed New Mexico projects are all matters of conjecture. While the project may be a desirable one and may well constitute an essential part of the plan for the development of the San Juan River, Colorado says that no appropriation for, or construction of, the project should be authorized or made until there has been made available to the affected States, and approved by the Congress, a report on the project comparable to the reports already prepared for the other participating projects.

POWER CONTRACTS

Hydroelectric powerplants comprehended within the plan should be operated in conjunction with other Federal powerplants, present and potential, on the Colorado River and its tributaries so as to produce the greatest practical amount of power and energy that can be sold at firm power and energy rates. The Secretary of the Interior should, so far as practicable, make contracts for furnishing firm power and energy at firm power and energy rates from such plants and other Federal powerplants on the Colorado River operated conjointly. Provision should be made for the termination, upon a reasonable notice, of all contracts relating to the disposition for use, outside the upper division States and outside that portion of the State of Arizona within and from which waters naturally drain into the Colorado River system above Lee Ferry, of power and energy generated at such plants to the extent that the power and energy so contracted for is required to satisfy the need of consumers in the mentioned areas.

INVESTIGATION FUNDS

While Colorado approves the recommendation made in paragraph (j) of the Commissioner's letter of December 22, 1950, relating to the establishment of a fund from which money may be appropriated for studies and investigations relating to the development of the waters of the upper Colorado River Basin, it points out that it will be a number of years before the necessary fund will be accumulated to

finance needed investigations. During the interim period, investigations on a large and expedited scale should be carried forward to provide information concerning prospective participating projects. The situation has particular significance to Colorado because it is desirous of determining at as early a date as possible the potential uses of water in the natural river basin in Colorado. At the present time the only money available for this purpose comes from the Colorado River development fund and the upper Colorado River share of general investigation funds. These funds have proven inadequate to accomplish the desired purpose. If a well-conceived program for the development of the Colorado River is to be realized in accordance with the recommendations of the report, then increased annual appropriations of money must be made to expedite investigations in the upper Colorado River Basin. Colorado urges that the report be revised so as to include a recommendation that the Congress authorize the creation of a special fund as a basis for future appropriations to carry on investigations in the upper Colorado River Basin in that period prior to the time when money will become available under the above-mentioned paragraph (j) and that the funds so appropriated shall be nonreimbursable.

ACREAGE LIMITATIONS

Much of the area of the upper Colorado River Basin is devoted to the raising of livestock at high altitude. Additional irrigated pasture and meadowland is needed by the ranchers if the basic meat supply of our country is to be maintained at adequate levels. In such ranching operations the 160-acre limitation of the Federal reclamation laws is unrealistic. The practical development of the upper Colorado River Basin will require water supplies for these livestock ranches. Consideration should be given to a revision of the present law relative to excess lands so that the principle of family operation may be retained in the mountain area.

CONCLUSION

The Colorado River storage project is of basic importance to the economy of the upper Colorado River Basin. A development plan must of necessity be flexible so as to permit adjustments made desirable by investigations and new conditions. Colorado recommends that the interested States should be given opportunity to comment from time to time on these new developments so that there may be the most complete cooperation between the States and the Federal Government to the end that a great national natural resource may be best developed.

Respectfully submitted.

DAN THORNTON,
Governor, State of Colorado, and Ex-Officio Chairman of the Colorado Water Conservation Board.

CLIFFORD STONE,
Director, Colorado Water Conservation Board.

COMMENTS, COLORADO GAME AND FISH COMMISSION

GAME AND FISH COMMISSION,
Denver, Colo., February 23, 1951.

ALBERT M. DAY,
Director, United States Fish and Wildlife Service,
Washington 25, D. C.

DEAR MR. DAY: Reference is made to a proposed supplement to the report of the Department of the Interior on the potential Colorado River storage project and participating projects, copy of which is enclosed herewith.

Careful scrutiny of the material contained in this supplement discloses that it presents an accurate and comprehensive summation of the responsibilities of the United States Fish and Wildlife Service.

The State of Colorado, through the responsible agency, namely the Colorado Game and Fish Department, strongly urges that this supplement be included as a part of the departmental report mentioned above.

We cannot emphasize too strongly the importance of preserving and protecting the wildlife fisheries values of the upper Colorado River Basin.

Very truly yours,

C. N. FEAST, *Director.*

COMMENTS, NEVADA STATE ENGINEER

OFFICE OF STATE ENGINEER,
Carson City, Nev., February 14, 1951.

WESLEY R. NELSON,
Assistant Commissioner,
United States Bureau of Reclamation,
Washington 25, D. C.

DEAR MR. NELSON: This will acknowledge receipt of your letter dated January 30, 1951 (your reference 737) with which you transmitted two copies of the Department of the Interior's proposed report on the Colorado River storage project and participating projects.

We have examined this report and have no objections to offer to its publication as submitted. It is well prepared and the Bureau of Reclamation is to be complimented upon the vast amount of excellent work it has done in preparing the report for publication.

Very truly yours,

ALFRED MERRITT SMITH,
State Engineer.

NEVADA STATE ENGINEER ON EARLIER DRAFT OF REPORT

OFFICE OF STATE ENGINEER,
Carson City, Nev., October 24, 1950.

Re review of upper Colorado River report.

Mr. E. O. LARSON,
Regional Director, United States Bureau of Reclamation,
Region IV, Salt Lake City 8, Utah.

DEAR MR. LARSON: I have reviewed the Bureau of Reclamation's proposed report entitled "Colorado River Storage Project and Partici-

pating Projects, Upper Colorado River Basin," and herewith submit comments on some of the material.

Mr. Michael W. Straus, commissioner, and yourself, who actively supervised the work, deserve the highest praise for this excellent survey and report. In particular we are pleased with the orderly and progressive manner in which it is proposed to construct the various unit dams beginning first with major units designed to protect and preserve existing downstream developments; to be timed over a period of years to permit a gradual absorption of the electric power; and, further, to not burden too rapidly the already exceedingly heavy national budget.

The recommended upper Colorado River account, which is to be credited with profits from power revenues, appears to be a well-designed part of your plan. It will assist the irrigation feature in projects that cannot repay all of their capital investment in 50 years. Disbursements from the river account will enable the more desirable power projects (those that are considered best from a financial view) to help the financially weak or marginal irrigation developments to repay capital investment.

However, I am not yet sold on irrigation projects that will be unable to repay construction costs within a reasonable period of years—if ever. I believe there is a necessity for the Nation to provide more agricultural opportunities for our increasing population, but these should be sound opportunities. We know, too, that various indirect benefits, impossible to precisely evaluate, will result from this new marginal agriculture but which cannot be counted on to directly repay capital investment. It would appear to be a sound business procedure to fix a minimum ratio of capital costs that must be paid rather than to leave this open as suggested on page 10 (d) of the report, which reads:

> * * * based on the irrigator's ability to pay in a period of 50 years following a suitable development period at least part of the capital costs allocated to irrigation.

It will certainly be argued that if any project is unable to pay all costs in 50 or 60 years it is a poor investment, and that the Bureau is only helping to promote such poor business in order to sustain and increase its personnel and prestige; and because it realizes that good reclamation projects are not numerous.

We do not find in your report estimates of time periods for totally paying-off irrigation features. It may have been too soon to have worked this out, but I am of the opinion that it should be done and that some information should be supplied regarding the liquidation of capital costs of irrigation before Congress is asked to give approval to the comprehensive project. Probably the reclamation feature of some of these units should be reduced or omitted and there also should be a fixed limitation as to what extent the Nation will support marginal reclamation features.

You are not to infer, however, that we do not favor any degree of such support. We do favor it, but believe all projects should be very carefully screened before approval by either the Bureau or Congress. Recommendation of irrigation projects by the Bureau, that cannot repay a reasonable part of capital costs, may cause the Bureau to be criticized as being a promotional agency.

We note that the Glen Canyon project as planned would provide 230,000 kilowatts of capacity in 1959 with ultimately completed installation of 800,000 kilowatts in 1964.

As outlined in your report and maps, it appears that all power to be generated at Glen Canyon will eventually be allocated to the Colorado River storage project, specifically in power market division IV. While no objection might be offered to the allocation of all power revenues from Glen Canyon Dam to the proposed upper Colorado River account, as the project is within the upper basin; the immediate and best market for the power would probably be within the lower basin at the rapidly expanding industrial center of basic magnesium project in Nevada and in densely populated southern California. It is suggested that a large portion of Glen Canyon Dam power should be allocated in perpetuity to this fully developed market, which is now extensively served by higher-cost, steam-generated power using oil as fuel. Conservation of the west coast oil reserves will probably be necessary in the interest of national defense as well as for other purposes.

The last paragraph on page 73 of the report states:

> For a number of years energy production by the Glen Canyon unit would exceed by a substantial amount the energy requirements of the States of the upper division. Until required by these States this energy would be available to other States. From time to time, the amounts of energy supplied from within and without the States of the upper division would be adjusted as necessary to meet needs which develop in the States of the upper division.

In accordance with the precedent established with regard to Hoover Dam in the lower division by the Boulder Canyon Project Adjustment Act, whereby $500,000 per year of net power revenue was diverted into a Colorado River development fund for investigation and construction of projects mainly in States of the upper division until the year 1987; it might appear that some portion of power revenues from Glen Canyon project, as well as from other power projects to be constructed on the Colorado in both the upper and lower division States, should be set aside in a special fund for the same purpose.

Very truly yours,

ALFRED MERRITT SMITH, *State Engineer.*

COMMENTS, NEW MEXICO STATE ENGINEER

OFFICE OF STATE ENGINEER,
Santa Fe, N. Mex., June 12, 1951.

Hon. OSCAR L. CHAPMAN,
Secretary of the Interior, Washington, D. C.

DEAR SECRETARY CHAPMAN: This letter contains the views and recommendations of the State of New Mexico with regard to project planning report No. 4–8a.81–1 entitled "Colorado River Storage Project and Participating Projects, Upper Colorado Basin States, December 1950." The report was transmitted by you in accordance with the provisions of section 1 of the Flood Control Act of 1944 (58 Stat. 887) and was received in this office on February 13, 1951. At the request of the Upper Colorado River Commission and some of the States individually, the 90-day period for review was extended by the Secretary of the Interior to June 15, 1951.

The report is an excellently prepared document evidencing a great deal of investigation and study over a period of years. The Department of the Interior and its various branches and employees are to be highly commended, particularly the Bureau of Reclamation which is largely responsible for the preparation of this fine report. During the investigation, the regional director of region 4 of the Bureau has kept the States of the upper Colorado Basin fully informed of the progress of the work and the problems encountered, in full compliance with the spirit and purposes of the Flood Control Act. The Department of the Interior has been particularly helpful to New Mexico by assisting in special studies of those phases of the upper Colorado River plan peculiar to our own State, which problems will be more fully discussed hereinafter. The State is most appreciative of that cooperation.

Subject to specific recommendations hereinafter made, the State of New Mexico approves the plan of development of the water resources of the Upper Colorado River Basin as described in this report and recommends that projects listed in paragraph (b) of the Commissioner's letter of December 22, 1950, be authorized for construction and thereafter operated in accordance with the Federal reclamation laws (act of June 17, 1902, 32 Stat. 388) and acts amendatory thereof or supplementary thereto.

The proposed storage project and the plan of financially assisting participating projects are vital, necessary factors in the development of the water resources of the upper basin. The plan is in accord with the provisions of the upper Colorado River compact and will be invaluable in assisting the upper division States to fulfill the delivery obligations at Lee Ferry called for by the Colorado River compact of 1922. It will also permit them to accomplish in full measure the development provided for through the apportionment made by the original Colorado River compact.

The State of New Mexico is in accord with and recommends the plan for a basin account as set forth in the Commissioner's letter and explained in detail in the report of the regional director. It is the opinion of the State that such an account is consistent with the policies and procedures previously adopted for other projects constructed by the Bureau of Reclamation and carried out within the existing reclamation law. It is consistent with the principle that mutually dependent projects should participate in the benefits of basin development, including, when necessary and with proper safeguards, financial aid from those projects which produce surplus revenues. It is strongly urged that the provisions for assistance to irrigation projects through the basin account method be incorporated as an essential part of the authorization bill.

New Mexico recommends that the hydroelectric plants comprehended within the plan should be operated in conjunction with other Federal powerplants, present and potential, on the Colorado River and tributaries so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates. New Mexico is frankly concerned that such power and energy may be sold to users outside of the upper basin and the States of the upper division in accordance with current demands which in the future may be necessary to provide essential power development to the State. Accomplishment of this objective involves considerations which, at this time, cannot be foreseen. New Mexico requests the privilege of

seeking, at an appropriate time, adequate provisions of law, or procedures for such power operation, as will insure the greatest future benefits for the upper basin and the States of the upper division from the power produced by the Colorado River storage project.

Chapter V of the substantiating materials accompanying the regional director's report deals with power resources available to the power market area, including the potential needs for additional power and energy in the power market area which may be served by the Colorado River storage project. The table on page 70 indicates that for New Mexico (fringe area C) additional power needed by 1970 will amount to 220,000 kilowatts. Preliminary information from the regional office of the Federal Power Commission at Fort Worth, Tex., indicates that the demand for additional dependable power capacity may be even larger than that shown in the regional director's report. New Mexico recommends that the power and energy needs in this State be given careful review and consideration before power contracts are entered into which might leave the State in the position of having to obtain power from other sources at rates which might be considerably larger than those which could be obtained from the storage project. It is realized that as and when the San Juan-Chama transmountain diversion is authorized and constructed there will be a substantial quantity of power and energy available from that source. It is our opinion, however, that the power market needs of the State will far outstrip any power which may be made available by the San Juan-Chama installation and will coincide more nearly with the power which will become available from the storage project.

New Mexico has concurred in the actions taken by the States of the upper basin from time to time through the Upper Colorado River Commission and the Colorado River Basin States Committee looking toward a plan which will insure orderly development so that all of the States will move forward on an even basis insofar as the solution of each State's problems will permit, and it is found practicable so to do. The storage project plan is a flexible one which permits, from time to time, the addition of other storage units and other participating projects, as plans are completed and as the necessary project reports indicate that such projects qualify for authorization within the provisions of the plan.

In recognition of the peculiarity and individuality of each State's problems New Mexico does not oppose any recommendations for changes in the plans within any State from those recommended by the report which may be made by such State or States of the Upper Basin so long as such changes are consistent with the best interests of the basin and with the ultimate plan of development. It has been brought to our attention that the State of Colorado may request the selection of the Curecanti storage unit on the Gunnison River for initial authorization in lieu of the Whitewater unit proposed in the report. It is recognized that such a change may well be in the best interests of the basin and of the State of Colorado and it is, therefore, recommended, should the State of Colorado make such a request for revision, that it have your careful consideration.

At the time the Upper Colorado River Commission and the Colorado River Basin States Committee were considering the preliminary draft of the subject report, a report on the La Plata unit of the Animas-La Plata project had been completed by the Bureau and the

project was approved as a participating project. By the time the main report was ready for transmittal to the affected States, however, departmental review of the La Plata report indicated that the cost-benefit ratio was unfavorable and the project could not be included. It is our understanding that region 4 is currently reviewing the project in an attempt to formulate a revised plan which will meet necessary requirements for participating projects. The La Plata is one of the most deserving projects within the entire basin from the standpoint of need for rehabilitation and reclamation of a project now deficient in water supply. Water shortages in that area are chronic. For this reason we urge that every effort be made to work out a revised project for the La Plata unit which can be included in the near future as a participating project.

In our letter to you dated April 13, 1951, certain inconsistencies were pointed out in the position of the Department of the Interior concerning projects in New Mexico for the utilization of its share of San Juan River water. The question set forth in that letter arose from the recommendations of the Commissioner of Indian Affairs contained in paragraph (*d*) of Commissioner Straus' letter of transmittal. Briefly, our letter sought to determine whether the Department intended to seek authorization of an open-end Shiprock project as indicated in that paragraph, or if the Department intended to continue the course which is now under way of attempting to negotiate the question of the size of Shiprock and other competing projects. Your reply under date of May 28, 1951, while helpful, did not completely answer our query. It is noted that you did agree "that an open-ended authorization of the Shiprock project would be undesirable." You stated that every effort was being made to seek a satisfactory solution and expressed the hope that such a solution would be reached by the time the report was forwarded to the President and the Congress. However, the complexity of the problems encountered is such that there appears to be no solution to the problem possible in time for inclusion in the current report. It is necessary, therefore, for the State to comment in some detail on the recommendation contained in the Commissioner's letter.

Under the provision of New Mexico's constitution, its statutes, and the decision of its courts, the water allocated in New Mexico for consumptive use by the terms of the upper Colorado River Basin compact (except as to present uses) is unappropriated water of the State of New Mexico held by the State as trustee for the benefit of the public.

Because of the physical situation on the San Juan River, the several large projects which would use a major portion of New Mexico's allocated water supply under the terms of the compact are dependent upon the amount of water in the Upper San Juan River and its tributaries available above the site of the Navaho Reservoir. Several facts concerning the final determination of water supply to these projects are important:

(*a*) A substantial Navaho-Shiprock project is a necessary feature of the program of development of the water supply in New Mexico, not only from the standpoint of taking care of the economy of the Navaho Indian but in making the best and fullest use of New Mexico's compact allocation.

(*b*) A transmountain diversion of water from the San Juan to the Chama River is also necessary in order for New Mexico to fully utilize its allocated water supply.

(*c*) The only substantial source of unappropriated water in the State is the San Juan River. This water is required not only to take care of the legitimate needs within the basin but to supply water to the Rio Grande Basin to assist in relieving shortages in existing irrigated areas, to provide for the growth of municipal, industrial, and military uses, and to replace those amounts of water which may be consumed in connection with programs of the Department of Agriculture for watershed rehabilitation within that basin.

Because of the far-reaching effect which allocations made at this time will have upon the economic, irrigation, and industrial growth within the entire State, the selection of projects and the determination of their respective sizes in the current program must be made with the greatest of care.

The record will show that the State has consistently worked for the Shiprock (Navaho) project. It would be desirable to recommend it without reservation for authorization in the initial list of participating projects if a project report had been made available for the States' prior consideration setting forth its size and other essential features demonstrating its qualifications for inclusion therein. Under the circumstances, however, it is obvious that the States cannot give unqualified approval to the blanket recommendations contained in paragraph (d) of the Commissioner's letter.

For over a year the San Juan Coordinating Committee of the Department of the Interior has been working to develop the engineering data necessary for a proper determination of respective sizes of the Shiprock project, the South San Juan (white lands) project in connection therewith, and a San Juan-Chama transmountain diversion project. The committee is working under a directive in the form of a memorandum from Assistant Secretary William E. Warne, which was approved by you August 30, 1950. The directive set forth certain aims and objectives, stating, among other things:

> Once a feasible project is reached which will combine the San Juan-Shiprock area and the San Juan-Chama diversion, while allowing for irrigation of 20,000 acres of white lands, the entire project should be included in one report.

It also directed:

> That the Department endeavor to complete by January 1, 1951, a mutually acceptable report on the above basis which will set out the magnitude of the recommended east slope and west slope units of the project, along with supporting economic data;

and

> That the Department complete by January 1, 1952, feasibility reports to be used as a basis for seeking project authorization.

It seems evident from the memorandum that the policy of the Department is to develop, with the aid and assistance of engineering data obtained by the Interior Coordinating Committee, a solution as to the respective sizes of the three projects which can be agreed upon at State level; and that such coordinated plan be then submitted to the Congress and authorized as a unit.

The work of the Coordinating Committee has been progressing quite satisfactorily. Due to unforeseen delays, however, it has not been able to proceed as rapidly as originally anticipated. For example, the Navaho Tribal Council has entered the picture and is seeking certain information which it feels is required before the council is willing to make any commitments regarding the potential size of their project. The council is employing a private engineer to conduct an independent review of the engineering data so that the council may be fully apprised as to its adequacy. The State feels that the Navahos are entitled to full information regarding their project.

There seems to have been an unfortunate tendency on the part of the several agencies involved in the early project studies to so plan their projects that they could maintain bargaining positions with respect to other projects or plans. I believe this situation has been largely rectified since the appointment of the Coordinating Committee, although there is still a tendency on the part of the Bureau of Indian Affairs to insist that it cannot recede from a certain predetermined size of the Navaho-Shiprock project. The State feels that it is necessary for all agencies to work wholeheartedly in presenting complete data regarding the proposed projects.

In this connection, it is evident that region V of the Bureau should collect and present at the earliest possible time a report showing the needs of the east slope for domestic, municipal, and supplemental water. Such data would be used, together with potential power possibilities, in preparing a transmountain project report. In the San Juan Basin, it is evident that additional data are required to complete the project report on the Shiprock project. Preliminary examination by engineers of the State indicate the need for more detailed study of such features of the project as (1) the question of inclusion of scattered tracts of good land where the distribution costs may be excessive, (2) the question of drainage of many areas on the project, where topography and soil conditions are such that drainage is expensive and difficult, and (3) other project features which might well be reviewed. A study of these matters could have a material effect on the ultimate area which should be recommended for inclusion within the project. A complete report on the South San Juan project is necessary to determine its feasibility and economic size for inclusion as a unit of the larger Navaho Reservoir project.

The above problems were brought to the attention of the Governor and a number of representatives of the areas of the State involved and were carefully considered by them. It was agreed that, since you have recommended the Shiprock project for current authorization, the State's other legitimate needs can be guaranteed and your directive of August 30, 1950, can be effectuated only by inclusion of the other two competing projects in the report for concurrent authorization. Accordingly, New Mexico recommends and strongly urges the inclusion in your recommendations to the President and the Congress of the following: (1) The South San Juan and San Juan-Chama projects, as well as the Shiprock project, be included in the subject report for authorization as participating projects as a unit; and (2) there be no appropriations for, or construction of, any of the

three projects until there has been made available to all of the affected States and approved by the Congress project reports, comparable to reports already prepared for the other participating projects, which demonstrate their feasibility, their favorable qualifications as participating projects, and their compatibility with each other.

On pages 6 and 7 of the regional director's report is set forth his proposed construction schedule for the storage project reservoirs. He recommends therein that the Whitewater, Echo Park, and Glen Canyon units be constructed immediately, followed by the Navaho and Flaming Gorge units. New Mexico, respectfully calls the Secretary's attention to the fact that the Navaho Reservoir is an essential initial phase of the construction of the Shiprock, the South San Juan, or the San Juan-Chama diversion projects since all three are dependent upon equating the flow of the San Juan River at or near that reservoir site. Further, due consideration should be given to the use of presently unappropriated waters of the San Juan for power purposes while such surplus power sources are available. The State, therefore, recommends and urges that you revise the construction schedule so that the Navaho Reservoir is included as one of the initial units of the storage plan, thereby permitting development in this State to proceed on an even basis with that in other States of the upper basin.

Because there will be sufficient credit in a basin account when and as approved by the Congress, and because of the continuing need for project investigations and reports as development of the upper basin progresses, it is recommended that investigational funds adequate for the purpose be authorized from this account in addition to those provided by the Colorado River development fund, Reclamation funds and subparagraph (j) of the Commissioner's letter of December 22, 1950.

Respectfully submitted.

JOHN H. BLISS,
State Engineer of New Mexico.

COMMENT, NEW MEXICO STATE GAME WARDEN

MARCH 22, 1951.

ALBERT M. DAY,
Director, United States Fish and Wildlife Service,
Washington, D. C.:

Reference Fish and Wildlife Service program for protection, development and utilization of fish and wildlife resources in upper Colorado River Basin, this program affects New Mexico only as far as Navaho Reservoir is concerned and in that case meets with our approval and is in accordance with our policies.

ELLIOTT S. BARKER,
State Game Warden, State of New Mexico.

COMMENTS, UTAH STATE ENGINEER

OFFICE OF STATE ENGINEER,
Salt Lake City, Utah, June 12, 1951.

Re Colorado River storage project and participating projects—views and comments

Mr. OSCAR L. CHAPMAN,
Secretary of the Interior, Washington, D. C.

DEAR MR. SECRETARY: Receipt of your letter of transmittal dated January 30, 1951, together with copies of the Colorado River Storage Project and Participating Projects, Upper Colorado River Basin, dated December 1950, as prepared by the Bureau of Reclamation, is acknowledged. It is understood that said reports were submitted to the State of Utah on behalf of the Secretary of the Interior in compliance with the provisions of section 1 (c) of the Flood Control Act of December 22, 1944 (58 Stat. 887). Included in each report was the Commissioner's letter to the Secretary of the Interior under date of December 22, 1950.

Under authority of Utah's Governor, the Hon. J. Bracken Lee, it becomes my responsibility to submit official views and recommendations on the reports for the State of Utah.

We wish to commend the Department of the Interior, the Bureau of Reclamation, and their staffs on the painstaking investigations that have made the reports possible. The basic principles underlying the reports are sound. The reports are comprehensive, well prepared, and the many details of preparation are well done. Region IV of the Bureau of Reclamation is to be particularly commended. Utah appreciates the complete cooperation and congenial working relationship that has existed continuously between the State and the Bureau of Reclamation during the period of report preparation. Full compliance with the spirit and purpose of section 1 of the Flood Control Act of 1944 has been exemplified.

Conferences have been held with State officials; the Utah Water and Power Board; the Utah Water Users Association; the Colorado River Development Association, representing 21 affected counties within the State; chambers of commerce and their water resources committees; the Utah Fish and Game Commission; the Utah State Agricultural College and Agricultural Experiment Station; the Metropolitan Water District of Salt Lake City; various consulting engineers; and many water users and other citizens of this State. In these conferences, the basic principles and details of the Colorado River storage project and participating projects in the upper Colorado River Basin have been explained and discussed. All of the above-mentioned organizations and individuals have officially endorsed and approved the project plan. Two exceptions, however, have been made relative to the details of distribution and construction as it relates to the central Utah project. These exceptions are discussed under the central Utah project.

The State of Utah is in accord with and fully endorses:

(*a*) The proposed plan of development. We believe that such plan will be of invaluable assistance in permitting the upper division States—first, to fulfill their obligations for deliveries at Lee Ferry; and second, to achieve their full measure of develop-

ment within the limits of apportionment made to the upper basin by the Colorado River compact of 1922. It is further believed that the plan contains that desirable degree of flexibility which will permit the upper basin States, the Department of the Interior, and the Congress, to consider from time to time, the addition of other worthy units and participating projects. It also provides coordination of the interests of the Nation and the upper Colorado River Basin States.

(*b*) The upper Colorado River Basin account as proposed in the report. We strongly endorse the provision for aid to irrigation from surplus revenues.

(*c*) The upper Colorado River development fund, as set out in the report. We recommend a development whereby all States of the basin will move forward on an even basis.

Relative the development of the Whitewater unit, as proposed in the report, Utah wishes to indicate its support of the views and comments of the State of Colorado with respect to the more complete development of power potentials on the Gunnison River. We understand that such development will be basically comparable to that proposed within the report.

With respect to the Shiprock project we wish to point out that inasmuch as the report treats it as a participating project, a project planning report should be prepared and made available to affected States. As of this date, no such report has been made available to the State of Utah. Without a planning report on the proposal and therefore not being advised as to project cost, size, or the water users ability to return operation and maintenance costs, we are not prepared to comment further. It is believed that any approval or construction relating to the project should be deferred until there has been made available to all of the affected States, as provided under the Flood Control Act of 1944, and approved by the Congress, a report on the project comparable to reports already prepared for the other participating projects. Such report should demonstrate project feasibility, its favorable qualifications as a participating project and its compatibility with other major projects on the stream which compete directly for the same water supply.

The hydroelectric plants of the Colorado River storage project should be operated in conjunction with other power plants present and potential on the Colorado River in such a way as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates. In this connection, however, Utah calls attention to the possible necessity, in the interests of its future economic welfare, as well as the welfare of that portion of the States which lies in the upper Colorado River Basin, of making available the full power output of the Colorado River storage project for use within the upper basin or within the States of the upper division. The determination of this objective involves consideration of conditions, such as production and market demand, which cannot, at this time, be foreseen. It also involves consideration of the extent of future interconnections and of the effect of Federal laws pertaining to preference in the use of power and the application of such laws to an entire river basin, comprising a number of States. Utah, for a number of reasons, reserves the privilege to seek at the appropriate time, adequate provisions of law or approval of plans or procedures for such power opera-

tions as will insure the use of the power output of the Colorado River storage project in a manner consistent with greatest future benefits for the upper Colorado River Basin or the States of the upper division.

Provision should be made, either in the report or in ensuing legislation, or both, for the specific authorization of appropriations of investigation funds, in addition to those provided by the Colorado River development fund, reclamation funds, and those recommended in subparagraph (j) of the Commissioner's letter of December 22, 1950.

CENTRAL UTAH PROJECT

The initial phase of the central Utah project plan reported in the supplement to the Colorado River storage project report dated February 1951, would bring water into Salt Lake County, now being partially served by the Provo River project, and also contemplates the use of works of the Provo River project including the Provo Reservoir canal and the Salt Lake aqueduct. The Metropolitan Water District of Salt Lake City, in commenting upon the report, has raised questions which are of concern to the district. The district points out:

(1) That water from the central Utah project should not be brought into Salt Lake County in competition with existing supplies from the Provo River project;

(2) That the district should be given the first opportunity to replace with water from the central Utah project its Provo River project water disposed of to Salt Lake County interests;

(3) That the district cannot surrender any of its capacity in the Salt Lake aqueduct and the Provo Reservoir canal; and

(4) Expressed some alarm as to integrating the proposed power development at Deer Creek with the central Utah project.

Any legislation authorizing the central Utah project should be sufficiently broad to permit scheduling the availability of water to Salt Lake County and repayment with respect thereto so as to permit full use of the water now available from the Provo River project. It appears that no central Utah project water for municipal and industrial purposes will be required in Salt Lake County prior to the year 1970.

Project authorization should also permit the Metropolitan Water District of Salt Lake City, or other proper organizations, to obtain water made available by the central Utah project for use in Salt Lake County. The circumstances existing at the time should determine the organizations to which central Utah project water should be made available.

Use of capacity in the Salt Lake aqueduct and the Provo Reservoir canal which is in excess of that required to deliver Provo River water is in the interest of development in Salt Lake County. Appropriate arrangements should be made with the Provo River Water Users Association, Metropolitan Water District of Salt Lake City and other proper interested parties for the use of any works of the Provo River project. Such an arrangement, we believe, can be accomplished without detriment to any participants in the Provo River project, and is for the best interests of developing the State of Utah. Legislation authorizing the central Utah project should be sufficiently flexible to permit these arrangements to be worked out and agreed upon when the central Utah project plan is in the final planning stages.

In regard to integrating the proposed power development at Deer Creek Dam with the central Utah project, appropriate agreements

should be made with the Metropolitan Water District of Salt Lake City and the Provo River Water Users Association and other proper interested parties during the final planning stages of the central Utah project.

Some concern has been expressed by the Utah Water Users Association about building the Strawberry aqueduct from Rock Creek to Strawberry Reservoir in two barrels as proposed in the report, see pages 27 to 34 of the central Utah project. Careful consideration has been given to this matter and it appears that the most economic way is to build the aqueduct to the capacity as required in the initial phase and then to build an additional barrel in the future when required. It is our view that since the second barrel of the aqueduct will not be needed for many years, the report presents the most economic plan for construction of the Strawberry aqueduct and we favor proceeding in accordance with the plan recommended in the report.

We have given careful consideration to all questions raised by the Metropolitan Water District and the Utah Water Users Association. These questions should not be interpreted as objections to the project plan. They are matters that can be dealt with appropriately during the final planning stages of the central Utah project.

In the light of the above comments, the State of Utah approves the plan of development of the water resources of the upper Colorado River Basin described in the report and requests authorization for the construction of the projects listed in paragraph (*b*) of the Commissioner's letter of December 22, 1950. We recommend that such projects be constructed and thereafter operated by the Bureau of Reclamation, in accordance with the Federal reclamation laws (act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto).

While recommending the construction of these projects, we believe such construction should be deferred if it in any way will impede the defense effort or injure our economy. It would appear to be desirable, in view of the shortages of materials and manpower, to defer such projects until these shortages no longer exist.

Sincerely yours,

JOSEPH M. TRACY,
State Engineer.

COMMENTS, UTAH FISH AND GAME COMMISSION

FISH AND GAME COMMISSION,
Salt Lake City, Utah, March 5, 1951.

MR. ALBERT M. DAY,
Director, Fish and Wildlife Service,
United States Department of the Interior,
Washington 25, D. C.

DEAR MR. DAY: Reference is made to Mr. John C. Gatlin's communication of February 21, 1951, relative to the proposed Colorado River storage project.

We have carefully examined the report of the Fish and Wildlife Service pertaining to this project and are in agreement with its contents. This Department has conferred with representatives of the river basin group of your Service and the report reflects our opinions.

We regret that shortage of funds and personnel have not permitted greater activity and more concentrated contact on such matters during the past several years, during which construction and development plans were being prepared. The meager information we have gained from actual field observations offers no additional data for your report.

Trusting this answers Mr. Gatlin's request, we remain,

Very truly yours,

UTAH FISH AND GAME COMMISSION,
J. PERRY EGAN, *Director.*

COMMENTS, WYOMING STATE ENGINEER

STATE ENGINEER'S OFFICE,
Cheyenne, Wyo., March 30, 1951.

(This letter to be substituted for our letter of February 17, 1951.)

MR. WESLEY R. NELSON,
Assistant Commissioner,
U. S. Bureau of Reclamation,
Washington, D. C.

DEAR MR. NELSON: Agreeable to your request I have reviewed the final report of the Bureau of Reclamation on the Colorado River storage project and participating projects dated December 1950.

Upon receipt of the preliminary draft, I mailed 8 of the 9 copies furnished me to the Wyoming Upper Colorado River Compact Commissioners and asked them to review same and meet with me at the United States Bureau of Reclamation Office in Rock Springs, Wyo., on October 28 at 10 a. m. for discussion and final review of the report.

On October 24 I received a letter from Mr. Emil C. Gradert, one of the compact commissioners, in which he informed me that he could not be present at the Rock Springs meeting, but that he had reviewed the report and forwarded his copy direct to Mr. Larson. In his letter he stated:

> I wish to state that I have read through said report, as time permitted, and find same a rather definite and comprehensive report, well gotten up, and far be it for one so little informed as I to criticize, in any way, or add to or detract from, such an authentic estimate and record of facts.

On October 28 a meeting was held in Rock Springs as scheduled with eight members of the Green River Basin Development Co. present. Also in attendance were 5 members of the industrial development committee of the Rock Springs Chamber of Commerce, Mr. George M. Stevens, chairman of the Board of Commissioners of Sweetwater County, and 6 employees of the U. S. Bureau of Reclamation.

Messrs. Jacobsen and DeLong of the Bureau staff explained the project and answered questions. Members of both the Green River Basin Development Co. and the Rock Springs Chamber of Commerce voiced approval of the project.

It is noted that there is no recommendation in the proposed report for legislation permitting preferential use in the upper basin of electric energy generated by Colorado River storage project units. It is our belief that such a provision should be included in the bill for authorization of the project. We hope you will see fit to include an appropriate recommendation to this effect in your final report.

I will comment that the report is in accord with statements of plans proposed by Mr. E. O. Larson, director of region No. 4, U. S. Bureau of Reclamation, at meetings held in Rock Springs, Wyo., and Salt Lake City, Utah, during the last 2 years. It seems to provide the flexibility for basin development and coordination of the interests of the States as proposed by Mr. Larson.

The plan has been made to conform with allocations of water contained in the upper Colorado River Compact and provides storage facilities to assure delivery at Lee Ferry of not less than 75 million acre-feet in continuing 10-year periods.

Reservoir storage is planned for multiple purposes. The plan is to hold over water from years of plentiful supply to meet the obligation of the Upper Basin at Lee Ferry under the terms of the Colorado River Compact, and to produce revenues to assist in repaying the costs of the dams and other facilities.

The upper Colorado River account will permit uniform power rates and equate costs of the developments with revenues from all sources and assist in repayment of the costs of participating irrigation projects made possible by the storage reservoirs.

From the report it appears that the storage project and participating projects are feasible, economically justified, and financially sound. The benefit in cost ratio being 1.8 to 1. The total benefits to exceed the costs in every instance.

The setting up of a special fund from receipts of the Colorado River storage project to be known as the upper Colorado River development fund is in my opinion a sound and equitable basis upon which to construct the entire project.

We note that in the initial participating projects that four Wyoming projects are included as recommended by the Green River Basin Development Co. and our Water Conservation and Planning Board, namely: LaBarge, Lyman, Seedskadee, and Eden.

Wyoming will be interested in securing detailed plans on the participating projects listed herein.

In conclusion I will say that the report appears to be comprehensive and very well prepared, and as the official representative of Wyoming, I respectfully urge your approval of the same.

Sincerely yours,

L. C. BISHOP,
State Engineer and Interstate Streams Commissioner for Wyoming.

COMMENTS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., July 3, 1951.

Hon. MICHAEL W. STRAUS,
Commissioner of Reclamation, Bureau of Reclamation, Department of the Interior, Washington, D. C.

DEAR MR. STRAUS: Reference is made to your letters of January 30, 1951, to the Secretary of the Army and to the Chief of Engineers, inclosing for the information and comments of the Department of the Army, in accordance with section 1 of the Flood Control Act of

1944, copies of your report dated December 1950 on the Colorado River storage project and participating projects in the upper Colorado River Basin. Reference is also made to subsequent letters furnishing copies of individual reports on the participating projects. I have been directed by the Secretary of the Army to furnish you the views of the Department of the Army on your report. You state in your letter to the Secretary of the Army that your report will be sent to the President and to the Congress under the provisions of section 9a of the Reclamation Project Act of 1939.

Your report recommends a combination of dams, reservoirs, power plants, and other appurtenant structures in the upper Colorado River Basin which together make up what you refer to as the upper Colorado River storage project and participating projects. Some of the participating projects are located outside the physical limits of the upper Colorado River Basin. The purpose of the structures recommended in your report would be primarily power and irrigation and incidentally river regulation, fish and wildlife benefits, recreation, sediment control, flood control, and mineral development.

The main storage project consists of 10 dams and reservoirs totaling in cost $1,139,100,000. The report also recommends 12 participating projects, including two already authorized, totaling in cost $293,188,800. The total cost of the plan recommended for approval, therefore, is $1,432,288,800, including the cost of the two participating projects already authorized, $12,177,000. One of the participating projects, the central Utah project, is included only to the extent of its initial phase, estimated at $222,015,000. The remaining cost of the central Utah project, after the initial phase, is shown in your separate report on the central Utah project to be $812,085,000. Adding the cost of the remainder of the central Utah project to the cost of the plan recommended for approval in your report gives a grand total of approximately $2¼ billion. In addition, mention is made in the report of certain dependent projects which may be authorized subsequent to the authorization of the storage and participating projects. The additional cost of these dependent projects is not given. In your recommendation you ask approval of the entire plan ($1,432,288,800) and immediate authorization for construction, operation, and maintenance of five of the dams and reservoirs in the storage project and all the participating projects. The cost of the 5 dams and reservoirs recommended for immediate authorization and the 10 participating projects not yet authorized is $996 million.

In addition to the authorization for the project works, your report requests authority for the Secretary of the Interior to establish an upper Colorado River account which, in general, is to be credited with power revenues and charged with the costs allocated to power and the costs of that portion of the irrigation allocation to local interests which cannot be paid by local interests. The account is also to be charged with certain special funds to be available for expenditure by the Secretary of the Interior. Your report also recommends certain provisions to be applied to several individual projects, including the Shiprock Indian irrigation project and Florida and Pine River extension projects. The report recommends the inclusion of recreational facilities in the plan of improvement.

My major comments on the report concern, first, the economic justification of the individual units of the overall plan, which are

reported upon separately, particularly the participating projects; and, second, the unrestricted subsidization of irrigation projects by power revenues.

With respect to the economic justification of the individual units, there is no information in the report which would enable a check on the evaluation of benefits from the irrigation projects. A study of the individual reports on the participating projects which you have furnished appears to reveal questionable methods of economic analysis of secondary benefits. Although the benefit-cost ratios of these participating projects are shown to be in excess of unity, data to support these ratios are missing both from the main report and from the individual project reports. However, the principles stated to be the basis for computation of benefits are not believed to represent an accurate approach to such analyses. The inclusion of relatively large secondary benefits based on the theory that the handling and processing of agricultural goods and the increase in associated goods and services are a benefit to the irrigation project to the extent reflected in your analysis is not concurred in. It may also be stated that the same theory of secondary benefits applied to power production, which you use, is considered unrealistic. For example, after determining that the direct power benefit from the storage project based on the sale of energy amounts to $35,359,000 a year, the report goes on to estimate that an additional $23,725,000 secondary power benefits (amounting to 67 percent of the direct benefit) would result from the following elements:

(*a*) A saving in production cost realized by utilities purchasing project power for resale.

(*b*) A proportionate share of the retailing benefits arising from resale of project power to the consumer at higher rates.

(*c*) A proportionate share in the increased value of goods and services produced by utilization of project power.

Although substantiating data have not been made available for a definitive analysis of the benefits from the overall plan and from the individual units, it is my opinion that these benefits are unrealistically high. The effect of reanalyzing the project and its component parts on the benefit-cost ratios cannot be determined with the information available.

My second concern is with the extent of subsidization of irrigation projects from power revenues, an integral part of the so-called "basin account." Although there are undoubtedly instances in which it would be to the national advantage to assist in the development of irrigation projects, the general formula embodied in the basin account proposed in your report would permit subsidization of any irrigation projects which come within the qualifications set up in your recommendations for the evaluation of participating projects. An examination of these requirements indicates that the minimum requirement with respect to reimbursement contemplates payment on the part of the irrigators of only the operation, maintenance, and replacement cost allocated to irrigation plus a part of the construction cost allocated to irrigation. Since the part of the construction cost is not defined, it would appear that there would be no restriction toward development of a project in which the undefined part of the repayment of the construction cost by the irrigators could be so small as to be negligible. This range of subsidy appears too wide to provide a proper safeguard for the

interests of the United States. It should also be pointed out in this connection that the qualification with respect to economic justification of participating projects may not have the force intended, since, as pointed out in a previous paragraph, the basic principle upon which the economic analyses in your report are predicated should in my opinion be subjected to further study.

In addition to the two basic issues discussed previously, I have certain general and specific comments to make.

The report is actually a preliminary treatment of a plan to provide regulatory storage capacity and power production facilities for the upper Colorado River Basin without full development of sufficient fundamental data for the comprehensive planning of such a system. There are unresolved questions of water rights, the allocation of water, and the optimum future development of the upper basin which would appear to make it impracticable to develop a plan of this magnitude at this time which would not be subject to future modification of such a large nature that the fundamental purpose of preparing a comprehensive plan would be defeated. For example, the question of providing storage for the treaty allocation to Mexico of 1,500,000 acre-feet per year is not covered by the report in a sufficiently firm manner to indicate the effect on the storage proposed. Although I am fully in sympathy with the objective of long-range planning and I realize the necessity of such planning in the development of our water resources, I believe that authorization of such plans should be sought only after the basic elements have become reasonably firm. When major questions remain unresolved, premature authorization may actually hamper and restrict future planning.

It is estimated in the report that full utilization of the water apportioned to the upper basin will not be realized for an estimated 75 years. At that time, the storage project will be operated primarily to supply the lower basin with its apportioned amount. In other words, it would appear that full utilization of the storage project potentialities, insofar as river regulation is concerned, would not be required for 75 years and, therefore, that the primary purpose of the project during its earlier life would be to provide power revenues to subsidize irrigation. Construction of 10 participating projects would not affect this conclusion, since the stream depletion caused by these projects would only be approximately 400,000 acre-feet a year, which is only a fraction of the surplus now available.

With respect to the estimated value of power used in justification of the project, it appears that in addition to the questions raised previously with regard to the assumed large secondary benefits there may also be a question with regard to the direct benefits based upon the value used of 5.5 mills per kilowatt-hour. According to the report, this value was based on the cost of producing energy at steam electric coal-burning plants at the principal load centers in each division of the project market area. However, as set forth in the report, the project market area will be, for a time at least, in the lower Colorado River Basin and in southern California. The report does not clearly show that the rate of 5.5 mills per kilowatt-hour would yield a sufficient return to the project to warrant construction of the necessary transmission facilities to the lower Colorado River Basin and southern California or that a market would exist for the quantity of power

estimated for sale in that area at the rate of 5.5 mills per kilowatt-hour.

In view of the foregoing discussion, it appears that your report on the upper Colorado River storage project and participating projects is insufficiently advanced to permit satisfactory comments to be made on the engineering and economic justification of the plan at this time. Substantiating data are not available to permit reaching conclusions with respect to the justification of the project units or the project as a whole at this time. In addition, some of the basic premises and assumptions used in the economic analysis appear to be questionable, and the effect of modification of these premises may be of major importance in the computation of the benefit-cost ratio. The questions of policy brought up by your report regarding subsidization of irrigation projects which cannot be paid for by irrigators under existing reclamation law is a matter which should require the most careful consideration because of its far-reaching implications in the field of Federal public works. In conclusion, therefore, I am unable to concur in the recommendations in your report at this time with respect to the approval of the overall plan and the immediate authorization of the initial phase proposed.

The opportunity to review your report and your courtesy in furnishing copies of the individual reports on the participating projects are appreciated.

Sincerely yours,

LEWIS A. PICK,
Major General, Chief of Engineers.

COMMENTS, DEPARTMENT OF AGRICULTURE

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., May 28, 1951.

The Honorable the SECRETARY OF THE INTERIOR.

DEAR MR. SECRETARY: This Department has reviewed a draft, dated December 1950, of a proposed report of the Department of the Interior entitled, "The Colorado River Storage Project and Participating Projects," transmitted, on your behalf, by Assistant Commissioner of Reclamation Wesley R. Nelson with his letter of January 30, 1951.

It is of vital importance that the Nation make the most of the resources with which nature has so richly endowed the Colorado Basin. Decisions taken now will powerfully influence the contribution these resources will make to the strength and prosperity of many generations of the American people. For this reason the planning we do today must be as complete and as farsighted as it is possible to make it. And to this end all agencies should freely offer any ideas or assistance that might contribute to better plans. It is in this spirit that we offer the following comments:

1. A comprehensive and coordinated long-range plan should be developed for the Colorado Basin at an early date

It is especially important, in our opinion, that the system of storage reservoirs proposed in your report be protected and complemented by a coordinate program for the land. The Department of Agricul-

ture recognizes its responsibilities in this matter and will, at the earliest possible moment, undertake to make its contribution to a comprehensive and unified plan for full and efficient development, utilization and conservation of the basin's resources.

2. Further economic studies should be made

To insure that the combined projects will yield a maximum return and that individual projects will constitute harmonious and effective elements in the ultimate program for the basin, additional economic studies should be undertaken.

3. The desirability of establishing the upper Colorado River account is questionable

An account of the type proposed might prevent full and equitable consideration of all components of a comprehensive program and would thus set an undesirable precedent.

For whatever value it may be to you in preparing your final plan and report we are attaching a supplement in which we have elaborated somewhat upon the foregoing points.

We hope that our comments and suggestions may contribute, in some degree, to the eventual development of the best possible plan for the region. We shall be glad to participate in efforts to arrive at such a plan.

Sincerely,

CHARLES F. BRANNAN, *Secretary.*

SUPPLEMENT TO COMMENTS UPON REPORT[1] OF THE DEPARTMENT OF THE INTERIOR ON THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

1. A comprehensive and coordinated long-range plan should be developed for the Colorado Basin at an early date

In commenting, in a letter dated September 27, 1946, upon the report The Colorado River (H. Doc. 419, 80th Cong., 1st sess.) the Department of Agriculture pointed out that a truly comprehensive plan for the basin would have to encompass the land. We note that the present report would authorize agencies of the Department of the Interior to prepare such a plan. Feeling sure that you do not intend to duplicate authorities and programs of the Department of Agriculture, we are suggesting that the authorizing language be revised to make it clear that agencies of the Department of the Interior would confine their planning activities to lands under their jurisdiction. We realize, of course, that a unified plan for all lands of the basin must be developed. This Department will make every effort to assume its obligations in this effort. As a matter of fact, we had hoped to initiate work on such a plan soon after pointing o , the need for it in our letter of September 27, 1946. However, limitations upon funds and personnel have so far made it impossible for us to undertake this important task. Our present plans call for a start on this undertaking during the fiscal year 1953. Your estimate (which we consider a conservative one) that the costly reservoirs you propose to build will fill with sediment at a rate of some 100,000 acre-feet annually, emphasizes the need for the earliest possible development

[1] Dated December 1950.

of a program for the land. We are, moreover, anxious to undertake this planning effort at the time that your agencies are planning a program for the lands under their jurisdiction in order that full coordination may be achieved.

As mentioned above, your report is designed to provide a legislative base for further investigations by agencies of the Department of the Interior. Among other things the report proposes that the United States Geological Survey investigate measures to control erosion at its source, and that the Bureau of Land Management undertake large-scale studies in erosion control and sediment abatement. The Department of Agriculture has for many years conducted research in the field of erosion and erosion control. We question the wisdom and necessity of starting a similar program in the Department of the Interior. We would suggest, as an alternative, that your agencies bring to our attention needs for additional investigations in this field. While we have considerable research underway in the Colorado Basin, we have realized for a number of years that additional investigations are needed. Recently, moreover, the Pacific Southwest Interagency Technical Committee recommended intensification of our research in this region. Every effort to expand our going program has been pledged. As a matter of fact, our preliminary plans for the fiscal year 1953 call for a substantial increase in our research work in the Colorado Basin.

Apparently it is planned to provide enough extra storage capacity to store the sediment inflow to the reservoirs for a period of 200 years. A large part of the investment in this extra capacity will provide no return for a long period of time. It seems to us that a study should be undertaken to determine if it would not be better to invest a part of this extra expenditure in a program for the land that would begin to reduce sediment damages, as well as to produce on-site benefits in a relatively short period of time.

We note that the proposal to expand the irrigated acreage in the basin is based upon the assumption that with vast areas of fine range land available for summer range, livestock production is limited by the production of hay for winter feeding. In our opinion the grazing capacity of the range is a more important limiting factor than is the availability of hay for winter feeding. Hence, unless and until steps are taken to improve large areas of depleted and deteriorating summer and spring-fall range, and, in some localities, to develop irrigated pastures, expanded production of winter feed might increase the pressure upon the range and lead to its further deterioration. This again emphasizes the necessity for reinforcing the engineering program with a complementary program for the land at the earliest possible moment.

The present report sets forth but an initial step in the development of the water resources of the basin. It seems to us that a long-range plan should be developed as soon as possible. In the course of formulating such a plan it will be highly important to consider all possible future needs for water. In particular, studies should be made to estimate how much water should be reserved for (*a*) the irrigation of range at higher elevations, and (*b*) industrial purposes—especially for the processing of oil shales and wood pulp. In some instances it can be shown that a given amount of water used to create scattered tracts of high-capacity range in mountain valleys will produce a net benefit

exceeding the net downstream. In some areas the use of water for industrial purposes may also be found to produce greater benefits than other uses. With the Nation's security becoming increasingly dependent upon oil, it is especially important that all necessary provisions be made for future development of the vast oil shale deposits of the basin. At any rate, these and other alternative uses of water should certainly be given full and equitable consideration in arriving at a long-range plan. This plan should be aimed at that combination of projects and uses that will yield a maximum benefit to the Nation. In volume I of its recent report the President's Water Resources Policy Commission advanced, as an essential principle of sound planning, the following:

> Planning should be approached with a multiple-purpose concept and with the aim of maximum net benefits based on full consideration of alternative plans for meeting existing and anticipated needs.

We thoroughly agree with this principle and feel that it should control the formulation of the suggested long-range plan for the Colorado Basin.

2. Further economic studies should be made

The annual benefits attributed to the storage project include the expected revenues from the sale of power ($34,903,000) plus an estimate of indirect benefits ($23,725,000). This latter figure is arrived at by methods that have been questioned, upon various occasions in the past, by the economists of this Department, and that have not been accepted as sound by economists generally.

It is also necessary to point out that almost one-fourth of the average annual cost of the storage project ($9,671,000 out of a total of $41,994,700) has been deducted on account of dependent (irrigation) projects. Since the irrigation benefits that justify this part of the proposed expenditure are not presented, the economic evaluation of the storage project is incomplete.

The report recommends the authorization of (*a*) the initial stage of the Colorado River storage project and (*b*) 11 participating irrigation projects. However, economic evaluations of these participating projects are not presented. Presumably the economic justification for the participating projects appear in the separate reports mentioned in the report submitted for review. This leads us to suggest that authorization of the irrigation projects be provided for in these individual reports rather than in the report on the storage project.

Completion of the storage project will require the construction of 10 major dams. These 10 units are combined for purpose of economic evaluation. It is a generally accepted principle that such a system should be formulated and evaluated increment by increment with a view to maximizing net benefits.

3. The desirability of establishing the upper Colorado River account is questionable

The report proposes the establishment of an upper Colorado River account. An account of the type proposed would establish a precedent in basin planning under which the decision to undertake an irrigation project would hinge upon the power potentials of the basin; a factor which should have no bearing upon that decision. As we have stated in commenting upon earlier proposals, we feel that it should be

possible to proceed with economically sound irrigation projects whether or not Federal power projects can be, or are, constructed in the particular basin within which the irrigation projects would be located.

Conversely, we believe that the presence, or absence, of irrigation projects should have no bearing upon the rates at which public power is sold. It is essential that full and equitable consideration be given to all means of deriving benefit from the resources of our river basins. The establishment of accounts of the type proposed would make it impossible to adhere fully to this principle. And this would prevent attainment of the desired goal of maximum net benefits.

As we have pointed out before, such an account has no real bearing upon the justification for, or the desirability of, the projects covered by it; nor upon the amount that must be withdrawn from the Treasury to construct these projects. If a basin account is considered desirable simply as a matter of information, we would suggest that it be designed to provide a record of all costs and all benefits. An account which merely compares one kind of benefit—power revenues—with the required public contribution toward irrigation projects is, to say the least, incomplete.

At any rate, the account proposed in the present report appears to be incorrectly set up. In the economic evaluation of the storage project, the interest upon the unpaid balance of the investment is correctly counted as a cost. In the repayment schedule on page 94, however, it is noted that only the construction cost of $1,139,100,000 is subtracted from the net project revenues in determining the amount to be credited to the upper Colorado River account. Yet in column 14 of this table (headed "Income deductions—Repayment of investment") the cost of this interest is shown to total $693,281,094. This exceeds the accumulated net credits of $674,906,800 appearing in column 26. In other words, during the first 70 years no net credits would accumulate. This, it seems to us, casts further doubt upon the meaning and utility of an account such as the one proposed.

COMMENTS, DEPARTMENT OF COMMERCE

DEPARTMENT OF COMMERCE,
BUREAU OF FOREIGN AND DOMESTIC COMMERCE,
OFFICE OF INDUSTRY AND COMMERCE,
Washington 25, D. C., April 10, 1951.

Memorandum.

To: Mr. Wesley R. Nelson, Assistant Commissioner, Bureau of Reclamation, United States Department of Interior.

From: H. B. McCoy, Department of Commerce member, Federal Interagency River Basin Committee.

Subject: Colorado River storage project and participating projects.

After reviewing the subject report two agencies of the Department of Commerce commented as follows:

Bureau of Public Roads: * * * our review of the Bureau of Reclamation report indicates that the Bureau of Reclamation estimates are generally sufficient to take care of necessary replacement of roads to be inundated by the dams (including those for which authorizations are not now sought). However, no data are presented regarding supplemental projects or participating irrigation

projects which may not only require relocation of existing roads but may require many additional roads to serve the newly developed agricultural areas.

In regard to the Glen Canyon Reservoir, there is some doubt whether provision has been made for the increment in cost of the Blanding-Hanksville Federal-aid secondary route which will be constructed at some time in the future.

Coast and Geodetic Survey: There is one adverse technical feature of the report itself that we would like to point out. The various maps shown throughout the report do not have any projection lines * * *. Without projections, it is difficult to transfer information shown on one map to another map with a high degree of accuracy; and without connections of surveys to a basic network of geodetic control, it is not practicable to show the correct projection lines on a map, nor will the various surveys for a basin development fit together properly.

H. B. McCoy.

COMMENTS, FEDERAL POWER COMMISSION

FEDERAL POWER COMMISSION,
Washington 25, D. C., May 21, 1951.

Subject: Colorado River storage project and participating projects.

Mr. MICHAEL W. STRAUS,
Commissioner, Bureau of Reclamation,
Department of the Interior, Washington 25, D. C.

DEAR MR. STRAUS: The comments herein with respect to the proposed report of the Department of the Interior on the Colorado River storage project and participating projects are transmitted in response to a letter dated January 30, 1951, from Mr. Nelson, Assistant Commissioner. Transmitted with Mr. Nelson's letter were copies of your report dated December 22, 1950, approved by the Secretary of the Interior on January 26, 1951, and the regional director's report of December 15, 1950. The transmittal of these comments by the Commission is in accordance with the established procedures of the Federal Interagency River Basin Committee.

The subject report proposes a plan for the development of the water resources of the upper Colorado River Basin, consisting of the Colorado River storage project and participating irrigation projects which are considered to be made possible by the storage development. The storage project, with which the report is primarily concerned, would include 10 dam and reservoir units, namely Echo Park, Flaming Gorge, Glen Canyon, Navaho, Whitewater, Cross Mountain, Crystal, Curecanti, Gray Canyon, and Split Mountain, with power-generating facilities at each unit and with associated transmission facilities. The first five named of these units, with appurtenant power and transmission facilities, are recommended for early authorization. An initial group of 12 participating irrigation projects is also recommended for authorization. The primary purpose of the Colorado River storage project is to provide the storage and regulation necessary for the utilization of waters allocated to the upper basin States under the Colorado River compact, and to meet the requirements for flows downstream at Lees Ferry and of the treaty with Mexico.

The aggregate active storage capacity in the 10 proposed reservoirs would amount initially to 37,530,000 acre-feet which, with encroachment by sedimentation, would be expected to be reduced to about 25,900,000 acre-feet in 200 years. The reduced active storage capacity is considered in the report to be adequate to meet the above-mentioned requirements up to that time. The aggregate ultimate

power installation at the 10 developments is 1,622,000 kilowatts. Under initial conditions, with full installation, the annual generation of firm energy would amount to about 9 billion kilowatt-hours. Under ultimate conditions of flow depletion and losses by evaporation, the generation of firm energy would be reduced to about 6 billion kilowatt-hours annually.

The estimated cost of the Colorado River storage project on the basis of December 1949 prices is $1,139,100,000. Of this amount, $806,150,000 is proposed to be allocated to power and the balance of $332,950,000 to irrigation. No part of the cost of the participating irrigation projects is included in these estimates. However, the proposed initial group of participating irrigation projects is estimated to cost an additional $293,188,800.

For purposes of benefit-cost analysis, the report estimates the equivalent annual cost of the storage project at $41,994,700, using a 2.5-percent interest rate and a 100-year amortization period. Estimated benefits to irrigation resulting from operation of the storage project are not given in the report. However, an annual cost of $9,671,000, derived from a study of the alternative justifiable cost of providing compact storage and considered chargeable to dependent irrigation projects, was deducted from the total estimated annual cost. This leaves an annual power cost of $32,323,700. The annual primary and secondary power benefits are estimated at $59,084,000, giving a benefit-cost ratio of 1.8 to 1.

The report also gives the results of a detailed financial analysis for the storage project covering 70 years, including a 20-year development period and a 50-year operating period following the installation of the last generating unit. Operating revenues would be derived from the sale of firm energy, averaging 6,346 million kilowatt-hours annually after allowance of 7 percent for transmission losses, at 5.5 mills per kilowatt-hour, and secondary energy in the amount of 152 million kilowatt-hours annually at 3 mills per kilowatt-hour. The table on page 94 of the substantiating materials shows that over the period of analysis such power revenues should be sufficient to cover all operating costs of the storage project and return its entire investment cost of $1,139,100,000 with interest at 3 percent on the investment of $806,150,000 allocated to power.

As stated above, the total annual power benefits of the storage project are estimated in the report at $59,084,000. This includes $35,359,000 of expected revenue from the sale of energy, $3,554,000 in savings on production cost realized by utilities purchasing project power for resale, $17,844,000 as a proportionate share of the retailing benefits arising from resale of the power to consumers at higher rates, and $2,327,000 as a proportionate share in the increased value of goods and services produced by utilization of project power. The latter three classes of benefits are defined in the report as indirect benefits. The direct benefit, or expected revenue, is computed on the basis of the sale of firm energy at 5.5 mills per kilowatt-hour and the sale of secondary energy at 3 mills per kilowatt-hour. The savings to utilities (assumed to be passed on to the consumers) or the first named of the indirect benefits, amounts to 0.56 mills per kilowatt-hour of firm energy. Together these amount to 6.06 mills per kilowatt-hour, which the report estimates as the cost of alternative steam-electric

power delivered to load centers. This cost of 6.06 mills is the same as the Commission staff estimate of the cost of alternative steam-electric power and is considered by the staff to represent the value of the power and the direct power benefit. The Commission does not include in power benefits the latter two classes of indirect benefits named above and believes that the inclusion of such benefits is, at the least, open to question.

On the basis of the firm energy value of 6.06 mills per kilowatt-hour, the Commission staff estimates the total annual power value at $38,913,000. Assuming that irrigation benefits are equal to the annual cost of $9,671,000 assigned by the report to the participating projects, the total benefits accruing to the Colorado River storage project as computed by the staff would be $48,584,000. Assuming that the total project cost is amortized in 50 years with interest at 2.5 percent and that the proposed power allocation pays interest at 2.5 percent, and using the operation, maintenance, and replacement charges given in the report, the total annual cost of the storage project would be $41,573,000. The resulting benefit-cost ratio for the project would be 1.17 to 1. If power benefits are computed on the basis of the expected selling price of 5.5 mills per kilowatt-hour for firm energy, the benefit-cost ratio would be 1.08 to 1. These ratios may be compared with the value of 1.8 to 1 shown in the report.

The commission staff has given considerable study to problems of the development of the Colorado River Basin over the past several years and reports, in connection with its studies, that it has received the full cooperation of your own field offices. The results of these studies with respect to the availability of water and regulation of stream flows and with respect to generation of power at the proposed projects are in substantial agreement with the estimates of your office. The staff advises that in its opinion the units of the Colorado River storage project are generally well planned and well suited for the purposes intended. It points out certain relatively minor modifications in the plans, however, which it believes may be found desirable. Included among such modifications are possible alternative methods of developing the fall of the Gunnison River immediately downstream from the proposed Curecanti Reservoir, and possible increases in the ultimate power installation at certain of the dams.

The staff observes that although the overall storage project appears to be justified, there is a wide variation in the economics of individual units, particularly with regard to the costs of power computed on the basis of the proposed cost allocations. For example, as planned the Crystal project, which is for power only and does not provide any regulatory storage, appears to be of doubtful economic feasibility. Among the more favorable units from the standpoint of economic justification are the Glen Canyon, Echo Park, and Whitewater projects which are proposed for early construction in the report. The staff is of the opinion that the Glen Canyon and Echo Park projects, particularly, are of such importance as to warrant their consideration for inclusion in any early program for the further development of the Colorado River Basin. Echo Park, possibly with an installation somewhat higher than the 200,000 kilowatts shown in the report, is considered by the staff to be strategically located to assist in serving

power loads of the northerly part of the upper Colorado River Basin. At the southerly end of the upper basin, the Glen Canyon project would also have strategic value from the standpoint of assisting in serving loads to the south and, in addition, in providing desirable regulation of stream flow and in protecting projects downstream from loss of value due to siltation.

The Commission staff has made independent studies of the present and future needs for power in the areas that could be served with the power produced at the Colorado River storage project powerplants. With respect particularly to 1970 loads, for which presumably the so-called initial installations would be made, the staff reports estimated loads as of that year substantially less than the estimates of your Bureau. The aggregate installation considered in your report for the year 1970 amounts to 1,364,000 kilowatts. As a result of its own estimates and studies the Commission staff finds that an aggregate installation of approximately 1 million kilowatts would be adequate for that year. The difference in the estimates results from differing determinations as to the needs for power in the fringe areas of the upper basin and differing assumptions as to the export of power to adjacent areas. It is pointed out that changes in the assumptions regarding the export of power, particularly to the southern California area, could materially alter either of the estimates of 1970 power needs.

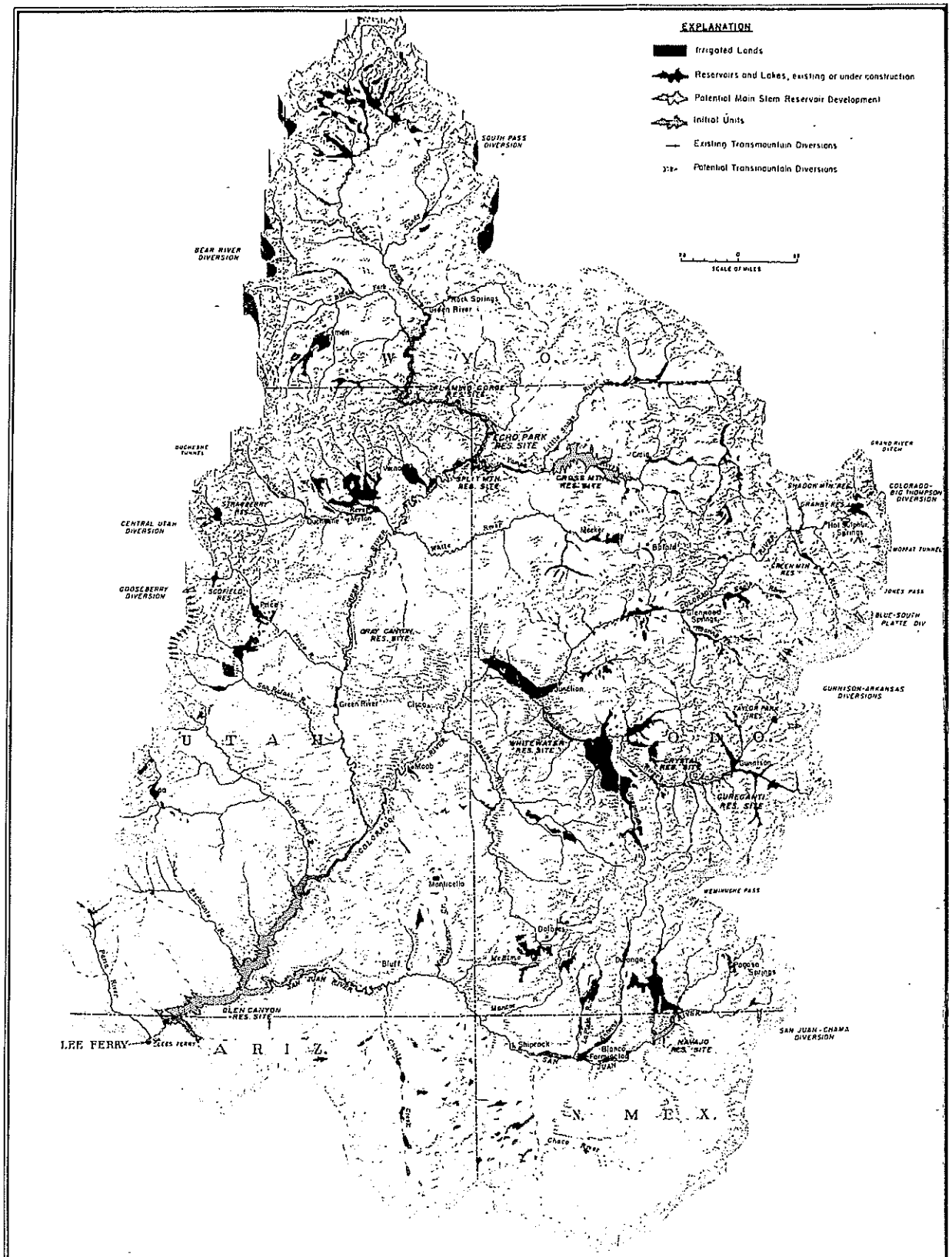
Your report does not state specifically that it is proposed to use the interest component of revenue received from the sale of storage project power in assistance to irrigation development. Analysis of the report, however, including the table on page 94 of the substantiating materials, shows that it is proposed to use the interest component for this purpose. The report shows that over a 70-year development and operating period, a total of about $675 million would be accumulated through use of the interest component. It is proposed that the funds so accumulated would be available through the recommended upper Colorado River account to assist participating and dependent irrigation projects by paying irrigation costs which are in excess of the ability of water users to repay. The Commission has consistently taken the position that the public interest would best be served if the interest component were returned to the Treasury of the United States rather than diverted for such other purposes. In this case there is an additional subsidy, amounting to $332,950,000 of the cost of the storage project allocated to irrigation, to be repaid from power revenues.

The Commission understands that the program proposed in your report will necessarily be long range in character, and that modifications may be found desirable from time to time as studies continue. In this connection the Commission staff's suggestions for modifications, which would not constitute major changes in the plans, can be discussed with representatives of the Bureau as studies and detailed consideration of the Colorado River storage project continue.

The Commission appreciates the opportunity of commenting upon the report of your Department.

Sincerely yours,

MON C. WALLGREN, *Chairman.*



UPPER COLORADO RIVER BASIN

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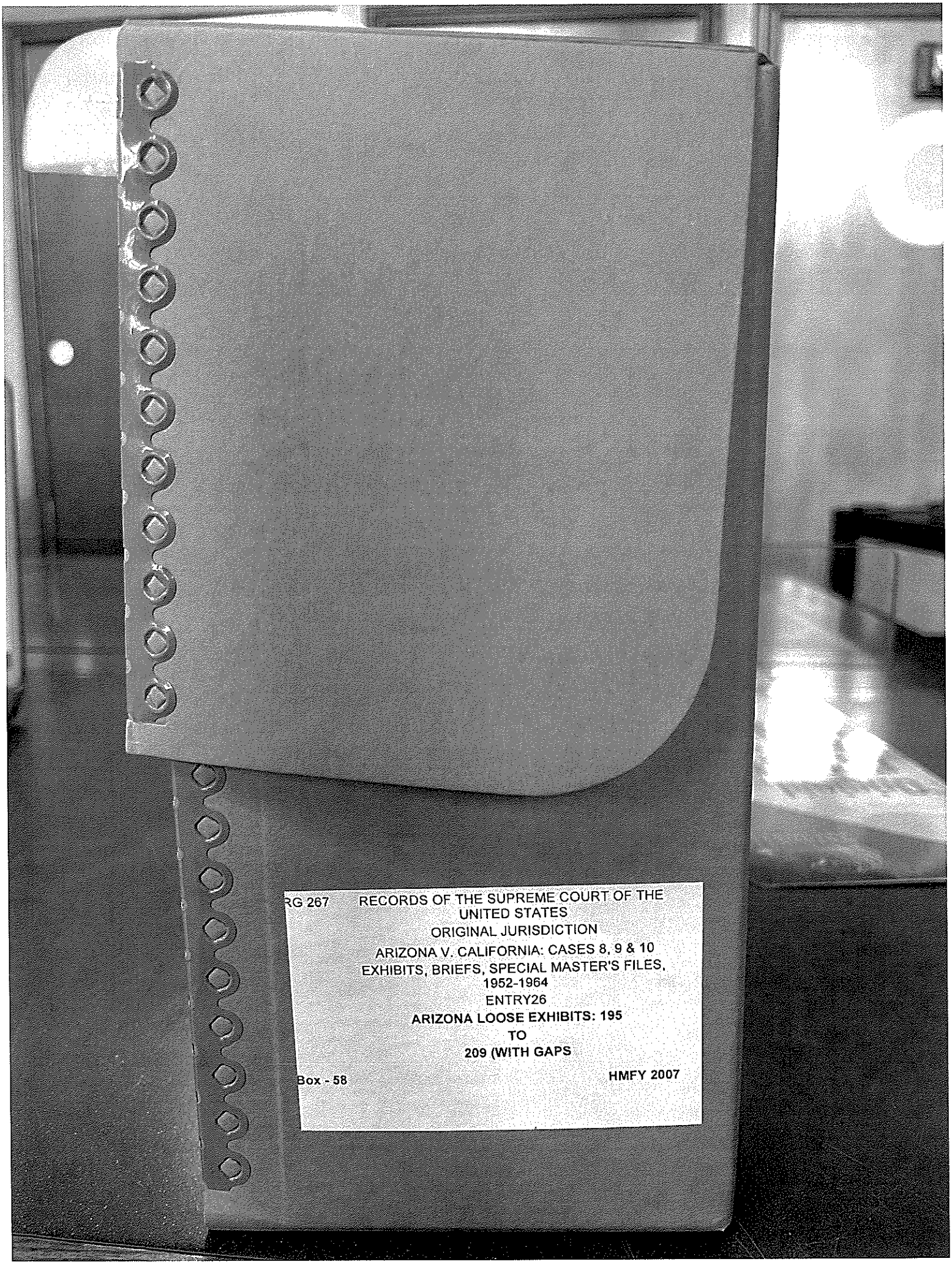
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UNITED STATES DEPARTMENT OF THE INTERIOR
OSCAR L. CHAPMAN, Secretary

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BUREAU OF RECLAMATION
MICHAEL W. STRAUS, Commissioner
E. O. LARSON, Regional Director

COLORADO RIVER STORAGE PROJECT

AND

PARTICIPATING PROJECTS

UPPER COLORADO RIVER BASIN

December 1950

Salt Lake City, Utah
Region 4

Project Planning Report
No. 4-8a.81-1

In Reply Refer To:

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UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Reclamation
Washington 25, D. C.

December 22, 1950

he Secretary

of the Interior

ir:

This is my report on the Colorado River Storage Project
nd Participating Projects, Upper Colorado River Basin. It is based
n the accompanying report of the Regional Director, Bureau of
eclamation, Salt Lake City, Utah, dated December 15, 1950, and is a
Department-wide report recommending authorization of the program
f all agencies of the Department.

The Departmental report on the inventory of potential
evelopments in the Colorado River Basin, House Document 419, Eightieth
Congress, pointed out that, in view of the fact that there is not
nough water available in the Colorado River system to permit con-
truction of all of the potential projects and have full expansion
f existing and authorized projects, the States of the Colorado River
Basin should determine their respective rights to deplete the flow
f the Colorado River consistent with the Colorado River Compact.
Following issuance of that document, the States of the Upper Colorado
River Basin negotiated and formalized a compact called the Upper
Colorado River Compact, which has subsequently received the consent
f the Congress. Completion of that compact has permitted formula-
tion of at least an initial stage of further development of the Upper
Colorado River Basin. The plan proposed and presented in this report has
been worked out in close cooperation with representatives of the States
of the Upper Colorado River Basin. It would provide flexibility in the
basin development and coordination of the interests of the Nation and
States of the Upper Colorado River Basin.

It is possible at this time to foresee rather clearly the needs
of the Upper Basin in terms of storage requirements for purposes of
river regulation, although facilities for utilization of the last drops
of water cannot be seen with any clarity. Consequently, the plan is
presented for ultimate development in terms of storage, but only for
partial development in terms of water utilization. Selection of the plan
for ultimate storage is based in general upon securing the needed reservoir
capacity for all purposes, while attaining the minimum in evaporation
losses, water being prerequisite to the livelihood of the area. As indi-
cated in the recommendations hereafter made, the proposal is such as to

permit additions to the plan as other participating projects are investigated and weighed in light of the overall water supply. The ultimate storage plan as proposed will permit, in so far as that is practicable, full utilization by the Upper Basin of the 7,500,000 acre-feet of water apportioned to the Upper Basin under the Colorado River Compact. The storage capacity contemplated is designed to assure that the flow of the river at Lee Ferry will not be depleted below 75,000,000 acre-feet in any ten consecutive years. Thus, the Upper Basin may now go forward safely with utilization of its waters and the Lower Basin may be assured that its rights under the compact are protected.

It is not contemplated that all of the ultimate storage plan should be constructed or even authorized at this time. The units will be constructed as required to meet the needs for consumptive use of water and for generation of electrical energy. Authorization is requested for only five of the storage reservoirs.

In addition to permitting the Upper Basin to move forward with utilization of its waters, the Colorado River Storage Project and Participating Projects will provide electrical energy to a large area where it is urgently needed. Flood protection, sediment retention, fish and wildlife conservation, and recreational opportunities will also be provided.

Basically, therefore, there are three fundamental elements in the plan:

(1) Reservoir storage, to conserve and regulate stream flows, and to generate power, which, in turn, produces revenues which assist in repaying the costs of the entire plan;

(2) The Upper Colorado River Account, which will permit uniform power rates and will equate costs of the developments with revenues from all sources; and

(3) Participating irrigation projects, which are made possible by the storage reservoirs, and which, through the Account, will be aided in the return of their reimbursable costs.

Of the ten major dams and reservoirs which will ultimately be required in the main storage plan, five are essential at the outset and are recommended herein. Of the several score of possible irrigation projects, twelve are recommended for authorization or reauthorization at this time, and provision is made for one additional project which is already authorized and under construction to be included under the Account. The Account, which is essential to the plan, is also recommended, and will make the entire system financially feasible.

The Director of the National Park Service has advised that the creational planning and construction program and the archeological, dlife, and geological programs, incident to the construction of dams d reservoirs in Dinosaur National Monument, are estimated to cost ,354,000. These specific programs should be added to those proposed the Regional Director and the project cost estimate increased by e above amount.

The Colorado River Storage Project and initial participating jects are engineeringly feasible, economically justified, and ancially feasible. Benefits from irrigation and other beneficial ter-consuming uses would be realized through construction of dependent jects. The evaluated annual benefits from the storage project 9,080,000) compare favorably with annual costs assigned to the ject ($32,848,000) to produce a benefit-cost ratio of 1.8 to 1.0. e benefits for each of the initial participating projects exceed the sts. Net revenues from the storage project will repay the total nstruction cost of the storage project within 50 years after the stallation of the last generating unit, aid in the return of rigation costs, make payments to the Upper Colorado River Development nd hereinafter proposed, and contribute substantial funds to the easury. Irrigation revenues from each participating project will y all of the operation, maintenance, and replacement costs of that oject allocated to irrigation, and, in addition, will repay a part of e capital cost of the participating project.

Power payments will be accomplished under contracts which will turn the power allocation together with interest at the rate of 3 rcent on the unamortized balance. Under such contracts, electrical ergy will be furnished at the lowest prices consistent with sound siness principles in order to encourage wide-spread use of power throughout the area of service. Irrigation and municipal water payments will be complished under contracts with appropriate political subdivisions, eferably districts of the water conservancy-type.

In view of the existing national emergency, consideration should given by those familiar with that situation, to the suitability of the wer features of the storage project as they relate to the national fense. The Echo Park and Glen Canyon Dams are so situated in the basin d the status of progress on plans for them is such that either or both uld assist in meeting power demands for defense purposes.

My recommendations follow. For all practical purposes they are dentical with the recommendations of the Regional Director but I am so recommending, pursuant to expressions subsequently received from he States, establishment of an investigation fund to assure a continuing d adequate program of investigations in the Upper Basin. This has ecessitated minor changes in the Regional Director's recommendations) and (h). For clarity and convenience, the entire set of recommendations, thus revised, is repeated.

It is recommended:

(a) That the plan of development of the water resources of the Upper Colorado River Basin described in this report be approved;

(b) That authority be sought for the Secretary of the Interior, acting pursuant to the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto) to construct, operate, and maintain (i) the following units of the Colorado River Storage Project:

Echo Park
Flaming Gorge
Glen Canyon
Navajo
Whitewater

and (ii) the following initial participating projects subject to the terms of paragraphs (c) or (g), as appropriate, of these recommendations:

Central Utah (initial phase), Utah
Emery County, Utah
Florida, Colorado
Hammond, N. Mexico
LaBarge, Wyoming
Lyman, Wyoming
Pine River extension, Colorado-New Mexico
Seedskadee, Wyoming
Silt, Colorado
Smith Fork, Colorado
Paonia, Colorado

all as described in the report of the Regional Director but with such modification of, omissions from, or additions to the works as the Commissioner of Reclamation, with the approval of the Secretary, may find proper;

(c) That, as contemplated in its authorizing legislation, the Eden Project, Wyoming, which has previously been authorized and is partially constructed, be included in the plan of development and that the Account hereinafter recommended be charged with that portion of the reimbursable construction cost of the Eden Project which is in excess of the amount specified in the Act of June 28, 1949 (63 Stat. 277); and that the Paonia Project, Colorado, as described in the Regional Director's report, which is also partially constructed, be included in the plan of development and that the Account hereinafter recommended be charged with that portion of the reimbursable costs of the Paonia Project which is in excess of the amount which will be repaid within the period specified in the Act of June 25, 1947 (61 Stat. 181).

(d) That, pursuant to the recommendation of the Commissioner of Indian Affairs, and in order to consolidate the recommendations of

he Secretary for dependent projects in the Upper Colorado River Basin, he Shiprock Indian Project be authorized for construction, operation, nd maintenance in accordance with laws applicable to the development f irrigation projects on Indian reservations including the provisions f the Act of July 1, 1932 (47 Stat. 564, 25 U.S.C. 386 A), the benefits which Act should be extended also to the Indian lands to be served the Florida and the Pine River Extension projects, provided, however, at the Shiprock project shall receive assistance from the Upper Colorado ver Account in the same manner and to the same degree as other parti- pating projects;

(e) That authority be sought for the Secretary, acting pursuant the laws applicable to the development of National parks, monuments, recreational areas to the extent to which those laws are not incon- stent with operation of the Colorado River Storage Project units for eir primary purposes, to construct, operate, and maintain the recrea- onal facilities proposed in this report;

(f) That, because of interrelationship of the projects in he Upper Colorado River Basin, authority be sought for the Secretary of he Interior to establish an Upper Colorado River Account. The Account hould be credited with all power revenues derived from (i) units of he Colorado River Storage Project, and (ii) participating projects ocated within the natural confines of the Colorado River Basin above ee Ferry, and with all net power revenues derived from the Central Utah roject (initial phase) subsequent to complete reimbursement of the eimbursable costs of that project. The Account should be charged with l reimbursable construction, operation, maintenance, and replacement osts of the Colorado River Storage Project and participating projects ocated within the natural confines of the Colorado River Basin above ee Ferry that are allocated to power purposes or assigned to be returned rom power revenues. The Account should be charged with that portion of he irrigation allocation of each participating project's construction ost which is required to be so charged in order to show full reimburse- ent thereof within 50 years following a suitable development period for hat project. The Account should also be charged with payments to the pper Colorado River Development Fund which is recommended and described n (j) below. Revenues and costs in connection with other undertakings ereafter authorized to be constructed should be included in the Upper olorado River Account only upon specific authorization by act of Congress;

(g) That the Secretary from time to time recommend to Congress or authorization additional units of the Colorado River Storage Project nd additional participating projects and that all participating projects e required to meet the following qualifications:

(1) A project, unit, or phase thereof may be eligible to participate only when and to the extent that all sources of estimated revenue directly available to said project, unit, or phase are insufficient to return its reimbursable costs during its payout period as hereafter specified in (4).

(2) It shall be a project for the use in one or more of the States designated in Article III of the Upper Colorado River Basin Compact of of the Upper Colorado River system, as water of the Upper Colorado River system, as that system is defined in such compact, the consumptive use of which is apportioned to those States by that article.

(3) Its total benefits shall exceed its total costs, including, but without limitation, any costs attributable to its direct use of the facilities of the Colorado River Storage Project or any other project, and an appropriate share of the costs of the Colorado River Storage Project.

(4) With anticipated revenues from irrigation, based on the irrigators' ability to pay, it shall be able to pay the operation, maintenance, and replacement costs allocated to irrigation and to pay in a period of 50 years following a suitable development period at least part of the construction cost allocated to irrigation.

(5) There shall be available to aid such participating project, or group of participating projects, an appropriate district, preferably of the water conservancy type, which shall be satisfactory to the Secretary of the Interior, one purpose of which shall be to provide revenues for the project over and above those paid by irrigators, to assist in repayment of construction costs allocated to irrigation.

(6) It shall not require assistance from the Upper Colorado River Account in an amount, which, taking into consideration the prior obligations of the Account and the anticipated revenues from its existing and authorized units, will leave the Account in a deficit position at the end of the pay-out period for the participating project as specified in (4) above or will require an increase in the general level of Colorado River Storage Project power rates

(7) Charges to the Upper Colorado River Account for the benefit of a project commingling water specified in (2) with other water shall not exceed an appropriat share of the construction cost of the works require by that project to use water specified in (2).

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(6) Pertinent data sufficient to determine its probable engineering and economic justification and feasibility shall be available.

(h) That the investigations and programs proposed to be undertaken by certain agencies of the Department of the Interior, as summarized in paragraphs 33 through 39 of the Regional Director's report and presented in detail in the appended substantiating materials, be authorized; and that appropriations therefor be nonreimbursable, and that in the case of investigations conducted by the Bureau of Reclamation, except those financed under (j) below, the provisions of the Act of April 19, 1945, should govern;

(i) That there be set up and maintained in the Treasury from the receipts of the Colorado River Storage Project a continuing fund of $1,000,000 to the credit of and subject to expenditure by the Secretary to defray emergency expenses and to insure continuous operation of the project;

(j) That there be set up and maintained in the Treasury from the receipts of the Colorado River Storage Project a special fund, to be known as the Upper Colorado River Development Fund, to which shall be transferred at the end of each fiscal year, beginning with the initial year of commercial power production by the Colorado River Storage Project and the participating projects, 7½ percent of the net power revenues for that year after such net revenues exceed 5 million dollars annually, but not to exceed one million dollars in any one fiscal year, which should be available, upon appropriation (such appropriation to remain available until expended), for expenditure by the Secretary, without prejudice to the use by him for the same purposes of other appropriated moneys, for studies and investigations relating to the development, conservation and utilization of the waters of the Upper Colorado River Basin, all expenditures from said fund to be non-reimbursable and non-returnable under the Federal reclamation laws;

(k) That, as of the close of each fiscal year, beginning with Fiscal Year 1955, the Secretary of the Interior report to the Congress on the status of the Upper Colorado River Basin Account and on the revenues from and costs of constructing, operating, and maintaining the Colorado River Storage Project and participating projects. The Secretary's report should be prepared in such manner as accurately to reflect the Federal investment allocated to power, to irrigation, and to other water supply purposes and the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

I recommend that you approve and adopt this report as your proposed report on the Colorado River Storage Project and Participating Projects, Upper Colorado River Basin, and that you authorize me in your

behalf to transmit copies to the Secretary of the Army and to the St
signatory to the Colorado River Compact for their views and recommend
in accordance with the provisions of Section 1 of the Flood Control A
1944 (58 Stat. 887), to the heads of the agencies of the States of Ar
Wyoming, Utah, Colorado, and New Mexico exercising administration ove
the wildlife resources of those states for their report and recommend
in accordance with the provisions of the Act of August 14, 1946 (60 St
1080), and to other interested Federal agencies for their views and
comments.

Respectfully,

(Sgd) Michael W. Straus

Commissioner

Attachment

Approved: JAN 26 1951

(Sgd) Oscar L. Chapman

Secretary of the Interior

Interior--Duplicating Section, Washington, D. C.

87617

UNITED STATES
DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary

BUREAU OF RECLAMATION
Michael W. Straus, Commissioner
E. O. Larson, Regional Director, Region 4

COLORADO RIVER STORAGE PROJECT

AND

PARTICIPATING PROJECTS

UPPER COLORADO RIVER BASIN

December 1950

Region 4
Salt Lake City, Utah

Project Planning Report
No. 4-8a.81-1

C O N T E N T S

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COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

EIGHTY-FOURTH CONGRESS

FIRST SESSION

ON

S. 500

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

FEBRUARY 28, MARCH 1, 2, 3, 4, AND 5, 1955

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Senator ANDERSON. May I say to you that he is scheduled to be a witness tomorrow morning, and we hope that he, along with Governor Johnson and Mr. Crawford and others, will put those proposed projects clearly before the committee at that time. He will be a witness.

Mr. WILL. That, then, Mr. Chairman, concludes what I had proposed to say to the subcommittee. As you see, we are trying to accommodate ourselves very fully to the wishes you expressed on February 5.

Senator ANDERSON. You are very kind, Mr. Will, and I appreciate it.

Mr. WILL. Thank you.

Senator ANDERSON. Mr. Larson, I believe, is the next witness. Mr. Larson, would you rather start fresh at 2 o'clock? How long will your testimony be?

Mr. LARSON. I might explain it, and then you can decide what you wish me to do.

Senator ANDERSON. I think in view of all the circumstances, we will recess until 2 o'clock.

(Thereupon at 12:30 p. m., a recess was taken until 2 p. m., the same day.)

AFTER RECESS

Senator O'MAHONEY (presiding). The committee will come to order, please.

The next witness is Mr. E. O. Larson from Salt Lake City. You are the head of the Bureau in that area, are you not?

STATEMENT OF E. O. LARSON, REGIONAL DIRECTOR, BUREAU OF RECLAMATION, REGION 4, SALT LAKE CITY, UTAH

Mr. LARSON. I am regional director of the Bureau of Reclamation, region 4, with headquarters at Salt Lake City.

Senator O'MAHONEY. And you are very familiar with this controversial project?

Mr. LARSON. I am, yes.

Senator O'MAHONEY. Very well. The committee will be glad to hear you.

Mr. LARSON. Mr. Chairman, I would first like to express my appreciation for the opportunity of appearing before you. I have a statement requiring about 30 to 35 minutes to read, and I assume you do not wish me to read it, but I can explain what is in my entire statement, the papers attached, and then by ready for questioning.

Senator O'MAHONEY. Unless there is some objection by some member of the committee, we will allow you to proceed in the manner you have indicated. You may summarize your statement. It will be printed in its entirety in the record. Questions, when the time comes for questioning, may be directed to any part of it.

Senator WATKINS. May I ask, Mr. Chairman, if it is not going to be read, that we permit it to be printed with the large type?

Senator O'MAHONEY. Without objection, it is so ordered.

Mr. LARSON. In addition to the 2 storage units and 11 participating projects recommended for initial authorization by the Secretary of the Interior, the legislation, S. 500, before you contains 2 other storage units and 3 other participating projects. I will first discuss the items recommended by the Secretary and then present material now available

on the additional units and projects in the bill. The investigation of two of the additional participating projects has not been under my administrative jurisdiction. I suggest, therefore, that questions concerning the Indian features of the Navaho project be referred to the Bureau of Indian Affairs, and likewise a representative of region 5 of the Bureau of Reclamation will answer questions concerning the San Juan-Chama project.

The Secretary's proposals would authorize construction of 2 storage reservoirs, Echo Park and Glen Canyon, with a total capacity of 32½ million acre-feet. Besides regulating the flow of the river, these units would generate power needed by the upper basin States and provide sediment control for the lower basin.

Construction of the 11 recommended participating projects would constitute a material advance in the development of the upper basin water resources. They would bring 132,360 acres of land into agricultural production and provide supplemental water to 233,930 acres of land now irrigated with an inadequate water supply. They would also supply industrial and municipal water and hydroelectric energy.

The Echo Park and Glen Canyon units of the storage project are part of the plan for regulation of the upper Colorado River through which the provisions of the Colorado River compact can be met and additional use of apportioned waters can be made in the upper basin.

The basin plan would eventually comprise a system of seven large regulatory reservoirs located at strategic points of control on the main stem and major tributaries of the upper Colorado River. At each of the seven storage sites a powerplant would be constructed for the generation of hydroelectric energy. Two additional power plants with small re-regulating reservoirs that would utilize upstream regulation, would complete the integrated storage and power system of the plan. The Secretary, however, recommends initial construction of only two of these power and storage units and has selected the Echo Park and Glen Canyon units because of their economy and efficiency.

Although the regulatory reservoirs proposed in the basin plan are generally below the points of diversion for the participating projects, they would serve essentially the same purposes as reservoirs above points of diversion. This would be achieved through a replacement practice quite common on western streams where water is diverted upstream in exchange for storage water releases from downstream reservoirs. In this manner the downstream obligations would be met. It would be impossible and there is no necessity to provide this replacement through reservoirs at the sites of the participating projects. Selection of a few large reservoirs would also facilitate the integrated operation of the system, which would be necessary in order to provide river regulation, water for consumptive use and generate the optimum amount of hydroelectric power from the system's water as it is released to meet downstream obligations.

Optimum production of power at the Glen Canyon and Echo Park units would be assured by the construction of interconnecting transmission lines. These interconnecting facilities would permit maximum flexibility in power operation and facilitate the delivery of Glen Canyon power to load centers in the upper basin States. The initial lines would be the backbone of the transmission grid to which subsequently constructed powerplants would be added. Supply lines from the transmission grid would be constructed to serve local market areas.

Ten major private power companies support this project and propose to absorb the project power output from a main transmission system and deliver it to existing and prospective customers. This would relieve the Federal Government of a portion of its contemplated construction cost.

Glen Canyon Dam would be on the Colorado River in northern Arizona approximately 13 miles downstream from the Utah-Arizona border and 16 miles upstream from Lee Ferry. The dam would be a concrete structure rising 700 feet from bedrock and 580 feet above the river. The reservoir would offer final regulation for deliveries of water at Lee Ferry in compliance with the Colorado River compact. Out of a total capacity of 26 million acre-feet, 20 million acre-feet would initially be active capacity. The reservoir when filled would have a normal water surface area of 153,000 acres and would extend about 186 miles up the Colorado River, nearly to the mouth of the Green River, and 71 miles up the San Juan River. It would be the principal point of sediment control in the upper basin. Even after 200 years, at the present rate of sediment flow and with upstream storage developed, almost half the initial storage space would be available for river regulation.

A powerplant would be located near the toe of Glen Canyon Dam. It would consist of 7 generating units with a total installed capacity of about 800,000 kilowatts or approximately one-half the total capacity contemplated for the entire Colorado River storage project.

The total construction cost of the Glen Canyon unit, with an appropriate share of transmission costs, is estimated at $421 million. Also provided in the proposed bill of authorization would be the construction facilities for adequate protection of the Rainbow Natural Bridge.

Echo Park Dam would be located in Colorado on the Green River about 3 miles east of the Utah-Colorado State line and 3 miles below the junction of the Green and the Yampa Rivers in the tri-corner area of Colorado, Wyoming, and Utah. The dam would be a concrete structure rising 690 feet from bedrock and 525 feet above the river. The reservoir would have a storage capacity of 6,460,000 acre-feet, including 5,460,000 acre-feet of active capacity. When filled to capacity, the reservoir would have a surface area of 43,400 acres and would extend 63 miles up the Green River and 44 miles up the Yampa River.

The powerplant at the dam would consist of 4 generating units with a total capacity of about 200,000 kilowatts.

The construction cost of the Echo Park unit is estimated at $176 million including an appropriate part of the basic transmission system but not including recreational development of the Dinosaur National Monument estimated to cost $21 million.

A participating project is defined as any water-consuming project which would utilize water of the upper Colorado River system for irrigation and require repayment assistance on irrigation costs from power revenues of the storage project.

The following 11 such participating projects are recommended for initial authorization in the Secretary's supplemental report.

LaBarge, Wyo.
Seedskadee, Wyo.
Lyman, Wyo.
Silt, Colo.

Smith Fork, Colo.
Paonia, Colo. (including Minnesota unit).
Florida, Colo.
Pine River extension, Colorado-New Mexico.
Emery County, Utah.
Central Utah (initial phase), Utah.
Hammond, N. Mex.

Brief statements on each of the initial participating projects are attached for filing with your committee, and further details can be found in the supplements to the Colorado River storage project report (H. Doc. 364, 83d Cong., 2d sess.).

A 12th project, the Eden project in Wyoming, was authorized in 1949 and is now under construction. That authorization provided that the project be assisted in repayment by power revenues from the Colorado River storage project. The Eden project is therefore included in the plan as a participating project.

The Secretary's supplemental report also included the Shiprock division of the Navaho project. Subsequent studies show that major features of the Navaho project, including the Navaho Reservoir, would be used jointly by the two divisions of the project. The Navaho Reservoir would also be used by the potential San Juan-Chama project. Thus, the Navaho project would be uneconomical of construction by divisions, and authorization of only the Shiprock division of the project would therefore be unsound. For the information of your committee, however, a brief summary on the overall Navaho project prepared by the Bureau of Indian Affairs is attached. Further details on this project can be found in the feasibility report, Navaho Project, New Mexico, January 1955, compiled by the Bureau of Indian Affairs.

The Colorado River compact in article III (a) apportioned from the Colorado River system in perpetuity to the upper basin and lower basin, respectively, exclusive consumptive use of 7½ million acre-feet per annum. There is a provision in article IIId of the same compact that the States of the upper division (Colorado, New Mexico, Utah, and Wyoming) will not cause the flow of the river at Lee Ferry, the point of division between the upper and lower basins, to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years. These are the controlling and most important limitations with respect to water uses in the upper basin although there are other provisions in the compact relating to uses and deliveries of water.

Substantial water development in the upper basin is impossible without regulation of the uneven flow of the Colorado River. Our studies show that without such control only about 58 percent of the water apportioned to the upper basin could be used.

During the past 59 years, the historic annual flow of the Colorado River from the upper basin has varied from a high of 22 million acre-feet in 1907 to less than 5 million acre-feet in 1934. That span of years also presented extended periods of abnormal and subnormal flows, the most impressive being the extremely high flows of the period 1914 to 1929 with historic annual flows averaging over 16 million acre-feet and the prolonged 25-year drought following thereafter with historic annual flows averaging only 11.5 million acre-feet. The long-time average flow, however, including periods of high runoff and

drought, is sufficient to supply the allocated consumptive uses in the upper basin in addition to the downstream obligations. The primary function of the storage units in the plan is to store water during years of high runoff for release during years of low runoff. Therefore, these cyclic conditions must be recognized in planning future uses of water in the upper basin.

A history of 59 years of river operation may or may not have revealed the full characteristics of the Colorado River. Yet an initial development of the magnitude now proposed has the assurance of the availability of sufficient water supply. Later stages of development would derive additional assurances as time goes on, or, if changes are required, time will permit appropriate adjustments in the later stages of development.

Under sound engineering and economic practices it would be impractical to completely regulate past historic flows of the river and its tributaries and in years of extreme drought conditions the users of upper basin water would experience shortages in their supply. In analyzing the upper basin's long-time program for developing its apportioned use of 7½ million acre-feet per annum, we found that such occasional shortages should be within the limits of normal irrigation, industrial, and municipal operations.

The initial storage-project units would provide for a greater amount of replacement storage than would be needed to permit the increase in consumptive use which would result from the initial development. However, these large storage facilities would develop the optimum power potential of these sites necessary to meet the demands of the region. These large power and storage units would also fit into any subsequent phase of the upper basin development which may be authorized.

A start on the required storage facilities in advance of their actual need is imperative because of the time element involved in the construction and initial filling of the storage reservoirs. Apportioned water not presently consumed in the upper basin would greatly facilitate the initial filling of the reservoirs.

Through electrical interconnection between Glen Canyon, Echo Park and existing powerplants in the lower basin a first filling of the storage reservoirs could be attained with no interruption in delivery of firm electric energy to existing and potential customers on the river's system.

The time required to initially fill the Glen Canyon and Echo Park reservoirs will largely depend upon the amount of runoff in the river. Under very favorable runoff conditions the filling period could be less than 5 years whereas a much longer period would be necessary under extreme drought conditions. In either event, however, dead storage levels at Glen Canyon and at Echo Park could be attained during the period of construction of the dams, thereby providing the heads necessary for initial power generation.

Since the initial participating projects do not require the full capacity of Glen Canyon and Echo Park Reservoirs for regulatory purposes, there would be no immediate need to completely fill these reservoirs. Thus the initial filling process can be readily adapted to the amount of runoff and downstream demands for water and firm electric energy. This initial filling process would not violate the terms of the Colorado River compact.

The total consumptive use of water in the upper basin by all constructed projects, those authorized and projects under construction will be approximately 2½ million acre-feet, or one-third of the annual allotment of 7½ million acre-feet to the upper basin.

The 11 participating projects recommended in the Secretary's supplemental report would increase present stream depletion by an additional 400,900 acre-feet annually. Average evaporation from the recommended Echo Park and Glen Canyon storage units would amount to about 613,000 acre-feet annually. The units and projects recommended for authorization would thus involve an increased use of approximately 1 million acre-feet per annum. With accelerated development in the future the remainder (4 million acre-feet per annum) of the upper basin's share of the Colorado River water may be put to beneficial use within the next 75 years.

Our studies show that the recommended units and projects would have no material effect on the quality of water downstream.

With respect to later phases of development, the plan provides for additional gaging and sampling stations to supply data for continued analysis and scrutiny as each phase approaches authorization. Our analysis of the quality of water at Lee Ferry reveals for the critical period of low flow (1931 to 1947) concentrations of dissolved salts averaging 0.78 ton per acre-foot (575 parts per minute), corresponding to uses totaling 2½ million acre-feet per annum in the upper basin.

An average concentration of 0.85 ton per acre-foot (625 parts per minute) or an increase of about 9 percent is anticipated at Lee Ferry following completion of the recommended Glen Canyon and Echo Park storage units and the 11 initial participating projects, with a corresponding use then totaling about 3½ million acre-feet. With full use of the 7½ million acre-feet per annum allotment in the upper basin, the average concentration of dissolved salts at Lee Ferry is estimated at about 1.20 tons per acre-foot (880 parts per minute).

Under any of the above conditions, concentrations and type of salts are well within the standard range for irrigation water designated by the United States Salinity Laboratory at Riverside, Calif., as good to permissible, and within the range of practical treatment for municipal and industrial purposes.

The total construction cost of the initial units and participating projects is estimated at $930 million as summarized in table I.

This cost includes $7,287,000 for the authorized Eden project now nearing completion, $2,035,000 expended on the Paonia project under a previous authorization, and $21 million proposed for recreational development of the Dinosaur National Monument. This cost is based on January 1953 price levels, and if adjusted to October 1954 price levels would be reduced by about 1 percent.

Also included is the cost of a transmission system necessary to deliver electrical energy to power market centers in the upper basin States and to tie in with the lower basin system.

If the Federal Government constructs only the interconnecting trunkline, with the remainder of the system to be constructed by non-Federal interests, the estimated Federal construction cost would be reduced and the purchase price for project power to those non-Federal interests decreased.

Costs of the two initial units of the storage project have been allocated to power, irrigation, and recreation. The costs of the participating projects have been allocated primarily to irrigation.

Costs allocated to recreation represent only the added cost resulting from the inclusion of recreational facilities. The allocation of costs will be subject to further study in connection with preparation of definite plans. The costs as presently allocated on a preliminary basis are presented in table I.

The reimbursable construction costs of each unit and participating project would be repaid within 50 years of the time that unit or project is completed, exclusive of authorized development periods. Commercial power and municipal and industrial water supply investments would be repaid with interest at the going rate for long-term marketable securities. Interest-bearing and non-interest-bearing investments would be paid concurrently to the extent practicable. Repayment of the irrigation investment would be accomplished during a 50-year period with the irrigators paying up to their ability and the balance paid by the application of excess power revenues from the storage project during the same 50-year period.

Exceptions to this are the Paonia and Eden participating projects for which special legislative provision has already been made, and those cases involving Indian lands to which the provisions of appropriate acts—the Leavitt Act—would be made applicable by the terms of the bill.

The cost of the recreational planning and construction program of the National Park Service in the Dinosaur National Monument would be nonreimbursable.

At a 6-mill per kilowatt-hour average firm power rate, power revenues would be sufficient during 50 years of operation to repay the costs allocated to power at the Echo Park and Glen Canyon units and central Utah project, with 2½ percent interest on the unpaid balance, and also to make substantial payments on irrigation costs. Thereafter power revenues would be sufficient to complete repayment of the non-interest-bearing construction costs allocated to irrigation and assigned for repayment from power revenues. The actual selling price of power would be established at rates consistent with sound business principles and would take into account the irrigation costs to be repaid from power revenues.

A payout schedule was included in the supplemental report of the Secretary illustrating how repayment could be accomplished within a 50-year period, assuming power revenues were applied first to the repayment of power costs. The Department now proposes that in those instances where repayment of bearing costs, such as power and non-interest-bearing costs, such as irrigation, are due concurrently, they will be repaid concurrently to the extent practicable.

A benefit-cost analysis has been made of each initial storage unit and each initial participating project to determine whether or not they are justified to the Nation as Federal developments. This analysis compares Federal project costs with tangible project benefits. It is used by the Bureau of Reclamation in addition to and apart from the repayment analysis.

The benefit-cost analysis covers the widespread local, regional and national benefits which are not included in the repayment analysis.

Such benefits susceptible to monetary evaluation are known as tangible benefits, and are used in the benefit-cost comparison. Other benefits for which no monetary value can be estimated are known as intangible and do not appear in this analysis.

There are three main types of tangible irrigation benefits used in the benefit-cost ratio—direct, indirect, and public.

Direct benefits are the increase in net farm income; indirect benefits, the increase in profits of businesses handling, processing, and marketing farm products, and the increase in the supply of goods and services. Public irrigation benefits comprise the increase or improvement in settlement investment opportunities and in community facilities and services.

In general, benefits from power and municipal and industrial water are limited to the costs of providing such power and water from the most economical alternative sources.

Flood control, recreational, and fish and wildlife benefits are computed by the Corps of Engineers, the National Park Service, and the Fish and Wildlife Service, respectively.

The cost side of the benefit-cost comparison includes all Federal or project costs. These are construction costs, interest costs, and operation, maintenance and replacement costs.

The recommended units of the storage project and the participating projects collectively and individually would have tangible benefits greater than costs.

In a plan of this magnitude the authorities and laws under which the various features would be constructed, administered, and operated would normally present serious problems, and certainly would raise grave questions of jurisdiction.

The plan before you is happily free of such complications. The storage project, with its regulatory reservoirs, is of interstate significance, and each of its units would be so treated. These would be constructed, operated, and maintained by the Bureau of Reclamation, and, as far as water is concerned, would be operated in conformance with the Mexican Water Treaty, the Colorado River and upper Colorado River basin compacts. The last document includes provisions to cover all the necessary aspects of such operation.

The participating projects are consumptive-use projects intrastate in character. In the proposed plan these projects would be constructed, operated, and maintained under reclamation law. Water rights would therefore be obtained and administered under the water code of the State in which the project would be built. The participating projects would in general be operated and maintained by water users' organizations after construction.

The plan includes the formation of appropriate districts, preferably of the water conservancy type and subject to Secretary approval, as contracting entities to represent project water users in project operation, repayment, and other matters.

In addition to the two units of the storage project and 11 participating projects I have discussed, the bill before you includes the Cross Mountain, Curecanti, Flaming Gorge and Navaho units of the storage project and the Gooseberry, San Juan-Chama and Navaho participating projects.

The bill provides that the Curecanti Dam shall be constructed to a height which will impound not less than 940,000 acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high water line located at 7,520 feet above mean sea level. The additional units of the storage project were covered in the 1950 report on the Colorado River storage project and participating projects and in the 1953 supplemental report of the Secretary.

Analyses of the Curecanti unit for any size reservoir, when a dam and powerplant at the Curecanti site are considered alone, indicate that power from the site would be more expensive than power from alternative sources. Preliminary studies are now in progress of a modified plan of development for this unit, including additional downstream power drops dependent on storage regulation at the Curecanti Reservoir. A summary statement of reconnaissance data on this modified plan is attached.

As I have previously stated, the Navaho Reservoir is treated as a feature of the potential Navaho participating project mentioned below rather than as a unit of the storage project.

Project reports have been prepared on the Gooseberry, San Juan-Chama and Navaho projects. Reports on the Gooseberry, San Juan-Chama and Navaho projects recently prepared by regions 4 and 5 of the Bureau of Reclamation and Bureau of Indian Affairs, respectively, are yet to be circulated to other agencies, States, and local interests for review in accordance with the 1944 Flood Control Act.

The present plan of development, as covered in the report on the San Juan-Chama participating project, is a modification of the plan presented for this project at the congressional hearings in 1954.

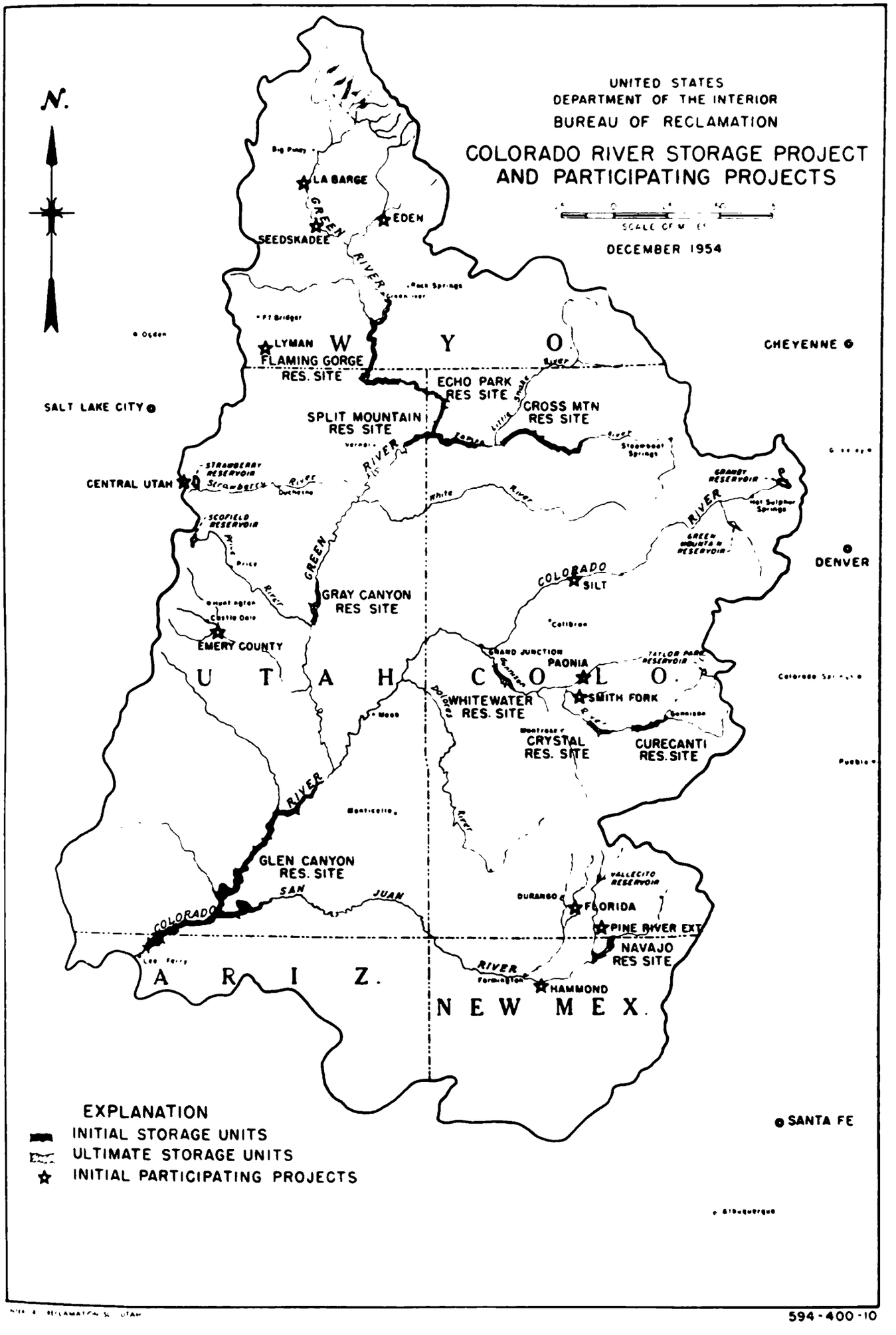
Brief summary statements on the Gooseberry, the modified San Juan-Chama and the Navaho participating projects are attached. A summary (table II), including the units and participating projects covered in the Secretary's supplemental report as well as the additional units and participating projects in the bill, is also attached.

The additional 3 units of the storage project in the bill would have a total storage capacity of about 10,080,000 acre-feet and an installed hydroelectric generating capacity of 172,000 kilowatts.

The 3 additional participating projects would bring into agricultural production 137.250 acres of new land and provide supplemental water of 245,400 acres of land now irrigated but with an inadequate water supply, as well as develop 55,800 acre-feet annually for municipal and industrial uses.

They would further deplete the flows of the upper basin by about 589,000 acre-feet annually.

(The information referred to follows:)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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
AND PARTICIPATING PROJECTS
DECEMBER 1954
LA BARGE
EDEN
SEEDSKADEE
GREEN RIVER
LYMAN
FLAMING GORGE
RES. SITE
W Y O.
CHEYENNE
SALT LAKE CITY
ECHO PARK
RES SITE
CROSS MTN
RES SITE
SPLIT MOUNTAIN
RES SITE
YAMPA RIVER
CENTRAL UTAH
STRAWBERRY RESERVOIR
SCOFIELD RESERVOIR
WHITE RIVER
GREEN RIVER
GRAND RESERVOIR
COLORADO RIVER
DENVER
COLORADO
SILT
GRAY CANYON
RES SITE
EMERY COUNTY
GRAND JUNCTION
PAONIA
TAYLOR PARK RESERVOIR
U T A H
C O L O.
WHITEWATER
RES. SITE
SMITH FORK
CRYSTAL
RES. SITE
CURECANTI
RES. SITE
GLEN CANYON
RES. SITE
SAN JUAN RIVER
COLORADO RIVER
DURANGO
VALLECITO RESERVOIR
FLORIDA
PINE RIVER EXT
NAVAJO
RES SITE
ARIZ.
HAMMOND
NEW MEX.
SANTA FE
EXPLANATION
INITIAL STORAGE UNITS
ULTIMATE STORAGE UNITS
INITIAL PARTICIPATING PROJECTS

594-400-10

TABLE 1.—*Summary of initial units of Colorado River storage project and 12 participating projects*

Project and State	Lands to be irrigated		Generating capacity	Municipal water annually	Stream depletion annually	Construction costs					Repayment of reimbursable costs [2]		
								Reimbursable allocations					
	New	Supplemental				Total [1]	Nonreimbursable	Power	Municipal water	Irrigation	By water users [3]	By initial power units (Echo Park, Glen Canyon, cental Utah)	Total
Colorado River storage project													
Initial units													
Echo Park unit, Colorado and Utah	*Acres*	*Acres*	*Kilowatts* 200,000	*Acre-feet*	*Acre-feet* 87,000	$176,426,000		$128,383,000		$48,043,000		$176,426,000	$176,426,000
Glen Canyon unit, Arizona and Utah			800,000		526,000	421,270,000		370,974,000		50,296,000		421,270,000	421,270,000
Subtotal initial units			1,000,000		613,000	597,696,000		499,357,000		98,339,000		597,696,000	597,696,000
Recreation development of Dinosaur National Monument, Colorado and Utah						21,000,000	$21,000,000						
11 participating projects													
LaBarge, Wyoming	7,970				14,200	1,673,300				1,673,300	$495,000	1,178,300	1,673,300
Seedskadee, Wyoming	60,720				110,400	23,272,000				23,272,000	4,785,000	18,487,000	23,272,000
Lyman, Wyoming		40,600			0	10,564,000				10,564,000	2,255,000	8,309,000	10,564,000
Silt, Colorado	1,900	5,400			5,800	3,356,000	73,600			3,282,400	1,020,000	2,262,400	3,282,400
Smith Fork, Colorado	2,270	8,160			7,500	3,367,000	21,000			3,343,000	1,045,000	2,298,000	3,343,000
Paonia, Colorado	2,210	14,830			9,000	6,914,000	152,400			6,791,600	2,411,000	4,377,600	6,791,600
Florida, Colorado	6,300	12,650			12,900	6,941,500	437,900			6,503,600	1,711,500	4,792,100	6,503,600
Pine River project extension, Colorado and New Mexico	15,150				28,300	5,027,000				5,027,000	2,045,000	2,982,000	5,027,000
Emery County, Utah	3,630	20,450			15,500	9,865,500	229,000			9,636,500	3,715,000	5,921,500	9,636,500
Central Utah (initial phase), Utah	28,540	131,840	61,000	48,800	189,400	231,044,000	5,991,000	46,699,000	$45,500,000	127,351,000	[4] 60,691,000	[5] 158,862,000	[6] 219,553,000
Hammond, New Mexico	3,670				7,900	2,302,000				2,302,000	370,000	1,932,000	2,302,000
Subtotal, 11 initial projects	132,360	233,930	61,000	48,800	400,900	304,356,300	6,907,900	46,699,000	45,500,000	199,749,400	80,516,500	211,401,900	291,948,400

Additional participating project authorized and under construction: Eden, Wyoming	10,660	9,540	.....	.....	32,400	7,287,000			7,287,000	1,500,000	5,787,000	7,287,000
Total, 12 participating projects	143,020	243,470	61,000	48,800	433,300	311,643,300	6,907,900	46,699,000	45,500,000	207,036,400	82,046,500	217,188,900	299,235,400
Grand total	143,020	243,470	1,061,000	48,800	1,046,300	[7] 930,339,300	27,907,900	546,056,000	45,500,000	305,375,400	82,046,500	814,884,900	896,931,400

[1] Exclusive of nonreimbursable CRDF expenditures.

[2] Costs allocated to power and municipal water are repaid with interest, including interest during construction.

[3] Repayment by water users toward construction costs over 50-year repayment period beyond a reasonable irrigation development period except 60-year period for Eden project and 68-year period for Paonia project

[4] Includes $15,191,000 in irrigation revenues and $45,500,000 from municipal and industrial water users

[5] Includes $27,838,000 of excess power revenues from the central Utah project powerplants accruing during the irrigation repayment periods of this project.

[6] Exclusive of $5,500,000 allocable to purposes of the ultimate phase of central Utah project.

[7] Includes cost ($7,287,000) of authorized Eden project now nearing completion and $2,035,000 expended on Paonia project under previous authorization.

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TABLE 2.—*Summary with additional units of Colorado River storage project and additional participating projects added to table 1*

Project and State	Lands to be irrigated		Generating capacity	Municipal water annually	Stream depletion annually	Construction costs					Repayment of reimbursable costs [1]		
								Reimbursable allocations					
	New	Supplemental				Total [2]	Nonreimbursable	Power	Municipal water	Irrigation	By water users [3]	By power	Total
	Acres	*Acres*	*Kilowatts*	*Acre-feet*	*Acre-feet*								
Colorado River storage project: Subtotal initial units (table 1)	------	------	1,000,000	------	613,000	$597,696,000	----------	$499,357,000	----------	$98,339,000	----------	$597,696,000	$597,696,000
Additional units:													
Cross Mountain, Colorado	------	------	60,000	------	70,000	50,225,000	----------	36,329,000	----------	13,896,000	----------	[4] 50,225,000	----------
Curecanti, Colorado	------	------	40,000	------	18,000	49,305,000	----------	41,205,000	----------	8,100,000	----------	[4] 49,305,000	----------
Flaming Gorge, Utah and Wyoming	------	------	72,000	------	56,000	82,942,000	----------	52,042,000	----------	30,900,000	----------	[4] 82,942,000	----------
Subtotal	------	------	172,000	------	144,000	182,472,000	----------	129,576,000	----------	52,896,000	----------	182,472,000	----------
Total storage units	------	------	1,172,000	------	757,000	780,168,000	----------	628,933,000	----------	151,235,000	----------	780,168,000	----------
Recreational development of Dinosaur National Monument, Colorado and Utah (table 1)	------	------	---------	------	---------	21,000,000	$21,000,000	----------	----------	----------	----------	----------	----------
Participating projects:													
Subtotal 12 initial projects (table 1)	143,000	243,470	61,000	48,800	433,300	311,643,300	6,907,900	46,699,000	$45,500,000	207,036,400	$82,046,500	217,188,900	299,235,400
Additional projects:													
Gooseberry, Utah	------	16,400	---------	------	12,500	5,760,500	33,000	----------	----------	5,727,500	2,375,000	[6] 3,352,500	----------
Navaho, New Mexico	137,250	------	---------	------	341,400	[5] 211,237,300	1,298,000	----------	----------	209,939,300	30,730,000	[6] 179,209,300	----------
San Juan-Chama, New Mexico	------	225,000	---------	55,800	235,000	[5] 135,169,000	470,000	----------	26,775,000	107,924,000	54,665,000	[6] 80,034,000	----------
Subtotal	137,250	241,400	---------	55,800	588,900	352,163,800	1,801,000	----------	26,775,000	323,590,800	87,770,000	262,595,800	----------
Total participating projects	280,250	484,870	61,000	104,600	1,022,200	663,810,100	8,708,900	46,669,000	72,275,000	530,627,200	169,816,500	[7] 479,784,700	----------
Grand total	280,250	484,870	1,233,000	104,600	1,779,200	1,464,978,100	29,708,900	675,632,000	72,275,000	681,862,200	169,816,500	1,259,952,700	----------

[1] Costs allocated to power and municipal water are repaid with interest, including interest during construction.

[2] Exclusive of nonreimbursable Colorado River development fund expenditures.

[3] Repayment by irrigation water users toward construction costs over a 50-year repayment period following a reasonable development period.

[4] A power rate of more than 6 mills would be required for these units to repay their construction cost in 50 years at 2.5 percent interest

[5] $800,000 of the $36,400,000 estimated cost for Navaho Dam and Reservoir allocated to the San Juan-Chama project for added capacity necessary to serve the San Juan-Chama project.

[6] Would require an extension of the payout period used in table 1 or an increase in the average power rate.

[7] Exclusive of $5,500,000 allocable to purposes of the ultimate phase of central Utah project.

Statement on La Barge Project, Wyoming

The potential La Barge project would make a direct flow diversion from Green River, a principal tributary of the Colorado River, to provide for the irrigation of 7,970 acres of desert lands in Sublette and Lincoln Counties in southwestern Wyoming. Only about 300 acres of these lands receive any irrigation water at the present time. Their meager supply would likely be used on other lands outside the project area if the project was constructed. Water for domestic and stock-watering use on farms in the project area would be taken from project canals and from shallow wells that would be developed by the water users.

Project lands would generally be utilized for the support of livestock enterprises. Climatically adaptable crops, such as hay, small grain, pasture, and some garden crops would be produced. The principal livestock would be dairy cows and sheep. Analyses made indicate that an average farm of about 210 irrigated acres in the project area would provide the farm family with a reasonable standard of living, provide employment for the available family labor, and permit payment of operation, maintenance, and replacement costs and some payment toward construction costs of project facilities.

Detailed land classification surveys show the project lands to be suitable for sustained production of crops under irrigation farming. Water supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply of 24,300 acre-feet annually would be available for the project from direct flows with permissible shortages in occasional drought years. A water right for the project can be obtained under Wyoming State law.

Construction features of the project would include a main diversion and distribution canal with an initial capacity of 175 second-feet and extending approximately 40 miles along the west side of Green River, a few short laterals, and a few short drains as required. Construction of the main canal and the laterals would require about 2 years. Drains would not be completed until a few years after application of water to the land so that the extent of works required could be determined. A period of 2 to 3 years would be required to construct the project.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the La Barge project, Wyoming, dated January 1951, a supplement to the Colorado River Storage project report dated December 1950. Results of current January 1953 estimates for this project plan are summarized in the attached project summary tabulation.

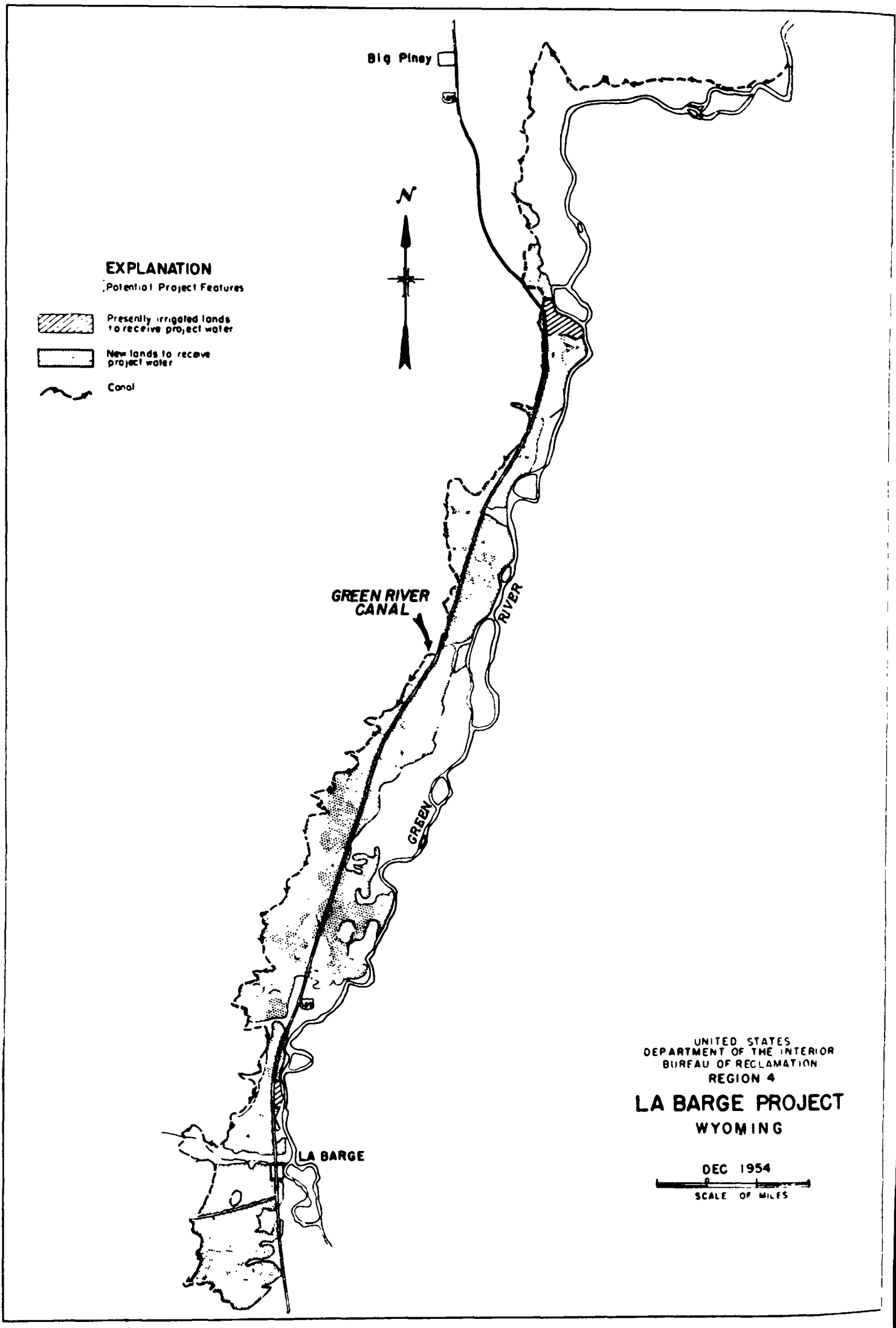
Summary data, La Barge project, Wyoming

Irrigated acreage: New lands, 7,970 acres.
Principal agricultural production:
Hay, pasture and small grain, dairy cows and sheep.

Water supply:	*Acre-feet*
Average annual increase in direct flow diversions	24,300
Average annual increase in storage yield	None
Stream depletion (average annual)	14,200

Project works:
Construction features would include main diversion and distribution canal with initial capacity of 175 second-feet and extending approximately 40 miles along west side of Green River, a few short laterals and a few short drains.

Construction cost and repayment:	
Estimated cost	$1,673,300
Reimbursable cost allocated to irrigation	1,673,300
Nonreimbursable allocation	None
Repayment by:	
Irrigation water users	495,000
Power revenues from Colorado River storage project	1,178,300
Total	1,673,300
Annual operation, maintenance, and replacement costs	14,700
Benefit-cost ratio	2.12 to 1



INTERIOR RECLAMATION SLC UTAH

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STATEMENT ON SEEDSKADEE PROJECT, WYOMING

The potential Seedskadee project would divert water from Green River, a principal tributary of the Colorado River, to provide for the irrigation of 60,720 acres of arable dry lands lying along both sides of the river in Lincoln and Sweetwater Counties in southwestern Wyoming. Of the total area 51,960 acres would be included in family-sized farm units and 9,030 acres would be used for community pasture. Water for domestic and stock watering use in the project area would be obtained from project canals and from shallow wells that would be developed by the water users. Fish and wildlife values in the area would probably suffer minor damage as a result of project development. Recreation values would not be materially affected.

With project development, the irrigated lands would be utilized primarily for the support of livestock enterprises, particularly dairy cows and sheep. Climatically adaptable crops, such as grasses for hay and pasture, small grain, alfalfa, and some garden crops would be produced. Analyses made indicate that an average farm of about 200 irrigated acres in the Seedskadee area would be required to provide the farm family with a reasonable standard of living, provide employment for the available family labor, and permit payment of operation, maintenance, and replacement costs of project facilities and some payment toward construction costs of project facilities.

Detailed land classification surveys show the project lands to be suitable for sustained production of crops under irrigation farming. Water supply studies based on records of stream flows as they have occurred in the past indicate that an adequate irrigation supply of 225,800 acre-feet annually would be available from direct flows for the project with permissible shortages in occasional drought years. A water right for the project can be obtained under Wyoming State law.

Principal construction features of the project would include a diversion dam on Green River, a system of main canals and laterals to convey water from the diversion dam and distribute it to project lands, two hydraulic driven pumps at drops in the distribution canals to lift water to some of the lands, and a few miles of artificial drains.

The Seedskadee diversion dam would consist of a low ogee overflow section 400 feet long, canal headworks, a sluiceway, and a dike 1,000 feet long. The Seedskadee diversion canal would extend along the west side of Green River and would convey water from the river to the project lands. It would be 19 miles in length and would have an initial capacity of 1,350 second-feet. The diversion canal would terminate at a bifurcation structure at the headings of the two main canal distribution systems, one serving lands west of the river and the other serving lands east of the river. Main canals in the distribution system would total about 160 miles in length. A lateral system would be constructed to deliver water from the main canals to individual farm tracts.

A construction period of about 8 years, including the completion of definite plan investigations, would be required to complete all project facilities except the drains. Drains would not be completed until several years after application of water to the lands so that the actual extent of drainage works required could be determined.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Seedskadee project, Wyoming, dated November 1950, a supplement to the Colorado River storage project dated December 1950. Results of current (January 1953) Bureau of Reclamation estimates for this project plan are summarized in the attached project summary tabulation. Studies of the upper Green River Basin made subsequent to 1950 indicate that significant modifications in the project plan may be found desirable during the definite planning stage of the investigation.

Summary data, Seedskadee project, Wyoming[1]

Irrigated acreage:	*Acres*
New lands (largely public domain)	60,720
Supplemental	None
Total	60,720

[1] Studies in the upper Green River Basin subsequent to 1950 indicate that enlargement of the project area and addition of some storage may be found desirable during the definite plan investigations of the potential project.

Principal agricultural production: Hay, pasture, and small grain; dairy cows and sheep.

Water supply:	*Acre-feet*
Increase in average annual direct flow diversions	225,800
Increase in average annual storage yield	None
Stream depletion (average annual)	110,400

Project works:

Construction features would include a diversion dam on the Green River, a system of main canals and laterals, 2 hydraulic driven pumps and a few miles of drains. The diversion canal, 19 miles in length, would have an initial capacity of 1,350 second-feet. Main canals and laterals in the distribution system would total about 160 miles in length.

Cost and repayment:	
Estimated cost	$23,272,000
Reimbursable cost allocated to irrigation	23,272,000
Nonreimbursable allocation	None
Repayment by:	
Irrigation water users	4,785,000
Power revenues from Colorado River storage projects	18,487,000
Total	23,272,000
Annual operation maintenance, and replacement costs	136,600
Benefit-cost-ratio	1.46 to 1

Statement on Lyman Project, Wyoming

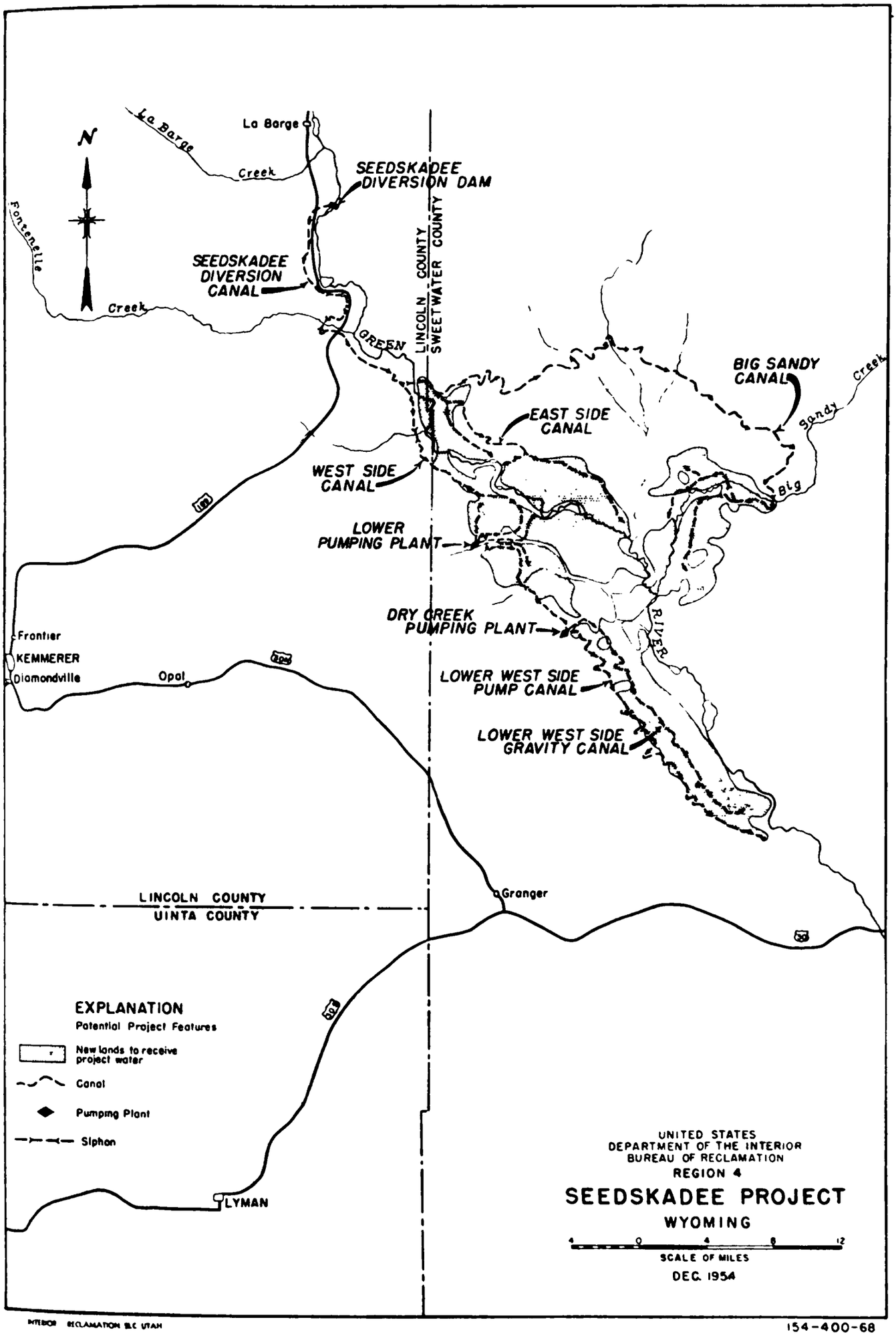
The potential Lyman project is contemplated as a means of improving the late-season irrigation water supply and thus of bettering agricultural production on 40,600 acres of land near the town of Lyman in Bridge Valley, a part of the upper Colorado River Basin in southwestern Wyoming. The lands are now irrigated with only a partial supply.

Because of the semiarid climate in the area, irrigation is necessary for successful crop production. Only grasses for hay and pasture, alfalfa, and some small grains can be produced to any extent as the growth of most other crops is precluded by a short growing season and untimely summer frosts that characterize the high 6,500- to 7,000-foot elevations of the project lands. Additional late-season irrigation water is needed to increase yields of the forage and grain crops to bolster the all-important local livestock industry. Principal livestock would be dairy cows and beef cattle.

The Lyman project would provide late-season irrigation water through construction of a dam and reservoir with 43,000 acre-feet total capacity at the Bridger site on Willow Creek to store the spring flood flows of Blacks Fork and its tributary, West Fork of Smiths Fork. Surplus flows of these streams, now largely used for excessive irrigation in the spring runoff season, would be conveyed to the reservoir by 2 feeder canals, 1 diverting from each of the streams. The water would be retained in the reservoir until needed and then released to the Willow Creek Channel. Enlargement of a few miles of this channel and construction of three canals to divert from this enlarged channel would provide the necessary facilities along with the existing irrigation systems in the area to effect the distribution of the water to project lands. The existing canal systems would be improved and extended as necessary. Drains would be provided where necessary to improve the removal of unavoidable waste and excess surface waters on the irrigated lands and to protect the lands from accumulations of harmful salts.

Preliminary land classification surveys indicate that project lands would be suitable for sustained irrigation farming although detailed surveys will be necessary to firmly establish their suitability. Some presently irrigated lands that may be found to be nonarable could be abandoned and their water supply transferred to readily accessible arable lands now idle.

Water supply studies, based on records and estimates of streamflows as they have occurred in the past, indicate the project would increase the irrigation supply from storage by an average of 32,500 acre-feet annually and reduce the present average irrigation shortage of 37 percent to an average of 12 percent. A water right for the project can be obtained for the project as planned under


N
La Barge
La Barge Creek
Fontenelle Creek
SEEDSKADEE DIVERSION DAM
SEEDSKADEE DIVERSION CANAL
GREEN
LINCOLN COUNTY
SWEETWATER COUNTY
BIG SANDY CANAL
Big Sandy Creek
EAST SIDE CANAL
WEST SIDE CANAL
LOWER PUMPING PLANT
DRY CREEK PUMPING PLANT
RIVER
LOWER WEST SIDE PUMP CANAL
LOWER WEST SIDE GRAVITY CANAL
Frontier
KEMMERER
Diamondville
Opal
Granger
LINCOLN COUNTY
UINTA COUNTY
LYMAN
EXPLANATION
Potential Project Features
New lands to receive project water
Canal
Pumping Plant
Siphon
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
SEEDSKADEE PROJECT
WYOMING
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SCALE OF MILES
DEC. 1954
INTERIOR RECLAMATION SLC UTAH
154-400-68

Wyoming State law provided the necessary agreements and adjustments in water rights can be negotiated with holders of prior natural flow rights in the project area.

A period of 5 or 6 years would be required to complete definite plan investigations and construction of the project facilities excepting the drains. The drains would not be completed until a few years after operation of the project and the actual extent of drainage required could be determined.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Lyman project, Wyoming, dated October 1950, a supplement to the Colorado River storage project report dated December 1950. Results of current (January 1953) Bureau of Reclamation estimates for this project plan are summarized in the attached project summary tabulation.

Summary data, Lyman project, Wyoming

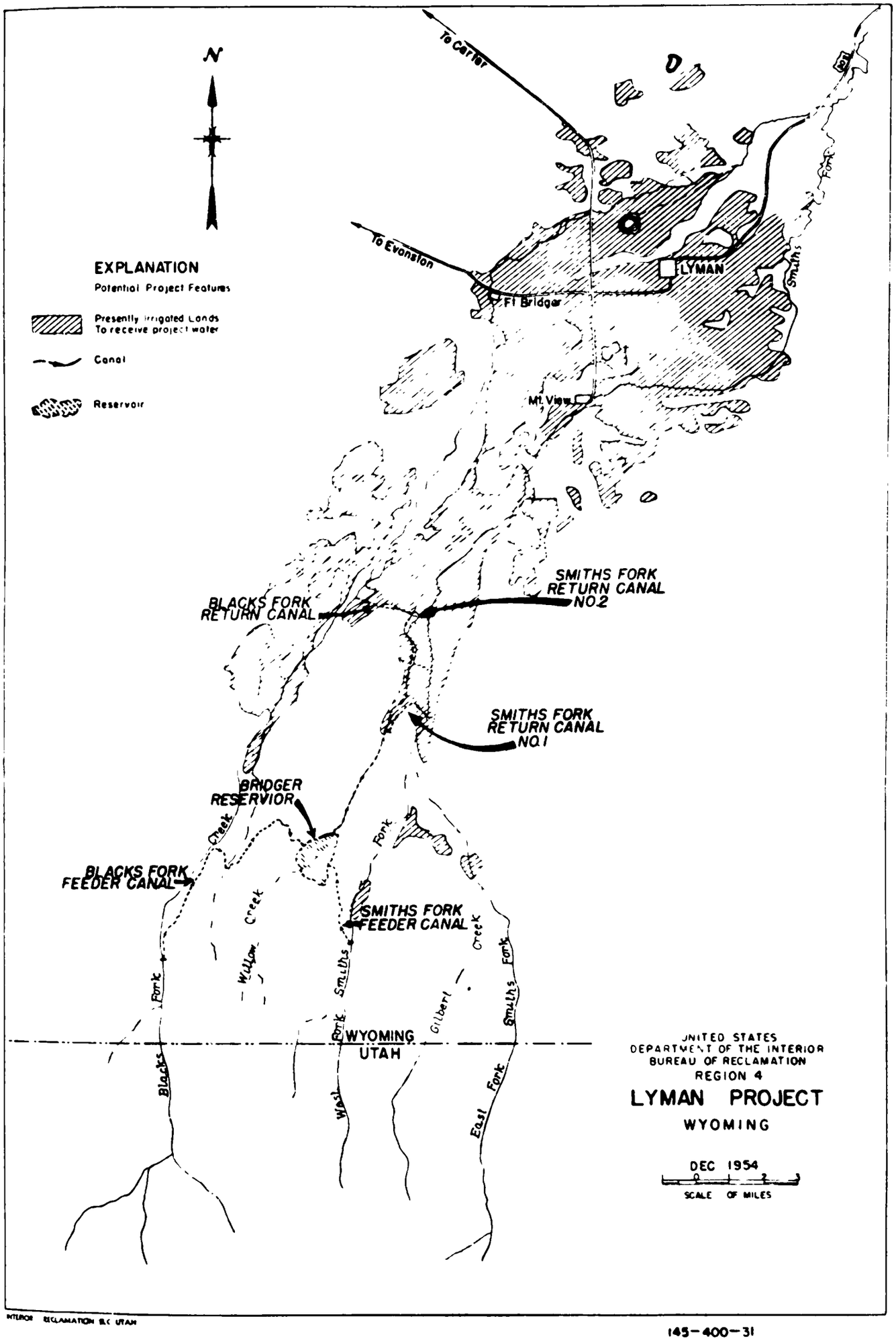
Irrigated acreage:	*Acres*
New lands	None
Supplemental	40,600
Total	40,600
Principal agricultural production: Hay, pasture, and small grain; dairy cows and beef cattle.	
Water supply:	*Acre-feet*
Average annual increase in direct flow diversion	0
Average annual increase in storage yield	32,500
Stream depletion	None
Project works: Construction features would include the Bridger Dam and Reservoir with total of 43,000 acre-feet capacity ,enlargement of the Willow Creek Channel, construction of 3 canals and some drainage facilities.	
Construction cost and repayment:	
Estimated cost	$10,564,000
Reimbursable cost allocated to irrigation	10,564,000
Nonreimbursable allocation	None
Repayment by:	
Irrigation water users	2,255,000
Power revenues from Colorado River storage project	8,309,000
Total	10,564,000
Annual operation, maintenance, and replacement	45,900
Benefit-cost ratio	1.01 to 1

STATEMENT ON SILT PROJECT, COLORADO

The potential Silt project would provide for the full irrigation of 1,900 acres of new land and provide supplemental water to 5,400 acres of partially irrigated land, all in the vicinity of Rifle and Silt, communities in Garfield County of west-central Colorado. The lands are situated in three compact blocks north of the Colorado River between Rifle and Elk Creeks, tributaries of the Colorado River. The project would also provide some enhancement in fish and wildlife values in the area.

The basic type of agriculture in the area would remain unchanged with project development because of climatic and soil conditions. With late-season water provided by the project, however, the plantings of row crops would be increased somewhat as would the yield of livestock feeds. Alfalfa, small grains, sugar beets, and potatoes would continue to be the principal crops grown. Principal livestock would be dairy cows, beef cattle and sheep.

Principal construction features include the Rifle Gap Dam and Reservoir of 10,000 acre-feet total capacity on Rifle Creek, a small hydraulic turbine and direct-connected pump at the dam, reconstruction of 1 presently abandoned ditch, rehabilitation of the existing Grass Valley Canal and construction of some laterals and drains. Except for minor drainage work, about 3 years would be required for construction of project features, including the completion of definite plan investigations.



INTERIOR RECLAMATION SLC UTAH

145-400-31

Preliminary land classification surveys indicate that the lands would be suitable for sustained crop production under irrigation farming. A detailed classification of the presently unirrigated lands would be required to confirm the degree of their suitability.

Water supply studies based on records of streamflows as they have occurred in the past indicate that an adequate irrigation supply would be available for the project from direct flows and storage yield with permissible shortages in occasional drought years. A water right for the project can be obtained under Colorado State law.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Silt project, Colorado, dated January 1951—a supplement to the Colorado River storage project report dated December 1950. Results of current (January 1953) Bureau of Reclamation estimates for this project plan are summarized in the attached project summary tabulation.

Summary data, Silt project, Colorado

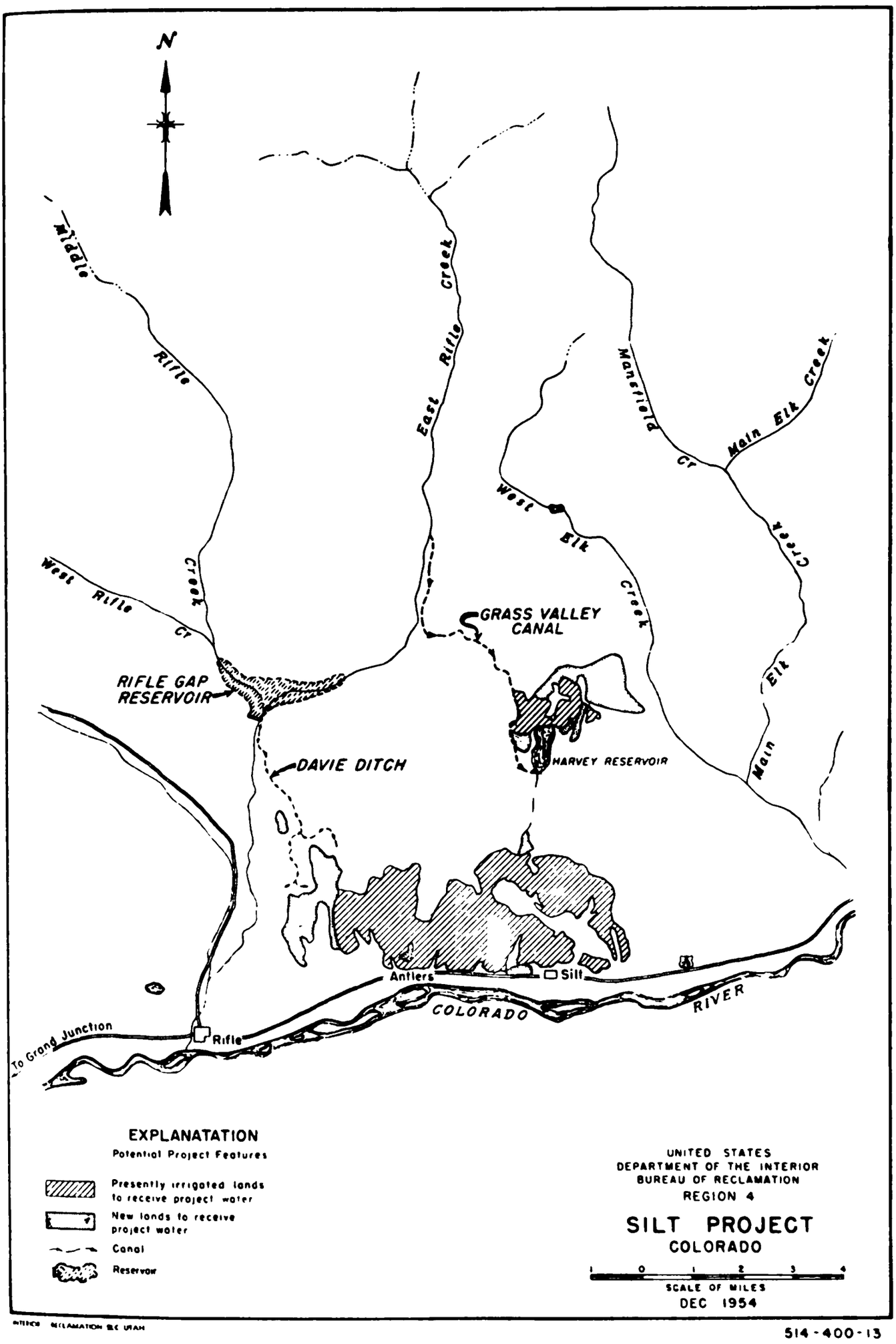
Irrigated acreage:	*Acres*
New lands	1,900
Supplemental	5,400
Total	7,300
Principal agricultural production: Alfalfa, grain, sugar beets, potatoes; dairy cows, beef cattle and sheep.	
Water supply:	*Acre-feet*
Average annual increase in direct flow diversion	4,200
Average annual increase in storage yield	5,900
Total	10,100
Stream depletion (average annual)	5,800
Project works:	
Principal construction features include the Rifle Gap Dam and Reservoir with 10,000 acre-feet total capacity, a small hydraulic turbine and direct-connected pump, reconstruction of abandoned ditch, rehabilitation of an existing canal and construction of some laterals and drains.	
Construction cost and repayment:	
Estimated cost	$3,356,000
Reimbursable cost allocated to irrigation	3,282,400
Nonreimbursable cost allocated to fish and wildlife	73,600
Repayment by:	
Irrigation water users	1,020,000
Power revenues from Colorado River storage project	2,262,400
Total	3,282,400
Annual operation, maintenance, and replacement costs	8,400
Benefit-cost ratio	1.71 to 1

STATEMENT ON SMITH FORK PROJECT, COLORADO

The potential Smith Fork project in west central Colorado would regulate surplus flows of Iron Creek and the Smith Fork of the Gunnison River, a tributary of the upper Colorado River, to increase the irrigation supply for 8,160 acres of land now partially irrigated and provide a new supply for 2,270 acres now unirrigated.

Although an improved irrigation supply would permit new lands to be cultivated and result in better crop yields on presently irrigated lands, the cropping program is largely controlled by climatic soil and topographic conditions. Most of the acreage would continue to be utilized for the production of livestock feeds with hay, small grains, and pasture predominating. Increased feed production in the area would result mostly in increased dairy cows with some increase also in beef cattle, hogs, and poultry.

Detailed land classification surveys show the project lands to be suitable for sustained production of crops under irrigation farming.



INTERIOR RECLAMATION SLC UTAH

514-400-13

Water supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply would be available for the project from direct flows and storage water with permissible shortages in occasional drought years. A water right for the project can be obtained under Colorado State law.

Construction features of the project include a storage dam and reservoir with 14,000 acre-feet total capacity at the Crawford site on Iron Creek, the Smith Fork diversion dam, the 2.7-mile long Smith Fork feeder canal of 100 second-feet, to divert from Smith Fork to Crawford Reservoir, the 6.6-mile Aspen canal of 145 second-feet initial capacity to convey water from Crawford Reservoir to part of the project lands and feed existing ditches and 4 small lateral canals. Existing irrigation facilities in the area would be utilized as fully as practicable. A period of 3 to 4 years would be required to complete definite plan investigations and construct the project works.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Smith Fork project, Colorado, a supplement to the Colorado River storage project report dated December 1950. Results of current (January 1953) Bureau of Reclamation estimates for this project plan are summarized in the attached project summary tabulation.

Summary data, Smith Fork project, Colorado

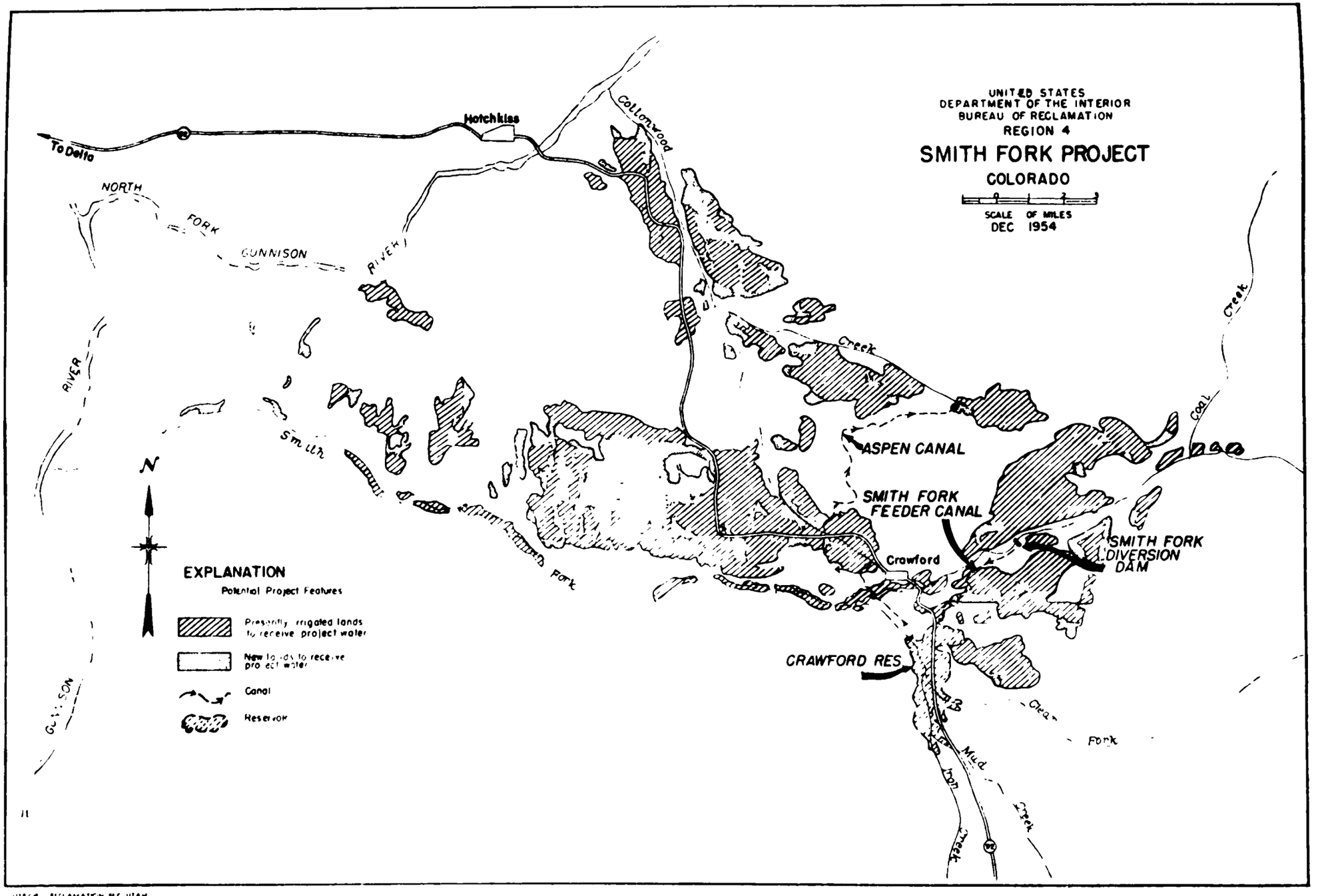
Irrigation acreage:	*Acres*
New lands	2,270
Supplemental	8,160
Total	10,430
Principal agricultural production: Alfalfa, pasture and grain; dairy cows and beef.	
Water supply:	*Acre-feet*
Average annual increase from direct flow diversions and storage	13,650
Stream depletion (average annual)	7,500
Project works:	
The construction features include the Crawford Dam and Reservoir, with 14,000 acre-feet of total capacity, Smith Fork diversion dam, the 2.7-mile-long Smith Fork feeder canal of 100 second-feet, 6.6-feet-long Aspen canal of 145 second-feet and 4 small lateral canals.	
Construction cost and repayment:	
Estimated cost	$3,367,000
Reimbursable cost allocated to Irrigation	3,343,000
Nonreimbursable cost allocated to Recreation	24,000
Repayment by:	
Irrigation water users	1,045,000
Power revenues from Colorado River storage project	2,298,000
Total	3,343,000
Annual operation, maintenance and replacement	8,400
Benefit-cost ratio	1.27 to 1

Statement on Paonia Project, Colorado

The potential Paonia project would divert water from the North Fork of the Gunnison River in the upper Colorado River basin to improve the irrigation water supply, and thus the agricultural production, of 17,040 acres of land in west-central Colorado. Of these lands 14,830 acres are presently irrigated and 2,210 acres are arable but not now irrigated. Fish and wildlife values in the area would be enhanced and flood damages would be decreased.

The general type of farming now practiced in the area would be continued with project development but the additional irrigation supplies would make possible a more intensive crop production. Production of livestock foods and fruit, such as apples, peaches, and cherries, would continue to be the major crops grown. Principal livestock would be dairy cows and beef cattle.

Under the project plan, the Spring Creek Dam and Reservoir would be constructed at a site on Muddy Creek 1 mile about its junction with the North Fork River. The reservoir would have a capacity of 18,000 acre-feet, of which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DEPARTMENT OF THE INTERIOR
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REGION 4
SMITH FORK PROJECT
COLORADO
SCALE OF MILES
DEC 1954
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Hotchkiss
Collbran
NORTH FORK GUNNISON RIVER
GUNNISON RIVER
Smith Fork
Creek
Coal Creek
ASPEN CANAL
SMITH FORK FEEDER CANAL
SMITH FORK DIVERSION DAM
Crawford
CRAWFORD RES
Clear Fork
Mud Creek
Iron Creek
N
EXPLANATION
Potential Project Features
Presently irrigated lands to receive project water
New lands to receive project water
Canal
Reservoir

517-400-11

11,000 acre-feet would be active and 7,000 acre-feet would be reserved for sediment retention and dead storage. The existing Fire Mountain Canal diverting from the North Fork River 5 miles below the Spring Creek Dam would be enlarged and extended. The enlarged canal would be capable of diverting an increased amount of natural streamflow during the early irrigation season and in the late season its supply would be supplemented by water released from the reservoir. In this manner the irrigation water supply for lands under the Fire Mountain Canal would be improved and through its extension the canal would also serve lands on Rogers Mesa that heretofore have been irrigated from Leroux Creek, a tributary of the North Fork River. The Leroux Creek water thus released from Rogers Mesa would be diverted into the higher Overland Canal, which would be improved and enlarged for this purpose, and used to augment the present irrigation supply for lands on Redlands Mesa. Beginning at a point on the Fire Mountain Canal 9 miles below its head, the Minnesota siphon would be constructed to convey part of the water southward 12,000 feet across the North Fork River to the existing Minnesota Canal.

Water supply studies based on records of streamflows as they have occurred in the past indicate that with project development the irrigation supply for project lands would be increased by 18,500 acre-feet annually from direct flows and storage yield. The increase in stream depletion attributable to the development is estimated at an average of 9,000 acre-feet annually.

Land classification surveys indicate that the lands would be suitable for sustained crop production under irrigation farming. Some further detailed classification would be required to confirm the suitability of all the lands, particularly in the Leroux Creek and Minnesota areas.

The project, exclusive of the Minnesota unit, was authorized, under a modification of the above-described plan, by act of Congress on June 25, 1947. Enlargement and extension of the Fire Mountain Canal has been essentially completed under this authorization. Reauthorization of the project, under the revised plan described above, was recommended in the Bureau of Reclamation report on the "Paonia project, Colorado" dated February 1951, a supplement to the Colorado River storage project report dated December 1950.

Results of current (January 1953) Bureau of Reclamation estimates for the physical plan of the project as covered in the Paonia project report of February 1951 are summarized in the attached project summary tabulation.

Summary data, Paonia project, Colorado

Irrigated acreage:	*Acres*
New lands	2,210
Supplemental	14,830
Total	17,040
Principal agricultural production: Alfalfa, grain, apples, peaches, dairy cows, and beef cattle.	
Water supply:	*Acre-feet*
Average annual increase in direct flow diversions	7,500
Average annual increase in storage yield	11,000
Total	18,500
Stream depletion (average annual)	9,000
Project works:	
The construction features include the Spring Creek Dam and Reservoir with 18,000 acre-feet total capacity, enlargement and extension of the Fire Mountain and Overland Canals and the Minnesota siphon. The enlargement and extension of the Fire Mountain Canal is essentially completed under prior project authorization.	
Construction cost and repayment:	
Estimated cost	$8,944,000
Reimbursable cost allocated to irrigation	6,791,600
Nonreimbursable cost allocted to:	
Flood control	74,100
Fish and wildlife	70,800
Recreation	7,500
Total	152,400

N
Leroux Creek
OVERLAND CANAL ENLARGEMENT
Cedaredge
Eckert
65
134
135
Austin
GUNNISON RIVER
NORTH
MINNESOTA SIPHON PUMPING PLANT
FIRE MOUNTAIN CANAL
FIRE MOUNTAIN CANAL EXTENSION
Hotchkiss
92
Hubbard Creek
DELTA CO.
GUNNISON CO.
West Muddy Creek
Muddy Creek
SPRING CREEK RESERVOIR
Bardine
Somerset
Bowie
GUNNISON RIVER
PAONIA
Minnesota Creek
FORK
EXPLANATION
Potential Project Features
Presently irrigated lands to receive project water
New lands to receive project water
Canal
Reservoir
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
PAONIA PROJECT
COLORADO
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SCALE OF MILES
DEC 1954

551-400-65

Summary data, Paonia project, Colorado—Continued

Construction cost and repayment—Continued	
Repayment by:	
Irrigation water users[1]	2,414,000
Power revenues from Colorado River storage project	4,377,600
Total	6,791,600
Annual operation, maintenance, and replacement costs	11,100
Benefit-cost ratio	1.6 to 1

[1] Based on 68-year repayment period as provided under project authorizing act of 1947.

STATEMENT ON FLORIDA PROJECT, COLORADO

The potential Florida project is planned primarily to supply irrigation water to, and thus increase the agricultural production on, 18,950 acres of Florida Mesa and Florida River Valley lands in the upper Colorado River basin in southwestern Colorado. The lands include 12,650 acres presently irrigated with only a partial supply and 6,300 acres presently not irrigated. Approximately 1,000 acres of the land, including 100 acres partially irrigated and 900 acres now unirrigated, are owned by Indians. In addition to irrigation values, the project would provide some enhancement in fish and wildlife values in the area and affect some decrease in flood damages along Florida River.

With project development, the irrigated lands would be utilized largely for the support of livestock enterprises as now practiced in the area. Climatically adaptable crops, such as small grains, alfalfa, hay, pasture, and some pinto beans, potatoes, apples, vegetables, and berries, would be produced. Analyses made indicate that a family-size farm would provide the farm family with a reasonable standard of living, provide employment for the available labor, and permit payment of operation, maintenance, and replacement costs of project facilities and some payment toward the construction costs of project facilities.

Preliminary land classification surveys indicate that project lands would be suitable for sustained production of crops under irrigation farming. Detailed land classification would be required to confirm the suitability of all the lands.

Water supply studies based on records of streamflows as they have occurred in the past indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. The increase in irrigation supply would average 23,200 acre-feet annually including 6,900 acre-feet of direct flows and 16,300 acre-feet of storage water. Water rights for the project could be obtained under Colorado State law.

Construction features of the project would include the Lemon Dam and Reservoir with a total capacity of 23,300 acre-feet to store water on Florida River, construction of a new diversion dam on Florida River at the head of the existing Florida Farmers ditch, enlargement and extension of the existing Florida Farmers ditch diverting from Florida River, and some distribution and drainage facilities. Water would be released from the reservoir as needed and conveyed in the natural river channel to heads of various downstream canals and ditches that would divert the flow for distribution to project lands. A 3- to 4-year period would be required to complete construction of the project.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Florida project, Colorado, dated January 1951, a supplement to the Colorado River storage project report dated December 1950. Results of current (January 1953) Bureau of Reclamation estimates for this project plan are sumarized in the attached project summary tabulation.

Summary data, Florida project, Colorado

Irrigated acreage:

	Indian	Non-Indian	Total
New	900	5,400	6,300
Supplemental	100	12,550	12,650
Total	1,000	17,950	18,950

Principal agricultural production: Alfalfa, grains, dairy cows, and beef.

Water supply:	*Acre-feet*
Average annual increase in direct flow diversions	6,900
Average annual increase in storage yield	16,300
Total	23,200
Stream depletion (annual average)	12,900

Project works:

Construction features include Lemon Dam and Reservoir with a total capacity of 23,300 acre-feet, a diversion dam on Florida River, enlargement and extension of existing Florida Farmers ditch, and some distribution laterals and drains.

Construction costs and repayment:	
Estimated cost	$6,941,500
Reimbursable allocation to irrigation	6,503,600
Nonreimbursable allocation to:	
Fish and wildlife	208,700
Flood control	229,200
Total	437,900
Repayment by:	
Irrigation:	
Non-Indian lands	1,585,500
Indian lands	126,000
Total	1,711,500
Power revenues from Colorado River storage project	4,792,100
Total	6,503,600
Annual operation, maintenance, and replacement costs	12,600
Benefit-cost ratio	1.4 to 1

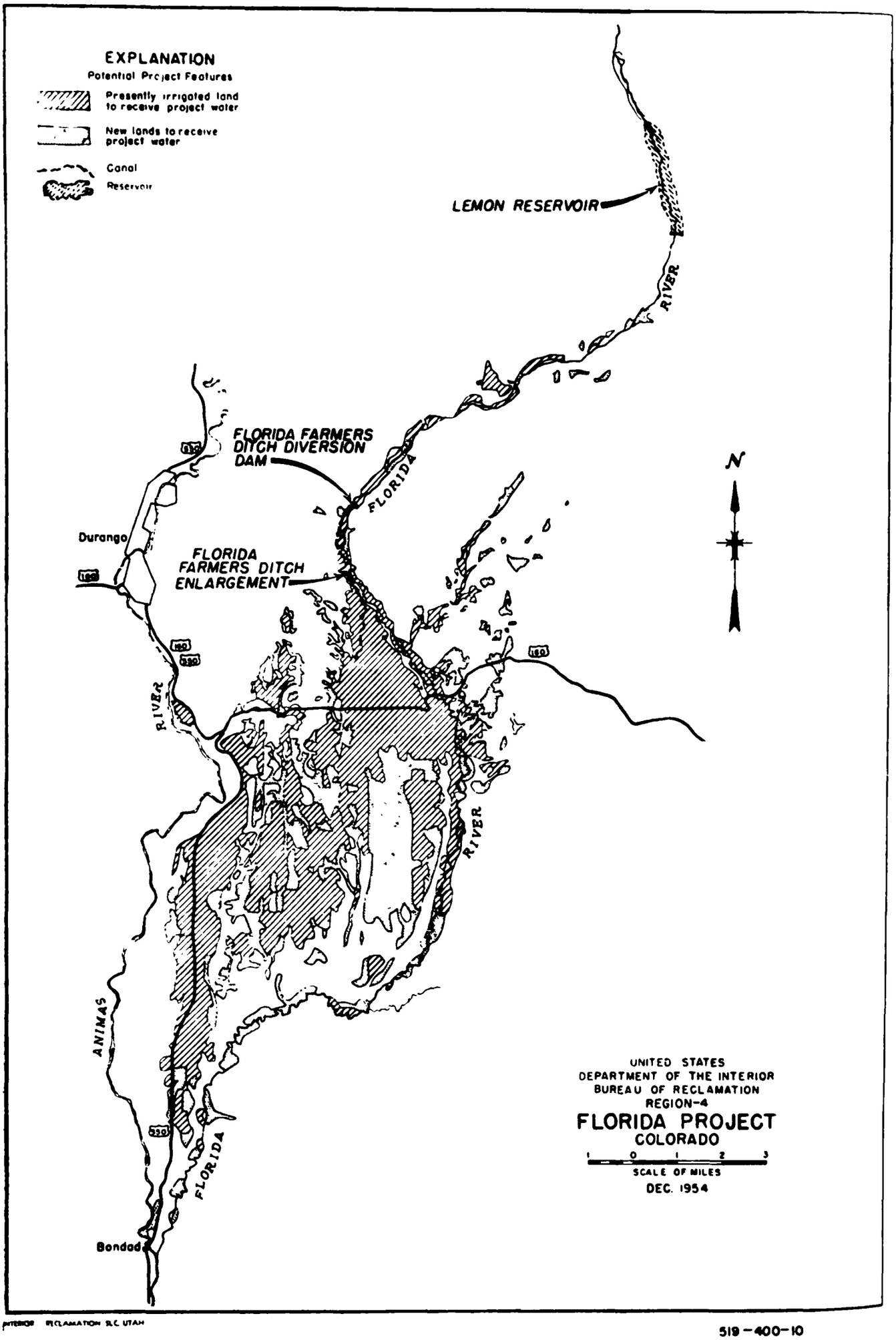
STATEMENT ON PINE RIVER PROJECT EXTENSION, COLORADO AND NEW MEXICO

The potential Pine River project extension would provide distribution canals to deliver water made available by the existing Pine River project to irrigate 15,150 acres of land now unirrigated in southwestern Colorado and northwestern New Mexico. Of this acreage 1,940 acres are within the boundaries of the existing Pine River Indian irrigation project.

The Pine River project, consisting of Vallecito Dam and Reservoir of 126,280 acre-feet active capacity on Pine River, was authorized for construction in 1937 to provide storage water for 69,000 acres and was substantially completed and placed in operation by the Bureau of Reclamation in 1941. About half of the lands to be served were under canals and partially irrigated at the time of construction and now receive supplemental water from Vallecito Reservoir. The remaining lands had no distribution facilities at the time of construction. Facilities for these lands were not included as part of the original project as it was thought that the works required were relatively minor and could be undertaken by the water users with private capital. The required works proved so costly, however, that they have not been privately constructed. As a result, canal systems for the lands that can be economically developed at the present time are planned for Federal construction as the Pine River project extension.

With development of the extension the irrigated lands would be utilized largely for the support of livestock enterprises as now practiced in the general locality. Major crops that would be produced on the extension lands are hay and small grains with some potatoes, pinto beans, and early maturing vegetables, and berries also grown. Principal livestock would be dairy cows and beef cattle.

The project extension would consist of the enlargement and extension of eight major canals and ditches diverting from Pine River, the construction of one new diversion dam on Pine River, and the construction of a number of small distribution laterals. Over half the extension lands would be served by enlargement and extension of the existing King consolidated canal and construction of a new diversion dam at the head of this canal. The other canals and ditches to be enlarged and extended include the Pine River canal and the Myers-Asher, Bennet and Myers, Bear Creek, and Pine River, Sullivan, Shroder



INTERIOR RECLAMATION SLC UTAH

519-400-10

extension, and Thompson Epperson ditches. A period of 3 to 4 years would be required to complete definite plan investigations and construction of the extension works.

Preliminary land classification surveys indicate the extension lands to be suitable for sustained crop production under irrigation farming. A detailed classification is necessary to confirm the suitability of all the lands.

Water-supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate water supply would be available for the development from direct flows and storage water from the existing Vallecito Reservoir. A water right for the project can be obtained under Colorado and New Mexico State laws.

This statement is based on the physical plan of development presented in the report on Pine River project extension, Colorado and New Mexico, dated January 1951—a supplement to the Colorado River storage project report dated December 1950. Results of current (January 1953) Bureau of Reclamation estimates for this development plan are summarized in the attached project summary tabulation.

Summary data, Pine River project extension, Colorado-New Mexico

Irrigated acreage:

	Colorado	New Mexico	Total
New lands:			
Indian	1,940		1,940
Non-Indian	12,580	630	13,210
Total	14,520	630	15,150

Principal agricultural production: Alfalfa, grains, dairy cows and beef.

Water supply:	*Acre-feet*
Average annual increase in direct-flow diversions	31,550
Average annual increase in storage yield	13,900
Total	[1] 45,450

Storage at existing Vallecito Reservoir of 126,280 acre-feet active capacity of which some 20 to 25 percent of such capacity would be available to the Pine River project extension lands.

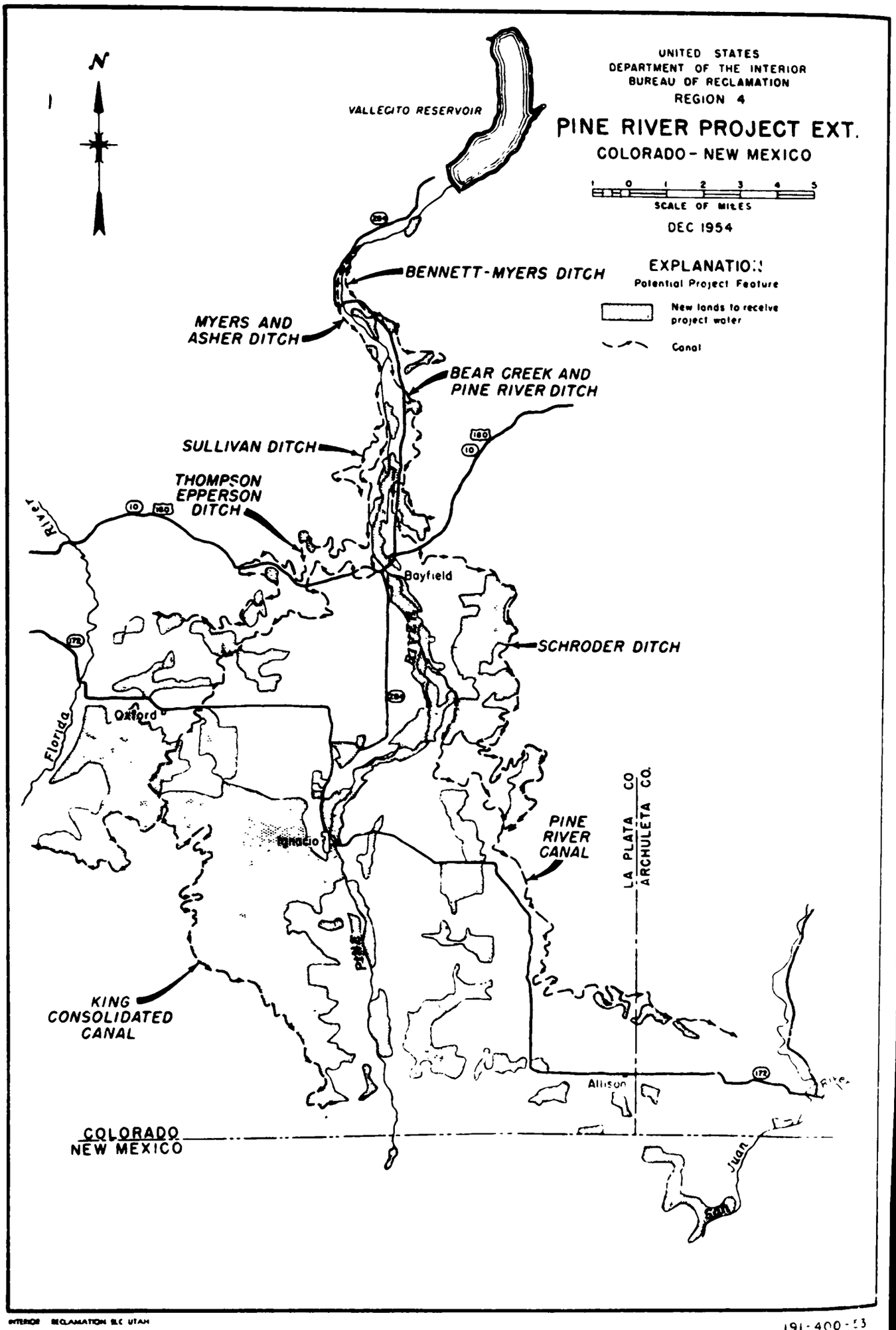
Stream depletion (average annual):	*Acre-feet*
Colorado	27,200
New Mexico	1,100
Total	28,300

Project works:

New construction features include enlargement and extension of eight canals and ditches, a diversion dam, and a number of distribution laterals

Construction cost and repayment:	
Estimated cost	$5,027,000
Reimbursable allocation to irrigation	5,027,000
Nonreimbursable cost allocation	None
Repayment by:	
Irrigation:	
Indian lands	262,000
Non-Indian lands	1,783,000
Subtotal	2,045,000
Power revenues from Colorado River storage project	2,982,000
Total	5,027,000
Annual operation, maintenance, and replacement costs	18,950
Benefit-cost ratio	2.2 to 1

[1] Return flow of 4,250 acre-feet would also be diverted, making a total diversion of water by extension lands of 49,700 acre-feet.



INTERIOR RECLAMATION SLC UTAH

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STATEMENT ON EMERY COUNTY PROJECT, UTAH

The potential Emery County project is planned primarily to improve the irrigation water supply and thus better the agricultural production of 24,080 acres of land in Emery County in east-central Utah near the towns of Huntington, Castle Dale, and Orangeville. The project is in the Green River Basin, a part of the upper Colorado River Basin.

The general type of farming now practiced in the area would be continued with project development. Agriculture would continue to center around the livestock industry with more than 90 percent of the irrigated area producing hay and grains. The increased production in livestock feed would permit increased production on the farm of beef, sheep, pork, and dairy products.

Principal construction features of the project would be Joes Valley Dam and Reservoir, with a total capacity of 57,000 acre-feet, to store water on Cottonwood Creek, the Swasey diversion dam on Cottonwood Creek, 10 miles downstream from Joes Valley, and the 17-mile Cottonwood Creek-Huntington Canal, with an initial capacity of 250 second-feet, heading at the Swasey diversion dam. Some canal laterals and drains would be constructed. Existing irrigation facilities in the area would be utilized as fully as practicable. Recreational facilities would be provided at the Joes Valley Reservoir. A construction period of 3 to 5 years, including completion of definite plan investigations, would be required to complete construction of the project.

The project would make available an average of 31,400 acre-feet of water annually for 24,080 acres of land in Emery County, including 20,450 acres now irrigated with only a partial supply and 3,630 acres not now irrigated. In addition, about 1,000 acre-feet of late-season water annually would be made available by exchange for transmountain diversion to lands in the Bonneville Basin now partially irrigated by the Ephraim and Spring City divisions of the existing Sanpete project. Recreational and scenic attractions at Joes Valley Reservoir site would be developed as planned by the National Park Service.

A preliminary land classification survey indicates that the project lands would be suitable for sustained production of crops under irrigation farming. A detailed classification would be necessary to confirm the suitability of the lands.

Water-supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. Water rights for the project can be obtained under Utah State law.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Emery County project, Utah, dated February 1951, a supplement to the Colorado River storage project report dated December 1950. Results of current (January 1953) Bureau of Reclamation estimates for this project plan are summarized in the attached project summary tabulation.

Summary data, Emery County project, Utah

Irrigated acreage:	
New land	3,630
Supplemental	20,450
Total	24,080
Principal agricultural production: Alfalfa, grain, peaches, vegetables, dairy cows, beef cattle, and sheep.	
Water supply:	*Acre-feet*
Average annual increase in direct flow diversions	3,900
Average annual increase in storage yield	28,500
Total	32,400
Stream depletion (average annual)	15,500
Project works:	
Joes Valley Dam and Reservoir, with a total capacity of 57,000 acre-feet, a diversion dam, the 17-mile Cottonwood Creek-Huntington Canal with 250 second-feet initial capacity, and some canal laterals and drains are the principal construction features.	

Summary data, Emery County project, Utah—Continued

Construction cost and repayment:	
Estimated cost	$9,865,500
Reimbursable cost allocated to irrigation	9,636,500
Nonreimbursable cost allocated to recreation	229,000
Repayment by:	
Irrigation water users	3,715,000
Power revenues from Colorado River storage project	5,921,500
Total	9,636,500
Annual operation, maintenance, and replacement costs:	
Irrigation	21,870
Recreation	15,110
Total	36,980
Benefit-cost ratio	1.38 to 1

Statement on Central Utah Project, Utah

The potential central Utah project would provide for the multiple-purpose use in Utah of water tributary to the Colorado River. Under the general plan of development, streams draining the southern slope of the Uinta Mountains in the Uinta Basin in northeastern Utah would be intercepted and conveyed westerly by gravity flow through the Wasatch Mountains to the Bonneville Basin. The water would be collected by an aqueduct leading to a storage reservoir high in the Wasatch Mountains. From the reservoir the water would drop through a series of hydroelectric powerplants before being used for irrigation, municipal, and industrial purposes. Replacement water and water for additional development in the Uinta Basin would be provided by a major diversion from the Green River and by smaller developments on local streams.

The project would serve an area along the eastern border of the Bonneville Basin. This area, the most highly developed region in Utah, includes the communities of Salt Lake City, Provo, Heber, Spanish Fork, Payson, Nephi, Richfield, Delta, and Fillmore. The flow of small local streams, practically the only source of water, falls far short of irrigation requirements.

In contrast to the Bonneville Basin, the Uinta Basin has abundant water resources as compared with the land resources. Streams flowing south from the Uinta Mountains—the Duchesne River and its major tributaries, together with Ashley Creek and Brush Creek—produce more than ample water for irrigation.

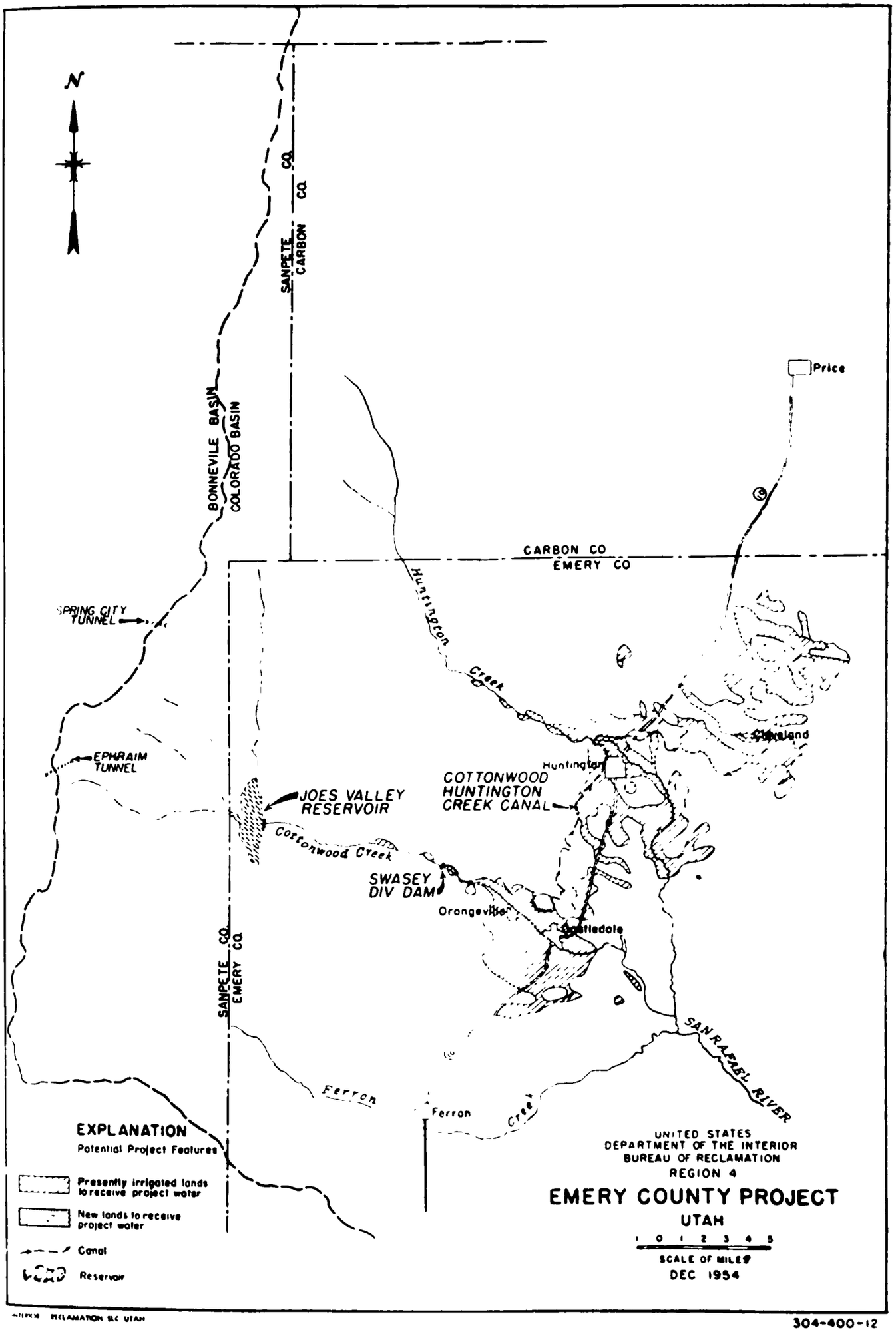
The project is of such magnitude it has been planned in two parts—the initial phase, a unified portion that could be developed and operate independently, and the ultimate phase. The two phases combined made up the comprehensive plan. Detailed investigations have been made only on the initial phase.

INITIAL PHASE OF PROJECT

In the initial phase of the project only Rock Creek and Uinta Mountain streams west of Rock Creek would be diverted into the Bonneville Basin where development would be limited to areas between Salt Lake City and Nephi. Initial phase development in the Uinta Basin would include the Jensen, Vernal, Upalco, and Duchesne River areas.

The initial phase of the project would provide for the irrigation of 28,540 acres of new land and 131,800 acres now irrigated but in need of more water. Full seasonal regulation would be provided for 42,600 acres of land in the Duchesne River area, more than half of which is owned by Indians or has been acquired from them. Forty-eight thousand, eight hundred acre-feet of water would be provided annually for municipal, industrial, and other miscellaneous uses. Powerplants with an installed capacity of 61,000 kilowatts would generate aproximately 373 million kolowatt-hours of electric energy annually. Aproximately 2.2 million kilowatt-hours of energy would be required by the project for irrigation and drainage pumping. Central Utah project powerplants would be interconnected with plants of the Colorado River storage project.

Preliminary land-classification surveys of the project lands indicate that they would be suitable for sustained crop production under irrigation farming.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SANPETE CO
CARBON CO
BONNEVILLE BASIN
COLORADO BASIN
Price
CARBON CO
EMERY CO
SPRING CITY TUNNEL
Huntington Creek
EPHRAIM TUNNEL
JOES VALLEY RESERVOIR
COTTONWOOD HUNTINGTON CREEK CANAL
Huntington
Cleveland
Cottonwood Creek
SWASEY DIV DAM
Orangeville
Castledale
SANPETE CO
EMERY CO
SAN RAFAEL RIVER
Ferron
Ferron Creek
EXPLANATION
Potential Project Features
Presently irrigated lands to receive project water
New lands to receive project water
Canal
Reservoir
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
EMERY COUNTY PROJECT
UTAH
0 1 2 3 4 5
SCALE OF MILES
DEC 1954
RECLAMATION SLC UTAH
304-400-12

The potential Strawberry aqueduct would intercept flows of Rock Creek, Hades Creek, Wolf Creek, West Fork of the Duchesne River, Currant Creek, Layout Creek, and Water Hollow. Reservoirs to regulate inflow to the aqueduct would be provided on Rock Creek (upper Stillwater), West Fork of the Duchesne River (Vat), and Currant Creek (Currant Creek).

The existing Strawberry Reservoir, terminus of the Strawberry aqueduct, would be enlarged through construction of the Soldier Creek Dam.

The existing outlet tunnel from the Strawberry Reservoir would be enlarged Below the tunnel outlet would be constructed the Old West powerplant, Sixth Water aqueduct, Hammock powerplant, Tanner powerplant, Monks Hollow Dam, the Wasatch aqueduct as far as York Ridge near Santaquin, and the Castilla powerplant. The Mona-Nephi Canal would be constructed from York Ridge to Salt Creek near Nephi. The Mona Reservoir would be enlarged, the Elberta Service Pipeline and the existing Elberta Canal would be enlarged to distribute water from Mona Reservoir.

Use of Provo River water through exchange would require Bates Dam on Provo River, Hobble Creek Dam on Little Hobble Creek, the West Valley Canal, and the Front Dam. Provo Bay would be diked and drained and the upper 7 miles of the Jordan River channel would be enlarged.

An exchange of water between the Bates Reservoir and numerous small storage reservoirs on the upper Provo River would be made to provide supplemental water to areas in the vicinity of Francis and Heber City. The Wallsburg area would be served by a similar exchange in Hobble Creek Reservoir. A dam would be constructed creating Round Knoll Lake for recreational and fish and wildlife purposes.

New project works to provide water for replacement and expanded irrigation and munipical use in the Uinta Basin would include Hanna Reservoir on the North Fork of Duchesne River, Starvation Reservoir on Strawberry River with a feeder canal from the Duchesne River, the Upalco Reservoir offstream from Lake Fork River, the Stanaker Reservoir with a feeder canal from Ashley Creek, and the Tyzack Reservoir on Brush Creek.

Construction of some new distribution laterals and drains would be required where existing facilities are not adequate to serve the area and where new lands are developed.

Necessary distribution and treatment facilities for municipal and industrial water within the communities would be constructed and financed by local interests.

Transmission lines for delivery of project power would be constructed to Salt Lake City on the north and to Manti on the south.

Facilities would be constructed for development of fish and wildlife, recreation, and forest resources in general as recommended.

Features would be constructed in an orderly sequence and as water became available irrigation development would be undertaken at different times in 13 areas or blocks, extending over a 13-year period, municipal and industrial water would be supplied in 3 different areas with construction extending over a 7-year period and construction of the 4 hydroelectric plants would require 8 years before reaching full production.

The operation of various existing facilities would require modification for correlation with the construction and operation of works planned for the central Utah project. Among the principal features in the Bonneville Basin affected would be the Strawberry Reservoir outlet tunnel, canals, and powerplants of the Strawberry Valley project; Deer Creek Reservoir, Provo Reservoir Canal, and Salt Lake aqueduct of the Provo River project; Utah Lake; and Mono Reservoir. Principal facilities in the Uinta Basin similarly affected would include Strawberry Reservoir of the Strawberry Valley project, Moon Lake and Midview Reservoirs and canals of the Moon Lake project, works of the Uinta Indian irrigation project, and various other structures on the Duchesne River, Ashley Creek, and Brush Creek systems. There would be a minor effect on some public and private power facilities in both basins.

This statement on the central Utah project, except as otherwise noted in the following paragraphs, is based on the physical plan of development presented in the Bureau of Reclamation report on Central Utah Project, Utah, dated February 1951, a supplement to the Colorado River Storage project report dated December 1950. Significant modifications may be found in the project plan during the definite planning stage of the investigation.

Since preparation of the 1951 report, the communities in eastern Duchesne County have constructed a municipal water pipeline and this feature would therefore be excluded from the project. As a result of eliminating the pipeline, about 2,300 acre-feet of Upalco Reservoir water is considered as a supplemental supply to 2,300 additional acres of land in the Upalco area. A refinement of the water supply studies for lands in the Duchesne River area—Indian and white owned—shows that 4,070 acres of "white lands" formerly considered as receiving replacement water would receive supplemental water instead. Allowances for these revisions in plan are incorporated in the results of current estimates as shown on page 6.

Results of current (January 1953) estimates are shown on the following two summary data sheets.

Summary data, Central Utah project initial phase, Utah

Irrigated acreage:

New land	28,540
Supplemental	131,840
Total	160,380

Principal agricultural production:

Alfalfa, grain, fruit, vegetables, sugar beets, tomatoes, dairy cows, beef cattle, and sheep.

Water supply: Average annual increase in supply (acre-feet):

Purpose	Uinta Basin	Bonneville Basin	Total
Irrigation:			
Direct flow		None	
Return flow and salvage		31,500	
Storage yield		97,500	
Subtotal	[1] 46,200	129,000	175,000
Municipal and industrial:			
Direct flow		None	
Storage		44,300	
Subtotal	[1] 4,500	44,300	48,800
Project summary:			
Direct flow		None	
Return flow and salvage		31,500	
Storage yield		141,800	
Total	[1] 50,700	173,300	224,000
Stream depletion (Colorado River)	47,600	141,800	189,400

[1] Water supplied by direct flow and storage.

Project works:

The principal project features would include construction of the 36.8-mile long Strawberry aqueduct along the south slope of the Uinta Mountains intercepting Uinta Basin streams as far east as Rock Creek, enlargement of the Strawberry Reservoir through construction of the Soldier Creek Dam, an enlargement of the Strawberry Reservoir tunnel, 4 powerplants with a combined generating capacity of 61,000 kilowatts, numerous reservoirs including 5 with capacities over 30,000 acre-feet:

Total Capacity

	Acre-feet
Starvation Reservoir	160,000
Upper Stillwater Reservoir	31,500
Strawberry Reservoir	1,370,000
Stanaker Reservoir	37,000
Bates Reservoir	65,000

Summary data, Central Utah project initial phase, Utah—Continued

Project works—Continued

Aqueducts (including the 28.4-mile long Wasatch), and canals and distribution systems as necessary to deliver and utilize the increased water supply. Drainage would be provided when necessary.

Construction cost and repayment-initial phase:

Estimated cost:	$231,044,000
Reimbursable cost allocated to:	
Irrigation	127,354,000
Power	46,699,000
Municipal and industrial water	45,500,000
Ultimate development	5,500,000
Total	225,053,000
Nonreimbursable cost allocated to:	
Flood control	3,113,000
Recreation	2,830,000
Forest resource development	48,000
Total	5,991,000
Repayment of reimbursable costs by:	
Irrigation costs:	
From water users	15,191,000
From central Utah project power revenue	[1] 27,838,000
From Colorado River storage project power revenues	[2] 84,325,000
Total	127,354,000
Power costs from project power revenues	46,699,000
Municipal and industrial water costs by users	45,500,000
Total repayment	219,553,000
Annual operation, maintenance, and replacement costs:	
Irrigation	253,930
Power	445,900
Municipal and industrial water	69,160
Total	768,990
Benefit-cost ratio	1.23 to 1

[1] Available from net power revenues from central Utah project powerplants over a 17-year period following payment of CUP power costs but prior to the end of the 50-year repayment period on the last irrigation block.

[2] A 1-mill tax under the Utah Water Conservancy Act could appreciably reduce this amount.

THE COMPREHENSIVE PLAN

When fully developed the Central Utah project would provide a full irrigation water supply for 200,000 acres of new land, a supplemental supply for 239,900 acres now inadequately irrigated, and 48,800 acre-feet of water to meet foreseeable demands for municipal, industrial, and other miscellaneuos purposes. Project powerplants would have an installed capacity of 249,000 kilowatts and generate almost 1.2 billion kilowatt-hours of electric energy annually. Additional power potentialities exist and will be evaluated as the investigations progress.

The flow of all important streams on the south slope of the Uinta Mountains would be intercepted by the potential 110-mile aqueduct and conveyed to the Strawberry Reservoir. The flow of Carter Creek on the Uintas' northern slope would be brought to the southern slope. The western 36.8 miles of the

aqueduct, extending from Rock Creek to the Strawberry Reservoir, would consist of two parallel bores.

Water would be released from the Strawberry Reservoir to the Bonneville Basin through two tunnels. In its 12-mile descent to the Bonneville Basin floor, a drop of about 2,600 feet, the water, including the water of the existing Strawberry Valley project, would pass through a series of hydroelectric powerplants, and then would be divided, part continuing to the south and part being diverted to the north.

During the irrigation season the water continuing south would be distributed for irrigation and other purposes in areas as far south as Fillmore. During the nonirrigation season water used through the powerplants and continuing south would be stored in the Dyer Reservoir for irrigation of the lands in the vicinity of Fillmore. Water of the Sevier River could be stored in existing reservoirs by exchange and used for irrigation of lands along the upper reaches of the river, principally near Richfield and on the lower reaches near Delta.

Water diverted during the irrigation season to the north would be used for irrigation and other purposes in the area from Santaquin to Springville now partially served by the Strawberry Valley project. During the nonirrigation season releases would flow down Spanish Fork River to Utah Lake, replacing Provo River water stored in the potential Bates Reservoir on the Provo River and the potential Hobble Creek Reservoir, a tributary. Project water stored in Bates and Wallsburg Reservoir would be used for irrigation, municipal, and industrial purposes in the Heber-Francis-Wallsburg areas and in the Provo-Salt Lake City region as well as the western part of the Jordan River Valley.

Where practicable the project reservoirs would impound water for recreational and fish and wildlife purposes, thus providing partial compensation for damages to these purposes.

A dike would be constructed across the mouth of Provo Bay, an arm of Utah Lake, and the bay drained, reducing evaporation losses and reclaiming 9,340 acres of land. The diking of Goshen Bay of Utah Lake, authorized as a part of the Provo River project but not yet undertaken, would permit the south 26,000 acres of Utah Lake to be drained, reducing the average annual evaporation by 60,000 acre-feet.

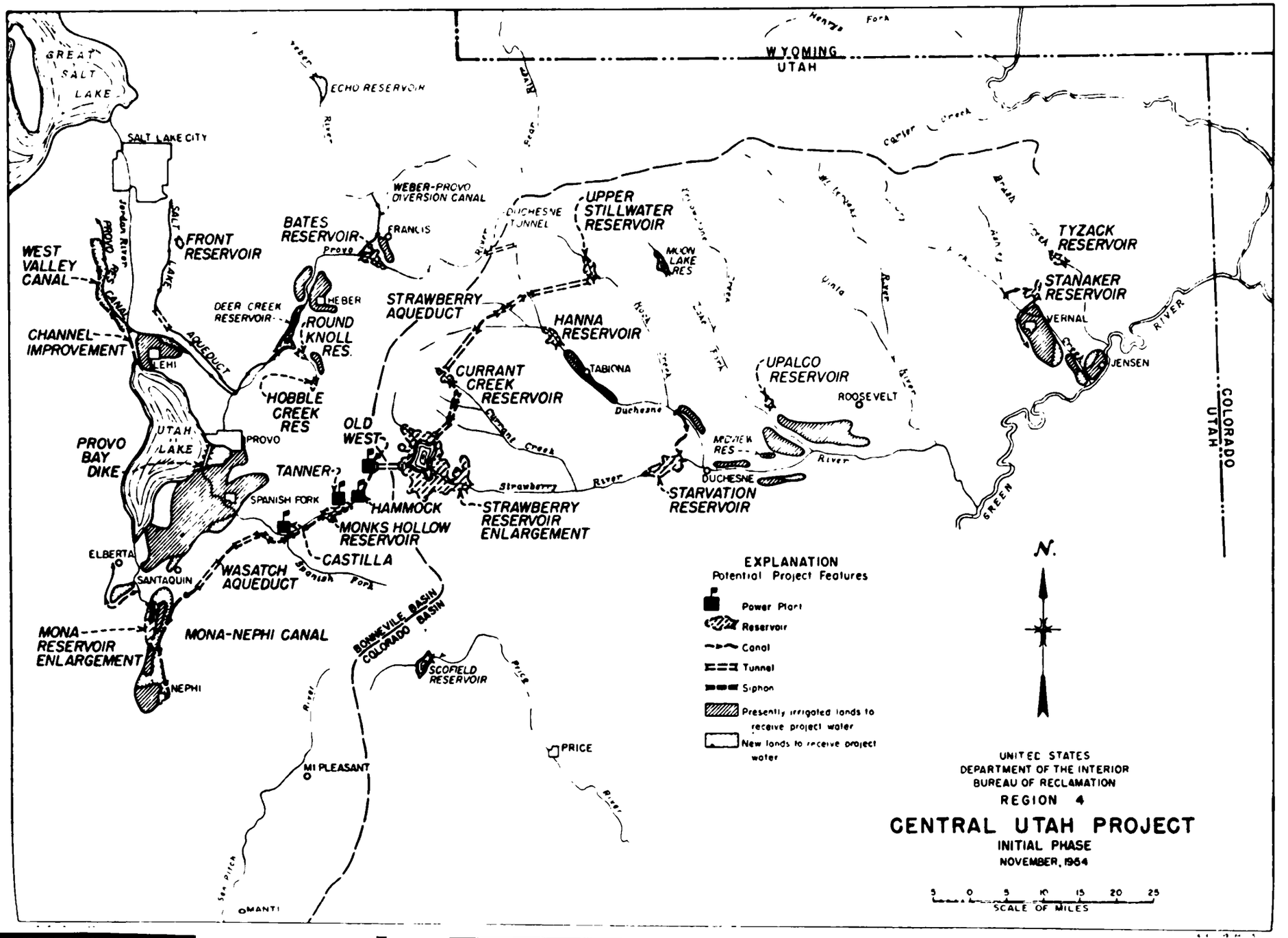
A 7-mile section of the Jordan River channel between Utah Lake and Jordan Narrows would be enlarged. The channel improvement was authorized as a part of the Provo River project. Improvement of the river channel from Jordan Narrows to Great Salt Lake is being investigated by the Corps of Engineers.

In order to replace water now used in the Uinta Basin that would be exported and to provide additional water for further development within this basin, water would be diverted from the Flaming Gorge Reservoir that would be constructed on the Green River as a feature of the Colorado River storage project. Under an alternative plan of development Green River water could be supplied to the Uinta Basin from Echo Park Reservoir, another potential feature of the Colorado River storage project and would be pumped an average lift of 170 feet.

Project powerplants and transmission systems would be interconnected with the system proposed for transmission of electric energy produced by plants of the Colorado River storage project.

Rights to flows of Uinta Basin streams have been acquired by both white settlers and Indians. The Central Utah project would largely control the Uinta Basin's surplus waters. Much of the water would be exported, but that needed for further development in the Uinta Basin would be provided directly from the Green River.

Annual depletions to the Colorado River at the sites of use are expected to average 800,600 acre-feet, or one-half of the water available to Utah under the terms of the upper Colorado River Basin compact.


GREAT SALT LAKE
SALT LAKE CITY
ECHO RESERVOIR
WYOMING
UTAH
WEBER-PROVO DIVERSION CANAL
BATES RESERVOIR
FRANCIS
DUCHESNE TUNNEL
UPPER STILLWATER RESERVOIR
MOON LAKE RES
TYZACK RESERVOIR
STANAKER RESERVOIR
VERNAL
JENSEN
WEST VALLEY CANAL
FRONT RESERVOIR
DEER CREEK RESERVOIR
HEBER
ROUND KNOLL RES.
STRAWBERRY AQUEDUCT
HANNA RESERVOIR
CHANNEL IMPROVEMENT
LEHI
AQUEDUCT
CURRANT CREEK RESERVOIR
TABIONA
UPALCO RESERVOIR
ROOSEVELT
HOBBLE CREEK RES
OLD WEST
PROVO
UTAH LAKE
PROVO BAY DIKE
TANNER
SPANISH FORK
HAMMOCK
STRAWBERRY RESERVOIR ENLARGEMENT
STARVATION RESERVOIR
DUCHESNE
MONKS HOLLOW RESERVOIR
CASTILLA
ELBERTA
SANTAQUIN
WASATCH AQUEDUCT
MONA RESERVOIR ENLARGEMENT
MONA-NEPHI CANAL
NEPHI
BONNEVILLE BASIN
COLORADO BASIN
SCOFIELD RESERVOIR
PRICE
MT PLEASANT
MANTI
COLORADO
UTAH
GREEN RIVER
EXPLANATION
Potential Project Features
Power Plant
Reservoir
Canal
Tunnel
Siphon
Presently irrigated lands to receive project water
New lands to receive project water
N.
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
CENTRAL UTAH PROJECT
INITIAL PHASE
NOVEMBER, 1964
5 0 5 10 15 20 25
SCALE OF MILES

STATEMENT ON HAMMOND PROJECT, NEW MEXICO

The potential Hammond project would divert waters of San Juan River to provide an irrigation supply for 3,670 acres of arable land now unirrigated. The lands lie along the south side of the river in a narrow 20-mile strip opposite the towns of Blanco, Bloomfield, and Farmington, in northwestern New Mexico.

The principal crops that would be grown on the lands with project development would be alfalfa, apples, corn, beans, and barley. Most of the farms are of the fruit-crop and dairy-field crop types.

Preliminary land classification surveys indicate that the lands would be suitable for sustained crop production under irrigation farming. A detailed classification would be necessary to confirm the suitability of all the lands.

Water supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply of 18,400 acre-feet annually would be available for the project from direct flows with permissible shortages occurring in occasional drought years. A water right for the project can be obtained under New Mexico State law.

Project works would include the Hammond diversion dam on San Juan River, a 28-mile mail gravity canal, a hydraulic turbine-driven pumping plant, the East Highline lateral, the West Highline lateral, minor distribution ditches, and a drainage system. A period of about 2 or 3 years would be required to complete definite plan investigations and construction of project works except the drains. A few years' operation of the project would be necessary to determine the extent of drainage actually required.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Hammond project, New Mexico, dated November 1950, a supplement to the Colorado River storage project report dated December 1950. Results of current (January 1953) estimates for this project plan are summarized in the attached project summary tabulation.

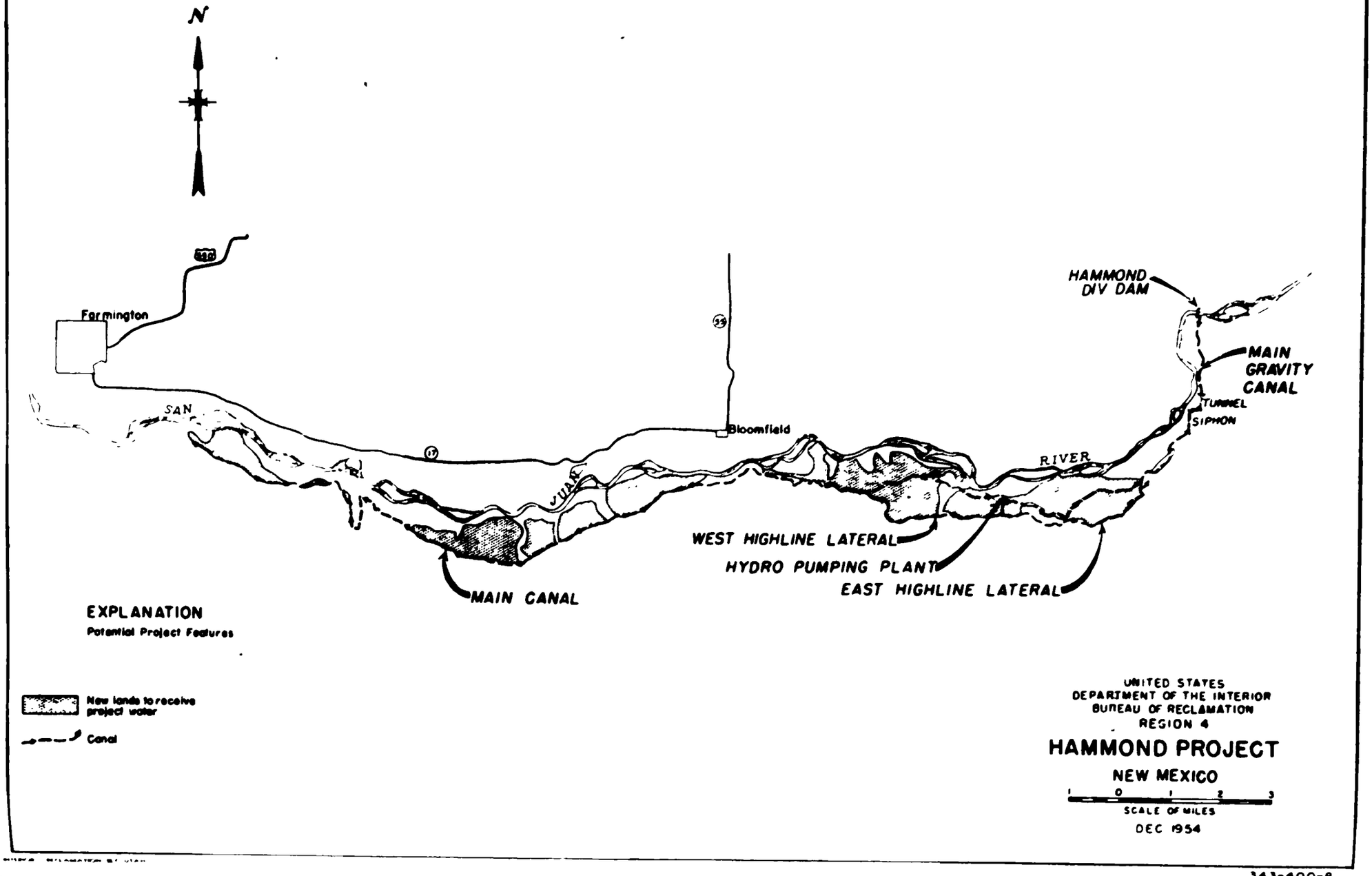
Studies of the potenial nearby Navajo project subsequent to 1950 indicate that it might be found desirable to materially modify the plan for serving the Hammond project lands during the definite plan investigations.

Summary data, Hammond project, New Mexico

Irrigated acreage: New land, 3,670 acres.

Principal agricultural production: Alfalfa, grains, beans, some fruit; dairy cows and sheep.

Water supply:	*Acre-feet*
Average annual increase in direct flow diversion	18,400
Average annual increase in storage yield	None
Stream depletion (average annual)	7,900
Project works:	
Construction features include Hammond diversion dam on San Juan River, a 28-mile 86-second-foot main gravity canal, a small hydraulic turbine-driven pump, distribution laterals, and drains.	
Construction cost and repayment:	
Estimated cost	$2,302,000
Reimmburable allocation to irrigation	2,302,000
Nonreimbursable allocation	None
Repayment by—	
Irrigation water users	370,000
Power revenues from Colorado River storage project	1,932,000
Total	2,302,000
Annual operation, maintenance, and replacement costs	16,100
Benefit-cost ratio	2.8 to 1


N
Farmington
SAN
Bloomfield
HAMMOND DIV DAM
MAIN GRAVITY CANAL
TUNNEL
SIPHON
RIVER
WEST HIGHLINE LATERAL
HYDRO PUMPING PLANT
EAST HIGHLINE LATERAL
MAIN CANAL
EXPLANATION
Potential Project Features
New lands to receive project water
Canal
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
HAMMOND PROJECT
NEW MEXICO
SCALE OF MILES
DEC 1954
343-400-8

STATEMENT ON EDEN PROJECT, WYOMING

When completed the Eden project in southwestern Wyoming will divert water from the Big and Little Sandy Creeks in the upper Colorado River Basin to irrigate 10,660 acres of arable lands not now irrigated and will replace or otherwise rehabilitate the major features of the irrigation system that heretofore was utilized to irrigate 9,540 acres.

Climatically adapted crops in the area, such as alfalfa, pasture grasses, and small grains, will be produced on the project lands largely in conjunction with livestock operations centered around dairy cows, beef, and farm flocks of sheep and of chickens.

Construction of the Eden project was originally approved by the President on September 18, 1940, as a water conservation and utilization project under the act of August 11, 1939 (53 Stat. 1418). Work on the project was about 16 percent completed when stopped by order of the War Production Board in December 1942. Completion of the project was subsequently authorized by act of June 28, 1949 (Public Law 132, 81st Cong., 1st sess.). Construction of the project under the latter authorization is now well advanced with two major features of the project already completed and work currently under way on some of the other project features. The latter act provided for "such modification in the physical features as the Secretary of the Interior may find will result in greater engineering and economic feasibility: *Provided*, That of the construction costs of the irrigation features of the project not less than $1,500,000 for the project of twenty thousand irrigable acres, or a proportionate part thereof based on the actual irrigable area as determined and announced by the Secretary of the Interior upon completion of the project, shall be reimbursed by the water users in not to exceed sixty years. * * * *Provided further*, That construction costs of the irrigation features of the project which are not hereby made reimbursable by the water users shall be set aside in a special account against which net revenues derived from the sale of power generated at the hydroelectric plants of the Colorado River Storage project in the Upper Basin shall be charged when such plants are constructed."

The current plan of the project is covered in a definite plan report prepared by the Bureau of Reclamation and dated May 1953. Construction features of the project include:

Big Sandy Dam and dikes (now completed) on Big Sandy Creek to form Big Sandy Reservoir of 39,700 acre-feet total storage capacity.

Means Canal (now completed) to convey water from Big Sandy Reservoir to the West Side lateral and to the existing Eden Canal.

West Side lateral to serve lands on the west side of Big Sandy Creek.

Eden Creek enlargement and relocation below the terminus of the Means Canal to serve lands east of Big Sandy Creek.

Little Sandy Canal rehabilitation and extension to connect with the upper section of the Eden Canal.

Enlargement of existing lateral system served by Eden Canal to serve both presently irrigated and new lands under that canal.

Project drainage system.

A detailed classification survey shows the lands of the project to be suitable for sustained crop production under irrigation farming.

Water supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply would be available for the project area from direct flows and storage with permissible shortages in occasional drought years.

Project construction costs based on January 1953 prices are estimated at $7,287,000. The project repayment was established by the project authorizing act of June 28, 1949, as $1,500,000 to be repaid over 60 years. This amount deducted from total project costs leaves $5,787,000 to be repaid from Colorado River storage project net power revenues under the general repayment plan of the latter project and in accordance with the Eden project authorizing act of 1949.

Data on the project are summarized in the attached tabulation.

Summary data, Eden project, Wyoming

Irrigated acreage:	*Acres*
New land	10,660
Supplemental	9,540
Total	20,200
Principal agricultural production: Hay, pasture, dairy cows, sheep, beef.	
Water supply:	*Acre-feet*
Increase in average annual direct flow diversions	39,600
Increase in average annual storage yield	20,400
Total	60,000
Stream depletion (average annual)	32,400
Project works:	
Construction features include the Big Sandy Dam, Dikes, and Reservoir with 39,700 acre-feet total storage capacity (now completed), Means Canal (now completed) laterals and improvements in existing distribution system, along with drainage to serve the project area.	
Construction costs and repayment:	
Estimated cost	$7,287,000
Reimbursable cost allocated to irrigation	7,287,000
Nonreimbursable cost	None
Repayment by:	
Irrigation [1]	1,500,000
Power revenues from colorado River storage project	5,787,000
Total	7,287,000
Annual operation, maintenance, and replacement costs	40,400
Benefit-cost ratio	1.3 to 1

[1] Based on 60-year repayment period as provided under project authorizing act of 1949

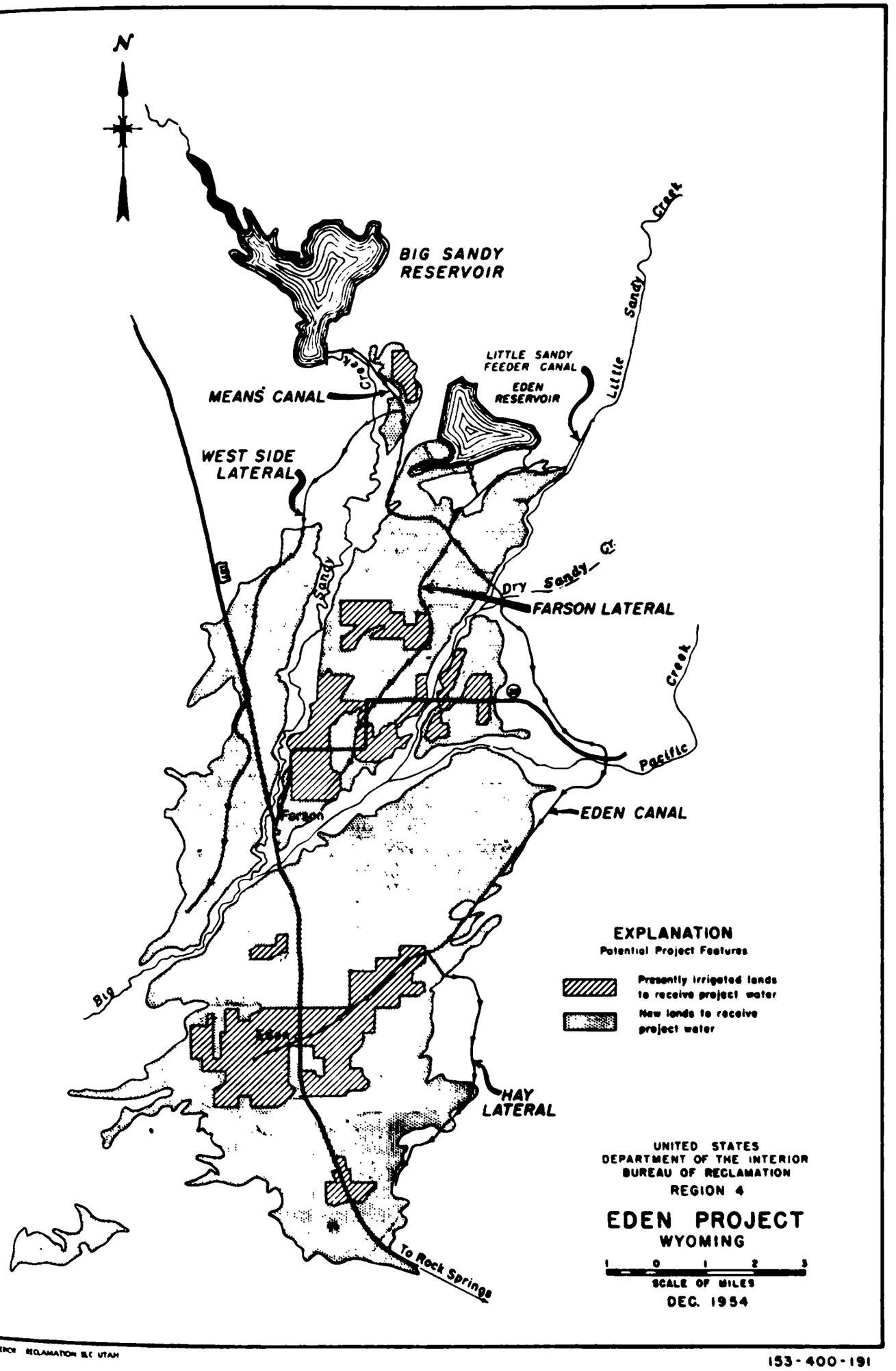
STATEMENT ON CURECANTI UNIT, COLORADO, OF COLORADO RIVER STORAGE PROJECT

(Modified plan)

The Curecanti unit of the Colorado River storage project is located on Gunnison River, a tributary of the Colorado River, in west-central Colorado. The report of the Colorado River storage project and participating projects of December 1950 included plans for development of the Curecanti and Crystal Reservoirs and powerplants. The Curecanti unit recommended in that report was for a reservoir capacity of 2,500,000 acre-feet. The State of Colorado requested that the reservoir water surface is limited to elevation 7,520 or a capacity of 940,000 acre-feet. As a result the committee reports on the bills before the last session of the Congress contained the recommendation of the State of Colorado that the Curecanti unit be limited accordingly. Since the cost of power produced by the smaller dam was somewhat higher than the cost of power produced by alternate means, we have endeavored to work out a plan for improving the economic feasibility of this unit.

Reconnaissance studies of a modified plan are now well advanced and indicate that a greater and more economical utilization of the power resources on the Gunnison River could be made by adding two dams and powerplants between the Curecanti and Crystal Reservoir sites. The resulting unit would consist of an integrated system of four dams and powerplants. It is planned primarily for hydroelectric development and would also provide benefits from flood control, recreation, and ultimately from irrigation and other uses dependent upon river regulation or replacement storage. The reservoirs would extend some 40 miles along a section of the Gunnison River between the town of Gunnison and the Black Canyon National Monument but would lie above and outside the boundary of the monument. Each of the features included in the unit under the modified plan would be dependent for maximum economy upon other features of the unit, and each feature would be justified economically for inclusion in the unit.

The Curecanti Reservoir would be formed by the Blue Mesa Dam. It would be the largest and uppermost of the four reservoirs in the system and would provide the major portion of the system's stream regulation. The three downstream reservoirs referred to as the Narrow Gauge, Morrow Point, and Crystal Reservoirs, in that order, would be primarily for development of power head with only nomi-



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nal active storage capacities. Sufficient active capacity, however, would be provided at the Morrow Point site for some seasonal regulation of stream inflows below Blue Mesa Dam. Small amounts of active capacity would also be necessary at the three downstream sites for successive reregulation of releases from upstream reservoirs to permit flexibility of power production in conformance with power load patterns. Releases from the Crystal Reservoir, the lowest site in the system, would be maintained to provide optimum use of water downstream for irrigation and other uses in addition to generation of power at the Crystal site.

Physical data and estimated reconnaissance construction costs of the principal features in the unit are shown below:

Dam and powerplant or other feature	Height of dam above stream bed (feet)	Reservoir capacity (acre-feet)		Installed generating capacity (kilowatts)	Estimated construction cost of dam and powerplants (July 1951 prices)
		Total	Active		
Blue Mesa	350	940,000	740,000	51,000	$36,500,000
Narrow Gauge	135	8,000	1,000	18,000	9,100,000
Morrow Point	260	82,000	42,000	60,000	20,700,000
Crystal	155	9,000	1,000	23,000	10,700,000
Transmission system					11,500,000
Total	900	1,039,000	784,000	152,000	88,500,000

Operation, maintenance, and replacement costs for the unit are estimated at a total of $863,000 annually.

Stream depletion (reservoir evaporation) attributable to development of the unit would total approximately 17,000 acre-feet annually.

An average of approximately 615 million kilowatt-hours of energy deliverable to power load centers after allowing for transmission losses would be produced annually. Of the total, about 213 million kilowatt hours would be produced at the Blue Mesa powerplant. Market studies show that the potential power could be marketed within a reasonable period after completion of construction. The plan is adaptable to scheduling construction of the dams and powerplants to conform in general with growing market conditions. The most practical initial construction of the unit would probably include the Blue Mesa Dam (Curecanti Reservoir) and powerplant with the other dams and powerplants added later consistent with power load growth.

All of the flows of the Gunnison River would not be controlled by the reservoirs of the unit. Flows of flood magnitude, however, could be reduced and much of the flood damage along the river under present conditions would be reduced. The Corps of Engineers has tentatively estimated that flood-control benefits would amount to $10,000 annually. The National Park Service has tentatively estimated that the recreational value of Curecanti Reservoir would amount to about $20,000 annually if adequate recreational facilities were provided. No evaluation of the recreational potentialities of the other three reservoirs has been made. The Fish and Wildlife Service is presently studying effects of the potential development on fish and wildlife values. No monetary appraisal has yet been made, but the studies made by the Service to date indicate that the development would have an adverse effect on present fish and wildlife values. The Service is therefore opposed to the development.

The following criteria and assumptions were used in the preliminary reconnaissance appraisal of the unit:

(*a*) Only direct power benefits are considered.

(*b*) No allocation of costs is made at this time to river regulation for future irrigation and other consumptive uses.

(*c*) Costs of the unit and of alternative steam power for comparative purposes are based on amortizing costs with an interest rate of 2.5 percent over a 50-year period of analysis. Taxes are not included in the analysis.

(*d*) Average firm-energy production deliverable to load centers is based on estimated 20-year depleted streamflows for the 1931–44 streamflow conditions and estimated power-transmission losses.

(*e*) Present worth of the estimated salvage value at the end of 50 years was deducted from construction costs in computing the benefit-cost ratio.

(*f*) Delta, Montrose, Grand Junction, Nucla, and Gunnison, Colo., were assumed as power market-load centers for the study.

General results of the reconnaissance appraisal on the above basis for the Curecanti Reservoir and Blue Mesa Dam and powerplant alone and for the overall Curecanti unit are summarized below.

	Scale of development	
	Curecanti Reservoir, Blue Mesa Dam, and powerplant alone	Curecanti unit (4 dams and powerplants)
Average cost per kilowatt-hour	9.4 mills	6.5 mills.
Cost per kilowatt-hour of alternative steam power	9.0 mills	8.3 mills.
Benefit-cost ratio	1.1 to 1	1.4 to 1.

Although the reconnaissance studies indicate that the Blue Mesa powerplant when considered alone would have a benefit-cost ratio slightly greater than unity if allowance is made for salvage value, the average cost of energy would slightly exceed the cost of alternative steam power. On the other hand, the benefit-cost ratio for the overall Curecanti unit would be well over unity and the average cost of energy would be 22 percent less than the cost of alternative steam power.

Detailed studies are necessary to refine the economic scale of development and to confirm the present reconnaissance apprasial.

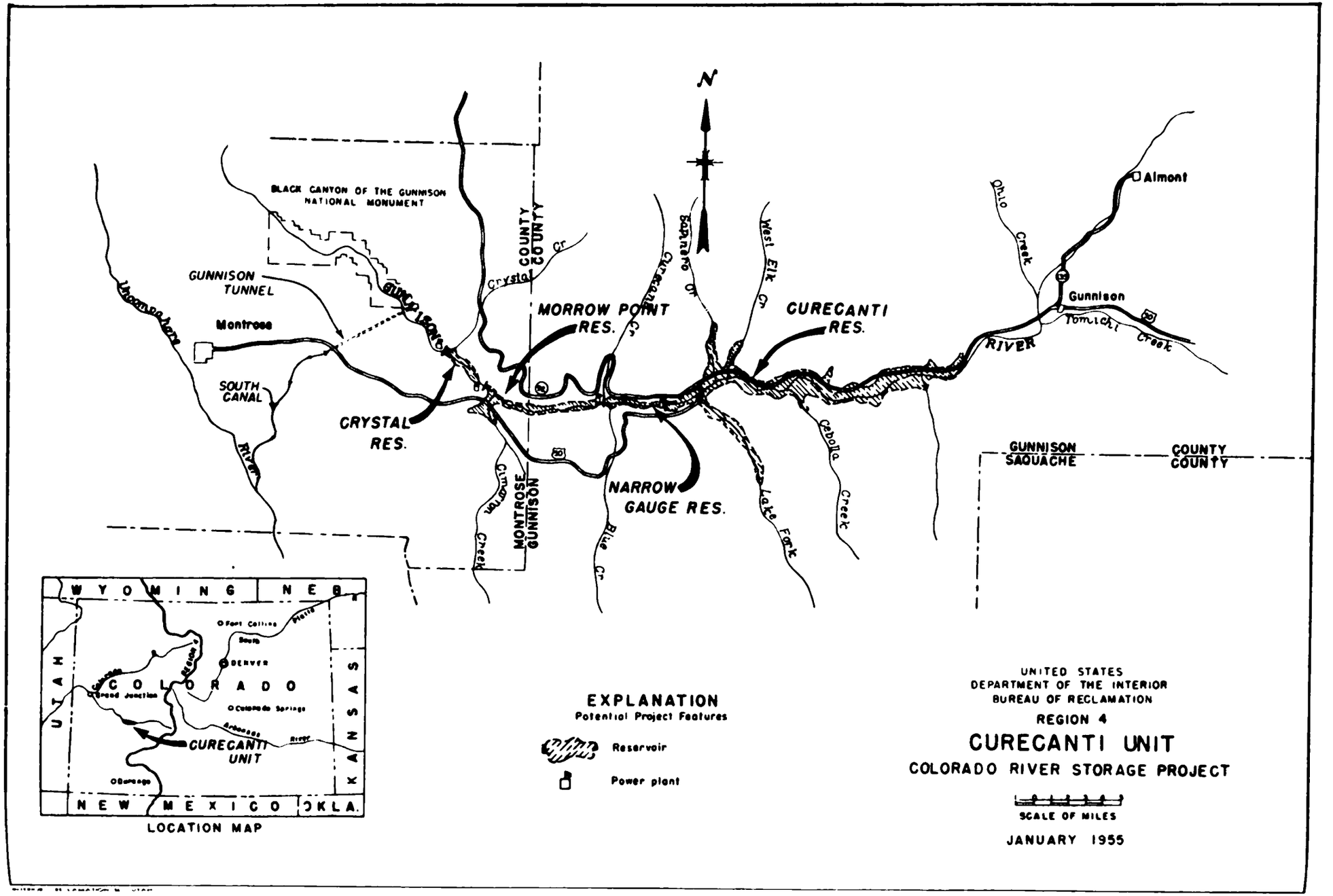
Statement on Gooseberry Project, Utah

The potential Gooseberry project would divert water from a headwater tributary in the Colorado River Basin to improve the irrigation water supply and thus the agricultural production, of 16,400 acres of arable lands in the Bonneville Basin in Sanpete County, central Utah. The project would also enchance recreational values for the population in the general vicinity of the project. A small net loss would probably result in fish and wildlife values. A net benefit to forest resource development would result from relocation of roads in connection with construction of project storage facilities.

The general type of farming now practiced in the area would be continued with project development. Agriculture would continue to center around the livestock industry with more than 95 percent of the irrigated area producing alfalfa, pasture, and small grains for livestock feed. Principal livestock would include dairy cows, beef cattle, and sheep.

Under the project plan surplus flows of Gooseberry Creek would be regulated at the 17,200 acre-foot capacity reservoir that would be constructed at the Mammoth site on the creek and would then be conveyed in the potential 2.4-mile Mammoth tunnel through the Colorado-Bonneville Basin Divide to Cottonwood Creek. The water would be diverted from Cottonwood Creek into existing canals and the potential Gooseberry Highline Canal for conveyance to project lands. The water would be distributed to individual farm tracts by existing laterals that would be rehabilitated as necessary as a part of the project development. Usable return flow would be collected in natural channels that would be cleaned and improved as part of the project. Drains would be provided for land with a high water table and the San Pitch River channel would be improved as necessary to provide an outlet for the drainage system. Boating, camping, and picnicking facilities would be provided at Mammoth Reservoir as recreational features of the project. As part of the reservoir construction, 3 miles of forest roads and sheep corral would be relocated and 2 miles of connecting roads would be constructed. A 3- to 5-year period would be required to complete construction of the project.

Water-supply studies based on records of streamflows as they have occurred in the past indicate that with project development the irrigation supply for project lands would be increased by an average of 14,000 acre-feet annually including 11,700 acre-feet of direct diversion of storage water and an increase of 2,300 acre-feet of usable return flows. Water rights for the project can be obtained under Utah State law.

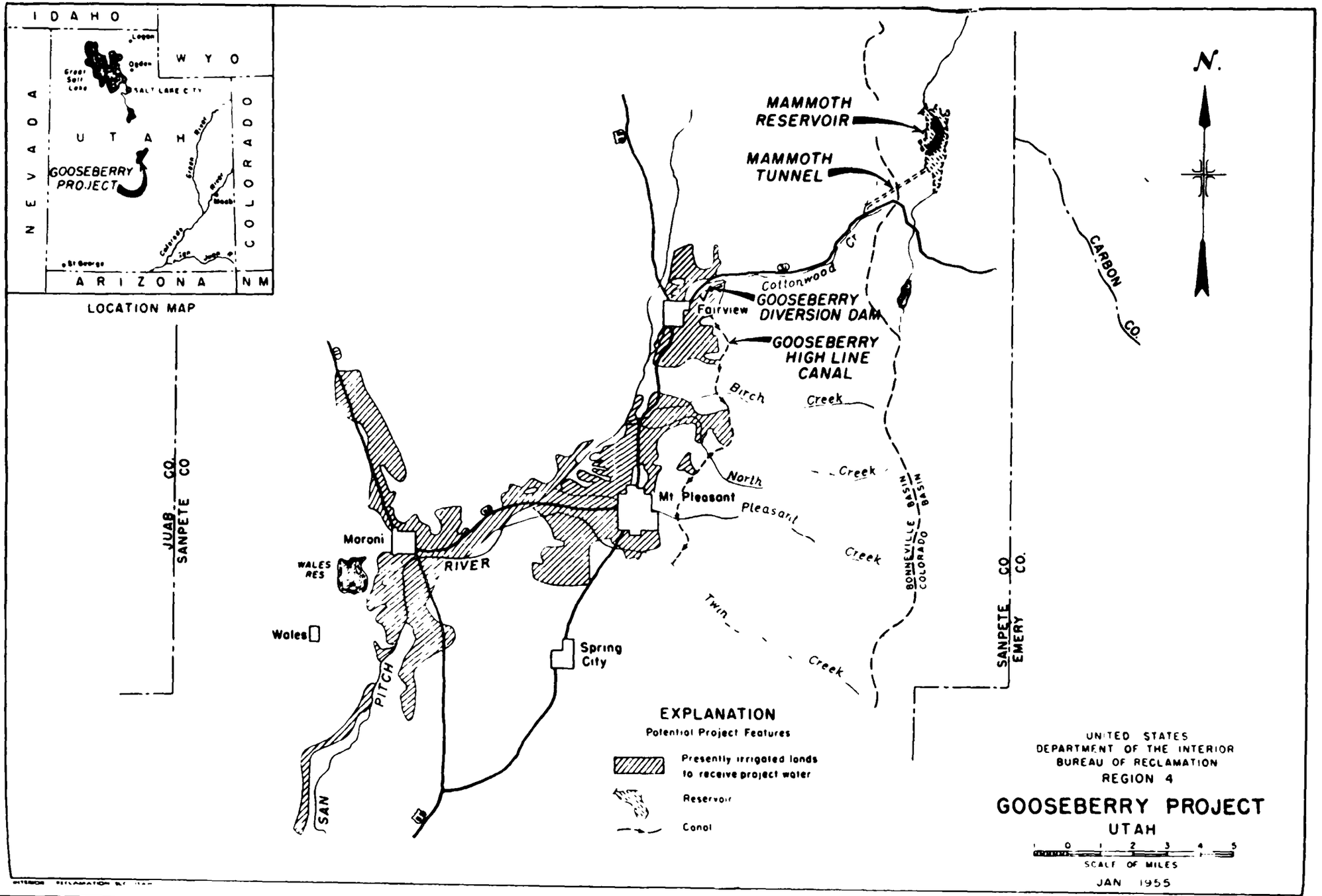

BLACK CANYON OF THE GUNNISON NATIONAL MONUMENT
GUNNISON TUNNEL
Montrose
SOUTH CANAL
CRYSTAL RES.
MORROW POINT RES.
CURECANTI RES.
NARROW GAUGE RES.
GUNNISON RIVER
Almont
Gunnison
Tomichi Creek
Ohio Creek
Cebolla Creek
Lake Fork
Blue Cr.
Crystal Cr
Cimarron Creek
MONTROSE COUNTY
GUNNISON COUNTY
SAGUACHE COUNTY
WYOMING
NEBR.
COLORADO
UTAH
KANSAS
NEW MEXICO
OKLA.
DENVER
Colorado Springs
CURECANTI UNIT
LOCATION MAP
EXPLANATION
Potential Project Features
Reservoir
Power plant
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
CURECANTI UNIT
COLORADO RIVER STORAGE PROJECT
SCALE OF MILES
JANUARY 1955
622-400-19

A preliminary land-classification survey indicates that the project lands would be suitable for sustained production of crops under irrigation farming. Detailed land classification would be required to confirm the suitability of all the lands.

Results of current (January 1953) Bureau of Reclamation estimates for the physical plan of the project, as covered in the Gooseberry project report dated January 1953, are summarized in the attached project summary tabulation.

Summary data, Gooseberry project, Utah

Irrigated acreage:		
New land		None
Supplemental		16,400
Total		16,400
Principal agricultural production: Alfalfa, pasture, grain, dairy cows, beef cattle, and sheep.		
Water supply:		*Acre-feet*
Average annual increase in return flow		2,300
Average annual increase in storage yield		11,700
Total		14,000
Stream depletion: 12,500 acre-feet.		
Project works:		
The construction features would include the Mammoth Dam and Reservoir with a total capacity of 17,200 acre-feet, the 2.4-mile Mammoth tunnel, the Gooseberry Highline Canal, and some rehabilitation of existing canals and laterals.		
Construction cost and repayment:		
Estimated cost		$5,760,500
Reimbursable cost allocated to irrigation		5,727,500
Nonreimbursable cost allocated to recreation		33,000
Repayment by:		
Irrigation water users	$2,375,000	
Power revenues from Colorado River storage project	3,352,500	
Total		5,727,500
Annual operation and maintenance and replacement costs:		
Irrigation	11,020	
Recreation	2,540	
Total		13,560
Benefit-cost ratio		1.2 to 1


IDAHO
WYO
NEVADA
COLORADO
UTAH
ARIZONA
NM
Logan
Ogden
Great Salt Lake
SALT LAKE CITY
GOOSEBERRY PROJECT
Green River
Virgin River
Colorado
St George
LOCATION MAP
MAMMOTH RESERVOIR
MAMMOTH TUNNEL
Cottonwood Cr
Fairview
GOOSEBERRY DIVERSION DAM
GOOSEBERRY HIGH LINE CANAL
Birch Creek
North Creek
Mt Pleasant
Pleasant Creek
Twin Creek
CARBON CO
N.
JUAB CO
SANPETE CO
Moroni
WALES RES
RIVER
Wales
Spring City
PITCH
SAN
BONNEVILLE BASIN
COLORADO BASIN
SANPETE CO
EMERY CO.
EXPLANATION
Potential Project Features
Presently irrigated lands to receive project water
Reservoir
Canal
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
GOOSEBERRY PROJECT
UTAH
0 1 2 3 4 5
SCALE OF MILES
JAN 1955
239-400-32

STATEMENT ON NAVAHO PROJECT, NEW MEXICO

The potential Navaho project (formerly called the Shiprock and South San Juan projects) would provide for the irrigation of about 137,250 acres of arable dry lands lying along the south side of San Juan River, a principal tributary of Colorado River, near the towns of Bloomfield, Farmington, and Shiprock in northwestern New Mexico. Of the lands that would be irrigated 109,000 acres are located in the Navaho Indian Reservation and 28,250 acres are outside the reservation. All the lands within the reservation and 1,660 acres outside the reservation are Indian-owned. Remaining lands outside the reservation are publicly owned or privately owned by non-Indians.

The general plan of the project includes the Navaho Dam and Reservoir on San Juan River of 1,450,000 acre-feet total capacity (778,000 acre-feet active), and a main highline canal to divert from the reservoir at a point near the dam and at an elevation about 270 feet above the stream bed. This main high line canal of 2,630 second-feet capacity would divert the water to a point about 29 miles downstream from Navaho Dam where the water would be dropped through a direct connected turbine pumping plant to a lower main canal that would extend westerly about 120 miles to serve the major portion of the project lands by gravity. The dropping water would energize the pump to lift a part of the water to serve the portion of the project lands inside and outside of the reservation that are too high to be served by the gravity diversion. A distribution system would extend beyond the pump lift to deliver the pumped water to the high lands. A system of drains would be provided as required to prevent seepage of project lands. The Navaho Reservoir would be used jointly by the Navaho and San Juan-Chama project. The latter project is a potential transmountain diversion to the Rio Grande Basin from the headwaters of the San Juan River.

Planning investigations of the Navaho project have been made jointly by the Bureau of Indian Affairs and region 4 of the Bureau of Reclamation. The project is an integral part of the Indian Affairs' program to bring relief to the Navaho Indians from their very low family incomes and to make them self-sustaining.

Navaho project lands range from about 5,000 to 6,100 feet in elevation and have a semiarid to arid climate with an average frost-free season of about 160 to 170 days. Annual precipitation averages less than 9 inches with about half occurring during the growing season, making irrigation necessary for successful crop production. With irrigation, climatic conditions are favorable for growing most field crops, a variety of garden crops, and such fruits as apples, pears, peaches, cherries, and apricots. Most of the project acreage would be utilized for production of livestock feeds with smaller acreages being utilized for fruit and garden crops. Principal livestock would be dairy cows and sheep.

Detailed land classification of virtually all the project area show the lands to be suitable for sustained production of crops under irrigation farming. Water supply studies show that the 137,250-acre project would require an average annual irrigation diversion of about 630,000 acre-feet. Simulated operation studies, based on streamflows as they have occurred in the past, indicate that an adequate water supply would be available with permissible shortages occurring in occasional drought years. The average annual stream depletion that would result from the development would be about 341,000 acre-feet.

This statement is based on the physical plan of development presented in the January 1955 feasibility report on the Navaho project compiled by the Bureau of Indian Affairs. Results of estimates for the project reflecting October 1954 construction prices are shown in the attached summary tabulation.

Navaho project, New Mexico, summary data

Irrigated acreage:

	Navaho Indian Reservation	Nonreservation	Total
New land, total	109,000	28,250	137,250
Gravity	90,240	2,800	93,040
Pump (hydraulic)	18,760	25,450	44,210

Principal agricultural production:
Alfalfa, grains, pastures, beans, some fruit and vegetables, dairy cows, sheep.

Water supply:	*Acre-feet*
Average annual increase in storage and direct flow diversions	630,000
Stream depletion (average annual)	341,000

Project works:
Construction features would include Navaho Dam and Reservoir on San Juan River, with approximately 1,450,000 acre-feet total capacity (778,000 acre-feet active), a 29-mile main highline canal to divert from reservoir about 270 feet above stream bed at dam, a drop from highline canal to a lower main gravity canal extending about 120 miles from the drop, a turbine-driven pump at the drop to lift water to about 32 percent of project lands, 2 main canals extending beyond the pump lift, distribution laterals, and drains. Reasonably efficient construction of the project would require about 15 years, except for drains.

Construction cost and repayment:		
Estimated construction cost[1]		$212,037,300
Reimbursable allocation to:		
Navaho project irrigation	$209,939,300	
San Juan-Chama project	800,000	
		210,739,300
Nonreimbursable allocation to:		
Flood control	1,106,000	
Recreation	192,000	
		1,298,000
Repayment by:		
Navaho project irrigation water users[2]	30,730,000	
San Juan-Chama project	800,000	
Power revenues from Colorado River storage project	179,209,300	
		210,739,300

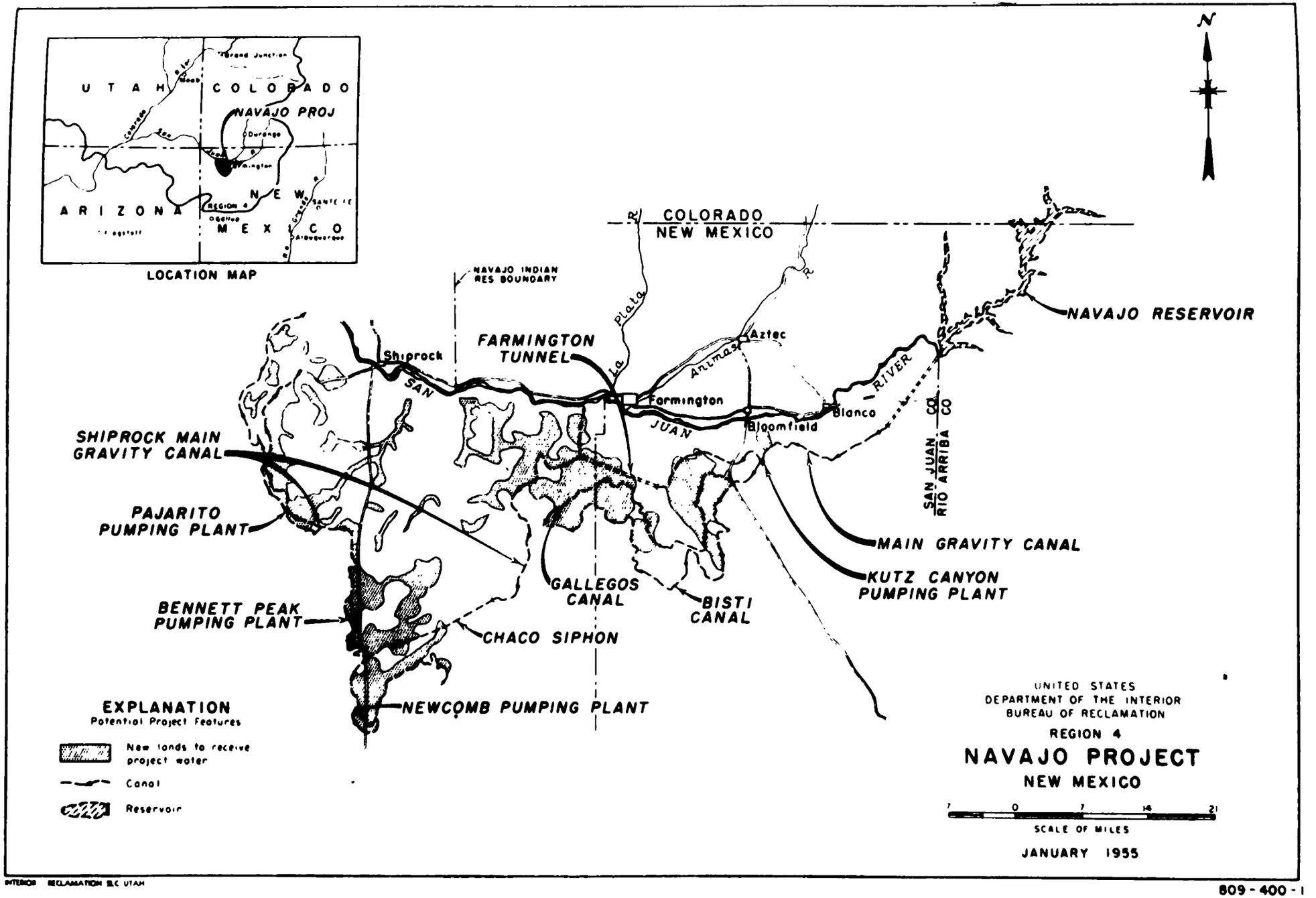
Annual operation, maintenance, and replacement costs:	
Irrigation	370,600
Flood control	200
Recreation	65,000
Total	435,800

[1] Includes $192,000 for cost of recreation facilities.
[2] Based on assumption that all Indian-owned lands would repay at same rate as non-Indian-owned lands, and that repayment on Indian-owned lands would be deferred under provisions of act of July 1, 1932 (47 Stat. 564).

Statement on San Juan-Chama Project, Colorado and New Mexico

The San Juan-Chama project would divert water from the headwaters of the San Juan River, a principal tributary of the Colorado River, into the Rio Grande Basin for the purposes of providing supplemental water for existing irrigation projects and for municipal and industrial uses. Although water for diversion would be collected from the tributaries of the San Juan located in both Colorado and New Mexico, all of the water would be used in New Mexico in the Rio Grande Basin. By exchange the project would also increase the use of water in New Mexico in the Canadian River Basin. The present plan provides for the diversion of 235,000 acre-feet of Colorado River Basin water annually out of the total amount allocated to New Mexico under the provisions of the upper Colorado River Basin compact.

With project development, an adequate supply of excellent quality water would be available to satisfy the rapidly growing municipal and industrial requirements of the Albuquerque metropolitan area, the population center of the Rio Grande Basin. Water would also be available to supplement the now deficient supply for some 225,000 acres of irrigated land in the area and to replace water depletions occurring throughout the basin from watershed improvement programs and groundwater pumping. In addition, the project would improve the conditions


U T A H
COLORADO
NAVAJO PROJ
Durango
Farmington
A R I Z O N A
N E W
M E X I C O
Albuquerque
LOCATION MAP
COLORADO
NEW MEXICO
NAVAJO INDIAN RES BOUNDARY
NAVAJO RESERVOIR
Shiprock
SAN JUAN
FARMINGTON TUNNEL
La Plata
Animas
Aztec
Farmington
Bloomfield
Blanco
RIVER
SAN JUAN RIO ARRIBA CO
CO
SHIPROCK MAIN GRAVITY CANAL
PAJARITO PUMPING PLANT
BENNETT PEAK PUMPING PLANT
GALLEGOS CANAL
BISTI CANAL
CHACO SIPHON
NEWCOMB PUMPING PLANT
MAIN GRAVITY CANAL
KUTZ CANYON PUMPING PLANT
EXPLANATION
Potential Project Features
New lands to receive project water
Canal
Reservoir
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
NAVAJO PROJECT
NEW MEXICO
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SCALE OF MILES
JANUARY 1955
INTERIOR RECLAMATION SLC UTAH
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for recreation, fish, and wildlife activities in the Rio Grande Basin, which is the center of one of the more important tourist and recreational areas in the country.

1. *Collection and diversion features.*—This system would comprise three reservoirs having a total capacity of 190,000 acre-feet located on the West Fork, East Fork, and Rio Blanco tributaries of the San Juan River and a feeder canal and conduit system to collect and transport the water to the head of Willow Creek in the Rio Grande Basin. The conduit system would be about 49 miles in length and would have a terminal capacity at the outlet of the tunnel through the Continental Divide of 1,000 cubic feet per second.

2. *Regulatory features.*—Heron No. 4 reservoir, having a 400,000 acre-foot capacity, located on Willow Creek, a tributary of the Rio Chama, would provide the storage required to regulate water releases for irrigation, municipal and industrial uses, and replacement of basin depletions. The outlet works of the existing El Vado Reservoir, downstream, woudl be enlarged to permit full transmissions of anticipated releases from Heron No. 4 reservoir.

3. *Water-use features.*—Construction features for irrigation purposes would comprise regulatory reservoirs, rehabilitation of distribution systems, and some relocation and extension of canals and laterals on existing irrigation projects on Rio Grande tributaries. Water for these projects would be made available by operation under exchange agreements. Supplemental irrigation water would also be furnished the Middle Rio Grande project and the Elephant Butte district of the Rio Grande project, utilizing existing distribution facilities. The present plan does not include construction features for delivery of municipal and industrial water beyond the regulating reservoir. Such features could be added later as part of the project if the local interests desire Federal construction and financing. No facilities are required to be constructed for delivery of the water to replace basin depletions. Construction of project features would be accomplished over a period of about 6 years.

This statement is based on the physical plan contained in a Bureau of Reclamation project report now in the process of completion. The financial data and analysis of the project were made in January 1955 and conform to current policy and procedure. The project investigations are of adequate degree of detail to use in project authorization, with the construction costs based on October 1954 prices. Preliminary studies of the potentialities of fish and wildlife development indicate it may ultimately be desirable to make an allocation of water to this purpose. Results of current estimates for the project are included in the attached summary tabulation.

Summary data, San Juan-Chama project, Colorado and New Mexico

Irrigated acreage:	*Acres*
New land	None
Supplemental land	225,000
Water supply: Allocation of diverted San Juan River water:	*Acre-feet*
Irrigation	179,200
Irrigated lands	136,700
Replacement of Rio Grande Basin depletions	42,500
Municipal and industrial water	55,800
Stream depletion (average annual diversion from San Juan River Basin)	235,000

Project works:

Principal construction features would include 3 reservoirs of 190,000-acre-foot total capacity in the headwaters of San Juan River, a 49-mile conduit system to collect and divert water from San Juan River Basin to Rio Grande Basin, a 400,000-acre-foot reservoir in Rio Grande Basin to regulate San Juan River diversions, some additional reservoirs, rehabilitation of distribution systems, and some relocation and extension of canals and laterals in existing systems on Rio Grande tributaries.

Summary data, San Juan-Chama project, Colorado and New Mexico—Continued

Construction cost and repayment:	
Estimated construction cost	[1] $135,169,000
Reimbursable allocation to:	
Irrigation:	
Irrigated lands	87,531,000
Replacement of Rio Grande Basin stream depletions	20,393,000
Municipal and industrial water	26,775,000
Total reimbursable allocations	134,699,000
Nonreimbursable allocation	470,000
Total allocation	135,169,000
Repayment by:	
Irrigation water users	21,290,000
Basin depletions (Rio Grande Basin)	6,600,000
Municipal and industrial water users	[2] 26,775,000
Power sources from Colorado River Storage project	80,034,000
Total	134,699,000
Annual operation, maintenance and replacement costs:	
Irrigation:	
Irrigated lands	234,100
Basin depletions (Rio Grande Basin)	41,400
Municipal and industrial water	54,300
Total	[3] 329,800
Benefit-cost ratio	1.84 to 1

[1] Includes $800,000 of cost of potential Navaho Dam and Reservoir on San Juan River $110,000 for stream gaging and river operating facilities, and $360,000 for recreational facilities.

[2] Interest during construction amounting to $728,000 and interest on investment amounting to $27,539,000 would also be paid.

[3] Excludes $33,500 operation and maintenance of stream-gaging program.

Senator O'MAHONEY. Do not skip anything which we ought to know.

Mr. LARSON. I assume you know pretty well what is in it.

Senator O'MAHONEY. Some people do not seem to think so. I want the Senator from California to know what is in your statement.

Senator KUCHEL. Mr. Chairman, I assume that the recommendation of the Senator from Utah that the matter be printed in large type would, he felt, facilitate my understanding of it. Actually I am ready to make a motion that we do away with this small type all the way through the hearing because I have a difficult time reading it anyway.

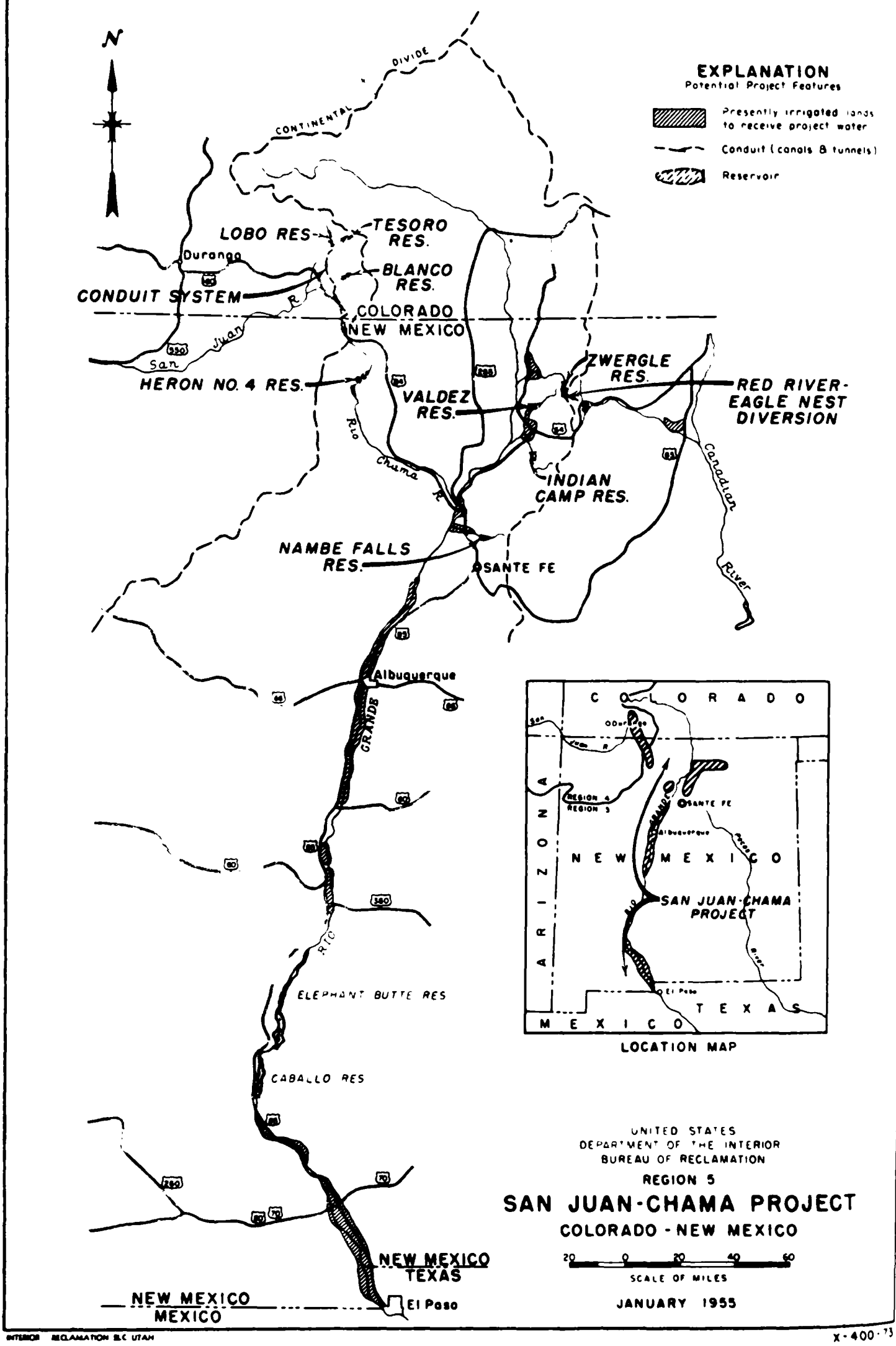
Senator O'MAHONEY. He was directing his remark to me because he sees I carry reading glasses.

You may proceed, Mr. Larson.

Mr. LARSON. In my statement I briefly covered the 11 participating projects and the 2 storage units recommended for initial authorization by the Secretary of the Interior.

Then I covered the additional projects and storage units contained in S. 500.

At the end of the statement I have a map of the Colorado Basin, showing the location of the storage units and the participating projects, and following the map is table 1, a summary of initial units of the Colorado River storage project and the 12 participating projects, the Eden project in Wyoming being the 12th project already authorized by previous legislation.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EXPLANATION
Potential Project Features
Presently irrigated lands to receive project water
Conduit (canals & tunnels)
Reservoir
CONTINENTAL DIVIDE
LOBO RES.
TESORO RES.
BLANCO RES.
Durango
CONDUIT SYSTEM
COLORADO
NEW MEXICO
San Juan R.
HERON NO. 4 RES.
VALDEZ RES.
ZWERGLE RES.
RED RIVER-EAGLE NEST DIVERSION
Rio Chama R.
INDIAN CAMP RES.
Canadian River
NAMBE FALLS RES.
SANTE FE
Albuquerque
RIO GRANDE
ELEPHANT BUTTE RES
CABALLO RES
NEW MEXICO
TEXAS
NEW MEXICO
MEXICO
El Paso
COLORADO
ARIZONA
NEW MEXICO
TEXAS
MEXICO
SAN JUAN-CHAMA PROJECT
REGION 4
REGION 5
LOCATION MAP
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 5
SAN JUAN-CHAMA PROJECT
COLORADO - NEW MEXICO
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SCALE OF MILES
JANUARY 1955

That gives a summary of information pertaining to the recommended projects.

Table 2 is a summary of information with the additional units added, namely, Cross Mountain, Curecanti, and Flaming Gorge, and the additional participating projects, Gooseberry, Navaho, and San Juan-Chama.

Following the tables there is a short 1- or 2-page statement of each of the participating projects and a small map showing the location of the land and the works.

For one of the projects, the Navaho, the statement was prepared by the Bureau of Indian Affairs, and another project, the San Juan-Chama, the statement was prepared by region 5 of the Bureau of Reclamation.

That is in general the information contained in my statement.

Senator O'MAHONEY. These charts are in such form that they can be reproduced in our hearings.

Mr. LARSON. Yes. The maps were all prepared on the basis that they readily can be reproduced for the hearings.

Senator O'MAHONEY. Very good.

Senator WATKINS. May I ask, Mr. Larson, have you any new matter in this statement that you did not give us a year ago when we held the hearings?

Mr. LARSON. I do not believe so, except that I have probably covered in a little more detail the water supply explanation.

Senator WATKINS. Is this largely a reproduction of what you gave us last year?

Mr. LARSON. Yes, it is essentially the same as last year, but changed to meet the present bill, S. 500, and as I stated, I have a more complete explanation of the water supply and have extended the explanations on costs, allocations and repayment, just to be more explicit as to what we meant before.

Senator WATKINS. Have you anything additional on the operation of the project and how it will work when completed?

Mr. LARSON. No. The operation of the plan has not been changed.

Senator O'MAHONEY. Have you made yourself familiar with the discussions which have been going on by members of the Upper Colorado River Basin Commission?

Mr. LARSON. Yes.

Senator O'MAHONEY. Are they covered in this statement?

Mr. LARSON. Do you have reference to the additional projects that were suggested by Governor Johnson of Colorado?

Senator O'MAHONEY. Yes; or any other project.

Mr. LARSON. Since those projects are not contained in S. 500, I did not include them in my statement. However, we do have information on those 20 projects.

Senator O'MAHONEY. When the Governor gives his testimony, you will be prepared to make any comment that the Bureau of Reclamation has reached with respect to such suggestions, will you?

Mr. LARSON. Yes, sir. We will be prepared to explain to you the reconnaissance work done on each of those projects and what the reconnaissance results show.

Senator O'MAHONEY. I think the question asked by Senator Watkins is one of great importance and ought to be made clear in everyday language so that those who do not understand how a flowing river

is administered by the Bureau and who fear that somehow or other the storage of water now being wasted would be disastrous or at least disadvantageous to those who through the magnificent action of Congress and its appropriations in the past have stored waters for the projects which they now enjoy.

Will you tell us how the Bureau balances the flow of the stream while it is building a reservoir so as not to destroy existing rights?

Mr. LARSON. Our studies show that the flow of the Colorado River varies greatly over the long period of years for which we have records. That means that we must build large holdover reservoirs that will carry water over from cycles of high runoff to dry cycles of drought years and smooth out, you might say, the river. With sufficient reservoir capacity the upper basin can be operated consistent with the 1922 Colorado River compact, and of course the 1948 upper Colorado River Basin compact.

Senator O'MAHONEY. Would I be stating it correctly by saying that the plan of administration of such a project as this would be to store floodwaters which in effect are not being used below and which would otherwise go to waste if they were not stored, and that this storage can be carried on without damage to those below?

Mr. LARSON. Yes, it can be accomplished within the terms of the compact without injuring rights below.

Senator O'MAHONEY. That is right. Of course, the compact binds us all. What was the purpose of those who drew the original compact in 1922, to provide that delivery of 7½ million acre-feet at Lee Ferry annually or 75 million in a 10-year period?

Mr. LARSON. Did you ask me a question?

Senator O'MAHONEY. Yes, sir.

Mr. LARSON. I do not think I have the question in mind. Will you please repeat it?

Senator O'MAHONEY. Yes. Do you know what the reason was of those who drafted the original compact to provide for the division at Lee Ferry of 7½ million acre-feet to the upper and lower basins—I am skipping the Mexican Treaty and the other provisions—and provide that the lower basin should deliver 7½ million acre-feet per year at Lee Ferry or 75 million acre-feet over a 10-year period? Was it not because of the great change in the flow of the stream?

Mr. LARSON. Yes, I assume the main purpose is to permit the development of the water resources of the Colorado River with an equitable share apportioned to each basin, so that the development could go forward. Both basins were anxious at that time to have things settled so development could go forward.

Senator O'MAHONEY. Was that not the only way by which there could be an adjustment of the great changes in the annual flow of the stream?

Mr. LARSON. By long-time regulation, yes.

Senator O'MAHONEY. Is there anything else you wish to tell the committee with respect to the Bureau of Reclamation's point of view? Some questions were asked of the Commissioner this morning, who referred the committee to you for answers. I assume you took note of them at the time; that is, having to do with some of the details.

Mr. LARSON. There is one point that we have tried to stress—the importance of the Glen Canyon Reservoir in the system. It provides

half of the storage of the main units in the upper basin. Inasmuch as it does, we tried to stress at least year's hearings, and we stress this time, that the holdover storage actually has to be long-time holdover storage and must be started in advance of when it is needed so that the reservoirs can be filled.

Senator BARRETT. May I ask a question, Mr. Chairman?

Senator O'MAHONEY. Surely.

Senator BARRETT. Mr. Larson, I note in your statement on page 9, you make the statement that the total consumptive use of water in the upper basin by all constructed projects, those authorized, and projects under construction, will be about 2½ million acre-feet.

Could you break those down and tell me offhand how much consumptive use is made by the constructed projects?

Mr. LARSON. It depends on which year you are talking about. Two or 3 years ago, or last year, we assumed that present uses were around 2 million acre-feet, and when all authorized projects are fully developed, it will be about 2½ million acre-feet. I do not know the latest figures on the transmountain diversion for Colorado-Big Thompson and other projects. We will have to bring that up to date for more accurate figures as to present cases.

Senator BARRETT. The total of the constructed projects and those under construction and the ones that are authorized now is 2½ million acre-feet?

Mr. LARSON. That is correct.

Senator BARRETT. How much do you estimate is the upper Colorado River depletion with the projects that are authorized in this bill?

Mr. LARSON. The stream depletion of the 11 participating projects and the Glen Canyon and Echo Park evaporation would bring the annual depletions up to 3½ million acre-feet, or an additional million acre-feet. The additional projects in the bill, the ones I read to you, would increase the total another 800,000 acre-feet. That is, the San Juan-Chama, Navaho, Gooseberry, Flaming Gorge, Curecanti, and Cross Mountain would bring the total up to 4,300,000 acre-feet.

Senator BARRETT. I would like to ask you, in 10 years time how much will the consumptive use be increased over and above the 2½ million we have at the present time, assuming that we have fairly orderly construction work going on?

Mr. LARSON. It would be a comparatively small amount because it would take at least 5 years to construct Echo Park and before the evaporation got too great. With the construction of Glen Canyon the period would be even longer than that. Then there is a long period of years for filling. The construction of anticipated initial projects is estimated at about 21 years, maybe more or less. These are the initial projects of our plan.

Senator BARRETT. In a period of 10 years, would you care to estimate how much of this additional consumptive use will be taken out of the stream there?

Mr. LARSON. What percent of the million acre-feet?

Senator BARRETT. Yes.

Mr. LARSON. Without making studies, I would not know. I would have to see which projects you are going to build first.

Senator BARRETT. Would it be less than half of it, would you say, in making a wild guess?

Mr. LARSON. For the first 10 years?

Senator BARRETT. Yes.

Mr. LARSON. There again it depends on whether you fill Glen Canyon within the 10-year period, stretch it out, and so on, and I don't believe I should pin that down. But it would certainly be much less than a million acre-feet.

Senator BARRETT. None of the 800,000 would be consumed in the 10-year period. That is, the other additional projects here. None of them will be under construction at all in 10 years.

Mr. LARSON. That again depends on the Congress appropriating money and their schedule of construction.

Senator BARRETT. First things are going to come first. We are going to work on the projects that are authorized under this bill, I assume, so it will be some time before you get on to other projects; is that right?

Mr. LARSON. Yes, I would assume that if all the other projects are added, the construction period will extend beyond 21 years.

Senator BARRETT. Would you be willing to say that in 10 years' time the consumptive use on the upper Colorado River project would not exceed 3,250,000 acre-feet, assuming that the project is authorized this year? That is adding 750,000 acre-feet annually to your 2½ million.

Mr. LARSON. Yes, that appears to be as good a guess as any.

Senator BARRETT. Assuming that is the case, would you think that my colleague from California, who is sitting on my right, has any reason to be concerned about the water that may be taken out of the river in the upper Colorado River States in that period of time?

Mr. LARSON. No; myself, I am not concerned. There is a feasible way of filling those reservoirs without interfering with the lower-basin rights under the compact.

Senator BARRETT. When we construct a reservoir that makes it doubly sure that his State, as well as the upper States are going to be that much better off; is that right?

Mr. LARSON. Yes; the lower basin States certainly will be better off with the construction of Glen Canyon.

Senator BARRETT. Thank you very much, Mr. Chairman.

Senator WATKINS. I would like to know, since you mentioned there is a way that could be done, how it can be done. How do you fill those reservoirs without interfering with anybody's rights?

Mr. LARSON. To begin with, we as engineers have assumed that the upper basin would have the right to store water, and would have the right to generate power. We realize that the Glen Canyon Reservoir has about half the capacity of the system of reservoirs that we have selected. So it sets the pace. If we can fill Glen Canyon, naturally we can fill the rest. It will take a long time.

Senator WATKINS. It will have a capacity of 26 million acre-feet.

Mr. LARSON. Yes, sir. We have proceeded on the basis that the upper basin would be completely fair in the delivery of water to which the lower basin is entitled under the compact, for the delivery of any water to Mexico which may have to come down from the upper basin and in the production of firm energy at Hoover Dam. Keeping those things in mind, Glen Canyon can be filled.

We have made a study and in years of high runoff when water runs on through the channel into the Gulf of California, there, of course, is

no question about filling Glen Canyon Reservoir. In average years it also could be done quite easily.

Senator WATKINS. What would you call an average year? What would be the flow of the river in an average year?

Mr. LARSON. I might say a series of average years when the historic flow was above 12 million acre-feet or some such figure. But the real test comes in the dry years. We have satisfied ourselves that under the most adverse streamflow conditions of record, upstream reservoirs can be filled and firm energy delivery maintained from Hoover through a combination of generation at Hoover and delivery of Glen Canyon energy to Hoover in lieu of releasing water through Hoover solely for power generation. In other words, in a year like we have right now, where water is short for firm energy at Hoover, we could not start storing at Glen Canyon. We must pick a year when Lake Mead has greater storage reserve, maybe over the 15 million acre-feet level. I am giving you one practical way in a dry cycle that will work. In that manner some water could be released from Lake Mead to keep up firm energy. With the interconnecting transmission line from Glen Canyon to Hoover, as soon as we get the dead-water space filled in Glen Canyon, and have at least half of the wheels installed before the gates are closed down, then Glen Canyon energy can be transmitted down to Hoover, thereby keeping the firm energy whole until Lake Mead reserve storage is built back. That is one practical way.

Senator WATKINS. What you would do in effect then is deliver power instead of water in the event of a shortage at Hoover of enough water for the energy needed.

Mr. LARSON. That is right. In some years you might take the whole 6 million acre-feet, which is about the dead-water capacity in Glen Canyon, or you could take it over 3 years, depending on the runoff years you have.

The other way is to wait for the years of high runoff when filling could be done fairly easily. So our study shows that there should be no insurmountable difficulties for the initial filling of the reservoir within a reasonable period of time. That is the conclusion we have reached as a result of our studies.

Senator WATKINS. That includes, of course, not only Glen Canyon, but Echo Park, and the rest.

Mr. LARSON. Yes. As soon as we get storage in Glen Canyon Reservoir, if the river should go down and we have to make deliveries to the lower basin, we can still do so from Glen Canyon and still store water in other reservoirs in the upper basin.

Senator WATKINS. Of course, Glen will make it possible through the catching of the silt to make Hoover itself much more valuable and have a bigger storage.

Mr. LARSON. That is correct. We have allowed for sediment detention in Glen Canyon for 200 years at the rate of somewhere near 100,000 acre-feet a year.

There is one other point I should have stressed in filling Glen. After we get up to the dead-water elevation of approximately 6 or 7 million acre-feet——

Senator WATKINS. What do you mean by "dead water"?

Mr. LARSON. It is the capacity which, after once filled is not drained, but used solely for power head and silt detention. The live storage is above that capacity.

Senator WATKINS. I was wondering when you said that you would take energy to make up at Hoover, whether you meant you would release water at Glen to make more power to send to Hoover, or whether you would take the normal flow of the stream which would go through Glen and develop the power sufficient there to make up for Hoover?

Mr. LARSON. In the drought years you could not afford to run any water from Glen solely for power into the Gulf of California. Naturally you would release what the lower basin was entitled to have, and simply transmit energy down there and some water, and let them store and build the reserve back in Lake Mead that was taken out during the filling of the 26 million acre-feet at Glen. That is just one way. There are different ways of filling Glen.

Senator WATKINS. I am certain that the committee would like to know some of the other ways.

Mr. LARSON. The other way is to wait for your high years. In other words, years of extremely high runoff.

Senator WATKINS. By doing that you would not interfere with the operation at Hoover Dam?

Mr. LARSON. No.

Senator WATKINS. You would simply be taking the water that otherwise would go into the gulf?

Mr. LARSON. Yes; we do not have many such years when water runs through Hoover without being used for power purposes, that is for firm and secondary energy purposes.

Senator WATKINS. For consumptive use there would be some that would be over and above what the lower basin could use consumptively.

Mr. LARSON. Yes. In working these studies we have based it on a delivery of 7½ million acre-feet to the lower basin through this drought period in case their uses were up to that.

Senator WATKINS. That would be each year delivery.

Mr. LARSON. That is right.

Senator WATKINS. In other words, you are not going to take advantage of the situation whereby you might short them for a time, but over a 10-year period deliver the full 75 million?

Mr. LARSON. Yes. Regardless of that provision, in our studies we have not shorted anybody in requirements up to that amount for irrigation and other uses.

Senator WATKINS. What I am getting at is that there would not be any time when you would short them under your program. They get full delivery every year.

Mr. LARSON. That is right.

Senator WATKINS. That is the program you are working out in connection with the filling of the reservoirs as they are built, and the delivery of water to lower interests.

Mr. LARSON. That is correct.

Senator WATKINS. So in effect they would not have any years in the future after this program got under way where they would only get 4 million, which was the amount of water delivered downstream a few years. I am talking about the shortage under the full amount for both divisions.

Mr. LARSON. The amount of releases from Glen Canyon would change from what the natural flow has been through the operation of a powerplant at the Glen Canyon Dam. The releases would be more uniform annually to generate power and meet the water requirements of the compact below.

Senator WATKINS. The point I want to be sure about is whether or not there would be under this arrangement sufficient water to meet the requirements on an annual basis for the lower users.

Mr. LARSON. Yes.

Senator KUCHEL. Mr. Chairman, first of all, does the Department's recommendations of projects coincide with the projects that are included in S. 500?

Mr. LARSON. The Secretary has recommended construction of 11 participating projects and 2 storage units, Glen Canyon and Echo Park, in his report of October of 1953. In addition to that you have other units and participating projects in the bill on which we are submitting information.

Senator KUCHEL. And those are Navaho.

Mr. LARSON. The Secretary has statements on Navaho, in his report of October, and some of the rest of them.

Senator KUCHEL. What are the others, Mr. Larson, which the bill includes, but which the Department does not recommend?

Mr. LARSON. Table 2 contains the additional projects in the bill not covered in the Secretary's initial recommendation.

Senator KUCHEL. This is in your large statement?

Mr. LARSON. Yes.

Senator KUCHEL. Subject to the approval of the chairman and the committee, I wonder if I might ask if you could be available in a week so that study could be made of your long report, and perhaps questions asked a little bit more intelligently.

Mr. LARSON. I am sure I will be here.

Senator KUCHEL. Mr. Larson, I want to thank you very much for sending me on Saturday a copy of your memorandum of February 24, 1955, addressed to you from the Assistant Commissioner and Chief Engineer. I would like to read a portion of it to the committee:

> In connection with the statement of the adequacy of the foundation rock at Glen Canyon Dam site, you are referred

says the memorandum—

> to my letter of July 1, 1954, to the Commissioner, subject: Colorado River storage project and possible alternative sites for Echo Park Reservoir, copy of which was sent to you at Salt Lake City. The third paragraph of this letter is quoted as follows:
>
> "The engineering and geologic problems incident to the construction of a dam at the Glen Canyon site have been discussed with Regional Director E. O. Larson, and he is familiar with the conditions at this site. The views of this office, which I am sure are shared by the regional office, are that the 26 million acre-feet capacity shown in the reports on the Colorado River storage project represents the maximum justifiable size of this reservoir on the basis of preliminary studies and testing. Following authorization of the project during the preconstruction phase, additional study and testing will be carried forward for the Glen Canyon site. It is anticipated that these tests will confirm our present opinion."

Then I would like to read a portion, Mr. Chairman, of a letter from the Secretary of the Interior under date of November 30, 1954, into the record, and I would like the permission of the Chair to put the entire letter in, which is only 2 pages.

Senator O'MAHONEY. Without objection it is so ordered.

Senator KUCHEL. Now, I quote a letter which Secretary McKay wrote to Mr. Brower, of California.

MY DEAR MR. BROWER: On October 21, 1954, you were informed that further reply would be made to your inquiries of September 28, 1954, addressed to the Secretary of the Interior and the Commissioner of Reclamation, concerning the effect of the proposed Glen Canyon Reservoir upon the Rainbow Ridge National Monument. We now have the necessary information from the field to complete that reply.

It is our intention to take whatever steps are necessary to protect the Rainbow Bridge National Monument from waters of the proposed Glen Canyon Reservoir and to ask Congress to provide for such protection in the authorizing legislation. Cooperative studies are underway by the field offices of the Bureau of Reclamation and the National Park Service to determine the best means of providing this protection, and to date these studies have revealed no unsurmountable problems. The topography of the area surrounding the monument indicates that a barrier dam 1 mile below the natural arch and outside the monument would provide adequate protection. Details of such a plan will require extensive study and are not available at this time.

On the basis of data available at the time of writing the 1950 report on Colorado River storage project and participating projects, a 700-foot dam (580 feet above stream level) at Glen Canyon was the maximum height which met the criteria of economy, safety of the structure, and adequate protection of the Rainbow Natural Bridge. Subsequent to writing the 1950 report on the Colorado River storage project, the Bureau conducted grouting tests in the drift tunnels driven 50 or 60 feet into each canyon wall of the Glen Canyon Dam site. Also, special bearing tests of 6-inch cores and large fragments of the foundation materials were made in the Bureau's Denver laboratory. The poorly cemented and relatively weak condition of the materials in comparison with the foundations common to most high dams has given the engineers who prepared the preliminary designs of the dam some concern as to the competency of the foundation to support any structure higher than 700 feet. Experiments to improve the strength of the foundation through a chemical grouting process were unsuccessful. These are the geological reasons why Commissioner W. A. Dexheimer made his statement in Denver about the limitation on the height of the proposed Glen Canyon Dam.

Following congressional authorization, more intensive studies will be made of the foundation conditions and of the Bureau's preliminary design to secure information for the preparation of plans and specifications for construction of the Glen Canyon Dam. If such intensive studies indicate the advisability of modifying the present selected height of dam, appropriate changes will be made in the designs prior to construction.

That to me is a very strange statement. It to me also however is a little bit troublesome. Would it be fair to say, Mr. Larson, that the technical engineering studies on the Glen Canyon Dam site so far indicates the possibility that Glen Canyon Dam might not be built there on the basis of engineering feasibility?

Mr. LARSON. No, sir; I do not think they infer that at all.

Senator KUCHEL. Tell me in your own words what the status is. Have you made some inquiry?

Mr. LARSON. The status is simply this. There have been more tests on Glen Canyon Dam site today than most dams that have been authorized in the past. Here the foundation is Navaho sandstone.

It is poor rock compared with granite and other dense rock, such as found at Hoover, so that our studies called for certain other elaborate tests. Six-inch cores were shipped to Denver and tested over a long period of time, to see what height of dam the rock would support. As a foundation gets less attractive, safety measures have to be taken to thicken the dam. You then get into economic design and ultimately, of course, you come to the safety of the structure as to how high you can go knowing certain conditions of the foundation and nature of the rock.

At the same time we have the large Rainbow Bridge to be concerned with upstream. A higher dam raises the water elevation on to the foot or pedestal of the natural bridge, so that taking into consideration the safety of the structure, the economics, and the protection of the Rainbow Natural Bridge, we arrived at 700 feet as the height that we would stop.

From all the studies we have up to now we feel that we can build a dam that high, but there is certainly a limit as to what you do, taking these three things into consideration. That was the height adopted, and we have nothing to cause us to change that height now, and I doubt it will be changed much later on.

Senator KUCHEL. Has the Bureau of Reclamation determined now that the present Glen Canyon Dam site is completely feasible from an engineering standpoint for construction?

Mr. LARSON. Yes, even though it does involve a large cost, it has a very great power potential and is a great storage reservoir. Taking those facts into consideration, to me it is a very feasible unit.

Senator KUCHEL. Would you say that the Secretary, when he said "following congressional authorization more intensive studies will be made of the foundation conditions and the Bureau's preliminary design" is now outdated since the time of this letter, and now you have completed your engineering studies?

Mr. LARSON. No. We would want to follow our usual practice. When a dam is authorized, we go in with much greater detailed tests to confirm what we have already found. That was true of Hoover, Hungry Horse, Shasta, and many other dams built in the past. Before we start construction we certainly want to verify our conclusions.

Senator KUCHEL. And if you were not sure and your subsequent inquiries demonstrated that you could not be sure, then you would not build Glen Canyon Dam at the present dam site?

Mr. LARSON. Yes. If they found something unexpected. But this rock is uniform both upstream and downstream from the site according to drill logs 400 feet below the bedrock under the river and 400 feet into the abutments, and examinations for miles upstream and each side, I cannot see that it can be upset very much, if any.

Senator KUCHEL. The only reason, again I speak as a layman, when I read a letter from the Secretary in which he speaks about experiments of the Bureau being unsuccessful, it raises in my mind some doubt as to just what the engineering feasibility of the project may be right now.

Mr. LARSON. You have to understand that in this way. Since the Navaho sandstone is what we call a somewhat porous rock, it would be advantageous if chemical grout could be used to close the pores. That might cheapen the construction cost of the dam. Certain factors of safety might be less, and we might save money by it.

Senator KUCHEL. So the fact that the experiments were unsuccessful really may be a boon?

Mr. LARSON. Then we do something else.

Senator WATKINS. The impression seems to have gone out from the Secretary's statement that there is grave doubt as to the safety of the height of the dam as proposed.

Mr. LARSON. I do not think there is any doubt as stated by the Chief Engineer in his letter just read by Senator Kuchel, which referred to stopping at a dam up to 700 feet high. That was the height he was willing to go on. I have been in conferences on this subject on several occasions.

Senator WATKINS. Then 700 feet is considered from the standpoint of the engineers to be safe?

Mr. LARSON. Yes. We can build a dam that high.

Senator WATKINS. In that particular formation.

Mr. LARSON. That is right.

Senator WATKINS. There is not any particular doubt or any specific doubt about the safety of a dam that high in that place?

Mr DEXHEIMER. May I amplify that a little bit?

Senator WATKINS. I wish you would because there has been some misunderstanding created. If it is not a safe place to build a dam, certainly we do not want to build it there.

Mr. DEXHEIMER. I have personally been in on the original exploration and the construction of Hoover Dam, Shasta Dam, and many others from days before they were conceived. I have investigated this site and gone through the geology. We have done a great deal more investigation on Glen Canyon than we have on Hoover or the others. We have no doubt at all but what a dam of 700 feet height at the Glen Canyon site is entirely practical, feasible, and economical, and would be safe from an engineering standpoint.

Senator WATKINS. Then how does this question arise about an additional height being unsafe?

Mr. DEXHEIMER. The question there related to a possibility that we might raise the height of Glen Canyon Dam as a substitute for some other project.

Senator WATKINS. To be specific, it has been suggested by some of the opponents of this project that Glen Canyon raised would be a substitute for Echo Park.

Mr. DEXHEIMER. The opposition has raised that question; yes.

Senator WATKINS. What you are saying now is that if you raise it beyond 700 feet in height you are taking a chance and it would be unsafe to build it to the extra height as a substitute for Echo Park.

Mr. DEXHEIMER. That is right. Under no circumstances should a higher Glen Canyon be considered as a substitute for Echo Park.

Senator WATKINS. If you are justified in your opinion, that would eliminate a high Glen Canyon as a substitute for Echo Park?

Mr. DEXHEIMER. That is correct, even though from an engineering standpoint it might be feasible to raise it a little higher, it still would not be a substitute for Echo Park, because of many other factors.

Senator WATKINS. Would you care to name those factors, because later on you are certainly going to be asked to name them.

Mr. DEXHEIMER. The question of the protection of the Rainbow Natural Bridge. Of course, the safety of the structure. If we went

higher, it might add to the cost of enlarging the foundation and so on, and the question of evaporation, because the water at a higher elevation than we plan for Glen Canyon would spread out over a wider territory, and evaporation would be much greater percentagewise over the water stored than the 26 million acre-foot limitation.

Senator WATKINS. Let us get back to the physical safety of a higher dam. It that an important element in what you have just said?

Mr. DEXHEIMER. It is very important.

Senator WATKINS. Then you would not recommend a higher dam than 700 feet even from the safety factor.

Mr. DEXHEIMER. The only reason we would go a little bit higher would be if our detailed investigations at a later time indicated that it was perfectly safe, was practical and economical to do so. But at the present time our studies indicate that 700 feet is the practical maximum at this time, because of all these other considerations.

Senator BARRETT. Mr. Dexheimer, I would like to ask you this question. Is the formation at Glen substantially the same as at Hoover and at Shasta?

Mr. DEXHEIMER. No, sir; they are entirely different rock formations.

Senator BARRETT. It is not sandstone at Hoover Dam?

Mr. DEXHEIMER. No, sir. Hoover Dam is what we call an andesite.

Senator BARRETT. Is Shasta sandstone?

Mr. DEXHEIMER. No, sir; it is granite.

Senator BARRETT. Do you have another dam site where you have used sandstone similar to this Navaho sandstone that is proposed to be used at Glen Canyon?

Mr. DEXHEIMER. There are a number of them around the world at different places, none quite the same as this particular formation, however.

Senator BARRETT. You never have heard of any difficulty arising because of the porosity of the sandstone being used as a base for the dam?

Mr. DEXHEIMER. No, sir. In fact, there are dams in other parts of the world where we have similar sandstone interlined with shale, which makes a much worse condition. We plan and think they can be feasibly built even to higher elevations than the 700 feet in this one.

Senator BARRETT. Now, Mr. Larson suggested that perhaps the porosity of the Navaho sandstone might be overcome by some filling of those little streaks through there. Has that ever been tried anywhere?

Mr. DEXHEIMER. We have experimented with cement grouting but it is just the porosity of the rock itself. When you get a certain amount of pressure on it, it might tend to give. There is a certain point where you might have a little difficulty. Chemical grouting has been tried in various formations and to some extent effective. It is particularly used in oil-well drilling. We would hope that when money is available for going ahead and this is authorized, to carry out further experiments to see if we could not solidify that foundation a little more by chemical grouting.

Senator BARRETT. Let me ask you this question. Assuming that you would take a slab of that standstone and exhibit it here on this table, would anybody be able to ascertain by looking at it that it was porous? I am talking about with the naked eye, and not a magnifying glass.

Mr. DEXHEIMER. Not that it would be porous as you might think of something with holes in it, but it is a question of relative porosity as compared with a much harder, denser rock. You could compare it in this way, that sandstone would appear to be something like a well-compressed brick as compared with a very dense hard rock.

Senator BARRETT. The reason I asked you that question is that I have seen cores come out of oil wells that looked just as solid as these colonnades here, and how in the world you could get oil to be produced from rocks of that type has always been intriguing to me, to say the least. I assume that is the same situation as far as this sandstone is concerned.

Mr. DEXHEIMER. Of course, the rocks they get oil from are generally a much more porous rock, and they have seams and cracks in them that let the oil through.

Senator BARRETT. If you look at one you will think it is just as solid as that marble over there. I will swear to that right now. You cannot ascertain it with the naked eye.

Mr. DEXHEIMER. I think that is true of many of our oil shales, too.

Senator KUCHEL. Mr. Dexheimer, I respect you as an engineer. I know nothing about it. When I receive a copy of a letter which the Secretary of the Interior has written, and he speaks of poorly cemented and relatively weak condition of the materials in Glen Canyon in comparison with the foundation common to most high dams has given the engineers who prepared the preliminary designs of the dam some concern as to the competency of the foundation to support any structure higher than 700 feet—so that I read his entire sentence—I do think we have a responsibility at least to inquire if it is not a fact that here at this time the conclusions which the Department has come to as to the site for Glen Canyon Dam, its feasibility, its safety, and all other factors, must at most be tentaive. Those are tentative conclusions?

Mr. DEXHEIMER. No, sir. They are firm conclusions for a structure up to 700 feet. There is no question in our minds.

Senator KUCHEL. Let me point out what else the Secretary of the Interior says:

> If such intensive studies—

and he is talking about the studies that would be made after congressional authorization—

> indicate the advisability of modifying the present selected height of the dam, appropriate changes will be made in the design prior to construction.

I shall not belabor this point, and certainly the engineering professionals in the Department are qualified to make that answer, I understand, but it did seem to me that the comments of the Secretary had some relevance to this hearing as they might indicate that the conclusions on a major project here, Glen Canyon, are tentative.

Mr. DEXHEIMER. No, sir; they are not. Up to 700 feet they are as firm as it is possible for us to get them with the much greater investigation than we have conducted on similar type structures. We are convinced that is entirely feasible and practical up to that height. As I mentioned before, however, we might change it a little bit depending on the future studies. It might even be a little bit higher provided all the other criteria of economy, protection of the bridge, and other factors would balance out in that important detailed design study.

Senator KUCHEL. The Secretary is correct, is he not, Mr. Dexheimer, that if authorization were provided by Congress, more intensive studies, to use the Secretary's words, would then be made of the foundation conditions and of your preliminary design?

Mr. DEXHEIMER. That is our standard practice. We always do that. However, we are much further ahead with those studies in the case of Glen Canyon than we have ever been on any dam before.

Senator KUCHEL. Now I would like to ask Mr. Larson just a few questions in addition. I think it might be of interest to the members of the committee. I have here an order of the United States Supreme Court entered this morning:

The motion of California defendants for leave to file an amended answer is granted. The motion to join as parties the States of Colorado, New Mexico, Utah, and Wyoming is hereby referred to George I. Haight, special master, to hear the parties and report with all convenient speed his opinion and recommendation as to whether the motion should be granted. The Chief Justice took no part in the consideration or decision of these motions.

That was the order of the Supreme Court this morning. I read it because I do feel that the whole question involved in quantity of water under the Colorado River compact is relevant here. I think this committee ought to be able to obtain from competent witnesses connected with the Department of the Interior their understanding of what the compact would require the Department of the Interior to do under the provisions of S. 500. I do not want to take the time of the committee, or yours, Mr. Larson, to go over the questions which I endeavored to ask Mr. Dexheimer this morning, except to ask you if S. 500 became the law, and if Glen Canyon Dam were erected, there would be a responsibility, would there not, on the Department of the Interior to release such waters from Glen Canyon as would meet the compact requirements at Lee Ferry?

Mr. LARSON. That is correct. There is so much leeway between the water that is used now, the 2½ million acre-feet for authorized projects, and since several years would elapse before it gets very much more than that there is so much leeway between the 2½ and the 7½ million acre-feet apportioned to the upper basin States that surely engineeringwise there is a way of filling Glen Canyon reservoir without violating or being inconsistent with the terms of the Colorado River compact.

Senator KUCHEL. What would be your understanding of the amount of water that would have to be released from Glen Canyon Dam to Lee Ferry in order to meet the obligations imposed by the Colorado River compact.

Mr. LARSON. That depends on several things. It depends on the requirements within the rights below, the streamflow, and whether there is surplus water or not. Several factors enter into that so I could not give you any exact amount.

Senator KUCHEL. What would be your understanding of your responsibility as the representative of the Department of the Interior under the very terms of the Colorado River compact?

Mr. LARSON. Our responsibility, I think, would be this: We start out on the assumption that the upper basin has the right to store water and has the right to use the water for the generation of power. Next would be to operate the river consistent with the Colorado compact of 1922 and the upper basin compact of 1948, and also make any

deliveries of water to Mexico that may be required of the upper basin under the Mexican Treaty or the compact.

Senator KUCHEL. And again with respect to the Colorado River compact, what would your understanding be of the amount of water required to be delivered by the Department of the Interior to the lower basin States at Lee Ferry?

Mr. LARSON. That again would vary from year to year but in our studies we have satisfied ourselves that if they were using the entire 7½ million apportioned to them together with any surplus to which they are entitled, we could still fill Glen Canyon Reservoir inasmuch as the upper basin is using only a small portion of its total 7½ million acre-feet.

Senator KUCHEL. Did you agree with Governor Johnson's statement which I read this morning on the Colorado River compact?

Mr. LARSON. I would not attempt to pass any opinion on the interpretations of the Colorado River compact.

Senator KUCHEL. Do you feel that the Colorado River compact must inevitably be interpreted by whoever determines how much the Department of the Interior is going to be required to release from Glen Canyon Dam?

Mr. LARSON. I do not think you have to have it interpreted to go ahead with the development in the upper basin on account of all the leeway I have described to you. There is so much leeway in unused water in the upper basin under its apportionment that we should not have any trouble filling Glen over the years and——

Senator KUCHEL. Suppose you did?

Mr. LARSON. And particularly where water is going to waste into the Gulf of California as far as irrigation use is concerned.

Senator KUCHEL. In other words, what I am trying to get to is this: In your statement you suggest on page 6 of the Colorado River compact in article IIIa apportioned from the Colorado River system in perpetuity to the upper basin and the lower basin, respectively, exclusive of the consumptive use of 7½ million acre-feet per annum. There is a provision in article IIId of the same compact, the States of the upper basin, Colorado, New Mexico, Utah, and Wyoming, will not cause the flow of the river at Lee Ferry, the point of division between the upper and lower basins, to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years. These are controlling and most important limitations with respect to the water uses in the upper basin, although there are other provisions in the compact relating to uses and deliveries of water.

That was a part of your prepared statement.

Mr. LARSON. That is correct.

Senator KUCHEL. So it seems to me that it should be a clear responsibility of the Department of Interior to regulate the flow of water from Glen Canyon in accordance with the Colorado River compact. There would be no question about that.

Mr. LARSON. No, regulation has to be consistent with it, that is correct.

Senator KUCHEL. And the needs of the people in the lower basin States and in particular parts of the State from which I come are going to grow. Their only guideline as to how much water they have from the waters of the Colorado River are involved in the Colorado

River compact: is that not right? Certainly I want them to get not a drop more than they are entitled to under the Colorado River compact, and I do not want them to get a drop less than what is entitled to them under the Colorado River compact. I do think that some of the reasonable people from my State have raised these questions of just exactly the jurisdiction the Interior Department would have over the project, and that got me this morning into the questions with Mr. Dexheimer.

Somewhere along the line someone is going to have to advise the Department of the Interior how much, and when, water shall be released from Glen Canyon Dam to be delivered at Lee Ferry. That is certainly correct; is it not?

Mr. LARSON. Yes, I assume so. The Upper Basin Commission will make a finding of fact which we would operate within.

Senator KUCHEL. Sir?

Mr. LARSON. The upper basin compact provides for the findings of fact by the Upper Basin Commission, and I assume we would operate within those, and also operate consistent with the 1922 compact.

Senator KUCHEL. The upper basin compact?

Senator WATKINS. If I may be permitted a question there, the use of the upper basin compact findings of fact would be for the distribution of water to the upper basin States.

Mr. LARSON. That is right.

Senator WATKINS. They would not attempt to write any findings of fact or regulations for the lower basin, I understand.

Mr. LARSON. No sir; as I understand it.

Senator KUCHEL. I do want that whole question of quantity of water explored, and again, Mr. Larson, I would like to be able to defer until later on in this hearing for a couple of days questions on your complete report. I want also very briefly, however, at this time, to raise the question which likewise is of concern to the lower basin, or anyway part of the lower basin, and that is this question of quality of water.

Have studies been made now by the Department of the Interior relative to the problem of quality of water?

Mr. LARSON. Yes. Our technicians have gone over the quality of water samples taken by the Geological Survey at various points in the upper basin States. If you care to have me read from my statement the comments I have on the quality of the water——

Senator KUCHEL. Where is that?

Senator O'MAHONEY. Pages 9 and 10 of the introduction.

Senator WATKINS. Mr. Chairman, I suggest that be read, because that is one of the controverted points.

Senator O'MAHONEY. Will you proceed, please?

Mr. LARSON. Our studies show that the recommended units and projects would have no material effect on the quality of water downstream. With respect to later phases of development, the plan provides for additional gaging and sampling stations to supply data for continued analysis and scrutiny as each phase approaches authorization. Our analysis of the quality of water at Lee Ferry reveals for the critical period of low flow, 1931 to 1947, concentrations of dissolved salts averaging 0.78 ton per acre-foot (575 parts per million), corresponding to uses totaling 2½ million acre-feet per annum in the upper basin. An average concentration of 0.85 ton per acre-

foot (625 parts per million) or an increase of about 9 percent is anticipated at Lee Ferry following completion of the recommended Glen Canyon and Echo Park storage units and the 11 initial participating projects, with a corresponding use then totaling about 3⅓ million acre feet. With full use of the 7½ million acre-feet per annum allotment in the upper basin, the average concentration of dissolved salts at Lee Ferry is estimated at about 1.20 tons per acre-foot (880 parts per million).

Under any of the above conditions, concentrations and type of salts are well within the standard range for irrigation water designated by the United States Salinity Laboratory at Riverside, Calif., as "good to permissible," and within the range of practical treatment for municipal and industrial purposes.

Senator KUCHEL. What does that phrase "good to permissible" mean, Mr. Larson? How do you define it?

Mr. LARSON. I would like to refer that question, if I may, to Mr. Jacobson, our engineer for the Colorado River storage project, who is more familiar with it and can answer the question better. May I do that, Mr. Chairman?

Senator O'MAHONEY. Certainly.

Mr. JACOBSON. The United States Salinity Laboratory in California is recognized as probably the most expert and well-grounded source of information in this field.

Senator O'MAHONEY. In what State is that?

Mr. JACOBSON. It is operated by the United States Department of Agriculture in Riverside, Calif. They have calibrated irrigation water into four different categories, the first being "excellent to good."

Senator KUCHEL. You were not attempting to attack the credibility, were you, Senator?

Senator O'MAHONEY. Not at all. I was trying to strengthen it.

Mr. JACOBSON. The second category is "good to permissible." The third is "doubtful to unsuitable." The fourth is "unsuitable." These categories are merely a means of calibrating irrigation water based on a salinity expressed in parts per million and the percentage of sodium in the dissolved solids.

Senator KUCHEL. In that category, then, I suppose the different types of water are all fit for human consumption except No. 4. If it is not to be defined as unsuitable, the other waters are good waters.

Mr. JACOBSON. These categories, of course, are calibrations for irrigation purposes, and not necessarily for domestic uses. Colorado River water is well within the range of treatment for domestic purposes.

Senator KUCHEL. It is well within for domestic purposes?

Mr. JACOBSON. That is right.

Senator KUCHEL. And also for purposes of irrigation?

Mr. JACOBSON. That is correct.

Senator KUCHEL. Have those studies gone along and are going along today by the Department of Agriculture?

Mr. JACOBSON. Yes, the most recent report of their salinity laboratory was released last year, going even one step further, whereby they apply water of various types and salt concentrations to soils of various absorptive abilities.

Senator KUCHEL. Has any other agency of Government made such study on the question of quality of water? Has your own agency made any studies along those lines?

Mr. JACOBSON. We do in relation to application of the water to soils, yes. But the experimental work is largely done under the Department of Agriculture, and I think this is the focus or the center where such experiments are conducted.

Senator KUCHEL. Was there not established in the Boulder Canyon Adjustment Act a fund of approximately half a million dollars a year to be used in part for determining studies of both quantity and quality of water?

Mr. LARSON. Yes. There was established the fund of $500,000 annually, retroactive to 1938, and it has been used by the Bureau of Reclamation ever since, and is being used today. There is some money being spent for quality of water analysis but most is used for investigation throughout the upper Colorado River Basin for the irrigation projects. The quality of water programs on the main river and tributaries are being carried on at sampling stations maintained by the Geological Survey.

Senator KUCHEL. So that the studies that have been made so far on the question of quality of water have not been made by the Department of Interior. They have been made by the Department of Agriculture, as Mr. Jacobson suggests, and by the Geological Survey.

Mr. LARSON. The measurements of the salt content of the water are by the Geological Survey which maintains these stations for measuring the silt and the salt.

Senator KUCHEL. Are the results of the investigation of the Geological Survey available for this committee?

Mr. JACOBSON. Yes. I possibly should make an explanation. The Geological Survey is a unit of the Department of the Interior. It is largely a basic data-gathering agency. The studies conducted by the Bureau of Reclamation are an assembly of the basic data, and an analysis by which the basic data are put into proposed river operations studies for the forecast of future salinity. The Geological Survey data are available in their annual publications.

Senator KUCHEL. Could they be made available? Do they have a bearing on this question of quality of water? Is there anything in the Geological Survey's investigations that would aid people in endeavoring to determine the quality of water? If they would, we ought to have them.

Mr. LARSON. The statement that I read is based on the salt measurements or the salinity measurements made by the Geological Survey, and then rated under the Standards of the Riverside Laboratory of the Department of Agriculture.

Senator O'MAHONEY. Mr. Larson, and Mr. Jacobson, is it not a fact that the human body can use more salt water than a farm can for growing good crops?

Mr. LARSON. I think that is correct, Senator.

Senator O'MAHONEY. And if the human body cannot consume a lot of salt water, what would the people on the California beaches do?

Mr. LARSON. Dehydrate, I suppose, if they did not have any salt.

Senator KUCHEL. I have nothing further.

I have no further questions on this quality of water except to say it has not been developed here as I think it ought to be developed.

I would like again to have an opportunity to ask further questions of you on that point, Mr. Larson.

Just so I understood the comments on so-called dead water, does that constitute water that remains in the Glen Canyon Dam more or less permanently as a part of the capacity of the reservoir that stays there?

Mr. LARSON. Yes, sir.

Senator KUCHEL. Under your contemplation that would have no bearing on the amount of water that was released from Glen Canyon?

Mr. LARSON. Yes, it would have a bearing. It would have to be acquired without interfering with the deliveries of water in the compact. It would be out of the upper basin's share.

Senator KUCHEL. To that extent its presence in that dam would not affect the flow of water out of the dam to the lower basin?

Mr. LARSON. That is correct. I should correct the figure of 7 million acre-feet; Mr. Jacobson tells me it is closer to 6 million than 7 million, but, anyway, it is within that range.

Senator KUCHEL. That is all.

Senator O'MAHONEY. Mr. Larson, just a few questions.

On page 10 of your statement you fix the amount of water to be used in the 11 participating projects in S. 500 as 3½ million acre-feet. That is the maximum, is it?

Mr. LARSON. That would be the amount of water depletion above Lee Ferry for all existing projects including those authorized and the projects in the bill recommended by the Secretary.

Senator O'MAHONEY. Yes.

Mr. LARSON. There are some additional ones in the bill other than the Secretary's recommendation that would bring it up to 4,300,000.

Senator O'MAHONEY. But the projects, the participating projects which the Secretary and the Bureau have had an opportunity to investigate——

Mr. LARSON. Echo Park.

Senator O'MAHONEY. Echo Park, Glen Canyon, and 11 participating projects altogether would not use more than 3½ million feet.

Mr. LARSON. That is correct.

Senator O'MAHONEY. And if some other projects which were put in the bill last year, which I take it are in this year, in the upper Colorado River, were to be authorized, that would raise the use of water about 11 million acre-feet additionally.

Mr. LARSON. About 800,000 more. That is the San Juan-Chama diversion, the Navaho and Gooseberry projects, and the additional units, Curecanti, Cross Mountain, and Flaming Gorge reservoirs, that is, the evaporation from these three reservoirs.

Senator O'MAHONEY. That would be just a little over 4 million acre-feet.

Mr. LARSON. That is right.

Senator O'MAHONEY. Would that use in the upper basin be any danger to the use in California?

Mr. LARSON. No. taking into consideration the average goal, the long-time goal.

Senator O'MAHONEY. Would it be any danger to the use in California and the lower basin of the 7½ million acre-feet annually totaling 75 million acre-feet over any given 10-year period, which the upper basin is obliged to deliver to the lower basin?

Mr. LARSON. No. It would not interfere in a 10-year period. If you had Glen Canyon, Echo Park storage reservoirs, you are O. K.

Senator O'MAHONEY. That is why you have Glen Canyon, that is why you have Echo Park, in order to provide storage for waste water so as to protect California while the upper basin gets the use to which California agreed when it signed the compact; is not that the fact?

Mr. LARSON. That is correct.

Senator O'MAHONEY. How long have you been with the Bureau?

Mr. LARSON. I have been with the Bureau since June 15, 1923, about 32 years.

Senator O'MAHONEY. Were you an engineer when you began?

Mr. LARSON. Yes; I have been an engineer for 37 years.

Senator O'MAHONEY. Have you ever built a dam that collapsed yet?

Mr. LARSON. No, sir; and I hope I never do.

Senator O'MAHONEY. You would not want to, would you?

Mr. LARSON. No, sir.

Senator O'MAHONEY. Mr. Dexheimer, how long have you been an engineer?

Mr. DEXHEIMER. Twenty-six years with the Bureau of Reclamation and about 30 years altogether.

Senator O'MAHONEY. You mean that 30 added to 26?

Mr. DEXHEIMER. No, sir; not altogether.

Senator O'MAHONEY. Well, I saw that baldness. So that 30 years you have been an engineer and you have worked on a number of dams?

Mr. DEXHEIMER. Yes, sir.

Senator O'MAHONEY. Have you ever built a dam that collapsed, or worked on one for the Bureau that collapsed?

Mr. DEXHEIMER. No, sir.

Senator O'MAHONEY. You personally gave your study to this project?

Mr. DEXHEIMER. Yes, sir.

Senator O'MAHONEY. Mr. Larson, did you?

Mr. LARSON. Yes, sir. I have been on the Colorado River with a force of engineers for 10 years.

Senator O'MAHONEY. Would you consciously recommend to the Congress the building of a system that would be dangerous to the lower basin?

Mr. LARSON. No, sir.

Senator O'MAHONEY. Have both of you gentlemen given time to examination of these plans?

Mr. DEXHEIMER. Yes, sir.

Senator O'MAHONEY. How much time have you given, Mr. Dexheimer?

Mr. DEXHEIMER. Off and on for a period of 5 or 6 years.

Senator O'MAHONEY. Mr. Larson, what about you?

Mr. LARSON. Almost every day for 10 years.

Senator O'MAHONEY. Have you any doubts, either of you, in your minds, about the recommendation which has been made by the Secretary and by the President of the United States to the Congress with respect to this upper Colorado storage project?

Mr. DEXHEIMER. None whatever.

Mr. LARSON. No, sir.

Senator O'MAHONEY. Are there any other questions?

Senator WATKINS. Mr. Larson, I think you mentioned several times there were 11 participating projects. Do you not mean 12?

Mr. LARSON. Twelve, with Eden. Eden is already authorized. It need not be recommended for authorization again. Eden is included because it participates in the storage project revenues.

Senator WATKINS. I do not think Eden is in the list. I am talking about the projects in the bill S. 500. Central Utah, initial phase; Emery County, Florida, Gooseberry, Hammond, LaBarge, Lyman, Paonia, Pine River extension, Seedskadee, Silt, Smith Fork.

As we add them up here they come to 12, the engineer coaching me here has miscounted.

Senator O'MAHONEY. As the witness has said, Eden was authorized by bill reported out of the Interior Committee several years ago. It does not have to be included in this bill.

But the question is suggested, the use of water in the Eden project, is that computed in your figure of approximately 4 billion acre-feet?

Mr. LARSON. Yes.

But, Mr. Chairman, may I make this explanation: the 11 projects I refer to are the 11 recommended by the Secretary that are in the bill. In addition, there is Eden.

Senator WATKINS. We do not find it in the list I just read. As we count them here, as I say if my engineer assistant here has not miscounted——

Mr. LARSON. I think I can clear it up now. In the Secretary's supplemental report he recommended Echo Park and Glen Canyon units, the 11 participating projects, and then mentioned the Eden project as participating in revenues. We have to put it in our table. It is already authorized to participate.

Then in table 2 of my statement I have included the additional projects in the bill.

Senator WATKINS. The ones we have in the bill itself come to 12. The ones I just read.

Mr. LARSON. Well, I have them in the tables, but there were not 12 in the Secretary's recommendation.

Senator WATKINS. Well, I am talking about the bill.

Mr. LARSON. It is in here.

Senator O'MAHONEY. Eden is not left out. Nobody need worry about that.

Senator WATKINS. Apparently you left out Gooseberry, because that had not been sent to the States yet.

Mr. LARSON. Yes; it had not cleared the Bureau of the Budget and the affected States, and therefore was not included in the Secretary's recommendation.

Senator WATKINS. He could not do that. That is why his package is 11 projects. The package we have here is 12.

Mr. LARSON. That is correct.

Senator O'MAHONEY. Are these all feasible projects, these 11?

Mr. LARSON. Yes; they all have a favorable benefit-cost ratio. One or two of them are very close.

We hope that the benefit-cost ratio will improve with detailed investigation.

Senator O'MAHONEY. Well, we are very grateful to you, Mr. Larson, for your presentation and for your responses to our questions.

Senator KUCHEL. May I ask 1 or 2 more questions, Mr. Chairman?

Senator O'MAHONEY. Yes, indeed.

Senator KUCHEL. I think this is self-evident, but I would like the record to show it.

None of the water which would be stored in the Glen Canyon Dam would ever be used for either agriculture, domestic, or other purposes in the upper basin; is that correct, Mr. Larson?

Mr. LARSON. No; it would be used for all the purposes by exchange.

Senator KUCHEL. What I mean is none of the water that would be stored in Glen Canyon Dam would ever be used for any domestic or irrigation purposes in the upper basin: is that correct?

Mr. LARSON. Yes, generally; but I can't answer you that direct. There may be a town right on the bank by the Glen Canyon Reservoir that would pump the water out of the reservoir the same as Boulder City does out of Lake Mead.

Senator KUCHEL. It is hardly necessary to make the 26 million acre-feet.

Mr. LARSON. It would be very minor.

Senator KUCHEL. So that aside from any such minor contingency you would agree with me that the water stored in Glen Canyon would not be used for purposes in the upper basin?

Mr. LARSON. Physically, that is correct.

Senator WATKINS. You are referring to the actual physical water stored in that dam, I believe, Senator?

Senator KUCHEL. Yes, sir.

Thank you, sir.

Senator O'MAHONEY. You are excused, Mr. Larson.

Senator WATKINS. May I make this remark, Mr. Chairman?

Senator O'MAHONEY. Yes.

Senator WATKINS. I think Mr. Larson is disappointed that I have not asked him the series of questions that I did before, but I am relying on the record that went on before so I am going easy on you today.

Mr. LARSON. Thank you.

Senator O'MAHONEY. Mr. Keesee, of Gallup, N. Mex.

I should say to you, Mr. Keesee, that Senator Anderson is obliged to attend the meeting of the Atomic Energy Committee of which he is chairman, a Joint Committee. So he is unable to be present today.

Will you state your name for the record and identify yourself and then proceed with your statement.

Mr. KEESEE. I am J. B. Keesee, irrigation engineer on the Navaho Reservation for the Bureau of Indian Affairs.

The statement which I will read is contained in Mr. Larson's report, the large report which he just referred to.

This was prepared by our office and included in his report as among the participating projects.

STATEMENT OF J. B. KEESEE, INVESTIGATION ENGINEER ON THE NAVAHO RESERVATION FOR THE BUREAU OF INDIAN AFFAIRS

The potential Navaho project, formerly called the Shiprock and South San Juan projects, would provide for the irrigation of about 137,250 acres of arable dry lands lying along the south side of San Juan River, a principal tributary of Colorado River, near the towns of Bloomfield, Farmington, and Shiprock in northwestern New Mex-

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

EIGHTY-THIRD CONGRESS

SECOND SESSION

ON

S. 1555

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

JUNE 28, 29, 30, JULY 1, 2, AND 3, 1954

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COLORADO RIVER STORAGE PROJECT

MONDAY, JUNE 28, 1954

UNITED STATES SENATE,
SUBCOMMITTEE OF THE COMMITTEE
ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met at 10:45 a. m., pursuant to call, in room 457, Senate Office Building, Senator Eugene D. Millikin presiding.

Present: Senators Eugene D. Millikin, Colorado (chairman of the subcommittee); Arthur V. Watkins, Utah; and Clinton P. Anderson, New Mexico.

Present also: Senators Edwin C. Johnson, Colorado, Thomas H. Kuchel, California; and Wallace F. Bennett, Utah.

Present also: Elmer K. Nelson, staff consulting engineer, and N. D. McSherry, assistant chief clerk.

Senator MILLIKIN. The subcommittee will come to order.

This will be the opening of hearings on the upper Colorado River Basin storage program. There will be inserted in the record S. 1555, a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project, and participating projects, and for other purposes.

(The bill S. 1555 is as follows:)

[S. 1555, 83d Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the obligation undertaken by the States of the upper division in article III of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and Upper Colorado River Basin Compact, respectively, providing for the control of floods and for the improvement of navigation, and generating hydroelectric power, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, power plants, transmission facilities, and appurtenant works: Echo Park, Flaming Gorge, Glen Canyon, Navaho, and Curecanti: *Provided, however,* That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high water line located at seven thousand five hundred and twenty feet above mean sea level; and (2) to construct, operate, and maintain the following additional reclamation projects (including power generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central

I thank you and commend you for using the language you did. But when you use the term "evolve," by whom would those plans be evolved? Do you recognize the responsibility of the State to decide where its water should be used?

Mr. WILL. We think that it is a responsibility of the State, working in close cooperation with our commission and with the Federal Government.

Senator ANDERSON. But the quotation you have on the front page of your statement speaks of this fundamental policy that includes the interests and rights of the States in the development of the watersheds within their borders.

Mr. WILL. Yes, sir. We believe that the States now have, by law, in the language of section 1 of the 1944 Flood Control Act, certain duties and responsibilities and privileges in connection with the utilization and control of the waters within their borders.

Senator ANDERSON. You recognize, then, the responsibility of the State?

Mr. WILL. Yes, sir.

Senator ANDERSON. That is all, Mr. Chairman.

Senator MILLIKIN. Thank you very much, Mr. Will.

The next witness is Hon. Ralph Tudor, Under Secretary of the Interior.

Senator ANDERSON. Mr. Chairman, again I have had no opportunity to go over Mr. Tudor's statement in advance. I wonder if we might have an agreement that if necessary he will come back at some other time in case questions arise.

Senator MILLIKIN. Yes. I hope he will be available at any time.

I would like to say, Mr. Tudor, that I have to appear on the floor of the Senate in just a little while, so I will not be able to be here all the time. Senator Watkins will take over pretty soon.

Senator ANDERSON. Could we depart a moment to ask whether you plan to continue this afternoon?

Senator MILLIKIN. Yes.

Senator ANDERSON. Senator Kuchel and I are involved in the Santa Margarita water bill which, as the chairman knows, is a somewhat warm issue in the State of California. I think that would be considered a moderate statement. We would like to try to finish the conference and at the same time I would like to be here.

Senator MILLIKIN. We should go ahead with this, Senator, and if anything develops in your absence, it would be an easy matter to restore the witness so you can have your questions and get what information you wish. I don't think we should stop the hearing once we have started it.

Proceed, Mr. Tudor.

STATEMENT OF HON. RALPH A. TUDOR, UNDER SECRETARY OF THE INTERIOR, WASHINGTON, D. C.

Mr. TUDOR. Senator Millikin and gentlemen, I must confess I was not aware of a rule that the statement should be up here 24 hours in advance and perhaps that was my fault. I do not think, however, that there is anything in my statement that is new. It is more of an emphasis to things that have been here before, and I will be glad to return at any time the committee desires.

Senator ANDERSON. I think, Mr. Secretary, that the rule was adopted so that when it comes to a technical question, the people who are going to examine will have a chance to prepare that examination, just as you prepare the statement.

Senator MILLIKIN. I would suggest that all witnesses get their written material into the committee as rapidly as possible in advance of their appearing before the committee.

Senator WATKINS (presiding). Proceed, Mr. Tudor.

Mr. TUDOR. I have a prepared statement which I would like to read, and if there are any questions as I progress, please interrupt me.

I am appearing before your committee this morning to discuss the proposal and the legislation for the Colorado River storage project.

The project has a considerable history and a background of negotiating and planning that has covered many years. The development of irrigation enterprises using water from the Colorado River and its tributaries accelerated very rapidly between 1900 and 1920. This is particularly true in the lower portion of the basin in Arizona and California. The river has always been very erratic in flow and even in those early years it was evident that the time would come when all of the available water would have to be used with care and economy if even the ultimate essential needs were to be met.

In particular, it was evident that large storage facilities would have to be provided to equalize the erratic flows, conserve supplies, and make it possible to have an equitable division of the available water among the various States of the basin.

To this end the Colorado River compact was signed on November 24, 1922, and all 7 States were participants. This compact apportioned to the 5 upper basin States (Wyoming, Utah, Colorado, New Mexico, and Arizona) the right to exclusive beneficial consumptive use of 7,500,000 acre-feet of water annually. At this time the upper basin was obligated not to deplete the flow of the Colorado River at Lee Ferry below an aggregate of 75 million acre-feet in any consecutive 10-year period.

Senator ANDERSON. Right there, Mr. Secretary, those two statements don't completely tie together, do they?

Actually, what the upper basin States were guaranteed was that they could have whatever was left over after they delivered the seven-million-odd acre-feet?

Mr. TUDOR. I believe that is right.

Senator KUCHEL. Wasn't that the same theory on which the Mexican water treaty was adopted and ratified by the Senate, that we would deliver to Mexico a certain annual quantity of water each year, so that to that extent all the States of the Colorado Basin would have what was left?

Mr. TUDOR. I believe that is the case. I am not familiar with the details, but I believe it was agreed that you would deliver a million and a half acre-feet which had to be divided equally between the upper States and lower States, with one State, I believe, having a specific amount.

Senator ANDERSON. I would only say there that Senators McFarland of Arizona and Downey of California tried to stop or modify the compact with the Republic of Mexico, and I think if we had known what direction we were headed, we might not have approved it, because we are certainly in a position now where we would like to buy back that

million and a half acre-feet. I don't imagine Mexico would sell at any low price, but unfortunately we made the treaty.

Senator WATKINS. Which State tried to stop it?

Senator ANDERSON. Arizona delayed Senate committee action and some of our other Western States should have realized the possibilities at that time, Arizona sensing apparently what was to happen. It has been a frightening thing ever since, because here we are with this guaranty and no water to fulfill it.

Senator WATKINS. I happen to have been present at those hearings. The State of Utah officially supported it as did the upper basin States, with the possible exception of Wyoming. I represented a faction in Utah at the time which was opposed to it, and I think time has vindicated our opposition. I wanted to call that to your attention.

Senator ANDERSON. I congratulate my colleague for that stand. I am not worrying about the official position of the States. I just happen to know that Senator McFarland went as long as he could with his committee filibuster and it is too bad he didn't get more help.

Senator KUCHEL. May I inquire, also, where you say as you just read, this compact apportioned to the five upper Basin States the right to exclusive beneficial consumptive use of 7½ million acre-feet of water annually, do I understand by that that you mean that your interpretation there is that the compact provided that in each 12-month period that amount of water would be the maximum of beneficial consumptive use of the waters of the river to the five upper basin States?

Mr. TUDOR. Did you say the maximum?

Senator KUCHEL. There are two sentences. The first one is this compact apportioned to the five upper basin States the right to exclusive beneficial consumptive use of 7½ million acre-feet of water annually. That is to say that each year they would be entitled to that much?

Mr. TUDOR. Without benefit of having that before me, I think that is the minimum and not the maximum.

Senator ANDERSON. I believe that is correct. There is a provision for subsequent adjudication of the waters, which we now think do not exist. But certainly if there had been surplus, there would be an opportunity to adjudicate it. I did not mean to get into an interpretation of the compact, but nevertheless the fact remains that the upper basin States may end up with 40 or maybe 37½ percent of the water in a short time.

Senator KUCHEL. By way of comments to the suggestion of my friend from New Mexico, it is a fact, is it not, Mr. Secretary, that the Colorado compact must control the manner in which this legislation would be considered by the Congress?

Mr. TUDOR. That is correct, sir. That is our anticipation.

Senator KUCHEL. To that extent, where interpretations are required with respect to the provisions of the Colorado River compact, those interpretations, obviously, would have an effect upon the legislation which we are considering?

Mr. TUDOR. That is our intention. Our recommendations are that this legislation be within the confines of those two compacts.

Senator WATKINS. You may proceed.

I may make a suggestion to the members of the committee present that, if possible, let's mark the text where we want to ask questions and ask them at the conclusion of the witness' statement. Probably we will get a more consecutive understanding of what he is trying to say. Sometimes we fill the record up so full between the parts of the statement that it is almost impossible to get the clearcut interpretation.

Senator ANDERSON. I am afraid the Senator from California and I cannot wait to get into an argument. But go ahead, that is all right.

Senator WATKINS. Proceed, please.

Mr. TUDOR. By this compact the quantity of water available for consumptive use in the upper basin was specifically limited. In addition, any deficit in the water supply available for delivery to Mexico under the Mexican Treaty of 1944 must be furnished one-half by the upper basin and one-half by the lower basin.

As a result of this 1922 compact, it was possible to proceed with the development of the lower Colorado for the benefit of the lower basin States. In particular, the Boulder Canyon project proceeded immediately and other projects have followed.

In the meantime, the upper basin States had a problem of their own to divide among themselves the water that had been allocated for their joint use. To this end the upper Colorado River compact, specifying the percentages of the available water which each upper basin State might use, was negotiated and formalized. The Congress granted its consent to this compact and it became effective on April 6, 1949.

Thus the presently proposed upper Colorado River project is now presented to enable the upper Colorado River States to carry out their responsibilities to the lower basin States under the Colorado River compact of 1922 and distribute the remaining benefits among themselves in accordance with the upper Colorado River compact of 1949.

The Department of the Interior through the Bureau of Reclamation has been working in close cooperation with the upper basin States and various Federal agencies in the preparation of a coordinated plan of development of these water resources.

Adequate reservoir storage is the key to this plan and it is necessary to store water not only to take care of fluctuations in flow during any year, but also to take care of the very erratic flow of the Colorado River from year to year. This may vary from 4 million to 23 million acre-feet annually. The variation is unusually broad.

For this reason, the ultimate plan of development anticipates a series of 9 storage reservoirs having an initial total storage capacity of about 47,000,000 acre-feet. This amount of storage regulation is necessary to assure meeting the obligation of the upper basin to deliver 75 million acre-feet to the lower basin over a 10-year period and, at the same time, permit development of irrigation, municipal, and industrial use of water in the upper basin.

It is not my purpose to describe in detail features of the plan of development. Other witnesses who have participated in the detailed work and are more familiar with it than I am are available and will appear before your committee to cover these items. It is my pur-

pose, however, to bring out the general features and the basic policies which this plan as now presented and recommended by the Department of the Interior includes.

In the first place, I want to emphasize that this is a basinwide plan, and the various individual projects are designed to support each other and to provide the maximum economy of use of this water resource which is so vital to the area.

It is our recommendation that authorization be approved to provide for the initial construction of 2 reservoirs, Glen Canyon and Echo Park, and subsequent construction of 11 new participating projects. Echo Park and Glen Canyon Dams are the most effective and necessary units to river regulation. Furthermore, they generate power and will contribute substantially to the financial success of the entire development.

It is to be noted that these two projects will pay for themselves together with interest within 50 years even if no other features are built in the meantime.

It is our further recommendation that these 11 new participating projects, including both storage and reclamation developments, be authorized at this time subject to reexamination of the economic justification of each project and further report by the Secretary to the President and the Congres when it is later proposed to proceed with each such project. These further reports shall include certifications that the benefits of each project exceed its cost.

It is also recommended that these further reports include a joint study with the Department of Agriculture of the direct agriculture benefits of each of these projects. It is our intention that this reappraisal of the economic justification of each project will be based upon national water, economic, and other appropriate policies in effect at the time the first appropriations for such project are sought.

The economics of the upper Colorado River project anticipate that all investments for the production and transmission of power and for providing municipal and industrial water will pay for themselves in full, including interest, within a period of not to exceed 50 years, and that both the interest and the principal will be returned to the Treasury. Additional net earnings from these activities are expected to be used to assist the irrigators in paying for the capital investment in irrigation developments.

In the case of irrigation, the plan contemplates that full repayment of the principal will be returned to the Treasury within a combined period of 10 years, allowed for initial development, and an additional pay-out period of 50 years. It is not anticipated that interest on the investment in irrigation will be repaid, since this has been the continuous national policy from the enactment of the original Reclamation Act of 1902. This policy relative to the interest has been applied to all other reclamation projects heretofore built by the Federal Government.

It is our proposal that in those instances where repayment of interest-bearing costs, such as power, and noninterest-bearing costs, such as reclamation, are due concurrently, they will be repaid concurrently to the extent practicable. In other words, it is not the intention to defer payments on noninterest-bearing items until the interest-bearing items have been paid out.

This total project is made up of a number of individual units. The initiation of construction of these individual units is to be scheduled over the years so that each one may be paid for within the time limits described above.

We propose that in order to assure better repayment of irrigation costs of these projects conservancy type districts be established in each instance. This will give a broader base for repayment.

We also recommend that provision be made for financing the entire undertaking through a separate revolving fund to be established in the Treasury of the United States. This fund would—

(*a*) Receive all appropriations for construction, operation and maintenance as advances from the general fund of the Treasury;

(*b*) Receive all revenues collected in connection with the operation of the project;

(*c*) Be available for the operation and maintenance of the project subject to such limitations as may be imposed by the Congress in annual appropriations acts;

(*d*) Be available for construction in accordance with the appropriations made therefor;

(*e*) Pay to the general fund of the Treasury, annually, after completion of any feature or unit, a sum sufficient to return within 50 years, exclusive of authorized development periods, the full reimbursable costs of that unit or feature, including interest on power and municipal water supply investment; and

(*f*) Provide Congress with a business-type budget for the project annually.

It is anticipated that the above recommendation will provide a sound and understandable continuous accounting of the funds invested in and received from this upper Colorado River project.

In making this presentation to the committee, it is my desire to give special consideraiton to one feature of the project because of certain unusual circumstances surrounding it and certain personal investigations and recommendations that I have made in this instance. I refer to the Echo Park Dam and reservoir. Inasmuch as this dam and reservoir fall within the confines of the Dinosaur National Monument, there has been opposition to its inclusion. In view of this opposition, the former Secretary of the Interior agreed to study and consider proposals for alternate reservoirs that would be outside the limits of the monument. In keeping with this commitment, Secretary McKay directed that such a study be made and in particular directed me to give it my personal attention.

In accordance with these instructions, I reviewed the reports which have been made by the Bureau of Reclamation and the studies, comments and other information which was made available to me by the National Park Service. I also met with a number of people and organizations who were interested and had expressed opinions both for and against this development. I was furnished with considerable literature and read most of it.

Finally, I made a personal reconnaissance of much of the upper Colorado River Basin area. In particular, and in company with the Commissioner of Reclamation, I went by auto and boat to the vicinity of the Glen Canyon Dam site. I flew over much of the Colorado River and its tributaries from the southern boundaries of Colorado to Vernal via Grand Junction and Salt Lake City.

These rivers are in a region noted for its scenery. I viewed a number of the proposed alternate dam sites, including New Moab, Desolation, and Dewey. Finally, in company with the Director of the National Park Service and the Commissioner of Reclamation together with members of their staffs, I spent 3 days in the Dinosaur National Monument. This included a boat trip through Whirlpool Canyon of Green River from the mouth of Yampa River to Island Park.

I also visited most other major points of interest by jeep and viewed by air the entire length of Lodore Canyon.

As a result of these studies and this field trip, I recommended to the Secretary that the Echo Park Dam and Reservoir be included in the upper Colorado River Basin project. My recommendation to him was in a brief memorandum, dated November 27, 1953, and approved by Secretary Douglas McKay November 30, 1953, which reads as follows:

In accordance with your verbal instructions I have made a study concerning the proposal to build the Echo Park Dam and the Split Mountain Dam as a part of the upper Colorado River Basin development. These two dams, if built, will be located within the Dinosaur National Monument. They were originally proposed to be included in the plan of development of the basin which was prepared by the Bureau of Reclamation and recommended for approval by the Secretary of the Interior in January 1951. Opposition developed to the construction of these two dams in the Dinosaur National Monument, and on December 4, 1952, the then Secretary of the Interior revised his recommendation and proposed that further consideration be given to studies of alternate sites. It was under these circumstances that you directed me to investigate the matter with particular reference to the suggested alternate sites.

In connection with this investigation I have reviewed the reports, sought and been furnished data, and information from both the National Park Service and the Bureau of Reclamation, conferred with various interested parties and organizations, and have, in company with the Director of the National Park Service and the Commissioner of the Bureau of Reclamation, personally visited the two dam sites in question and inspected a considerable portion of the Dinosaul National Monument. I also inspected on the ground and from the air other portions of the upper Colorado River area.

The oppostion to the two dams in question arises from persons and organizations interested in the national parks and their desire to preserve the Dinosaur National Monument in its present natural state. The Echo Park Dam, in particular, will create a large reservoir within this monument and will alter its appearance and the existing conditions. It is a matter of personal opinion as to the extent of the harm that may be created by this reservoir. My own feeling is that the alteration will be substantial and if conflicting interests did not exis, I would prefer to see the monument remain in its natural state. However, I do feel that if the dam is built, the beauty of the park will by no means be destroyed, and it will remain an area of great attraction to many people.

It should be noted that neither of these proposed reservoirs will inundate any portion of the quarry where the dinosaur skeletons have been found.

I have examined the proposals for various alternate reservoirs. To be effective these alternates must provide approximately the same storage of water and must waste as little water as possible. The latter is extremely important for the available water for consumptive uses in the upper Colorado River Basin is for less than will be needed for the full economy of this region.

I have been furnished with information on the New Moab, Dewey, Desolation Dam sites, and have considered the possibility of increasing the height of the proposed Glen Canyon Dam. I am particularly impressed with the showing that any of these alternate dam and reservoir sites would result in a net loss of water from evaporation from approximately 100,000 to 200,000 acre-feet per year. Even the lower figure is enough to provide all of the domestic, commercial, and industrial water for a city the size of Denver. In an area where water is so precious this is a matter of very serious consequence. Such lost water cannot be replaced at any cost and the ultimate regional economy would have to be reduced accordingly.

There has been some question as to the accuracy of the estimates of evaporation and the application of the formulas used to compute losses. I have reviewed this matter and, while there may be some error due to a shortage of experimental data, I am convinced that the calculations are reasonable and any error that exists is equally applicable to the calculations for all reservoirs. Therefore, the error in net differences in calculated losses between any two reservoirs must be small.

There would be substantial loss in electric generating capacity if any one of the alternate sites were selected. While this is a matter of economic importance, I do not attach as much weight to it as the loss of water. The power loss could be replaced by steam power at some increased cost.

I share the concern of those who would preserve the beauties of the Dinosaur National Monument in their present natural state, but as between a choice of altering this scenery without destroying it in a basin which is and will remain rich in scenery, or the irreplaceable loss of enough water to supply all the needs of a city the size of Denver, I believe the conservation of the water in the interest of the Nation is of greatest importance.

In view of the foregoing, I recommend that the plan for the development of the upper Colorado River Basin include the Echo Park and Split Mountain Dams and Reservoirs within the Dinosaur National Monument. This is in keeping with the original recommendation made by the former Secretary of the Interior.

Except to the extent that an error was made by the Bureau of Reclamation in a calculation of evaporation losses of the high Glen Canyon Dam and Reservoir, this statement stands. In the case of a high Glen Canyon Reservoir, the increased evaporation compared to that of Echo Park and Split Mountain Reservoirs would be approximately 25,000 acre-feet annually.

However, as pointed out in testimony before the House committee, a high Glen Canyon Dam is not an acceptable alternate. The storage it provides is at the extreme lower end of the upper basin and would, therefore, be very substantially less effective than upstream storage. This would impair needed regulation of the upper section of the river system and have important adverse effects on the operation and economic value of the total development.

In making this recommendation on behalf of the Echo Park Dam and Reservoir, the Department is, of course, on the horns of a dilemma. On the one hand, there is a fundamental desire to preserve the natural beauty of the Dinosaur National Monument. The Department does not subscribe to any policy which contemplates indiscriminate or haphazard construction of reservoirs or other artificial developments in this or any other national park or monument area.

It opposes any development in such areas if this can possibly be avoided without undue and irredeemable losses of some other natural resources. On the other hand, the Department does recognize that in this instance any otherwise acceptable alternate would result in a serious loss of water in a region which will always be short of this commodity and in which water is the limiting factor on the development of the economy and resources of the basin.

Again I point out that the choice is simply one of altering the scenery of the Dinosaur National Monument without destroying it in a basin which is and will remain rich in scenery, or of irreplaceably losing enough water to supply all the needs of a city of more than 600,000 people. In the opinion of the Department of the Interior, in this particular instance, and not as a matter of precedent, we believe that the choice should be in favor of building the dam and reservoir, and that this is to the greatest interest of the Nation. We so recommend to the Congress.

Senator WATKINS. At this point the committee will take a recess. I think the members of the committee would like to be on the floor when the new Senator is sworn in, and the Secretary has immediate appointments downtown.

I would like to inquire of the Senators present if they would like to question Secretary Tudor.

Senator ANDERSON. Yes.

Senator WATKINS. Then we will ask the Secretary to come back at 2 o'clock.

Senator ANDERSON. Senator Kuchel and I would be very appreciative if you would give us an hour to be on the floor and reconvene at 3 o'clock. I am doing this not at the convenience of myself, I assure you, but the Senator from California has too been interested in this, and I would like to stay through the conference if at all possible.

Senator KUCHEL. I urge you, Mr. Chairman, to consider that request.

Senator WATKINS. May I say this: I am not entirely a free agent in this matter. I am acting at the instance of the Chairman of the Subcommittee, and he asked that I recess until 2 o'clock.

Senator KUCHEL. Would you consider recessing until 3 o'clock, Mr. Chairman, so that that extra hour would be available to us? That would be all the time we would spend in our conference committee.

It does represent a 2 weeks' continuance, to 2 o'clock this afternoon, and it would be of great benefit to the junior Senator from California, and certainly the junior Senator from New Mexico is interested in the problem.

If we just had that hour's time, I am sure we could make substantial progress and come back here.

Senator ANDERSON. I will put it this way, Mr. Chairman. If we do come back at 2 o'clock, others can go ahead and question Mr. Tudor as much as desired, but I am going to be back at 3 o'clock and question him all over again. I just hope we can delay it.

Senator WATKINS. You heard the explanation the presently acting chairman made. I don't want to be unreasonable about it. I will go as far as I can. Can you make it at 2:30?

Senator ANDERSON. As far as I personally am concerned, the Senator from California knows I have been opposed to earlier versions of his bill for a long time. It might suit me individually to let the bill die. Unfortunately I am in this group now trying to help individuals get a solution to a problem that has been bothering the people in California a long time. And I would like to see it through.

Senator WATKINS. I will assume the responsibility for recessing until 3 o'clock.

Senator ANDERSON. Thank you.

Senator WATKINS. That means we will probably continue later tonight.

Senator ANDERSON. That is all right.

(Whereupon, at 12:15 p. m. the committee was recessed, to reconvene at 3 p. m. the same day.)

AFTERNOON SESSION

Senator WATKINS. The committee will be in session.

The chairman is advised that the two Senators who wish to examine Mr. Tudor will not be here for a few minutes. They are still in conference on the Santa Margarita bill.

We will call a witness out of order. Hon. L. C. Bishop, Colorado River Commissioner for Wyoming, will be our next witness.

STATEMENT OF L. C. BISHOP, WYOMING STATE ENGINEER

Senator WATKINS. Mr. Bishop, we are very glad to have you with us. You may proceed.

Mr. BISHOP. Mr. Chairman, members of the committee, my name is L. C. Bishop. I am State engineer of the State of Wyoming, and I offer the following statement with reference to the bill that is now before the Senate, for authorization of the upper Colorado River storage project and participating projects. The bill under consideration by this committee proposes the authorization for construction of 5 initial units of the so-called Colorado River storage project, and 16 participating projects. Three of the participating projects are located in Wyoming. None of the proposed storage units are in Wyoming.

The proposed storage units are important, not only to the upper Colorado River Basin but to the State of Wyoming. These storage units are essential to making possible the use of the water by the upper Colorado River Basin States which was allocated to them under the 1922 Colorado River compact. They are essential to meeting the minimum flow obligations at Lee Ferry imposed by the 1922 compact.

The most important of the five proposed storage units to the upper Colorado River Basin and to Wyoming are the Glen Canyon and Echo Park Reservoirs. These two units are essential elements of the team of reservoirs required to permit the use and to meet the obligations resulting from the 1922 Colorado River compact. The power revenue from these two units are necessary in connection with the irrigation development in the upper basin States, since irrigation development cannot be accomplished without a subsidy from power revenues. These two units are essential from the standpoints of (1) maximum water utilization, (2) minimum evaporation loss and (3) most economical power production.

I discussed the Echo Park Reservoir situation at some length at the House hearings on the Colorado River storage and participating projects and I refer you to pages 273–280 of the House committee hearings on this matter.

The three participating projects in Wyoming proposed for construction under this bill are the LaBarge, Lyman and Seedskadee projects. These projects will irrigate 68,000 acres of new land and provide supplemental supply to about 40,000 acres which are already under irrigation. The total water depletion resulting from these 3 projects will be using only about 35 percent of the water allocated to it under the 1948 upper Colorado River Basin compact.

The completion of the units of the Colorado River storage project and the participating projects proposed under this bill will result in a

85TH CONGRESS
2d Session

SENATE

DOCUMENT
No. 77

COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

LETTER

FROM THE

SECRETARY OF THE INTERIOR

TRANSMITTING

THE FIRST ANNUAL REPORT ON THE STATUS OF THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS TOGETHER WITH A STATEMENT ON HYDROLOGIC BASES FOR FINANCIAL STUDIES, COLORADO RIVER STORAGE PROJECT, PURSUANT TO PUBLIC LAW 485 OF THE EIGHTY-FOURTH CONGRESS



PRESENTED BY SENATOR ANDERSON

JANUARY 16, 1958.—Ordered to be printed with an illustration

UNITED STATES
GOVERNMENT PRINTING OFFICE
20223 WASHINGTON : 1958

LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., December 30, 1957.

Hon. RICHARD M. NIXON,
President of the Senate,
Washington, D. C.

DEAR MR. NIXON: Transmitted herewith is the first annual report on the status of the Colorado River storage project and participating projects as required by section 6 of the authorizing act of April 11, 1956 (70 Stat. 105).

The Department also has in progress preliminary repayment studies. They are associated, among other things, with hydrologic conditions, time needed for reservoir filling, and the schedule of construction of the project. The Department contemplates keeping the legislative and appropriation committees informed of the results of these studies.

Attached also is a copy of the statement "Hydrologic Bases for Financial Studies Colorado River Storage Project, Revised December 1957." In considering the processes of initial storage, many factors must be taken into consideration. These factors are now being studied by the Department and by the States concerned. The statement recognizes that changing conditions must be appraised in relation to formulation and application of operational rules. A final operating rule has not been adopted.

Sincerely yours,

FRED A. SEATON,
Secretary of the Interior.

COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

Legislative Authorization

Colorado River Storage Project and Participating Projects Act of April 11, 1956 (70 Stat. 105).

AUTHORIZED FOR CONSTRUCTION

Storage units

Curecanti
Flaming Gorge
Glen Canyon
Navajo

Participating projects

Central Utah (initial phase)
Emery County
Florida
Hammond
LaBarge
Lyman
Paonia
Pine River Extension
Seedskadee
Silt
Smith Fork

Fred A. Seaton, Secretary of the Interior

Wilbur A. Dexheimer, Commissioner of Reclamation

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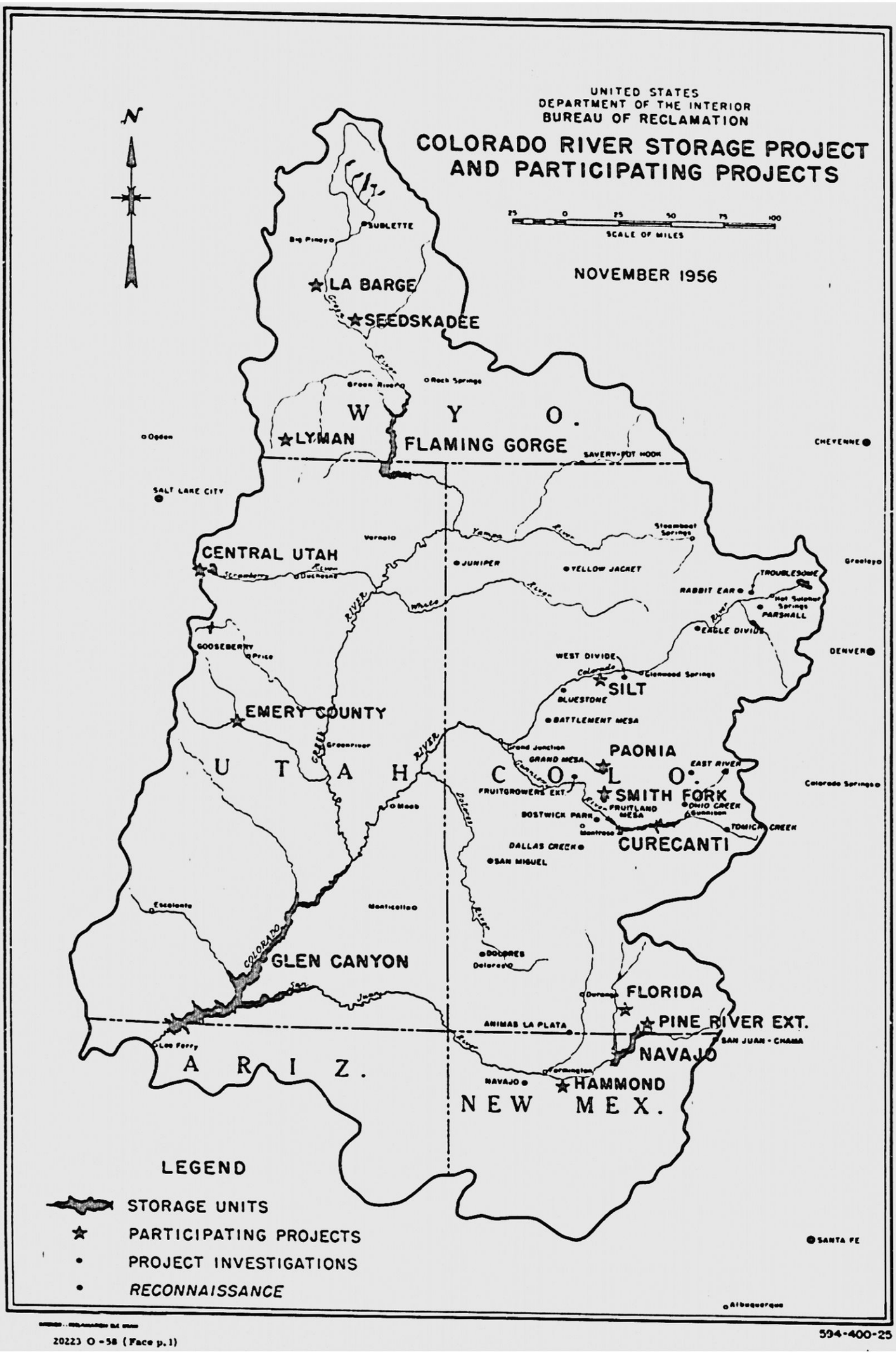

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FIRST ANNUAL REPORT, COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

Introduction

On April 11, 1956, legislation authorizing construction of the Colorado River storage project and participating projects was signed into law (70 Stat. 105) by the President. The act initiated an extensive program for the development of water resources in the upper Colorado River Basin. Authorized for construction were 4 initial units of the Colorado River storage project on the Colorado River or its larger tributaries, primarily for river regulation and power production, and 11 participating projects for irrigation and other related purposes. Construction of the Curecanti unit, 1 of the 4 authorized units, is not to be undertaken until the Secretary of the Interior has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs.

Section 6 of the act stipulates that on January 1 of each year the Secretary shall report to Congress for the previous fiscal year—

1. Status of revenues from, and
2. Cost of, constructing, operating, and maintaining the Colorado River storage project and participating projects (hereinafter referred to as the project).

The report is to be prepared so as to reflect accurately the

3. Federal investment allocated at that time to power, to irrigation, and to other purposes;
4. Progress of return and repayment thereon; and
5. Estimated rate of progress, year by year, in accomplishing full repayment.

During the first fiscal year of the project, which ended June 30, 1957, activities were confined to initiation of construction on 3 of the 4 storage units and continuation of investigations on the Curecanti storage unit and the 11 participating projects authorized for construction by the act.

This report deals primarily with the status to June 30, 1957, of the cost of construction and of investigations related thereto or financed from project funds, as required to be reported under item 2 above. The statements under each of the other matters required to be reported upon will be expanded in future annual reports as the activities pertaining to them progress.

1. Status of Revenues

Nonoperating revenues amounting to $1,443 arising from grazing leases accrued to the project during fiscal year 1957. However, there were no revenues from water rental, water sales, or from sales of electric energy during the period. For this reason no statement of revenues accompanies this first annual report.

2. Cost of Constructing, Operating and Maintaining the Project

The attached "Balance sheet, June 30, 1957, exhibit A" presents the financial position of the project at that date.

Costs to June 30, 1957, of constructing the project are identified as follows:

Particulars	*Amount*
Direct costs: Construction work in progress	$8,394,711
Unapplied costs:	
Investigation costs	1,282,719
Construction service facilities	1,205,420
Materials and supplies	24,400
Prepayments and advances	72,091
Other charges and work in progress	18,575
Total	10,997,916

Through June 30, 1957, no costs had been incurred with respect to operating and maintaining the project.

3. Allocation of Federal Investment

No formal allocations to the several purposes served by the project have been made of the cost to June 30, 1957, as reflected in construction work in progress accounts. This is in accordance with the provisions of section 6 of Public Law 485 which states that upon completion of each unit, participating project or separable feature thereof, the Secretary shall allocate the total costs of constructing said unit, project or feature to the various purposes authorized in the act or authorized under reclamation law.

4. Progress of Return and Repayment of Federal Investment

As indicated in the forepart of this report the fiscal year 1957 marked the inception of construction on the project and no income producing facilities were in an operational status. Hence, there is no progress to report on the return and repayment of the Federal investment.

5. Estimated Rate of Project Repayment Year by Year

During the first fiscal year of the project, no storage unit, participating project, or separable feature thereof had been completed. Therefore, at June 30, 1957, cost allocations of the Federal investment to the several purposes served by the project, as prescribed by section 6 of the act, had not been made. Accordingly, no estimated rate of progress of return and repayment, year by year, of the investment to be so allocated, is included in this annual report.

EXHIBIT A.—*Balance sheet, June 30, 1957*

ASSETS

Plant: Construction work in progress		$8,394,711
Construction service facilities		1,205,420
Investigation costs		1,282,719
Current assets:		
Cash and fund balances with U. S. Treasury:		
Operating funds (note 1)	$5,320,870	
Special deposit funds	289,747	
	5,610,617	
Accounts receivable:		
Government agencies	20,300	
Other	293,181	
Materials and supplies	24,400	
Prepayments and advances (note 2)	72,091	
		6,020,589
Other assets:		
Undistributed and deferred charges	18,425	
Other work in progress	150	
		18,575
Total		16,922,014

LIABILITIES

Net investment:		
United States:		
Congressional appropriations	$13,600,000	
Transfers of property and services	1,508,090	
Interest accrued on plant under construction	75,273	
	15,183,363	
Non-Federal: Contributions in aid of project development and construction	843,772	
		16,027,135
Current liabilities:		
Accrued liabilities	289,706	
Accounts payable:		
Government agencies	67,392	
Other	536,336	
		893,434
Other deferred credits		1,445
Total		16,922,014

The accompanying notes are an integral part of this exhibit.

Note 1. Operating funds:

Cash and fund balances available for payment of outstanding obligations and accounts payable	3,765,393
Unobligated balances	1,555,477
Total	5,320,870

Note 2. Prepayments and advances, includes advances to other Bureau of Reclamation activities aggregating $66,720. The components of such advances, as reflected on the records of such other Bureau entities, namely:

Fund balance with U. S. Treasury		$219,742
Accounts receivable:		
Other	$56,292	
Project	13,903	
		70,195
		289,937
Less accounts payable:		
Other	219,153	
Project	4,064	
		223,217
Total		66,720

have not been consolidated with or eliminated from the related components of the project for purposes of this balance sheet.

HYDROLOGIC BASES FOR FINANCIAL STUDIES, COLORADO RIVER STORAGE PROJECT

Public Law 485, section 6, requires that certain financial data relative to the Colorado River storage project be reported to Congress on January 1 of each year commencing in 1958. Basic to such a report is the relationship of anticipated power revenues to the financial requirements of the act. In turn, the anticipation of power revenues involves assumptions and premises as to future hydrologic conditions and as to water passing the storage dams to downstream uses. This statement deals with the development of a working hypothesis employing those assumptions and premises for short term application.

Four main storage reservoirs are authorized by Public Law 485: Glen Canyon, Flaming Gorge, Curecanti, and Navajo. For simplification, storage at the latter three may be recognized by reflecting the effect of their operations upon streamflows at Glen Canyon, the last point of storage control in the upper Colorado River Basin.

Under the assumption of average streamflow conditions, the premises of river regulation set forth herein would, if ultimately employed, result in obtaining by 1970 initial storage and power head in the storage reservoirs, to be followed by long-time cyclical operation.

The basic premises to be used in connection with development of the January 1, 1958, report to Congress follow:

(1) Water to be passed by the Glen Canyon Dam sufficient to meet downstream uses, exclusive of power, with Lake Mead used only for the purpose of providing seasonal regulation for water so passed at Glen Canyon.

(2) Net flow differences between Glen Canyon Dam site and Hoover Dam should account for channel losses and inflows based on the period 1938–56, inclusive, for present and future uses on tributaries, Lake Mead evaporation, and present and future uses by pumping out of Lake Mead.

(3) Water uses below Hoover Dam, exclusive of power, should be those estimated to occur in the interim between 1958 and 1970. By 1970 they are assumed to consist of and be the sum of the following:

	Acre-feet [1]
(*a*) Arizona	1, 225, 000
(*b*) California	5, 362, 000
(*c*) Nevada	46, 000
(*d*) Mexico	1, 762, 000
(*e*) Unaccounted-for wat[illegible]	508, 000

[1] Of the total face amount of the Arizona water contract of 2,800,000 acre-feet, this figure represents the estimate of use by 1970.

(4) Power is to be generated at Hoover to the extent that water required to meet downstream uses, as defined in (3) above, will permit such generation. If such releases do not permit generation of firm power as defined by contract, then Lake Mead storage would be drawn upon for firm power, except that when Lake Mead storage is thereby drawn down to 17 million acre-feet (active), the accumulation of additional storage in Glen Canyon Reservoir shall be restricted to the extent necessary to permit continuance of firm power production at Hoover without further demand upon Lake Mead storage. Water already stored in Glen Canyon Reservoir shall not be released, however, for continuance of firm generation at Hoover.

Reservoir operations will necessarily depend upon the conditions of use, of flow, and of storage as they develop. If, in the course of actual operations during the period 1958–70, there are appreciable deviations from average flows the foregoing premises, including the criteria for operation of Glen Canyon and Hoover, should be reconsidered.

Application and further discussion of, and the resulting computations under the foregoing basic premises are contained hereinafter.

ASSUMED STREAMFLOW CONDITIONS

An assumption as to expected streamflows is necessary in any reservoir-filling demonstration. The assumption of average streamflow conditions is a reasonable one for this study. Reservoir operation studies presented herein assume average streamflow at Glen Canyon equal to that obtained from the period 1914–45, inclusive, modified to reflect present conditions of development and progressively reduced each year through the operation period consistent with a projected schedule of increasing annual depletions. Of course, streamflow realized at Glen Canyon will depart from the average in any given year, but speculation involving variants in the developing physical situation is premature and would not be useful.

Lake Mead storage reached a low point immediately prior to the 1957 flood season due to a recent drought (1953–56 being the lowest 4 years in sequence in the history of the Colorado River). The flood runoff in 1957 was considerably greater than average and Lake Mead active storage content is expected to be 20.0 million acre-feet on April 1, 1958. Therefore the operation studies begin April 1, 1958, with Lake Mead active storage content of 20.0 million acre-feet.

Historically, the annual flow at the Glen Canyon Dam site averaged 13.8 million acre-feet during the 32-year period 1914 to 1945, inclusive. When modified to reflect present conditions of development in the upper basin, the average annual flow is about 13.1 million acre-feet. Further developments in the upper basin, such as construction of water-consuming projects and storage reservoirs, will require further adjustment in the expected flow. Table I is a tabulation of the flows to be expected in the near future at Glen Canyon Dam assuming average streamflow conditions.

TABLE I

[Million acre-feet]

Year beginning Apr. 1—	Average flow at Glen Canyon Dam with present development	Adjustment for new upstream uses		Assumed inflow to Glen Canyon Reservoir
		Consumptive use including evaporation	Upstream storage gains	
1958	13.1	0	0	13.1
1959	13.1	0	0	13.1
1960	13.1	0	0	13.1
1961	13.1	0	.2	12.9
1962	13.1	.1	.5	12.5
1963	13.1	.1	.4	12.6
1964	13.1	.3	.4	12.4
1965	13.1	.3	.4	12.4
1966	13.1	.4	.3	12.4
1967	13.1	.5	.6	12.0
1968	13.1	.5	.4	12.2
1969	13.1	.6	.4	12.1
1970	13.1	.7	.4	12.0

NET FLOW DIFFERENCES BETWEEN GLEN CANYON AND HOOVER

Table II compares, for the past 19 years of record, the flows at the Glen Canyon Dam site (Colorado River at Lees Ferry), the changes in Lake Mead storage, and the flows of the Colorado River below Hoover Dam. In this 19-year period, the indicated annual differences vary from a loss of 1,003,000 acre-feet to a gain of 524,000 acre-feet with an average annual loss of about 113,000 acre-feet. Studies presented by the Bureau of Reclamation in the report on the Colorado River Basin (H. Doc. 419, 80th Cong., 1st sess.) show annual streamflow depletions from present irrigation and industrial developments in this portion of the Colorado River Basin to the extent of 166,000 acre-feet. These present uses are reflected in the determination of past annual net losses.

TABLE II

[In thousands of acre-feet]

Year beginning Apr. 1—	Colorado River at Glen Canyon Dam site [1]	Storage change in Lake Mead	Colorado River below Hoover Dam	Net gains (+) or losses (−) Glen Canyon Dam site to Hoover Dam
1938	15,620	+6,393	8,224	−1,003
1939	8,387	+808	7,749	+170
1940	8,047	+738	7,833	+524
1941	17,849	+110	18,234	+495
1942	14,539	+760	13,679	−100
1943	11,366	−2,390	13,691	−65
1944	13,001	−1,070	14,137	+66
1945	11,336	−260	12,090	−6
1946	8,858	−1,387	10,242	−3
1947	14,268	+2,237	11,590	−441
1948	12,779	−885	13,311	−353
1949	14,598	[2] +659	13,504	−435
1950	10,496	−880	10,904	−472
1951	10,102	−1,115	10,979	−238
1952	17,826	+2,073	15,479	−274
1953	8,566	−2,063	10,452	−177
1954	6,179	−4,143	10,382	+60
1955	7,063	−838	8,125	+224
1956	8,597	+782	7,692	−123
Average	11,578	−25	11,490	−113

[1] Historic flow at Lees Ferry gaging station.
[2] New capacity curve placed into use beginning Oct. 1, 1949.

Potential future irrigation developments in this portion of the Colorado River Basin are estimated in House Document 419 to deplete the stream flow by an additional 285,000 acre-feet annually, if and when the potential projects are constructed. In the operation studies reported herein, the average annual net loss is assumed to vary from 100,000 acre-feet in the year 1958 to 400,000 acre-feet in the year 1970 as shown in table III.

TABLE III.—*Net losses and uses, Glen Canyon to Hoover Dam,*[1] *by year beginning Apr. 1*

[In million acre-feet]

1958	0.1	1963	0.2	1968	0.3
1959	.1	1964	.2	1969	.3
1960	.1	1965	.2	1970	.4
1961	.2	1966	.2		
1962	.2	1967	.3		

[1] Net losses (including Lake Mead evaporation) and uses in excess of net inflow. Estimated to vary from 100,000 acre-feet in 1958 to 400,000 acre-feet in 1970.

USES AND LOSSES BETWEEN HOOVER DAM AND MEXICO

The uses below Hoover Dam which are expected to increase in the immediate future are discussed hereinafter.

The estimate of potential Arizona uses is based upon serving the following acreages or legal limitations: Colorado River Indian Reservation, 100,000 acres; Yuma Valley, 48,000 acres; unit B, 3,300 acres; Gila project, 600,000 acre-feet. Circumstances seem to indicate that there will not be further new major developments completed in Arizona prior to 1970 to utilize its contract amount of 2,800,000 acre-feet.

The estimate of potential California uses of 5,362,000 acre-feet is equal to the total of the first 6 priorities referred to in the California contracts.

Nevada uses are based upon furnishing water equal to the contract amount of 300,000 acre-feet. Of this total, it is estimated that 46,000 acre-feet will be used below Hoover Dam while 254,000 acre-feet will be used above the dam. The 254,000 acre-feet is accounted for in the estimate of flow differences between Glen Canyon and Hoover.

During operating year beginning April 1, 1956, measured water reaching Mexico totaled 1,762,000 acre-feet. A part of this total consisted of water released to satisfy orders made by United States users, and not taken by them. As additional skill is gained in the operation of the river with a close water supply, it is expected that the amount could be reduced somewhat. Nevertheless, for purposes of this study, 1,762,000 acre-feet should be a part of the assumed releases.

TABLE IV

[Units in thousands of acre-feet]

Item	Year beginning Apr. 1—					
	1951	1952	1953	1954	1955	1956
(*a*) Colorado River below Hoover Dam [1]	10,979	15,479	10,452	10,382	8,125	7,692
(*b*) Wasteway and drainage returns [2]	1,534	1,690	1,776	1,802	1,554	1,534
(*c*) Net storage release from Lake Mohave and Havasu Lake [3]	[4] −40	[4] −67	[4] −161	34	54	5
Sum of (*a*), (*b*), and (*c*)	12,473	17,102	12,067	12,218	9,733	9,231
(*d*) Diversions [5]	6,282	6,808	7,159	7,210	6,952	6,935
(*e*) Colorado River at Mexican Boundary [6]	5,698	9,854	4,383	4,413	2,323	1,762
Sum of (*d*) and (*e*)	11,980	16,662	11,542	11,623	9,275	8,697
(*f*) Unaccounted for water [7]	493	440	525	595	458	534

[1] The flows of the Colorado River below Hoover Dam.

[2] Measured wasteway and drainage returns to the Colorado River between Hoover Dam and the Mexican boundary (Colorado River Indian Reservation, Palo Verde Irrigation District, Pilot Knob wasteway, California wasteway, drainage from reservation division of Yuma project, waste from valley division of Yuma project, east main canal wasteway, and boundary pumping plant).

[3] Net storage releases from Lake Mohave and Havasu Lake.

[4] Storage impounded in reservoirs.

[5] Measured diversions from the Colorado River between Hoover Dam and the Mexican boundary (Metropolitan Water District, Colorado River Indian Reservation, Palo Verde Irrigation District, Yuma project, All-American Canal above Pilot Knob, Gila gravity main canal and (prior to 1955) North Gila Irrigation District from Laguna Dam).

[6] Measured water reaching Mexico (sum of Colorado River at northern boundary, waste from valley division, Yuma project, east main canal wasteway and boundary pumping plant).

[7] Unaccounted for water.

The item of "unaccounted-for water" consists of the average amount necessary to be placed algebraically in the hydrologic equation in order to balance that equation under the conditions encountered during the operating years 1951–56. It includes reservoir losses, channel losses, impoundment and recovery of bank storage, inflow from tributary streams, unmeasured diversions, unmeasured returns, and errors in stream-flow measurements. The amount is 508,000 acre-feet, which is the average of the annual amounts shown in table IV.

It is estimated that by the year 1970 demands will be made upon Lake Mead to meet downstream uses in the United States and Mexico to the extent of about 8,900,000 acre-feet; the derivation of this estimate is shown on table V. By use of this figure, it is not intended to imply that this figure represents the legal bounds of permissible use under the law of the river.

TABLE V

[In thousands of acre-feet]

Arizona uses:	
Colorado River Indian Reservation, 100,000 acres at 4 acre-feet per acre	400
Yuma Valley, 48,000 acres at 4 acre-feet per acre	192
Unit B, 3,300 acres at 10 acre-feet per acre	33
Gila project	600
Subtotal, Arizona	1, 225
California uses	5, 362
Nevada uses	46
Subtotal	6, 633
Unaccounted for water, Hoover Dam to boundary	508
Water at the Mexican boundary	1, 762
Total	8, 903

OPERATION OF LAKE MEAD FOR POWER

Firm power from the Boulder Canyon project is defined under the Hoover Dam power contracts as 4,330 million kilowatt-hours annually with a diminution of 8.76 million kilowatt-hours annually after operating year ending May 31, 1938. In years of high runoff, when excess flow would be available and the reservoir nearly full, such excess flow may be used for the generation of secondary energy. During the immediate past few years, due to severe drought and low reservoir content, some shortages have occurred in the firm-energy generation. It is estimated that by April 1, 1958, the active content of Lake Mead will be about 20 million acre-feet.

Table VI summarizes the operations of Lake Mead and Glen Canyon Reservoirs, under the premises adopted for these studies, during the years 1958–70, inclusive.

TABLE VI.—*Expected operation Glen Canyon Reservoir and Lake Mead with years of average streamflow*

[Units in millions of acre-feet]

Year beginning Apr. 1—	Glen Canyon Reservoir				Lake Mead					Active content end of year	Energy million kilowatt-hour firm
	Inflow	Loss	Releases	Storage at end of year	Net inflow [1]	Releases					
						For downstream uses	Addition for firm energy	Spill [2]	Total		
1958	13.1	.....	13.1	0	13.0	8.1	1.5	3.4	13.0	20.0	4,146
1959	13.1	.....	13.1	0	13.0	8.2	1.4	3.4	13.0	20.0	4,137
1960	13.1	.....	13.1	0	13.0	8.3	1.3	3.4	13.0	20.0	4,128
1961	12.9	.....	12.9	0	12.7	8.4	1.2	3.1	12.7	20.0	4,120
1962	12.5	.....	11.5	1.0	11.3	8.5	1.0	0	9.5	21.8	4,111
1963	12.6	0.1	8.7	4.8	8.5	8.5	1.1	0	9.6	20.7	4,102
1964	12.4	.2	8.8	8.2	8.6	8.6	1.1	0	9.7	19.6	4,093
1965	12.4	.3	8.9	11.4	8.7	8.7	1.2	0	9.9	18.4	4,085
1966	12.4	.4	9.0	14.4	8.8	8.8	1.3	0	10.1	17.1	4,076
1967	12.0	.4	10.4	15.6	10.1	8.8	1.4	0	10.2	17.0	4,067
1968	12.2	.5	10.4	16.9	10.1	8.8	1.3	0	10.1	17.0	4,058
1969	12.1	.5	10.4	18.1	10.1	8.9	1.2	0	10.1	17.0	4,050
1970	12.0	.5	10.5	19.1	10.1	8.9	1.2	0	10.1	17.0	4,041

[1] Estimated by deducting from Glen Canyon releases, the net losses and uses shown in table III.
[2] Available for generation of secondary energy.

SUMMARY OF ASSUMED OPERATION

In the years 1958 to 1961, inclusive, the entire flow of the Colorado River would have been bypassed at Glen Canyon Dam site. In these years Lake Mead storage would have been drawn down to an active content of 20 million acre-feet at the end of each operating year. In these years a total of about 13,300,000 acre-feet would be available for generation of secondary energy at Hoover.

In the year 1962, storage would have been initiated at Glen Canyon with about 1 million acre-feet being impounded. In that year, due to the availability of vacant storage space in the Glen Canyon Reservoir, in lieu of producing secondary energy at Hoover powerplant about 1,800,000 acre-feet of inflow would have been withheld in the zone of Lake Mead previously reserved for flood control purposes. This 1,800,000 acre-feet is in excess of releases for generation of firm energy.

In the 4 years 1963 to 1966, inclusive, while sufficient storage was being impounded in Glen Canyon Reservoir, first to permit initial generation at minimum head (beginning in June 1964), and later to permit firm generation (beginning April 1967), releases would havebeen made from Glen Canyon to meet downstream uses and losses in the United States and deliveries to Mexico. In this 4-year period, Lake Mead storage would have been released to the extent of about 4,700,000 acre-feet (including that stored in the flood-control reservation in 1962) to sustain firm power generation. In the year 1967 Lake Mead storage would have been drawn down to an active content of 17 million acre-feet.

In the years 1968 to 1970, inclusive, releases would have been made from Glen Canyon for the generation of firm and secondary energy at that site. Such releases would have been sufficient for the generation of firm energy at Hoover Dam in these years without drawing Lake Mead storage below an active content of 17 million acre-feet while accumulating additional storage in Glen Canyon Reservoir.

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for residence purposes lots not exceeding three acres in area; but any lot not sold after public auction, or sold and forfeited, or any lot or part thereof surrendered with the consent of the commissioner, which consent is authorized, may upon application be sold without further public notice or auction within the period of two years immediately subsequent to the day of the public auction, at the advertised price if the sale is within the period of six months immediately subsequent to the day of the public auction, and at the advertised price or the price fixed by a reappraisal of the land, whichever is greater, if the sale is within the period subsequent to the said six months but prior to the expiration of the said two years:".

SEC. 2. This Act shall take effect on and after the date of its approval. Effective date.

Approved April 6, 1956.

Public Law 483 — CHAPTER 186

AN ACT

April 6, 1956
[H. R. 7236]

To amend section 8 (b) of the Soil Conservation and Domestic Allotment Act with respect to water conservation practices.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the second sentence of section 8 (b) of the Soil Conservation and Domestic Allotment Act, as amended (16 U. S. C., sec. 590h (b)), is amended by striking out of said sentence "In arid or semiarid sections," and inserting in lieu thereof "Clauses". 52 Stat. 31.

Approved April 6, 1956.

Public Law 484 — CHAPTER 187

AN ACT

April 6, 1956
[H. R. 8100]

To authorize the loan of two submarines to the Government of Brazil.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President is authorized to lend two submarines to the Government of Brazil for a period of not more than five years and may, in his discretion, extend the loan for an additional period of not more than five years. The President shall, prior to the delivery of the submarines to the Government of Brazil, conclude an agreement with the Government providing for the return of the submarines in accordance with the provisions of this Act and in substantially the same condition as when loaned. All expenses involved in the activation of the submarines, including repairs, alterations, outfitting, and logistic support shall be charged to funds programed for the Brazilian Government under the Mutual Security Act. Brazil. Loan of submarines. 65 Stat. 373. 22 USC 1651 note.

Approved April 6, 1956.

Public Law 485 — CHAPTER 203

AN ACT

April 11, 1956
[S. 500]

To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to Colorado River storage project.

initiate the comprehensive development of the water resources of the Upper Colorado River Basin, for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods, and for the generation of hydroelectric power, as an incident of the foregoing purposes, the Secretary of the Interior is hereby authorized (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities and appurtenant works: Curecanti, Flaming Gorge, Navajo (dam and reservoir only), and Glen Canyon: *Provided*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level, and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Emery County, Florida, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt and Smith Fork: *Provided further*, That as part of the Glen Canyon Unit the Secretary of the Interior shall take adequate protective measures to preclude impairment of the Rainbow Bridge National Monument.

63 Stat. 31.

Initial units.

Curecanti Dam. Report to Congress and President.

Participating projects.

Rainbow Bridge National Monument.

Planning reports. Priority.

SEC. 2. In carrying out further investigations of projects under the Federal reclamation laws in the Upper Colorado River Basin, the Secretary shall give priority to completion of planning reports on the Gooseberry, San Juan-Chama, Navajo, Parshall, Troublesome, Rabbit Ear, Eagle Divide, San Miguel, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, Animas-La Plata, Yellow Jacket, and Sublette participating projects. Said reports shall be completed as expeditiously as funds are made available therefor and shall be submitted promptly to the affected States, which in the case of the San Juan-Chama project shall include the State of Texas, and thereafter to the President and the Congress: *Provided*, That with reference to the plans and specifications for the San Juan-Chama project, the storage for control and regulation of water imported from the San Juan River shall (1) be limited to a single offstream dam and reservoir on a tributary of the Chama River, (2) be used solely for control and regulation and no power facilities shall be established, installed or operated thereat, and (3) be operated at all times by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission. The preparation of detailed designs and specifications for the works proposed to be constructed in connection

Reports to States, President and Congress.

53 Stat. 785.

with projects shall be carried as far forward as the investigations thereof indicate is reasonable in the circumstances.

Juniper project.

The Secretary, concurrently with the investigations directed by the preceding paragraph, shall also give priority to completion of a planning report on the Juniper project.

Congressional intent.

SEC. 3. It is not the intention of Congress, in authorizing only those projects designated in section 1 of this Act, and in authorizing priority in planning only those additional projects designated in section 2 of this Act, to limit, restrict, or otherwise interfere with such comprehensive development as will provide for the consumptive use by States of the Upper Colorado River Basin of waters, the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, nor to preclude consideration and authorization by the Congress of additional projects under the allocations in the compacts as additional needs are indicated. It is the intention of Congress that no dam or reservoir constructed under the authorization of this Act shall be within any national park or monument.

63 Stat. 31.

Laws governing.

SEC. 4. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564): *Provided further*, That for a period of ten years from the date of enactment of this Act, no water from any participating project authorized by this Act shall be delivered to any water user for the production on newly irrigated lands of any basic agricultural commodity, as defined in the Agricultural Act of 1949, or any amendment thereof, if the total supply of such commodity for the marketing year in which the bulk of the crop would normally be marketed is in excess of the normal supply as defined in section 301 (b) (10) of the Agricultural Adjustment Act of 1938, as amended, unless the Secretary of Agriculture calls for an increase in production of such commodity in the interest of national security. All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

43 USC 371 note.

Repayment contracts.

43 USC 485a.

53 Stat. 1194, 1195.
43 USC 485h.

25 USC 386a.
Restriction.

63 Stat. 1051.
7 USC 1441 note.

52 Stat. 41.
7 USC 1281.

46 Stat. 3000; 45 Stat. 1057.
63 Stat. 31.
59 Stat. 1219.

Basin Fund.

SEC. 5. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which

shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 8.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 8, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

Availability of revenues.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts: *Provided*, That with respect to each participating project, such costs shall be paid from revenues received from each such project; (2) payment as required by subsection (d) of this section; and (3) payment as required by subsection (e) of this section. Revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 6 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 6 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (f), and interest due shall be a first charge; and

(4) the costs of each storage unit which are allocated to irrigation pursuant to section 6 of this Act within a period not exceeding fifty years.

Apportionment of revenues.

(e) Revenues in the Basin Fund in excess of the amounts needed to meet the requirements of clause (1) of subsection (c) of this section, and to return to the general fund of the Treasury the costs set out in subsection (d) of this section, shall be apportioned among the States of the Upper Division in the following percentages: Colorado, 46 per centum; Utah, 21.5 per centum; Wyoming, 15.5 per centum; and New Mexico, 17 per centum: *Provided*, That prior to the application of such percentages, all revenues remaining in the Basin Fund from each participating project (or part thereof), herein or hereinafter authorized, after payments, where applicable, with respect to such projects, to the general fund of the Treasury under subparagraphs (1), (2), and (3) of subsection (d) of this section shall be apportioned to the State in which such participating project, or part thereof, is located.

Revenues so apportioned to each State shall be used only for the repayment of construction costs of participating projects or parts of such projects in the State to which such revenues are apportioned and shall not be used for such purpose in any other State without the con-

sent, as expressed through its legally constituted authority, of the State to which such revenues are apportioned. Subject to such requirement, there shall be paid annually into the general fund of the Treasury from the revenues apportioned to each State (1) the costs of each participating project herein authorized (except Paonia) or any separable feature thereof, which are allocated to irrigation pursuant to section 6 of this Act, within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such participating project or separable feature thereof, or, in the case of Indian lands, payment in accordance with section 4 of this Act; (2) costs of the Paonia project, which are beyond the ability of the water users to repay, within a period prescribed in the Act of June 25, 1947 (61 Stat. 181); and (3) costs in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277).

Interest rate.

(f) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

Budget to Congress.

(g) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

Cost allocations.

SEC. 6. Upon completion of each unit, participating project or separable feature thereof, the Secretary shall allocate the total costs (excluding any expenditures authorized by section 8 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act.

Navajos.

In the event that the Navajo participating project is authorized, the costs allocated to irrigation of Indian-owned tribal or restricted lands within, under, or served by such project, and beyond the capability of such lands to repay, shall be determined, and, in recognition of the fact that assistance to the Navajo Indians is the responsibility of the entire nation, such costs shall be nonreimbursable.

Report to Congress.

On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1957, upon the status of the revenues from, and the cost of, constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

Power plant operations.

SEC. 7. The hydroelectric powerplants and transmission lines authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but in the exercise of the authority hereby granted he shall not affect or interfere with the operation of the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the

45 Stat. 1057.
43 USC 617 note.
54 Stat. 774.
43 USC 618o.

Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act and any contract lawfully entered unto under said Compacts and Acts. Subject to the provisions of the Colorado River Compact, neither the impounding nor the use of water for the generation of power and energy at the plants of the Colorado River storage project shall preclude or impair the appropriation of water for domestic or agricultural purposes pursuant to applicable State law.

Recreational and fish and wildlife facilities.

SEC. 8. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of, and improve conditions for, the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

Saving provision.

43 USC 617 note.
43 USC 618o.

SEC. 9. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with the provisions of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty with the United Mexican States (Treaty Series 994).

53 Stat. 785.
59 Stat. 1219.

Expenditures.

SEC. 10. Expenditures for the Flaming Gorge, Glen Canyon, Curecanti, and Navajo initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

67 Stat. 266.

Effectivity and approval of court decree, etc.

SEC. 11. The Final Judgment, Final Decree and stipulations incorporated therein in the consolidated cases of United States of America v. Northern Colorado Water Conservancy District, et al., Civil Nos. 2782, 5016 and 5017, in the United States District Court for the District of Colorado, are approved, shall become effective immediately, and the proper agencies of the United States shall act in accordance therewith.

Appropriation.

SEC. 12. There are hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, such sums as may be required to carry out the purposes of this Act, but not to exceed $760,000,000.

Net power revenues.

SEC. 13. In planning the use of, and in using credits from, net power revenues available for the purpose of assisting in the pay-out of costs of participating projects herein and hereafter authorized in the States of Colorado, New Mexico, Utah, and Wyoming, the Secretary shall have regard for the achievement within each of said States of the fullest practicable use of the waters of the Upper Colorado River system, consistent with the apportionment thereof among such States.

Operation and maintenance, compliance.

SEC. 14. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable

provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

63 Stat. 31.
45 Stat. 1057; 54 Stat. 774.
43 USC 617 note, 618o.
59 Stat. 1219.

SEC. 15. The Secretary of the Interior is directed to continue studies and to make a report to the Congress and to the States of the Colorado River Basin on the quality of water of the Colorado River.

Report to Congress.

SEC. 16. As used in this Act—

Definitions.

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "Upper Basin", and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948 by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785);

The term "Treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States, signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

59 Stat. 1219.

Approved April 11, 1956.

Public Law 486 CHAPTER 204

AN ACT

April 11, 1956
[S. 1289]

To establish a Domestic Relations Branch in the Municipal Court for the District of Columbia, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

DOMESTIC RELATIONS BRANCH, MUNICIPAL COURT FOR THE DISTRICT OF COLUMBIA

SEC. 101. That there is hereby created in the Municipal Court for the District of Columbia a Domestic Relations Branch.

SEC. 102. DEFINITIONS.—As used in this Act—

(a) "Branch" and "Domestic Relations Branch" mean the Do-

"Branch", "Domestic Relations Branch".

143:1

Colorado River 1951-1954 Eagle
Upper Colorado Storage Projects

NE
3/18/54

EXPLANATION OF PROPOSED AMENDMENTS
TO H. R. 4449 AND COMPANION BILLS,
TO AUTHORIZE CONSTRUCTION OF THE
COLORADO RIVER STORAGE PROJECT

Amendment No. 1:

Page 8, line 1. This amendment strikes all of Section 5 and substitutes language reserving to the Congress the right to add participating projects to those listed in Section 1 and delete any now listed in Section 1. Section 1 specifically lists fifteen participating projects, whereas Section 5 contains general language authorizing the addition of un-named, undescribed future participating projects at some later time, with no standards of feasibility prescribed, leaving it uncertain whether the Secretary of the Interior is authorized by Section 5 to add these later participating projects by his own action without further action by Congress, or whether Congress is to pass upon them after he identifies them. The proposed amendment simply provides that these un-named, undescribed future participating projects shall be brought to Congress and individually authorized by Congress on their merits, under existing statutory procedure. For example, the Flood Control Act of 1944 requires the submission of reports on the proposed projects to the affected states for their comments.

Amendment No. 2: assurance against interpretations.

Page 12, line 24. This amendment simply provides that nothing in the Act shall be deemed to construe or interpret any provision of the documents which comprise the law of the river, i.e., the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, or the treaty with Mexico.

The meaning of these documents is now at issue in Arizona vs. California et al., No. 10 Original, October Term, 1953, in the United States Supreme Court. The Bureau's Upper Basin plan, and some of the testimony in support of it, does interpret these documents. For example, the Bureau assumes that the apportionment to the Upper Basin States in Article III(a) of the beneficial consumptive use of 7,500,000 acre-feet per annum means that there is available that average amount, instead of that maximum amount each year, so that the Upper Basin may use nine million acre-feet or more of water in one year and consider it as apportioned under Article III(a), if it uses six million acre-feet or less in some other year so long as it averages 7,500,000 acre-feet. This is diametrically opposed to the Reclamation Bureau's interpretation of the Compact in negotiating its water delivery contracts with the three States in the Lower Basin, which were all upon the assumption that the apportionment to the Lower Basin is of a maximum, not an average, and the quantities each contractor may use each year are stated in maximum, not average quantities. This one issue involves about 1,250,000 acre-feet

per year. There are other assumptive interpretations in the pending report. Congress should disclaim any intention to interpret the law of the river in enacting this bill.

Amendment No. 3: transmountain diversions.

Page 13, line 2. This amendment provides that waters of the Colorado River which are taken into other river basins by transmountain diversion shall be made available only for use in the states parties to the Colorado River Compact, and shall not be made available by exchange, substitution or use of return flow, or otherwise, for consumptive use in any other state, and that nothing in the Act by implication or otherwise, shall commit the United States to the further exportation of water from the Colorado River System.

The water supply of the Colorado River Basin is too short as it is to permit it to come to the rescue of other basins such as the Missouri, by exchange with Nebraska or any other state. There is reason to believe that the State of Colorado does plan to effect such exchanges and improve its position in its controversy with some of its neighbor states. If Colorado has no such intention it should not object to this language.

Amendment No. 4: studies of salinity.

Page 3, line 9. This amendment proposes to insert a new section to require a report by the Secretary of the Interior on the effect of transmountain diversions on the quality of water available at Lee Ferry.

The amendment is obviously sensible. California maintains that Article VIII of the Colorado River Compact, which provides that present perfected rights are unimpaired by the Compact means, that they shall be unimpaired both as to quality and quantity. The Upper Basin States, or some of them, dispute this. Whichever group is right, the facts ought nevertheless to be ascertained.

Amendment No. 5: state representation in the operation of reservoirs.

Page 13, line 9. This amendment proposes a new section authorizing each state of the Colorado River Basin to appoint one representative to an intergrading committee to advise with the Secretary of the Interior in the programming of the storage and release of water from the main stream reservoirs in the Upper Basin, for use in the Lower Basin; directs the Secretary of the Interior to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Mexican Water Treaty, and in the event of its failure to do so, authorizes any state in the Colorado River Basin to maintain an action in the Supreme Court against him to enforce the provisions of this section of the Act, and grants the consent of Congress to the joinder of the United States as a party in such suit or suits.

A provision of this sort is absolutely essential to all seven states of the Basin. Under the Upper Basin Storage Project plan the Secretary of the Interior would build a gigantic reservoir at Glen Canyon and perhaps also at Echo Park, capable of impounding the whole flow of the river for several years. If there is no control over him as to the rates at which he accumulates water in these reservoirs, and releases it, he has the whole interpretation

of the Colorado River Compact in his own hands. These reservoirs are too far down stream to impound water for actual diversion by the Upper Basin, yet are outside of the Lower Basin. As no state can sue the United States without its consent, if the Secretary builds up storage in these reservoirs more rapidly than the Lower Basin States think he is entitled to do under the Compact, they have no way of controlling him. Conversely, if he releases water in larger quantities than the Upper Basin States think he should, they have no control over him. Both groups of states are entitled to this protection against the United States.

Amendment No. 6: covenants.

Page 13, line 9: This amendment proposes a new section subjecting all projects and uses of water in the Upper Basin to the Colorado River Compact and directs that this obligation shall "run with the land" as a covenant.

It is modeled on language in the Boulder Canyon Project Act, and in the provisions which the Upper Basin insisted be inserted in the legislation which authorized the San Diego Aqueduct.

Amendment No. 7: subjection to law of the river.

Page 13, line 9. This amendment also is modeled on those inserted by the Upper Basin states in the legislation authorizing the San Diego Aqueduct, and is founded on language in the Boulder Canyon Project Act.

H. R. 4449

COLORADO RIVER STORAGE PROJECT

AND PARTTICIPATING PROJECTS

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WEDNESDAY, APRIL 14, 1954

House of Representatives,

Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs

Washington, D. C.

The subcommittee met, pursuant to recess, in the committee room, New House Office Building, at 10:32 a.m., Honorable William H. Harrison (chairman) presiding.

Mr. Harrison. The Subcommittee on Irrigation and Reclamation will come to order. We will continue the discussion on amendments to H. R. 4449.

Mr. Engle. Mr. Chairman?

Mr. Harrison. Before I recognize the gentleman from California, the Chair would like to say he will try so far as possible today to see the time is evenly divided among those who amendments, so that all possible amendments may be discussed in the time allotted.

Mr. Engle has, as I understand, a couple of amendments which have been more or less agreed to, and at this time the Chair recognizes Mr. Engle.

Mr. Engle. I have five amendments. I am going to ask to

have them all distributed. There are two that are not controversial and I understand there are no objections to them. I will submit them. Each one is a new section to be added on to the end of the bill. This one reads as follows:

"The Secretary of the Interior is directed to institute studies and to make a report to the Congress and to the States of the Colorado River Basin of the effect upon the quality of water available at Lee Ferry, of all transmountain diversions of water of the Colorado River System and of all other storage anc reclamation projects, existing and proposed to be made in the Upper Colorado River Basin under full practicable development and use of water apportioned by the Colorado River Compact, including those proposed to be made under the authority of this Act."

Now the purpose of that amendment is simply to authorize and direct the Secretary to make a study, to keep us informed, as he certainly should, on one of the questions which is most vital, of course, to the people in the Lower Basin; namely, that we do not get the quality of the water in such condition that we not only would be in difficulty down in the Lower Basin but that we would have trouble with the Mexican Treaty, which has an overriding claim on the Colorado River water to the tune of about a million acre feet.

Mr. Saylor. Will you yield?

Mr. Engle. Just let me add one more sentence and I will

be glad to yield.

I say that this amendment does not does not do anything except to get what we regard as continuing and necessary information to protect the quality of water.

There are only three things that California, as far as I am concerned, is interested in in this bill. Number one is that we be given absolute assurance that the quantity of water is not affected by anything you do in the Upper Basin, which we regard as safeguarded under the Colorado River Basin Compact. Number 2 is that the quality of water be maintained at least so that the water is fit for the use for which it is intended in the Lower Basin. And Number 3 is with reference to the administration of the project itself, that it be administred fairly and that the States themselves have some participation in that. I have another amendment dealing with that.

That is about all we think that ought to be done here to perfect this legislation as far as California's direct interests are concerned. This first amendment is one along that line; it does nothing more than provide for study.

Mr. Regan. Will you yield?

Mr. Engle. I will yield now.

Mr. Regan. I would like to ask you what your obligation is to the Republic of Mexico in this million acre feet of water. Do we supply them with a certain quality of water or

just the quantity of a million acre feet?

Mr. Saylor. Following that, where in the Mexican Treaty or the Colorado River Compact is the quality of water mentioned?

Mr. Engle. It is not mentioned specifically, but it is implicity in the treaty and in the Compact. In short --

Mr. Dawson. Will you yield to me?

Mr. Engle. I will, but let me finish the sentence. In short, we did not make a treaty with Mexico which presupposed that we would deliver to Mexico water unfit for the uses specified in the treaty, which are domestic uses, agricultural uses, as well as municipal uses. And any intimation that this country could get away with burdening this water with as much salt that it would be unusable for the purposes for which the treaty was entered into is repugnant to the basic terms and intent of the treaty itself.

I am not implying that it is in that shape yet, but I say we ought to watch it; and all this amendment provides for is continuing studies so it can be watched.

Mr. Bentsen. Will you yield?

Mr. Engle. Yes.

Mr. Bentsen. Is it not also for the protection of California?

Mr. Engle. Yes, by all means. But I say we are not the only fellows who might be gored in this. Arizona might get

gored too.

Mr. Rhodes. Will the gentleman yield?

Mr. Engle. Yes.

Mr. Rhodes. Is it the gentleman's thought that an increase in the salinity content of the water is quite similar in legal connotations to pollution of water? In other words, I think it is a pretty well known fact that an upstream user cannot pollute the water in such manner that downstream users are denied riparian or appropriative rights to use the water. You mentioned you felt this question was inherent in the Compact. Is that the theory upon which you go?

Mr. Engle. Yes. I think the question of water quality is inherent in the Compact and is inherent in the treaty. This does not imply we are in shape yet where we are going to get pinched in either one. This does nothing more than to say that the Secretary will study it on the proposition we may get in trouble.

Mr. Harrison. The time of the gentleman from California has expired. Do you desire time, Mr. Rhodes?

Mr. Rhodes. Yes, I wish time to continue my colloquy with the gentleman from California.

Mr. Harrison. The gentleman from Arizona is recognized for five minutes.

Mr. Rhodes. As I understand your amendment, it does not stop any project which is now existing or may be existing in

the future. It merely asks the Secretary of the Interior to inform the Congress and member States of the Colorado River Basin as to the true situation as it exists. Therefore, it seems to me that certainly it is information which might be very helpful to the Congress and particularly to those States.

Mr. Dawson. Will you yield to me?

Mr. Rhodes. I yield.

Mr. Dawson. I call the attention of the gentleman from California to the fact that the argument he is making is exactly the same argument that the people from Mexico made when they were asking that California guarantee the purity of water, and I would like to read the comment from the representatives of California in the 1947 report. Here is what your own people from California said when Mexico was making these same demands:

"The Treaty makes no direct reference to quality of water. The ambiguity of the Treaty with respect to the subject shown by the diametrically opposed interpretations of the negotiators creates a serious problem. The final division will greatly affect the burden of the Mexican Treaty and water users of the Unites States." Listen to this: "If the Mexican interpretation were upheld, annual quantity of water that would be required in fulfillment of the Treaty might be several times the annual quantity that would be required if the interpretation of the negotiators of the United States

were upheld."

Our argument is the same argument that you people from California were making. There is no reference in the treaty guaranteeing the purity of the water, and for us to step in here now and try to write something into that treaty that was not in is just opening it up to endless complications.

Mr. Engle. Will the gentleman yield?

Mr. Dawson. Yes.

Mr. Engle. All this says is that the Secretary shall study and keep abreast of this question of water quality.

Mr. Dawson. Of course the gentleman knows the Secretary is making continual study, and the effect of this amendment would be to confine it to the Upper Basin States. The studies are being made continually on it.

Mr. Hosmer. Will the gentleman yield?

Mr. Engle. It would not confine it, it is the whole river. If they are going on now, I do not see why you object to putting it in the bill. It is not hurting anybody. It is a subject we should know about. I do not see how asking somebody to study something can hurt.

Mr. Rhodes. Mr. Chairman, I will yield back the balance of my time if nobody wants me to yield.

Mr. Aspinall. Mr.Chairman?

Mr. Harrison. The gentleman from Colorado is recognized for five minutes.

Mr. Aspinall. I oppose the amendment as now written because it presupposes there is an obligation on the Upper Basin to furnish certain quality of water at Lee Ferry. I am not opposed to study the Secretary whatsoever, but I think that general legislation would be more appropriate in this instance than to place it in the bill before us.

However, with the thought that perhaps the committee would feel favorable toward the proposed amendment, I offer the following amendment as an amendment to the amendment:

Line 4, strike the words "available at Lee Ferry" and insert in lieu thereof the phrase "of the Colorado River."

Mr. Westland. What is the first word?

Mr. Aspinall. Strike the words "available at Lee Ferry" and insert in lieu thereof the phrase "of the Colorado River."

Mr. Saylor. Mr. Aspinall --

Mr. Aspinall. Just a minute; that is only part of the amendment, and then I will be open for questions.

Mr. Saylor. All right.

Mr. Aspinall. Then in line 6, strike the comma and the balance of that line and the following three lines and insert in lieu thereof the words "in the Colorado River Basin" period.

The reason that I do this is in order to make it necessary that we consider the whole Basin in this question, and that we do not write anything into this legislation which would try to determine as of this time the obligation of the Upper Basin

as to duty of delivering certain water at Lee Ferry.

Mr. Engle. I have no objection to the amendment and I will accept the amendment to the amendment. We are perfectly willing to have the whole river studied.

Mr. Saylor. Would you yield at that point?

Mr. Aspinall. Yes, I yield.

Mr. Saylor. I think that your amendments to the amendment are good, but would it not further the purpose for which these studies are being made to have a place of study both in the Upper Basin and the Lower Basin? I think that the study should be made in the entire river. With that I agree. But I think that we should make the study both for the Upper Basin and the Lower Basin.

Mr. Aspinall. I think that is in the province of the Secretary to report back to Congress; and if we cannot come to some agreement, which sooner or later I feel we must come to about this question of the quality of water, then Congress will perhaps have to take up this question. Let the Secretary make his surveys and attendant determinations.

Mr. Engle. I am not asking the Secretary to make a determination, but to make findings of facts and studies. That is all.

Mr. Aspinall. That is what I mean by "determination."

Mr. Engle. If there is no further discussion, Mr. Chairman, because we are on short time, I will ask the previous

question. The author of the amendment will accept the amendment to the amendment. Is there any objection to the amendment.

Mr. Dawson. I have a further objection. The amendment presupposes that somehow or other by transmoutain diversion of water there is a promise of a guarantee of the purity of that water. I think you are writing something into the Compact that was never there. I think you are attempting to make the interpretation of the Colorado River Compact.

Mr. Engle. No, we are not. We say this: When we take pure water out of the watershed that it has a tendency to take away water which would otherwise dillute water which might not be so pure. But this does not make an interpretation; it asks the Secretary to make studies on it.

SEVERAL MEMBERS: Question.

Mr. Harrison. The Chair rules that the gentleman from California has accepted the amendment to the amendment as proposed by the gentleman from Colorado, Mr. Aspinall. Unless there is objection, the vote will be upon the amendment offered by the gentleman from California, as amended by the gentleman from Colorado.

All those in favor of that motion will say aye.

Opposed, no?

The Chair is in doubt. Those in favor of that motion will raise their hands. (Showing of hands.)

Those opposed will raise their hands. (showing of hands.)

The vote is 6 to 5. The amendment is agreed to.

Mr. Engle. Mr. Chairman?

Mr. Harrison. Mr. Engle is recognized.

Mr. Engle. Mr. Chairman, I have one further amendment, which is the most important amendment I have to offer, and I will have the clerk pass it out. I will read it. This is additional new section to be added to the bill following the addition of the new section just adopted, as amended:

"Each State of the Colorado River Basin is authorized to appoint one representative to an Integrating Committee, to advise with the Secretary of the Interior in programming the storage and release of water from main stream reservoirs located in the Upper Basin, for use in the Lower Basin.

"(b) The Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Upper Basin for use in the Lower Basin, and, in the event of his failure to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States against him to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits."

I will be very brief about this. Here is what we are

getting into: We have a river hundreds of miles long under the supervision of one individual, to wit, the Secretary of the Interior. Now we want to be sure that he complies with the basic law of the river which is set forth in these various documents which are mentioned in this amendment and which are also mentioned in the bill, by the way, in section 9. The sponsors of this legislation have said in their bill that this project shall be subject to precisely these provisions.

But we get into this situation: Let us assume that the Secretary of the Interior makes an interpretation of the basic compact in his operation of the river which is contrary to what the people in the Upper Basin think that it should be. They have no appeal from his decision unless someway is provided for them to challenge his operation of the river under what he believes to be the provisions of the compact. So this simply says this: that we set up an advisory committee. Each State, little ones and big ones, have one representative on the advisory committee to advise the Secretary. Then if the States get into a hassle about whether or not the Secretary is correctly interpreting and managing the river under basic law, they can go to court and test his decision in that regard.

I want to make this very clear: that this not an amendment necessary to protect California. It protects every State in the Basin, because the time might come when the people in

the Upper Basin are looking at a Secretary of Interior from the State of California, and they might think that his ruling as to the operation of the river is totally unfair and unwarranted by the basic law. This would give them some recourse to challenge his decision which they thought was adverse to their interests in the courts -- Arizona or anybody in the Lower Basin or Upper Basin. It provides for a method for getting a legal administration of the river.

This is not a reflection on the present Secretary of the Interior, who I regard as a fair man, or anybody who is Secretary; but this thing is going on for 50 or 100 years, and there ought to be some way, if one of the States disagrees or thinks they are being prejudiced, or the Lower Basin thinks they are being prejudiced by his interpretation, to get it straightened out.

That is all this does and I submit it on that statement.

Mr. Pillion. Will you yield to me for a question?

Mr. Engle. Yes.

Mr. Pillion. Is there a possibility that this section may be creating a right of action against the United States for more than an injunctive relief, in that it may provide a basis for suits for damages against the United States? If it does that, it simply is a borad section. I hate to see the United States Government spend a billion dollars and then be subjected to a series of suits for damages by the

various States by reason of this section,

Mr. Hosmer. Will you yield?

Mr. Pillion. Yes.

Mr. Hosmer. I think it is clear in stating that the suit may be maintained in the Supreme Court to enforce the provisions of this section, and that is certainly a limitation on it.

Mr. Pillion. I am not so sure it is a limitation.

Mr. Engle. I have never heard of a damage suit in the Supreme Court. This would be an action for declaratory relief to the interpretation of the compact. That is what we are trying to get to.

Mr. Pillion. Suppose it were determined that the Secretary of the Interior did make an honest error or was guilty of a negligent act and so determined. In the meanwhile some of the States had suffered losses while the suit was pending. Would there be any recourse against the United States by reason of that finding?

Mr. Engle. This does not create a right of action.

Mr. Pillion. I know it does not specifically so state. I am just wondering if there is not an inferential grant of a right of action here created.

Mr. Engle. I suggest the gentleman read the language of the amendment. All the amendment does is give the right to get an interpretation of the Compact. It creates no right of

action which would not exist in the absence of this provision. If there is any doubt about it, I suggest to the gentleman that he just prepare a line to go on the bottom of this amendment which says that this would not create any right of action against the Federal Government or any of its agencies that did not exist in the absence of the amendment.

Mr. Saylor. If you will yield, that may be true. It might not create any additional right which did not exist, but the gentleman has had enough prior experience to know that if you went back to try a case in the lower court with a decision of the United States Supreme Court saying that you had a right to be here, and there had been an injunction performed, you have an awful leg up on your opponent.

I think it creates that right, whether it be a suit against the United States or a suit between States, and I think that is a very dangerous precedent.

Mr. Harrison. The time of the gentleman from California has expired. Do any other members of the committee desire time?

Mr. Regan. I would like to ask the gentleman a question.

Mr. Harrison. Mr. Regan.

Mr. Regan. You have representatives from each of the 7 States. What are you going to do about Mexico? Should not they have a man to represent Mexico on this board you are setting up?

Mr. Engle. No, because they are a foreign country.

Mr. Harrison. Any further discussion?

Mr. Engle. Did you take the time, Mr. Saylor?

Mr. Saylor. I will take five minutes.

Mr. Engle. I wanted to get somebody to yield.

Mr. Hosmer. I will ask for time so I can yield.

Mr. Harrison. I am not going to shut anybody off as long as you want to talk. All I want to do is to follow procedure and have somebody recognized.

Mr. Hosmer. Mr. Chairman?

Mr. Harrison. Mr. Hosmer.

Mr. Hosmer. I yield to the gentleman from California.

Mr. Engle. I thank the gentleman.

I want a minute to make further comment on this matter that Mr. Pillion has brought up. The question he brings up is whether or not we are creating a liability on the Federal Government which would not exist in the absence of this amendment. What I am saying to him is that all this amounts to is an intent to go to the Supreme Court, just like we passed here last year or two years ago, when we permitted the States of the Colorado Basin Compact to go to the Supreme Court. It is over there now.

What we are saying is that 25 or 50 years from now when we get this big integrated project in operation we want consent ahead of time and want an advisory committee to work with

the Secretary of the Interior. I say --

Mr. Saylor. Will you yield?

Mr. Hosmer. I have the time.

Mr. Harrison. Mr. Hosmer has the time.

Mr. Hosmer. I would like to state that this reads that action may be maintained in the Supreme Court to enforce the provisions of this section. So it is highly restricted and highly limited and applies only to this section, which in no way provides any rights to damages or anything other than the Secretary's programming the storage and release of water.

Now I will yield to the gentleman from New York.

Mr. Pillion. I will yield to Mr. Saylor.

Mr. Saylor. The thing I am worried about is this: If there is this much concern over this matter among the members of the committee who are representatives of the States on the Colorado River, then I would suggest that in 1963 when the Colorado River Compact is up for review this matter be then considered. It is only 9 years away, and who is to say when all of these projects will be built. If it is a matter of such importance, I feel certain we will be in a position to have this considered at that time.

Mr. Rhodes. Will you yield?

Mr. Saylor. Yes.

Mr. Harrison. The gentleman from California, Mr. Hosmer,

has the time.

Mr. Hosmer. I yield to the gentleman from Arizona.

Mr. Rhodes. If the gentleman from Pennsylvania will read the first section, I think it would be fairly obvious that in order for this Integrating Committee to come into being at all it would be necessary for the States to take some action. It does not say the Integrating Committee is hereby created; it says "Each State is authorized to appoint a member." And if two States appoint members of the committee, I would doubt that the committee would be in existence. I would think that the legislature of each State involved would have to state that they would desire an Integrating Committee and they would appoint a member of the Integrating Committee. We are not creating the committee in this amendment in my opinion.

Mr. Engle. Will the gentleman yield?

Mr. Rhodes. Yes.

Mr. Harrison. Mr. Hosmer has the time. Do you yield?

Mr. Hosmer. I yield to Mr. Engle.

Mr. Engle. All we are doing is setting up, authorizing an advisory committee. But the essential of this amendment is in the portion of it that gives consent to take an interpretation of the basic law to the Supreme Court. It avoids an absolute impasse on the river.

After you get all of these great reservoirs set up, the rate at which the water is accumulated in those reservoirs

and released from those reservoirs for any purpose can in effect rest in this one man and his interpretation solely is the complete law of the river. All we are saying is, "That is all right with us provided that it is done under the law of the river, the basic Compact." But if we get in an argument about the interpretation -- Arizona may get into an argument about the interpretation -- and say, "That is wrong" -- or the Upper Basin may say that the Secretary being a Californian, 25 years from now, is handling the reservoirs in such a way as to favor California's position on the river, and challenge it on the grounds that it is contrary to basic compact. In the situation as it now exists they could not go anywhere if the Secretary of the Interior in that instance wanted to thumb his nose at them.

Mr. Regan. Will you yield?

Mr. Engle. Yes.

Mr. Hosmer. It is still my time. I want to say the amendment is crystal clear, and I think the interpretations are quite unwarranted here. If the gentlemen will just read the thing again, it is very simply worded and provides only these States can have a checkrein, both the Lower Basin and Upper Basin, in case of indiscretion on the part of the Secretary.

Now I will yield to the gentleman from Texas.

Mr. Regan. Does not your Compact Commission carry out

those functions? You have a compact commission set up now.

Mr. Hosmer. Yes; but in the event of a disregard by the Secretary of the Interior, this would provide the means by which the Commission could unite in joint action to require the Secretary to observe the provisions of the agreements between the States. So that is all we are trying to do -- we are trying to avoid an impossible situation where you would have a Secretary of the Interior who might by reason of his programming of the release and storage of this water act in a fashion detrimental to the States along this river.

Mr. Regan. Is not that the function of the Compact Commission to direct the Secretary to see there is an equitable divis'on of the waters under the Compact?

Mr. Hosmer. That is his function, yes, sir; but if he refuses to do so, then they have the right to ask the Supreme Court to require him to do so. This merely puts them into the Supreme Court.

Mr. Harrison. The time of the gentleman from California has expired.

Mr. Pillion. Mr. Chairman, I would like to offer an amendment to the amendment.

Mr. Harrison. The Chair recognizes Mr. Pillion of New York.

Mr. Pillion. Following the section itself, insert a

comma instead of a period at the end of the last sentence and insert "Provided, That no right of action for damages against the United States shall be created by this section."

Mr. Harrison. You have heard the amendment to the amendment submitted by the gentleman from New York, Mr. Pillion. Is there any discussion on that? Are you ready for the question?

Mr. Engle. May I suggest to the gentleman that I would accept his amendment if he would change it to read -- "Provided, That this section creates no liability on the United States which would not exist in the absence of this section."

Mr. Pillion. I will accept that.

Mr. Engle. I will accept then the gentleman's amendment to my amendment.

Mr. Dawson. What you are doing here is opening up a Pandora box. You are providing something here that should not be in my opinion. If you want to say you are going to put it in the court of appropriate jurisdiction which is already open to them rather than let them come right into the Supreme Court, there might be more sense to it.

Mr. Engle. The gentleman does not seem to realize the Supreme Court is the only court with jurisdiction.

Mr. Dawson. I do not know about that.

Mr. Engle. Yes, sir, by the Constitution itself.

Mr. Harrison. The gentleman from New York, Mr. Pillion,

has the time.

Mr. Pillion. I will yield back the balance of my time.

Mr. Harrison. Is there further discussion on the amendment? The amendment before the house now is the amendment of the gentleman from California, Mr. Engle, as amended by the gentleman from New York, Mr. Pillion.

Mr. Aspinall. Mr. Chairman, I wish to be heard in opposition.

Mr. Harrison. The gentleman is recognized for five minutes.

Mr. Aspinall. This again is a change in the interpretation or in the provisions of the Compact which governs. I think I know what the gentleman has in mind. I am not so sure but what later on after we get some installations in the Upper Basin I may look with favor on some arrangement such as he proposes, but at the present time the only obligation on the Upper Basin is to deliver certain waters in certain amounts at Lee Ferry; and the Lower Basin has nothing to say whatsoever providing those waters are delivered in accordance with the Compact.

Now we are setting up another body which is to have jurisdiction over this particular obligation of the Upper Basin. Personally, I just do not see that it is material to the bill before us.

Mr. Engle. Will the gentleman yield?

Mr. Aspinall. Certainly.

Mr. Engle. This body is merely advisory and they cannot tell the Secretary what to do. What this section says is that if your State thinks that the Secretary of the Interior is operating the river in violation of the very Compact you want to abide by, that you have a right to take him to the Supreme Court and get that settled. That is all it does.

There is no hidden motive or secret intent on our part. We just think that eventually you are bound to run into an impasse if you do not have some mechanics set up where you get a final decision that is beyond the province of one man. Nobody likes to go to court; it takes time and costs a lot of money. We do not want to go to court and we are sure no other State wants to.

Mr. Aspinall. In fact what you are saying is there shall be appointed a commission, members of which shall be from the Lower Basin, and they shall have the right to go into the Upper Basin and make examinations to determine what they consider to be the equities involved, and then advise the Secretary; and then it is up to the Secretary to determine whether or not he shall listen to the advice which he has. But if any State considers he is not right, then it has a right to go into the Supreme Court of the United States to ask for relief.

Mr. Engle. Only if it violates the basic law of the river.

Mr. Aspinall. To determine whether it is in violation of the basic law of the river.

Mr. Engle. The Supreme Court will determine eventually, as it is going to do over there with reference to the suit now pending. We admit the Secretary has certain discretionary powers which cannot be challenged in any court because they fall within the province of his discretion within the operation of the river. This is a protection for little states on the river. California's political power in the years to come, when we expect to be a greater State in population than New York, which we will achieve in the next 10 years, will be such that we will take care of ourselves in any political hassle.

This amendment is a good amendment for small states, and I just cannot understand anybody in the Upper Basin sitting up there opposed to this kind of thing, because it gives them absolute access to the final authority in case they think in someway or other the law of the river is being violated in the operation of the project. Most people do not complain about giving a man a right to go into court.

Mr. Bentsen. Will you yield?

Mr. Harrison. The gentleman from Colorado has one minute left. Will he yield for a question from the gentleman from Texas?

Mr. Aspinall. I yield.

Mr. Bentsen. Is it correct then they do not have the authority to go to the Supreme Court now if they believe the Secretary of the Interior is operating the project in violation of the Compact?

Mr. Aspinall. I would not place that interpretation upon present law because California and Arizona are in the Court at the present time. If any of these problems should arise, I think the State would be able to get in without this Integrating Committee.

Mr. Engle. You know the trouble we had getting in on this last one.

Mr. Harrison. The time of the gentleman from Colorado has expired.

Mr. Dawson. Mr. Chairman?

Mr. Harrison. The Chair recognizes Mr. Dawson.

Mr. Dawson. I want to call attention to the fact the gentleman from Pennsylvania has a point which would solve this. If we do have problems in the river they will develop within the next 10 years and then would be the time to come in and decide whether we need to open up the door to going into court. I think we are making a mistake by writing it into this legislation.

Mr. Saylor. If the gentleman will yield, is it not correct the Compact itself, the so-called law of the river, requires it be subject to review in 1963?

Mr. Dawson. That is correct. Not only that, but tied into this bill is the Colorado Compact in a good number of places so as to be sure it would not be done in violation of the Compact.

Mr. Engle. Will you yield?

Mr. Dawson. Yes.

Mr. Engle. How does the gentleman say, just because it says in this bill or elsewhere that the Compact will be complied with, that it will in fact be complied with?

Mr. Dawson. If it is not complied with --

Mr. Engle. What would you do?

Mr. Dawson. It is time to come to Congress and say, "We have to have permission that a review be made", and it will be given.

Mr. Engle. Why go to all that trouble? Why not just put it in here?

Mr. Dawson. Why go looking for trouble.

Mr. Engle. You fellows may find yourselves the ones out on a limb, not California, when it comes down to getting into the courts.

Mr. Harrison. Any further discussion on the amendment?

Mr. Saylor. Question.

Mr. Harrison. The amendment you will vote on now is the amendment of the gentleman from California, Mr. Engle, as amended by the gentleman from New York, Mr. Pillion.

All those in favor --

Mr. Saylor. A parliamentary inquiry. Is it correct that the gentleman from California has accepted the amendment to his amendment?

Mr. Harrison. That is correct. All those in favor of the amendment so amended will say aye.

Opposed, no?

The Chair is in doubt. All those in favor of the amendment will raise their hands. (Showing of hands.)

All those opposed will raise their hands. (Showing of hands.) The vote is 6 to 6. Is that right?

The Clerk: Yes, sir.

Mr. Harrison. The Chair will have to cast the deciding vote against the amendment. The amendment is not agreed to.

Mr. Engle. Mr. Chairman, I ask the roll be called.

Mr. Harrison. A roll call has been requested and the clerk will call the roll.

The Clerk: Mr. Aspinall?

Mr. Aspinall. No.

The Clerk: Mr. Bender?

Mr. Dawson. No, by proxy.

The Clerk: Mr. Bentsen?

Mr. Bentsen. Aye.

The Clerk. Mr. Barry?

(No response.)

The Clerk. Mr. Budge?

(No response.)

The Clerk. Mr. Dawson?

Mr. Dawson. No.

The Clerk. Mr. D'Ewart?

(No response.)

The Clerk. Mr. Donovan?

(No response.)

The Clerk. Mr. Engle?

Mr. Engle. Aye.

The Clerk. Mr. Hosmer?

Mr. Hosmer. Aye.

The Clerk. Mr. O'Brien?

(No response.)

The Clerk. Mrs. Pfost?

Mrs. Pfost. Aye.

The Clerk. Mr. Pillion?

Mr. Pillion. Aye.

The Clerk. Mr. Regan?

Mr. Regan. No.

The Clerk. Mr. Rhodes?

Mr. Rhodes. Aye.

The Clerk. Mr. Rogers?

(No response.)

The Clerk. Mr. Saylor?

Mr. Saylor. No.

The Clerk. Mr. Westland?

Mr. Westland. No.

The Clerk. Mr. Wharton?

Mr. Wharton. No.

The Clerk. Mr. Yorty?

Mr. Engle. Aye, by proxy.

The Clerk. Mr. Young?

(No response.)

The Clerk. Mr. Miller?

Mr. Dawson. No, by proxy.

Mr. Harrison. The vote on the amendment shows 7 votes in the affirmative and 8 votes in the negative, and the motion is defeated, the amendment is not agreed to.

The gentleman from California, Mr. Hosmer, will be recognized for amendments and then Mr. Saylor, or do you want to go ahead?

Mr. Saylor. I thought Mr. Engle had five amendments.

Mr. Harrison. He is withholding the balance at this time.

Mr. Saylor. I might ask, were the two he offered the controversial ones or the noncontroversial ones?

(Discussion off the record.)

Mr. Harrison. Mr. Hosmer.

Mr. Hosmer. Mr. Chairman, I have four amendments to section 4. I do not know we have the time for all of them.

Mr. Harrison. I believe the gentleman from Pennsylvania, Mr. Saylor, has an amendment and I would like to recognize hime. Take one amendment and see how the time is. I do not want to cut your short, but I do also want to recognize the gentleman from Pennsylvania.

Mr. Hosmer. Do you recognize the gentleman from Pennsylvania or myself?

Mr. Harrison. You. All I say is I would like to give him some time before we adjourn this morning.

Mr. Hosmer. I hardly know how to proceed under that basis. I will offer the amendments to section 4.

Mr. Bentsen. Did you say section 4?

Mr. Homser. Yes.

Mr. Dawson. Do we have a copy of these?

Mr. Hosmer. I am trying to figure out which one to offer in line with the time, and I have them all on one paper, so I have a little difficulty here.

Mr. Harrison. Do you want to offer them all at one time and vote en bloc?

Mr. Hosmer. I will offer one at a time and vote on them separately. I think some of them you might like and some of them you might not. I can do that, Mr. Chairman?

Mr. Harrison. Yes.

Mr. Hosmer. Those on the mineographed page. At page 6, line 18, add after the word "maintenance" the words

"and replacements".

The purpose of that is that in numerous projects authorized over recent years they have provided for inclusion of a maintenance fund provision as well as making allowances for replacements. This would merely add to that section and allow for replacements, which is more or less considered as a depreciation reserve. This thing was provided in Mr. Dawson's original bill and was probably overlooked in the preparation of the current committee print.

Mr. Dawson. I have no objection to the amendment.

Mr. Saylor. Will the gentleman yield?

Mr. Hosmer. Yes.

Mr. Saylor. I have a substitute to that section which I would like to offer at this time.

Mr. Harrison. Does the gentleman yield?

Mr. Hosmer. A substitute for the whole section or the amendment?

Mr. Saylor. The whole section.

Mr. Harrison. Does the gentleman from California yield for that purpose?

Mr. Hosmer. I yield.

Mr. Saylor. My amendment is on page 6, line 14, strike out line 14 and the rest of page 6 down through and including line 9 on page 7, and substitute therefor the following:

"All revenues collected in connection with the operation

of the Colorado River storage project and participating projects shall be paid annually into the general fund of the Treasury, except such amounts as are necessary to defray the costs of operation, maintenance, and replacement of, and emergency expenditures for, all facilities of the Colorado river storage project and participating projects, within such separate limitations as may be included in any annual appropriation act."

Now, Mr. Chairman, the purpose of this amendment. If you will look at section (d) of this section, it states that all revenues shall be paid annually into the general fund of the Treasury such as are necessary for certain specific items; and in order to clarify this and to indicate that the revenues are to be paid into the Treasury I have made section (c) and section (d) consistent.

I think that if Committee Print No. 17, which has been presented to all of the members, represents the thinking of the proponents of this bill, they should have no objection to this amendment, because it specifically states what section (d) authorizes and is merely for the purpose of making sure that section (d) will be carried out with the exception of the funds which are specifically specified in section (c), namely, the cost of operation, maintenance and repair and emergency expenditures.

Mr. Dawson. Do you have a copy of that?

Mr. Saylor. Here (handing document).

Mr. Aspinall. Will you yield for a question?

Mr. Saylor. Yes.

Mr. Aspinall. Does not your amendment in fact destroy the basic account system?

Mr. Saylor. It does not destroy the basic account system because, if you will look at section (d), I was very careful to make sure it did not. If you will notice section (d) and read it, section (d) says, "Revenues in excess of operating needs shall be paid annually to the general fund of the Treasury" and then specifies what credits shall be given when they are in the general fund of the Treasury. I am not touching that section of the bill.

Mr. Harrison. The time of the gentleman from California has expired.

Mr. Hosmer. I ask unanimous consent all debate on this amendment end in five minutes.

Mr. Harrison. Do I hear any objection?

Hearing none, it is so ordered.

Mr. Saylor. If I can be recognized, I would like to say to the gentleman from Colorado, I have been very particular to see to it that the basic account system has not been destroyed.

Mr. Harrison. The Chair has not recognized anyone. We have five minutes. Does anyone ask to be recognized at this time?

Mr. Dawson. Mr. Chairman?

Mr. Harrison. Mr. Dawson is recognized for five minutes.

Mr. Dawson. I think it definitely has destroyed the basin account. He is requiring that any revenues in excess of the amount needed for maintenance expense for the current year be paid into the Treasury. That would mean we would have to come back here.

Mr. Saylor. If the gentleman has read his own bill, that is just what you provide if you will look at section (d) -- "Revenues in excess of operating needs shall be paid annually to the general fund of the Treasury."

Mr. Dawson. Then that is true, but what are you doing here with this amendment?

Mr. Saylor. All my amendment is doing is making section (c) and section (d) consistent, in stating that we are specifying what shall be paid in and we are authorizing them -- I have almost taken verbatim the wording of your section in the bill in many instances.

Mr. Dawson. I see no inconsistency in those two sections. I cannot see what the gentleman is attempting to do by his amendment other than destroy the basin account.

Mr. Saylor. I am not attempting to destroy the basin account. The Director of the Budget stated that when they they prepared this bill -- all revenues in excess of those certain items should be paid into the Treasury.

Mr. Bentsen. Will you yield to me?

Mr. Saylor. Yes.

Mr. Bentsen. Are you contending there is now an inconsistency between section (c) and section (d)?

Mr. Saylor. Yes.

Mr. Bentsen. There is an inconsistency?

Mr. Saylor. Yes.

Mr. Bentsen. And you are doing away with it?

Mr. Saylor. All I am trying to do is to make sure section (c) and section (d) are consistent.

Mr. Bentsen. What is the inconsistency now?

Mr. Saylor. In other words, if you will read section (c), if says, "All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation" for certain specified things. Now section (d) states that revenues in excess of the operating needs which are specified in 1, 2, and 3 of section (c) shall be paid annually into the general fund of the Treasury.

Now all I am specifying is that section (c) and section (d) be consistent and that all revenues shall be paid into the Treasury in excess of the operating funds which are specified in items 1, 2, and 3. I am not destroying the Basin account

in any manner.

Mr. Rhodes. Will you yield?

Mr. Saylor. Yes.

Mr. Harrison. The gentleman from Utah has the time.

Mr. Dawson. I will yield to the gentleman from Arizona.

Mr. Rhodes. The way it is written it appears to me all the money is paid into the Treasury and they actually have to get appropriations from Congress to spend any money for replacement, operation and maintenance. Is that the intent of the gentleman?

Mr. Saylor. No, sir.

Mr. Rhodes. I will read the language back: "All revenues to be collected in connection with the operation of the Colorado Storage project and participating projects shall be paid annually into the general fund of the Treasury" --

Mr. Saylor. Except.

Mr. Rhodes. --"except such amounts as are necessary to defray the cost of operation, maintenance and replacement of, and emergency expenditures, for all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in any annual appropriation act."

Mr. Saylor. And I have taken that language, since you object to it -- I have taken that language verbatim right from section (c), lines 20 and 21 -- "within such separate

limitations as may be included in annual appropriation acts."

Mr. Rhodes. I see.

Mr. Saylor. In other words, I have taken it verbatim -- taken the very bill out of it.

Mr. Dawson. I think you have taken more than out.

Mr. Rhodes. I think Committee Print No. 17 needs some revamping in section (c) then.

Mr. Saylor. In other words, the sections vary.

Mr. Rhodes. Because the way it reads now, these items of operation, maintenance and replacement are apparently subject to limitations in the annual appropriations bill.

Mr. Saylor. If they are in section (c) of the committee print, they under my amendment.

Mr. Rhodes. Then it would appear to me they are.

Mr. Saylor. I have taken the language right out of the bill of the gentleman from Utah.

Mr. Rhodes. Also you have left out the provision for repayment of reimbursable construction costs for the Paonia and Eden projects.

Mr. Saylor. That is correct.

Mr. Harrison. The time of the gentleman from Utah has expired. All time has expired and thevote is on the amendment to the amendment proposed by the gentleman from Pennyslvania, Mr. Saylor. All those in favor of the amendment --

Mr. Saylor. I ask the ayes and nayes.

Mr. Harrison. The ayes and nayes have been asked for. The clerk will call the roll.

Mr. Bentsen. A parliamentary inquiry. Has the gentleman accepted the amendment to the amendment?

Mr. Hosmer. No, it has not been accepted.

Mr. Bentsen. I did not think so.

Mr. Harrison. He merely yielded to him for the purpose of making an amendment.

Mr. Bentsen. That is what I thought. You stated an amendment to the amendment. This is just an amendment of the gentleman from Pennsylvania. He has not amended the amendment of the gentleman from California.

Mr. Dawson. He is attempting to do it now.

Mr. Saylor. A substitute.

Mr. Hosmer. He is substituting a new subsection (c).

The Clerk. Mr. Aspinall?

Mr. Aspinall. No.

The Clerk. Mr. Bender?

Mr. Dawson. No, by proxy.

The Clerk. Mr. Bentsen?

Mr. Bentsen. No.

The Clerk. Mr. Berry?

Mr. Harrison. No, by proxy.

The Clerk. Mr.Budge?

Mr. Harrison. No, by proxy.

The Clerk. Mr. Dawson?

Mr. Dawson. No.

The Clerk. Mr. D'Ewart.

(No response.)

The Clerk. Mr. Conovan?

(No response.)

The Clerk. Mr. Engle?

Mr. Engle. No.

The Clerk. Mr. Hosmer?

Mr. Hosmer. Aye.

The Clerk. Mr. O'Brien?

(No response.)

The Clerk. Mrs. Pfost?

(No response.)

The Clerk. Mr. Pillion?

Mr. Pillion. Aye.

The Clerk. Mr. Regan?

Mr. Regan. No.

The Clerk. Mr. Rhodes?

Mr. Rhodes. Pass.

The Clerk. Mr. Rogers?

(No response.)

The Clerk. Mr. Saylor?

Mr. Saylor. Aye.

The Clerk. Mr. Westland?

Mr. Westland. No.

The Clerk. Mr. Wharton?

Mr. Wharton. Aye.

The Clerk. Mr. Yorty?

(No response.)

The Clerk. Mr. Young?

Mr. Young. No.

The Clerk. Mr. Miller?

Mr. Dawson. No, by proxy.

The Clerk. Mr. Rhodes?

Mr. Rhodes. No.

Mr. Harrison. The vote on the amendment to the amendment shows four votes in the affirmative and 12 votes in the negative, and the amendment is not agreed to.

The question now before the committee is --

Mr. Regan. Mr. Chairman, before putting that, I notice there are two and's -- and maintenance and replacements. Do you not want to strike out the one "and" before maintenance?

Mr. Hosmer. I will accept the gentleman's suggestion -- strike out the "and" after "operation", insert a comma, add "and replacements".

Mr. Harrison. The question before the committee now is the amendment offered by the gentleman from California, Mr. Hosmer, to page 6, line 18. Is there further discussion or

are you ready for the question?

Mr. Westland. I would like to ask the gentleman from California a question.

Mr. Harrison. Mr. Westland.

Mr. Westland. As I understand it, you put the funds for replacement of these projects into the Basin Fund?

Mr. Hosmer. You would allow the Basin Fund to expend for replacement as well as defraying the cost of operation and maintenance.

Mr. Westland. Ordinarily replacement is an amortization fund, is it not?

Mr. Hosmer. It is more in the nature of a depreciation reserve in this case, and it has been used in previous legislation, and I think it was in Mr. Dawson's original bill.

Mr. Westland. This could be actual cash then, could it not? What would the gentleman from California figure they would do with this money?

Mr. Hosmer. It would be in the discretion -- say they had 35 feet of pipe that went sour and they wanted to replace, they could do it.

Mr. Westland. I think a thing like that would come under operation and maintenance.

Mr. Saylor. No.

Mr. Hosmer. It is a difficult question, but this certainly has no effect except the one to make the expenditure of

of the fund a little bit more liberal and more in line with ordinary business-type procedures which would probably be used and would want to be used by the Secretary in maintaining, operating and replacing segments of the project.

Mr. Harrison. Is there further discussion? Are you ready for the question?

SEVERAL MEMBERS. Question.

Mr. Harrison. The question before the committee now is the amendment by Mr. Hosmer of California, page 6, line 16. All those in favor of the amendment will say aye.

Opposed, no?

In the opinion of the Chair the noes have it. The noes have it.

Mr. Hosmer. May we have a show of hands?

Mr. Harrison. A division has been asked for. Those in --

Mr. Dawson. Mr. Chairman, I demand a roll call.

Mr. Harrison. A roll call has been asked for. The clerk will call the roll.

The Clerk. Mr. Aspinall?

Mr. Aspinall. No.

The Clerk. Mr.Bender?

Mr. Dawson. No, by proxy.

The Clerk. Mr. Bentsen?

Mr. Bentsen. Aye.

The Clerk. Mr. Berry?

Mr. Harrison. No, by proxy.

The Clerk. Mr. Budge?

Mr. Harrison. No, by proxy.

The Clerk. Mr. Dawson?

Mr. Dawson. No.

The Clerk. Mr. D'Ewart?

(No response.)

The Clerk. Mr. Donovan?

(No response.)

The Clerk. Mr. Engle?

Mr. Engle. No.

The Clerk. Mr. Hosmer?

Mr. Hosmer. Aye.

The Clerk. Mr. O'Brien?

(No response.)

The Clerk. Mrs. Pfost?

(No response.)

The Clerk. Mr. Pillion?

Mr. Pillion. Aye.

The Clerk. Mr. Regan?

Mr. Regan. Aye.

The Clerk. Mr. Rhodes?

Mr. Rhodes. Aye.

The Clerk. Mr. Rogers?

(No response.)

The Clerk. Mr. Saylor?

Mr. Saylor. Aye.

The Clerk. Mr. Westland?

Mr. Westland. No.

The Clerk. Mr. Wharton?

Mr. Wharton. Aye.

The Clerk. Mr. Yorty?

(No response.)

The Clerk. Mr. Young?

Mr. Young. Aye.

The Clerk. Mr. Miller?

Mr. Dawson. No, by proxy.

Mr. Engle. Mr. Chairman, I want to change my vote.

Mr. Harrison. Mr. Engle changes his vote from no to aye.

The vote on this amendment shows 9 votes in the affirmative and 7 votes in the negative, and the amendment is agreed to.

Mr. Dawson. There is a typographical error on the next to the last line. I think "businesslike budget" should be "business-type budget."

Mr. Hosmer. Yes, but that is another amendment.

Mr. Harrison. Proceed, Mr. Hosmer.

Mr. Hosmer. Page 8, line 9, in discussing the pay-back to the Treasury after 50 years, following the word "years" insert: "(in annual payments over that period approximately equal in amount)".

All that does is prevent the pay-back first of interest-bearing features and then leave to last the non-interest-

bearing features.

Mr. Dodge's letter of March 18 says, "It is expected interest-bearing andnon-interest-bearing investments will be paid concurrently to the extent practicable." This amendment would merely accomplish this expectation and insure there is an orderly pay-back in proportionate amounts to both interest- and non-interest-bearing features of the project.

That is all I have to say on it, Mr. Chairman.

Mr. Harrison. Any further discussion on this amendment?

Mr. Engle. Will you read the amendment again, please?

Mr. Hosmer. I would be glad to. On page 8, line 9, add after the words "for a period not exceeding 50 years", the following: "in annual payments over that period approximately equal in amount."

Mr. Dawson. Does the gentleman have a copy of that?

Mr. Hosmer. Yes, you have it in front of you on the purple sheet.

Mr. Dawson. Will you yield to me?

Mr. Hosmer. Yes.

Mr. Dawson. Do you have in mind that the total payments including those to be paid by power will be included in those payments?

Mr. Hosmer. No; we are talking about the cost of these units -- each unit, participating project, or any separable feature thereof which are allocated to irrigation.

Mr. Dawson. I would like to have Mr. McFarland explain what this does to us, what it would mean. I think we are getting into some amendments that are pretty technical and which may throw us all out of kilter.

Mr. McFarland. As I understand it, the cost of the participating project, if it includes the part to be repaid by power, that part is paid over the last few years in heavy amounts.

Mr. Hosmer. I think there is a misunderstanding there. We are talking about repayment of the part allocable to irrigation, and we are trying to get it so that they will pay it in almost equal amounts and not use the money to pay off the part allocable to interest-bearing, power, in the first few years, and leave this non-interest-bearing obligation unrepaid until the very last when it could be repaid in part over this period of 50 years.

Mr. Dawson. Of course, it is anticipated that there will be more than uniform payments at the end of the power payout.

Mr. Hosmer. That does not interfer with that anticipation at all. You still got your Collbran formula in there. It just means until the Collbran formula takes effect in the last six years your irrigators are going to pay as nearly as possible equal amounts during the 44 years. Say in the first 44 years they would allocate five cents of it to irrigation

and all of the rest of it to power. You would still have this big non-interest-bearing debt hanging out on it, and this requires them as anticipated by Mr. Dodge's letter -- he said he expects that the interest and non-interest-bearing investments would be paid concurrently to the extent practicable.

Mr. Dawson. Of course, this bill is drafted by Mr. Dodge's office; so I assume they had this in mind when they drafted it.

Mr. Hosmer. We ran across one other case where they left out something that was supposed to be in, and I do not think we can assume they are perfect down there.

Mr. Rhodes. Will you yield to me?

Mr. Hosmer. Yes.

Mr. Rhodes. Does the gentleman feel if this provision is put in the Act that it would do away with the authority of the Secretary of the Interior to provide irrigators pay only that amount which they can afford to pay?

Mr. Hosmer. No. That amount which they can afford to pay, it just requires them to pay it in approximately equal annual installments.

Mr. Westland. Will the gentleman yield?

Mr. Hosmer. Yes.

Mr. Westland. What does that mean on Echo Park and Glen Canyon -- that this $98 million that is debited to irrigation, instead of being paid off principally in the last

6 years of this project, would be paid off equally during the 50-year period?

Mr. Hosmer. That is not it at all. It means that amount which irrigation is going to pay without the additional power help, as you have written into this bill, will be paid in approximately equal annual installments.

Mr. Bentsen. Will the gentleman yeild?

Mr. Hosmer. Yes.

Mr. Bentsen. Is it not possible there will be cycles in there where they might be more able to pay and others where they might be less able to pay, and it might influence?

Mr. Hosmer. We have written the word "approximately" into the amendment.

Mr. Dawson. Will you yield to me?

Mr. Hosmer. Yes.

Mr. Dawson. The bill already provides there is some discretion given, as I read it. You are putting them into a strait jacket here where they could not move.

Mr. Hosmer. No, this amendment does not do that at all. I ask unanimous consent all debate on the amendment end in 3 minutes.

Mr. Harrison. A unanimous consent request has been made. Is there any objection?

Mr. Dawson. No objection, but I would like counsel to make a statement.

Mr. Harrison. Proceed, Mr. McFarland.

Mr. McFarland. I do not believe that the amendment does what Mr. Hosmer has stated that it will do. The cost of these participating projects allocated to irrigation include about 85 percent to be repaid by power revenue. I believe the wording of the amendment would require that the total cost including the 85 percent to be repaid by power revenues would have to be repaid in approximately equal payments over the 50 years.

Mr. Harrison. Any further discussion of it? We have two minutes. Further discussion not being asked, the question is on the amendment of the gentleman from California, Mr. Hosmer, to page 8 line 9. All those in favor will say aye.

Opposed, no?

In the opinion of the Chair the noes have it. The noes have it and the amendment is not agreed to.

Mr. Hosmer. On the same page, line 15, reletter the existing subsections (e) and (f) of section 4 to make them subsections (f) and (g) respectively and insert a new section 4(e) as follows:

"(e) Contracts for water and power shall in the aggregate provide revenues at least sufficient to meet the requirements of subsection (c) of this section 4."

This amendment would merely provide that the sources of revenues shall when taken together provide enough money to

handle the repayments requirements enumerated in section 4 (c). It is very simply a businesslike requirement in there and points up to the Secretary the need for doing what he is required to do under the Act in order to make the Basin Account pay off.

I have no further discussion on the amendment.

Mr. Dawson. Do you have a copy of that?

Mr. Hosmer. It is also on the same sheet.

Mr. Harrison. It is on the sheet "Proposed Amendments to Section 4".

Is there further discussion?

Mr. Aspinall. Will the gentleman yield for a question?

Mr. Harrison. Mr. Hosmer has yielded back his time. I will recognize the gentleman from Colorado.

Mr. Aspinall. As I understand it, Mr. Hosmer, you state this is just to see that the Secretary does what by law at the present time he is supposed to do. Now let me ask you what advantage there would be by placing this in the law if that is right.

Mr. Hosmer. It is not in the law as a requirement in section 4(c) that he make these various payments, and without such amendment as mine thereis nothing in the bill to require that the contracts provide enough revenues to meet these requirements.

Mr. Aspinall. What if the contract does not? What if the Secretary should proceed and then sometime later the

contracts should not provide those revenues? Then what are you going to do?

Mr. Hosmer. The contracts when made are the best basis that he can go on. You cannot blame him for what happens if he makes a contract and something happens 10 years later. But when he makes these contracts he is required to make them in such fashion they will be able to provide the revenues to make the payout he is required to pay out.

Mr. Aspinall. You suggest that is not the procedure at the present time?

Mr. Hosmer. There is nothing at all with respect to it. He could sell the stuff for a penny if he wanted to, and I do not think we are entitled to give any Secretary that amount of discretion.

Mr. Aspinall. Do you mean to say our Secretaries for the last 50 years have proceeded that way and that any of them have violated their trust to see that the Government was repaid?

Mr. Hosmer. I think there is some argument about the activities of some of them. I just have a businesslike provision up before you, and I offer it to you in that spirit and in that light. If there is no further discussion, I ask the question.

Mr. Young. Mr. Chairman?

Mr. Harrison. Mr. Young is recognized.

Mr. Young. I would like to ask the gentleman from California a couple of questions.

Does it apply to irrigation repayments or distribution repayments?

Mr. Hosmer. This applies to contracts for both water and power he makes under the authority of this bill, to the aggregate of them. It does not say, like we had the other day when we had this difficulty about one project and one power plant that you might have to sell below cost. We are talking about the aggregate of all the power and water contracts he sells. We are just telling him he ought to do what he ought to have sense enough to do anyway, that is, make those contracts for such amounts of money so the revenues will come in and pay out the money this bill requires him to pay out.

Mr. Young. It requires him to pay out for operation, maintenance and replacements.

Mr. Hosmer. Yes.

Mr. Young. And the minimum from a water contract would have to bring in enough for operation, maintenance and replacement; is that it?

Mr. Hosmer. Yes. You take what happend out in Sacramento Valley, Central California project, where the Secretary went in and deliberately made a contract with the Sacramento Public Utilities District to sell power over a long period of years below cost, so that he put the project there in a non-paying status so it would not be attractive to the people of California to take it off the Federal Government's hands.

Mr. Aspinall. If you will yield, that is your opinion of what took place? You are not stating that as fact?

Mr. Hosmer. That is the facts as I know them. It comes to me as hearsay, just as most of the rest comes as hearsay. That is the official position of most people in my State.

Mr. Harrison. Any further discussion?

Mr. Young. I have one more question. I am not sure whether this applies only to operation, maintenance and replacement or to the capital investment which is to be repaid too.

Mr. Hosmer. This meets the requirements of subsection (c) of section 4. If you read that you will see where it applies to the whole thing.

Mr. Young. In other words, they cannot charge below cost then?

Mr. Hosmer. On the over-all project, that is right.

Mr. Harrison. Does the gentleman from Nevada have further questions?

Mr. Young. I will yield back the balance of my time.

Mr. Harrison. The question now is on the amendment submitted by the gentleman from California, Mr. Hosmer, on page 6, line 15. Those in favor of that amendment will say aye.

Opposed, no?

The Chair is in doubt. Those in favor of the amendment will raise their hands.

Those opposed, the same?

Mr. Dawson. Mr. Chairman, I demand a roll call.

Mr. Harrison. A record vote has been demanded. The clerk will call the roll.

The Clerk. Mr. Aspinall?

Mr. Aspinall. No.

The Clerk. Mr. Bender?

Mr. Dawson. No, by proxy.

The Clerk. Mr. Bentsen?

Mr. Bentsen. Aye.

The Clerk. Mr. Berry?

Mr. Harrison. No, by proxy.

The Clerk. Mr. Budge?

(No response.)

The Clerk. Mr. Dawson?

Mr. Dawson. No.

The Clerk. Mr. D'Ewart?

(No response.)

The Clerk. Mr. Donovan?

Mr. Donovan. Aye.

The Clerk. Mr. Engle?

Mr. Engle. Aye.

The Clerk. Mr. Hosmer?

Mr. Hosmer. Aye.

The Clerk. Mr. O'Brien?

(No response.)

The Clerk. Mrs. Pfost?

(No response.)

The Clerk. Mr. Pillion?

Mr. Pillion. Aye.

The Clerk. Mr. Regan?

Mr. Regan. No.

The Clerk. Mr. Rhodes?

Mr. Rhodes. No.

The Clerk. Mr. Rogers?

(No response.)

The Clerk. Mr. Saylor?

Mr. Saylor. Aye.

The Clerk. Mr. Westland?

Mr. Westland. No.

The Clerk. Mr. Wharton?

Mr. Wharton. Aye.

The Clerk. Mr. Yorty?

(No response.)

The Clerk. Mr. Young?

Mr. Young. Aye.

The Clerk. Mr. Miller?

Mr. Dawson. No, by proxy.

Mrs. Pfost. Mr. Chairman, I was to far away. I vote no.

Mr. Harrison. The vote on this amendment shows 8 voting in the affirmative and 9 voting in the negative, and the amendment is not agreed to.

Mr. Hosmer. Mr. Chairman?

Mr. Harrison. Mr. Hosmer.

Mr. Hosmer. At page 9, after line 4, at the end of section 4, add a new subsection (g), providing:

"Notwithstanding other provisions of this Act, the Secretary shall delay, during any fiscal year or years, commencement or continuation of construction of such participating projects, or any separable features thereof, authorized by this Act or subsequently, as reasonably may be necessary to insure that estimated revenues for any succeeding fiscal year or years, in excess of estimated costs of operation and maintenance, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, will be sufficient to permit payment from the Basin Account to the general fund of the Treasury amounts required to make the returns specified in subsection (d) of this section; and the Secretary shall make such estimates annually, before the commencement of each fiscal year, and include a statement with respect to same with the business-type budget required by subsection (f) of this section."

In other words, this amendment merely goes to the financial soundness of the over-all project; and if and when

it appears to the Secretary that the project is going to be bankrupt, he can delay construction or the additional construction until such time as revenues will be enough to pay out.

Mr. Harrison. The gentleman from California is recognized for five minutes.

Mr. Rhodes. Will you yield for a question?

Mr. Hosmer. I yield for a question.

Mr. Rhodes. Does this amendment presuppose that participating projects will be constructed from the Basin Fund? It is my understanding from the language of section (c) of section 4 that will not be done.

Mr. HOsmer. We do not know what may be done in the future with respect to this thing. The whole affair is bank-account business, and that is why the amendment includes the projects authorized by this Act or which might subsequently be authorized to be constructed out of the Basin Fund.

Mr. Rhodes. I call the gentleman's attention to the language on page 7, line 6: "Provided, That revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act."

Mr. Hosmer. And, as I say, this encompasses the additional development that is going on, anticipated to go on by the statements of the witnesses before this committee.

Mr. Westland. Will you yield there?

Mr. Hosmer. Yes.

Mr. Westland. About eight lines down you say "estimated revenues for any succeeding fiscal year or years." Would that mean he might estimate the revenues 40 years from now? That might be any year. He can pick at random. And if the revenues then were derived in sufficient amount to meet these requirements of this amendment, that would be satisfactory? Or are you going to confine it --

Mr. Hosmer. Will you yield?

Mr. Westland. Just a second. Are you going to confine it to the next year?

Mr. Hosmer. You cannot do that because he has got a 10-year development period on some of these projects. Maybe 31 years from now he sees with all the revenues coming in that year he is going to be in trouble. All right. So he would delay this construction for an additional year to get him over that hump. So that he would not have to make quite as many expenditures in that 31st year forward; he can delay it to the 32nd year forward, and at all times guarantee the financial feasability of this project.

Mr. Bentsen. Will you yield to me?

Mr. Hosmer. Yes.

Mr. Bentsen. Is it not possible at the end of 31 years he is losing money and he sees if he builds this particular project he will get in the black, and --

Mr. Hosmer. That is right, and this does not prevent him.

Mr. Bentsen. It seems to me this does prevent him.

Mr. Hosmer. No, because if he can see the 31st year it is going to be in the black, he can go ahead and build; and if it is going to be in the red --

Mr. Bentsen. It might be a project of three or four years construction, and one year it may be in the red, maybe two or three years which would be required for completion of this project.

Mr. Hosmer. Then he is required to so initiate his construction that he can keep this project in the black, which is the only businesslike thing to do. I do not want the Basin Account to go bankrupt, do you?

Mr. Bentsen. I can see a position where it might be in the red for a while, but in a period of years come back in the black.

Mr. Hosmer. But your Basin Account theory is not predicated upon an insolvent Basin Account, but it is predicated, built and argued and presented to the Congress on the basis of a solvent account at all times.

Mr. Dawson. Will you yield to me?

Mr. Hosmer. This requires him, it says, "Mr. Secretary, you will do that. You will carry out the intent of Congress. You will so operate, manage and commence your construction and

regulate your expenditures on this project you will do what Congress wants you to do -- keep a solvent basin account, a solvent series of projects."

Mr. Dawson. Will you yield?

Mr. Hosmer. Yes.

Mr. Harrison. The time of the gentleman from California has expired. Does the gentleman from Utah wish time?

Mr. Dawson. Just this one word: I think we still have in the bill plenty of safeguards to do the very thing the gentleman from California wants. This is simply putting us in a strait jacket here that may defeat the very purpose which he is seeking to achieve here. It may even thrust us into bankruptcy by tying us up here so we cannot spread these operations over a number of years.

Mr. Hosmer. Will you yield?

Mr. Dawson. Yes.

Mr. Hosmer. In his estimates which are required to be submitted with the business-type budget he estimates that very thing. If he starts this particular project and it is going to start paying in revenues in the 31st year, then he is free to start it.

Mr. Dawson. Does not the bill already provide for that?

Mr. Hosmer. No, it certainly does not.

Mr. Rhodes. Will the gentleman yield?

Mr. Dawson. Yes.

Mr. Rhodes. Actually, is not the amendment telling the Secretary in one place he may build participating projects from the Basin Fund, and on page 7 we are telling him he cannot build participating projects from the Basin Fund? It seems to me inconsistent with the other provisions of the Act.

Mr. Hosmer. I tried to explain that to the gentleman from Arizona a few moments ago, and I must call his attention to the fact that this particular amendment contemplates the addition of projects to the Upper Basin by subsequent legislation.

Mr. Dawson. Mr. Chairman, I yield back the rest of my time.

Mr. Regan. Will you yield?

Mr. Dawson. I yield.

Mr. Saylor. I ask unanimous consent --

Mr. Regan. Would you not feel you are putting the State of California and the Lower Basin in a rather hazardous position if you bankrupt the Upper Basin? The people who expect to supply the water, if they are bankrupt, might not be able to supply this water.

Mr. Hosmer. No, sir; I can guarantee --

Mr. Regan. I think you defeat your own objective there.

Mr. Hosmer. We are trying to avoid bankruptcy.

Mr. Harrison. The gentleman from Utah yielded back the rest of his time, so there is no one recognized now, and the gentleman from Pennsylvania has an unanimous consent request.

Mr. Saylor. I ask unanimous consent that all debate on this amendment and amendments thereto end in two minutes.

Mr. Harrison. Is there any objection?

The Chair hears no objection and it so ordered.

Does anyone wish to be recognized for the two minutes?

SEVERAL MEMBERS. Question.

Mr. Harrison. The question has been called for. All those in favor of the amendment submitted by the gentleman from California, Mr. Hosmer, say aye.

Opposed, no?

In the opinion of the Chair the noes have it. The noes have it and the amendment is not agreed to.

At this time the Chair will recognize the gentleman from Pennsylvania for an amendment.

Mr. Hosmer. Will the gentleman yield for just one observation?

Mr. Harrison. Does the gentleman from Pennsylvania yield to the gentleman from California?

Mr. Saylor. For an observation. I want to make sure I get this amendment in.

Mr. Hosmer. This time, I think, has been very well spent, and I think we have accomplished some matters of benefit to the bill. With the time limitation now imposed on the committee, it is going to be impossible to offer these amendments, and further discussion would be of help to the project.

I would like to state, Mr. Chairman, in my opinion, that perhaps it might be well if the committee could see fit and have a quorum present and sit this afternoon and finish off this business.

Mr. Saylor. I yielded for an observation. Now I have an amendment.

Page 12, section 11, line 9, after the word "appropriated" strike the comma and insert the following: "such sums as may be required to carry out the purpose of this Act but not to exceed $1,000,000,000."

Now the purpose of this amendment that I have is to take care of the action which the committee took yesterday. Yesterday we very graciously went along with our colleague from Colorado, and very properly so, for a project in the Colorado storage known as the Curecanti project, and it was adopted in this committee.

Now certainly if the committee adopted the resolution, they certainly intended to pay for it; and if they intend to pay for it, we have got to provide the money.

Now there seems to be some confusion as to just what this is going to cost the --

Mr. Dawson. Will the gentleman yield?

Mr. Saylor. I will not yield. I only have a couple of minutes here.

Mr. Dawson. I just wanted to say to the gentleman we will

accept his amendment.

Mr. Aspinall. Now --

Mr. Harrison. Does the gentleman yield or does he not?

Mr. Saylor. I do not.

Mr. Harrison. The gentleman refuses to yield.

Mr. Saylor. I want to say there are figures which have been submitted by the Bureau indicating that the cost of the high Curecanti is $80 million. Now it was very evident at the time the gentleman from Colorado made his amendment, which was adopted by this committee, that he did not want high Curecanti, in fact, he was very careful to fix the maximum elevation at which the water could be stored; and the purpose of it was to prevent a town in his district from being flooded out.

But the best estimate that anybody has seen -- and I just called this morning -- is that even the low Curecanti which he suggested would be $49,300,000.

Now I think the members of this committee have had enough experience with the Bureau of Reclamation to know that they cannot even come that close, and I do not want this bill to be considered as a bargain bill. This is not a sale item. This is not a one-cent sale which has become so popular. We want to give this great Bureau of Reclamation and all of its engineers, who have been able in 50 years to build one project at cost, a lot of money they can play with. So I am willing to up this $700,000, according to the best estimates which

they have, because I want this to be rounded out in a nice figure of a billion dollars.

Mr. Dawson. A parliamentary inquiry?

Mr. Aspinall. Will you yield to me?

Mr. Saylor. I will yield to my good colleague from Colorado.

Mr. Aspinall. I appreciate the position of my colleague, I think all of us do. We know he would like to refer to this as a "billion-dollar bill." But do not put the onus on your colleague from western Colorado.

Mr. Saylor. Oh, no.

Mr. Aspinall. We did yesterday, with the help of my colleagues, not quite bring this to a billion-dollar bill. Would my colleague be willing to make it $199,300,000?

Mr. Saylor. I do not want to put the onus on my colleague and that is why I fixed it at a billion dollars. The reason I fixed it at a billion dollars is that I do not want you to go back to Colorado and have it said that you were responsible for having this really tremendous sum. I want this big committee to step right up to it and assume the responsibility for a billion dollars when they go on to the floor of the House.

Mr. Aspinall. Of course, my colleague --

Mr. Saylor. As much as I love my colleague from Colorado and as much as I admire him, I would not want the people back

there to say he was responsible for the expenditure of this $49,300,000. So since the Bureau has always been under before-- I would like to call the attention of the committee to that business which we had before, namely, one up in Alaska known as Eklutna -- knowning the experiences which we have had -- and there has not been much change downtown with the engineers and their estimates -- then I think we are being very conservative when we only give them an additional $300,000, and I think that we ought to give them at least a billion dollars.

Mr. Harrison. The time of the gentleman from Pennsylvania has expired.

Mr. Bentsen. Mr. Chairman, a comment off the record.

(Discussion off the record.)

Mr. Harrison. The question has been called for. All those in favor of the amendment of the gentleman from Pennsylvania will say aye.

Those opposed, no?

In the opinion of the Chair the ayes have it.

Mr. Dawson. Mr. Chairman?

Mr. Harrison. Mr. Dawson.

Mr. Dawson. I have just two minor amendments which are noncontroversial.

Mr. Saylor. I am delighted to know they are not controversial.

Mr. Dawson. On page 11, line 10, insert the word in

italics "necessary."

Mr. Hosmer. Where is that?

Mr. Dawson. Page 11, line 10, the word in italics -- "necessary." That is conforming to the previous practices. In other words, it is our feeling that we would not want the Government to withdraw lands if they were not necessary. I do not think there would be any question on that.

Mr. Saylor. Where?

Mr. Dawson. Page 11, line 10. In other words, the Secretary may withdraw land, and we felt that he should not be withdrawing it unless it was necessary.

Mr. Harrison. Any objection to that amendment?

Mr. Hosmer. Will you yield to me?

Mr. Dawson. Yes.

Mr. Hosmer. I am going to ask you a question that you have asked me several times. Why is this necessary, because of the fact you have expressed such reliance upon the great judgment and obedience to law of the Secretary of the Interior?

Mr. Dawson. I have no objection if you want to take it out. It does not make any difference.

Mr. Hosmer. I just asked the question. Do you have an answer for it?

Mr. Dawson. I think we have put plenty of curbs on him as we have gone along.

SEVERAL MEMBERS. Question.

Mr. Harrison. Any further discussion? The question has been called for. All those in favor of the amendment by Mr. Dawson, page 11, line 10, will say aye.

Opposed, no?

In the opinion of the Chair the ayes have it.

Mr. Saylor. A point of order. The House is in session.

Mr. Harrison. The point of order has been raised that the House is in session. The point of order will be sustained.

The committe started working at 10:30 this morning and we have consumed an hour and one-half of the two hours which were allotted yesterday by the action of the committee.

The committee will stand adjourned until April 29 at ten o'clock a.m., for one-half hour's work on amendments. Following that one-half hour there will be a vote on the bill.

Mr. Hosmer. I ask unanimous consent that the time on April 29 be extended for an additional hour and a half.

Mr. Regan. I object.

Mr. Harrison. Objection has been heard.

Mr. Hosmer. I will so move.

Mr. Harrison. A point of order has been raised, Mr. Hosmer. The committee cannot transact any business, I regret to say. The committee stands adjourned.

(Whereupon, at 12:02 p.m., the subcommittee adjourned, to reconvene at 10:00 a.m., Thursday, April 29, 1954.)

H. R. 4449

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TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES.

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TUESDAY, MAY 18, 1954

House of Representatives,

Committee on Interior and Insular Affairs,

Washington, D. C.

The Committee met at 9:30 a.m. in the Committee Room of the House Committee on Interior and Insular Affairs, the Honorable A. L. Miller (The Chairman) presiding.

The Chairman. We have for further consideration at this time H. R. 4449.

Let the Chair inquire of the Clerk: When we recessed, when the House was in session last Thursday, I believe there was an amendment pending before the Committee.

Mr. Young. Mr. Chairman, I have several amendments.

The Chairman. I would like to ask: Was there an amendment pending at that time? I thought there was an amendment pending at that time. That will be the next order of business.

Let the Chair say that when we closed before we had

hoped we might finish the bill in thirty minutes. Is there any objection to limiting debate to all amendments and to all amendments thereto to thirty minutes?

Mr. Young. I have three or four amendments, Mr. Chairman. I am not sure how long they will take.

Mr. Saylor. Mr. Chairman, I move the time be limited to 11:45.

Mr. Engle. May I be heard on the motion?

The Chairman. The gentleman from California may be heard.

Mr. Engle. May we find out how many amendments will be offered? I have one I would like to have five minutes on.

Mr. Regan. I have an amendment.

The Chairman. The motion was: Not later than 11:45?

Mr. Saylor. Not later than 11:45.

Mr. Engle. Let us get an idea of who has amendments and divide the time.

The Chairman. How many amendments are there?

Mr. Engle. I have one.

The Chairman. Mr. Young.

Mr. Young. I have four.

The Chairman. Mr. Regan has one. That is six.

Mr. Engle. Six times five is thirty minutes.

The Chairman. Thirty minutes would give five minutes

on an amendment.

Mr. Saylor. Five minutes for and five minutes against; to make it not later than 11:45.

The Chairman. Not later than 11:45. We will proceed on that basis, without objection.

The amendment pending when we recessed or adjourned on last Thursday can be reported.

Let us try to limit debate on the amendments to not more than ten minutes. We will ask the Clerk to keep the time on the amendments.

The gentleman from Pennsylvania, Mr. Saylor, had an amendment pending, I believe.

Mr. Saylor. On page 18, line 3, strike out the provision,

"contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9(c) of the Reclamation Project Act of 1939;"

The Chairman. The gentleman is recognized on his amendment.

Mr. Saylor. I have spoken, Mr. Chairman, on that. I say that the municipal water supply in this project should be subject to the same rules and regulations of municipal water supply for other projects. That is all.

The Chairman. Are there any other comments?

Mr. Saylor. Question.

My motion is to strike out, and make the municipal water supply in this project subject to the same rules and regulations that there are on other projects.

The Chairman. The motion is on the amendment, page 18, line 3.

Mr. Engle. What are the limitations? May I ask a question?

The Chairman. The gentleman may.

Mr. Engle. What limitations are provided in Section 9(c) of the Reclamation Project Act of 1939, which are taken off?

Mr. Saylor. The present law is this: That no contract relating to municipal water supply or miscellaneous purposes or for electrical power purposes shall be made unless in the judgment of the Secretary it will not impair the efficiency of the project for irrigation purposes. That is the present law.

Mr. Aspinall. Mr. Chairman, I would like to be heard.

The Chairman. Mr. Aspinall is recognized.

Mr. Aspinall. This goes to the heart of the control of the use of water in the western states. It is not only the use of water, but the state's power to declare priorities of use.

In the State of Colorado we have a system whereby

domestic water users have first priority. All rights can be condemned for that use where it is found to be necessary. Then come the other uses. Irrigation is placed down around the third place.

If we do not have this provision in this bill it takes away from the state the right to determine just what uses shall have priority. This is placed here so that if there is any necessity for using the water which will be taken into consideration by this legislation the state can go ahead and declare the right of the municipality to be first.

The present Reclamation Law, as our colleague from Pennsylvania states, is to the effect that irrigation users have priority. We folks in the West contend that the states should have jurisdiction over this question. It is not a matter for federal determination.

Mr. Saylor. In other words, Mr. Aspinall, what you are trying to tell this Committee is that you are in favor of having one law apply to this section, which will be affected by the Upper Colorado River Basin, and another law apply to the other, so far as municipal water is concerned.

Mr. Aspinall. If the gentleman has asked me to yield, he has not stated my position correctly. I still maintain that the states should have the right to make the priority
7-13 on the use of water.

The Chairman. Are there any other comments? If not,

the question is on the amendment. Those in favor signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary, "No".

(General response of "No.".)

The Chairman. The Chair is in doubt. Those in favor of the amendment signify by holding up their right hands. The Clerk will count. Seven.

Those opposed? Seven.

The vote is seven to seven. The Chair votes "No". The amendment is defeated.

For the next amendment the Chair recognizes Mr. Young. Then he will recognize Mr. Regan for his amendment.

Mr. Young. Mr. Chairman, I would like to first move to amend the present Section 6 by striking out the existing language and inserting the language contained on the typewritten memorandum which has been distributed.

(The information is as follows:)

A H. R. 4449 - Committee Print No. 21; p.22, sec.6.

The hydroelectric power plants authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal power plants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Reimbursement Act, or any contract lawfully entered into under said Acts without the consent of the other contracting parties. Neither the impounding nor the use of water for the generation of power and energy at the plants of the Colorado River Storage Project shall preclude or impair the appropriation for domestic or agricultural purposes, pursuant to applicable State law, of waters apportioned to the States of the Upper Colorado River Basin.

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Mr. Young. In effect the present Section 6 provides for disposition of power created or produced on the Upper Colorado Project. It gives a priority to the Upper Basin and prohibits the sale of firm power to the Lower Basin for periods of more than twenty years.

In essence my proposed substitute would grant the same right to purchase this power produced at Glen Canyon and Echo Park, on the same basis, upon the same conditions as the states of the Upper Basin.

I oppose the present provisions of Section 6 for a number of reasons. In the first place, I think the priority provisions of the present Section 6 are novel, arbitrary, and unprecedented.

The Bureau of Reclamation at the present time disposes of some 20 billion kilowatts of power each year. I have been unable to find any place where a geographic limitation is put upon the distribution of power. In most instances the only limitation is one of economic transmission.

I recall having read one provision of the Bonneville Power Administration Act, which provides with respect to preference customers that the economic transmission shall be the determinant factor in determining who shall be the consumer.

When Hoover Dam was constructed it is my understanding there was no limitation upon who would be allowed to purchase

the power.

It so happens that none of the states of the Upper Basin desired to participate, so the power was distributed to allottees all of whom were located in the Lower Basin.

Secondly, I oppose the present provisions because I do not believe they make a maximum use of facilities so as to obtain an optimum amount of firm power. The thing that will best develop our economy and create growth of the western states is a maximum amount of firm power.

I can visualize some day when the Colorado River is developed and such plants as Bridge, Marble, and seven or eight additional multiple-purpose dams are constructed, that the Upper Basin will be able to have an integrated grid system which will permit the production of maximum firm power, which is the type of power upon which industry can depend to come in and invest and contribute to the economic growth of that area.

As a corollary of that, by failing to produce the maximum firm power I think we are reducing the maximum income or revenues that can be obtained from the production of this power. Our reclamation is expensive. I know many of our colleagues from the East look askance at the millions they are asked to invest in Western reclamation.

I think in considering these bills we should try to formulate plans and enact legislation which will permit the

obtaining in revenues of the maximum amount of money so as to lighten the burden upon our taxpayers.

I think that by providing for integration of power produced on the Colorado River and by allowing all of the states to participate on an equal basis we can obtain the maximum amount of firm power and as a result thereof get the greatest amount of income to help pay for the investment on the part of the American taxpayers.

Lastly, I think the plan which provides for a basin use or a basin priority with respect to distribution of power violates the basic philosophy of our federal power legislation, which is to obtain the most widespread use of our power to make the maximum use of our resources.

I particularly am interested in the position of the State of Nevada with respect to this power. We have limited power resources. We do not have the vast coal and oil of the Upper Basin. We have a growing industrial area in Southern Nevada, particularly in the city of Henderson. We are producing, I believe, the largest part of the titanium produced in this country at the present time. It is highly sought after by the Air Force.

There is a serious power shortage. If this project is constructed of course we in the Lower Basin are anxious to see the Upper Basin continue with its development. There is no doubt but what there will be a reduction of power at

Hoover Dam. Hoover Dam now produces some 4.3 billion kilowatts of power each year, which are distributed to consumers in the Lower Basin. There is already a power shortage in that area.

If Glen Canyon is filled it will result in an increased power shortage which will only further the difficulties of industrial growth in that area.

Mr. Bentsen. Will the gentleman yield?

Mr. Young. Very well.

Mr. Bentsen. Has his time expired?

The Chairman. The gentleman's time has expired. Does anyone wish to be heard in opposition?

Mr. Bentsen. I would like to be heard.

The Chairman. The Chair recognizes Mr. Bentsen.

Mr. Bentsen. I had a little difficulty hearing you at first.

Can you show me specifically what the difference is in objective?

Mr. Young. Yes, I can.

Mr. Bentsen. Between the wording as it is in the bill and your amendment?

Mr. Young. The present provisions of Section 6 provide that the Lower Basin states shall not be able to purchase power for more than twenty years. My substituted Section 6 would provide for disposition of power under the provisions

of Reclamation Law, allowing the Secretary of Interior to dispose of the power in a manner which he feels will give the most widespread value to its disposition for forty-year periods.

Mr. Bentsen. I yield to the gentleman from Colorado.

Mr. Aspinall. In other words, as I understand your amendment, it permits the following procedure: If the firm power can be made more effective in the Lower Basin at any time in the future than the use of such power could be made effective in the Upper Basin, it permits the Lower Basin to use the power at the expense of the development of the Upper Basin.

Mr. Young. Not at the expense of the development of the Upper Basin, because the Upper Basin is getting the revenue from the sale of the power at the present time. It enables the irrigation and reclamation development of the Upper Basin.

This will allow all states in the Upper and Lower Basins and elsewhere, if within economic distance of the production of that power, to put in their offers or applications for distribution of power.

Mr. Aspinall. Then your answer is that this supervision and administration is not to be made at the expense of the Upper Basin; is that right?

Mr. Young. Not at the expense of the Upper Basin,

unless the gentleman assumes that the Upper Basin has a priority with respect to this power, which, of course, I do not assume. It is admitted that they do with respect to the water, but there are other benefits, too.

Mr. Aspinall. If the Lower Basin and the Upper Basin should both need the power in the future, at any time in the future, if the use had already been established in the Lower Basin, the Upper Basin would have to look elsewhere for its power?

Mr. Young. The Upper Basin has seven additional multiple-purpose dams which will be constructed. It has vast resources of oil and coal.

Mr. Aspinall. Let me ask my colleague this: It is my understanding that those who represent Nevada in Congress from now on will be friendly toward the authorization of additional projects in the Upper Basin when necessary?

Mr. Young. We certainly want to see the Upper Basin developed. If Bridge Canyon is ever built it is my hope that the Upper Basin will be able to seek power on the same basis as the Lower Basin.

Mr. Bentsen. Is it not correct that what you are saying is that the Lower Basin will be put on an equal competitive basis for the purchase of that power? Your contention is that they have the right to the water but that the power is more of a free agent. The revenues of it go to pay

for the project. The Lower Basin has just as much right to competitively bid for that power; is that right?

Mr. Young. That is it, in essence.

Mr. Bentsen. I yield back the balance of my time.

Mr. Dawson. Mr. Chairman?

The Chairman. Would you yield to the gentleman from Utah? You have two or three minutes left.

Mr. Bentsen. I yield to the gentleman.

Mr. Dawson. I want to say I have no objection to this amendment. I think the objective the gentleman seeks to attain is worth while. I can see some benefit to us in the Upper Basin states in firming up this power.

Mr. Bentsen. It might mean a picking up of the project sooner.

Mr. Dawson. That is right.

The Chairman. The question occurs on the amendment suggested by Mr. Young. The amendment is before you. Those in favor of the amendment signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary, "No".

8-23 (Responses of "No".)

The Chairman. In the opinion of the Chair the "Ayes" have it. The "Ayes" have it. The motion is carried.

Mr. Young, have you another amendment?

Mr. Young. Mr. Chairman, with respect to the production

of power at Hoover Dam, at the present time there are a number of power allottees and they have firm contracts which extend up to 1987. The construction of Glen Canyon and the filling of the reservoir behind that, which will contain some 26 million acre-feet, which would hold the entire flow of the Colorado River for several years, means that there will inevitably be some drop in power production in the generators at Hoover Dam. Of course, that was recognized when Hoover Dam was constructed.

It was provided that there would be a diminution of at least 1,000 kilowatts a year, and I believe that is around 8,760,000 kilowatt-hours a year.

If the power is reduced at Hoover Dam, it is going to have a bad effect upon industry in Southern Nevada, Arizona and California.

Mr. Bentsen. Will the gentleman yield to me?

Mr. Young. Yes, I will.

Mr. Bentsen. Have we not just passed an amendment that takes care of you on that, and puts you on a competitive basis for that power which is generated?

Mr. Young. That is for the power to be produced at Glen Canyon. There perhaps will be a reduction in the water which flows into Lake Meade.

Mr. Bentsen. But you have a supplemental source you can bid for now.

Mr. Young. Perhaps it will not be available for a number of years. It takes at least five or six years to complete the construction of Glen Canyon and the filling up of the reservoir behind it. Therefore I would like to amend the new Section 6 by adding:

> "Provided further, that to the extent that the operation of Glen Canyon and Echo Park Dams diminish the production of firm energy at Hoover Dam below the quantities specified in contracts of the United States heretofore made, replacement firm energy from Glen Canyon Dam shall be made available at Hoover Dam upon the same prices, terms and conditions as the Hoover Dam firm energy so replaced."

I feel that it would be only fair that if the existing contracts are harmed by filling up the reservoir behind the Glen Canyon Dam that the Secretary should take that into consideration, and allow newly produced power to go to the allottees whose power has been diminished by the filling of Glen Canyon Dam.

On the amendments, that would be on the second page, paragraph 6:

> "Provided further, that to the extent that the operation of Glen Canyon and Echo Park Dams diminish the production of firm energy at Hoover Dam below the quantities specified in contracts

of the United States heretofore made, replacement firm energy from Glen Canyon Dam shall be made available at Hoover Dam upon the same prices, terms and conditions as the Hoover Dam firm energy so replaced."

We in the Lower Basin are anxious to see the Upper Basin developed, but we hate to see it develop at the expense of firm power contracts now in existence in the Lower Basin.

Mr. Pillion. Will the gentleman yield?

Mr. Young. Yes.

Mr. Pillion. Is there an engineering or a mathematical method by which this reduction in power can be measured definitely?

Mr. Young. Yes, there is. You can take the power head and use a slide rule and come out with the exact amount of reduction. There will be a substantial reduction in the power produced at Hoover Dam with the filling up of Glen Canyon.

Of course, that was anticipated when the original contracts were made. It was visualized that the Upper Basin would develop and as a consequence there would be a reduction in the power. But the reduction will probably be greater than was anticipated in the contracts providing this distribution of power to the present allottees.

Mr. Dawson. Will the gentleman yield to me?

Mr. Young. Yes.

Mr. Dawson. Was it not anticipated that when the Upper Basin put the water to use there would be some diminution of the flow to the Lower Basin?

Mr. Young. Yes, it was. It was estimated, I think, to be 1,000 kilowatts a year, or 8,760,000 kilowatt-hours.

Mr. Dawson. Is it not also a fact that in these contracts which the government has with these power users they took it into consideration, and that there is a clause in there providing that the government is not bound to deliver any particular amount of power?

The Chairman. The time of the gentleman has expired. Does anyone else desire to be heard in opposition to the amendment?

Mr. Dawson. Mr. Chairman, I oppose the amendment. I think if we accept this amendment we will simply be modifying in effect the Colorado River Compact. We are asked to guarantee the Lower Basin the same amount of power which they have had. They have been using the water allocated to the Upper Basin states. If they want to be guaranteed the same amount of power which that additional water gave them they are going completely beyond the agreement contained in the compact.

Mr. Young. Will the gentleman yield for a question?

Mr. Dawson. Yes.

Mr. Young. Of course, the compact says nothing with respect to the present contracts with the allottees. Those were made under the provisions of the Boulder Canyon Project Act.

Of course, it was understood there would be a diminution. However, the amendment I have suggested is only with respect to the firm power. I believe that the other power to a large extent is what they call secondary power and is based upon the additional water which has been coming down, admittedly, from the Upper Basin; more than perhaps would come once the contract is in operation.

Mr. Dawson. I would say your amendment goes further than that. It concerns firm power as well as secondary power. It concerns all power.

Mr. Aspinall. Will my colleague from Utah yield to me?

Mr. Dawson. I will yield to my colleague from Colorado.

Mr. Aspinall. I wish to state my opposition to the proposed amendment. I think that the amendment which our colleague from Nevada suggested before takes care of the equities concerned.

It is my understanding that the feeling of all parties concerned to the Colorado River Compact was that the various basins -- the Upper Basin and the Lower Basin -- should be permitted to develop, and that each should be entitled to the equities of that development.

Now it seems to me that my colleague from Nevada by this proposal, at least, -- and I am not so sure but what by the other, also -- is placing certain road blocks in the way of the equities which the Upper Basin has a right to expect will be received, and those are endangered by his proposal to write into this bill everything which will benefit the Lower Basin and the danger and the cost to the Upper Basin is not clear.

Mr. Bentsen. A parliamentary inquiry. Is the gentleman proposing all these amendments as one?

Mr. Young. Just the one on the second page, at the top of the second page.

Mr. Bentsen. Is that all?

Mr. Young. That is all on this particular section. I have another amendment after this.

Mr. Dawson. Mr. Chairman, I yield back the balance of my time.

The Chairman. The gentleman yields back his time. There are two minutes remaining.

Mr. Harrison. Mr. Chairman?

The Chairman. Mr. Harrison.

Mr. Harrison. I just wanted to add my statement to those made by the gentleman from Utah and the gentleman from Colorado.

All during the hearings on this particular project bill

we of the Upper Basin have tried to assure those of the Lower Basin that we did not want any change made in the Colorado River Compact and that we were perfectly willing at all times to see that the proper language was placed in the bill to see that no change would be made in the compact.

It is my position that we in the Upper Basin want nothing more than the Compact guarantees us. We want to live up to the terms of the Compact, and in return we want the Lower Basin to live up to the terms of the Compact. I think if we follow that Compact explicitly both basins will not suffer.

That was a compact entered into in good faith in 1922. I think that good faith should extend not only to now but into the future.

Mr. Saylor. Will the gentleman yield for an observation?

Mr. Harrison. Yes.

Mr. Saylor. If that is the position which the State of Wyoming takes, and Utah and Colorado take, then I am surprised that they voted to accept the First Amendment which Mr. Young offered, because that goes to the very heart of it and does not do what the gentleman just specified that the upper states desire. It changes entirely the concept of the Colorado River Compact and puts an entirely new light on it, and gives now to the Lower Basin states a right which

they never had and will only have if this bill goes through.

Mr. Dawson. Will the gentleman from Wyoming yield to me?

Mr. Harrison. Yes.

Mr. Dawson. I call the attention of the gentleman from Pennsylvania to the fact that the same wording is already in the bill, practically, which went in with that last amendment.

Mr. Saylor. Oh, no. It is very important to notice that the very important wording which changes the whole context is on page 23, and that has been carefully deleted from the bill.

The Chairman. All time has expired on the amendment offered by the gentleman from Nevada, Mr. Young. Are you ready for the question?

Mr. Bentsen. Question.

The Chairman. Those in favor of the amendment as suggested signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary, "No".

(General response of "No".)

The Chairman. In the opinion of the Chair the "Noes" have it. The "Noes" have it.

The Chair observes that the next amendment the gentleman wishes to offer is a new section. I think we will pass over

9-32 that and recognize the gentleman from California, Mr. Engle. Mr. Regan has kindly yielded to the senior member on his side, Mr. Engle.

Mr. Engle. I appreciate that very much, Mr. Chairman.

I offer now the same amendment that was offered in the Subcommittee, with some changes; that amendment having been defeated by one vote.

The purpose of the amendment deals with disagreements about the interpretation of the Compact. It has been agreed throughout these discussions that all of the projects of the Colorado River shall be administered and managed in accordance with the terms of the basic law of the river; the Colorado River Compact and all the other laws of the river.

The only thing which has concerned us is the fact that there have been reoccurring disagreements as to what the Compact means and what the law of the river is. Therefore, we have sought for some assurance for everybody -- not just California, Arizona, or Nevada, but for everybody in the Upper Basin -- that in the management of the river there can be some final determination of the meaning of the Compact where there is disagreement about the Compact.

So this amendment which I shall submit to you has been submitted also to Mr. Aspinall, and he has made some changes. As I read the amendment I will indicate what he has added.

The amendment before you starts:

"The Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, -- "

and so forth.

Mr. Aspinall has added this language in front of that:

"In the operation and maintenance of all facilities authorized by federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed -- "

and so forth. Then follows the language of the amendment as submitted to you.

The purpose of Mr. Aspinall's addition is to make this amendment applicable to the whole basin, and not just the Upper Basin. So down in the middle of the section, where "Upper Basin" appears, he has stricken "Upper Basin" and substituted "Colorado River Basin".

With those two changes that is the amendment which I am offering. It goes on to say that the Secretary is required to comply with all the law of the river, naming the documents, and that in the event of the failure of the Secretary to so comply any state of the Colorado River Basin may maintain an action in the Supreme Court of the United

States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party to such suit or suits.

(The language of the amendment is as follows:)

Page 25, line 2, insert the following:

In the operation and maintenance of all facilities authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this Section, and consent is given to the joinder of the United States as a party in such suit or suits.

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Mr. Engle. I have briefly stated the purpose of this amendment; that is, to settle quickly and effectively disagreements about the interpretation of the basic compact.

It is altogether conceivable that both sides would swear up and down they were complying with the compact; the Secretary would say he was; but there would be disagreement either in the Upper Basin or in the Lower Basin or by some state that he had correctly interpreted the compact.

This amendment would allow any state so affected -- that means Wyoming, Colorado, Utah and all the others in the Upper Basin, or any state in the Lower Basin -- Nevada or Arizona or California -- to step in and ask for an immediate interpretation, because this amendment deals solely with management of the river and it does not -- and I emphasize this -- does not interfere with construction of the project.

I want to make it perfectly clear that there is no intention in offering this amendment to interfere with construction of the project. It relates solely to management of the river. Because it relates solely to management of the river it facilitates a problem for everybody. I hope the amendment will be adopted.

I now yield to Mr. D'Ewart.

Mr. D'Ewart. I remember all of the arguments that we had in the Arizona-California case about justiciable issues. As I remember it, only the Supreme Court can determine what

is a justiciable issue before that court. Here we are trying to write into the law that in the event of failure to comply then there is a justiciable issue. I believe that is something which the Supreme Court has to determine, and not the Congress.

Mr. Engle. The gentleman is correct, except as to what this amendment does. The Congress cannot create a justiciable issue. Each case is taken into the Supreme Court and the Supreme Court says that if it is not a justiciable issue then the petitioner is immediately tossed out. That is what will happen if this amendment goes into effect, as under all circumstances. It does not create a justicable issue.

It would be impossible for Congress in the very nature of the case to legislate a justiciable issue. If it is not there it is not there, and the Supreme Court would so declare.

Mr. Rhodes. Is it not true that about all this amendment does, Mr. Engle, is to give consent to the joinder of the United States as a party to any such action? You will remember that in the action between the two states the court has held that the United States is a necessary party, and we have had trouble at times getting the United States in.

Mr. Engle. That is correct, with one limitation, and that is the one I want to put my finger on: It limits the

consent to those actions relating to the management of the river. You will note the specific language:

" -- in the storage and release of water from reservoirs in the Colorado River Basin."

It is those downstream from the Upper Basin as well as those upstream.

Mr. Donovan. I ask unanimous consent that the gentleman from California have one more minute.

Mr. Engle. Take the time yourself.

The Chairman. The debate is limited. Take the time yourself.

The Chair will recognize the gentleman from New York, Mr. Donovan.

Mr. Donovan. For one specific question.

Will the gentleman from California agree that this amendment, if adopted, will to some extent broaden the area of litigation which now exists?

Mr. Engle. No, it will not. It will merely facilitate the procedure for getting the litigation settled. Otherwise it would be necessary in each instance for a state disagreeing --

Mr. Donovan. Will it broaden it to any extent, however slight?

Mr. Engle. It would not. It would not broaden the field of litigation. It would merely facilitate litigation.

Mr. Donovan. Then what is the need for it?

Mr. Engle. Because you have to have the consent of Congress to go into court. There would be a constant barage of bills in here to get consent.

Mr. Donovan. Does the state have to have the consent of Congress to sue another state?

Mr. Engle. No, but you have to have the consent of Congress to join the Federal Government, and the Supreme Court has held that the Federal Government is a necessary party on the Colorado River.

Mr. Donovan. Then it does broaden the area of litigation.

Mr. Engle. It does not broaden the area of litigation; it only facilitates the method for getting it into court.

Mr. Donovan. It brings another party into it who would not be in it before, does it not?

Mr. Engle. That depends. We could get a bill through Congress. This simply takes care of it ahead of time.

Mr. Rogers. Mr. Engle, would this amendment not open a field where the parties could control the situation, if they could have the Supreme Court rendering declaratory judgments?

Mr. Engle. That is right. Any time you have a disagreement about the river you can step in and get it settled.

Mr. Rogers. The thing about it is that this amendment,

as Mr. D'Ewart pointed out, actually in effect permits the states to determine what is a justiciable issue.

Mr. Engle. No, it does not. The Supreme Court will determine that in any case. All this does is give the parties a chance to get a final decision, because there is not going to be any final decision, if there is disagreement on the interpretation of the compact, except in the Supreme Court.

The Chairman. Mr. Donovan, will you yield to Mr. Rhodes of Arizona?

Mr. Donovan. I will yield to anybody who wants the time.

The Chairman. Mr. Rhodes.

Mr. Rhodes. It is my understanding this would not create a justiciable issue and could not create a justiciable issue where none exists.

Mr. Engle. That is correct.

Mr. Rhodes. This is purely a matter of allowing these states to get into court to decide the one question of the storage of water and its release from the Upper Basin to the Lower Basin.

The Chairman. Will the gentleman yield to Mr. Pillion of New York?

Mr. Donovan. Do I still have the time?

The Chairman. Yes.

Mr. Donovan. I yield.

Mr. Pillion. This amendment appears to grant injunctive relief against the United States, but supposing that the injunctive relief were given to a state against the United States and then the United States were to violate it. Would this amendment give rise to a possible action for money damages and thereby create new liabilities and broadened liabilities against the United States Government? After the United States Government has financed these various projects are we going to be placed in a position where we are then sued by reason of differences that may arise?

Mr. Donovan. I will answer that. It certainly would.

Mr. Engle. May I answer that question? The answer to
10-42 the question is that it would create no liability that would not exist in the absence of the section. All this does is to permit somebody to get into court and take care of the multiplicity of bills which might come along to adjudicate specific issues as they arose. It gives everybody a chance to get a final determination.

Mr. Donovan. May I have the last few minutes of my five minutes?

The Chairman. The time of the gentleman has expired. All time has expired on this amendment.

The vote occurs on the amendment suggested by Mr. Engle of California, page 25, line 2.

Are you ready for the question? All those in favor of the amendment signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary, "No".

(General response of "No".)

The Chairman. The Chair is in doubt. Those in favor of the amendment signify by raising their right hands. The Clerk will count. Nine.

Those in opposition?

The vote is nine "Ayes" and ten "Nays". The motion is lost.

The next amendment to be offered is by Mr. Regan of Texas, who is recognized for his amendment for five minutes.

Mr. Regan. On page 19, line 21, I want to add this proviso following the period:

> "Provided further, that the subsidy from power revenues to assist the participating irrigation projects in each state shall be proportional to the revenues derived from sale of power of the Colorado River Storage Project in that state."

That is to limit the moving of this money from one state to another; and I have in mind particularly the State of New Mexico, where they propose putting in participating projects in the number of four power dams, which we are convinced would not be profitable.

I do not want to see them moving money from the Upper States to subsidize those projects on the Rio Grande River or its tributaries.

Mr. Dawson. Would the gentleman yield to me?

Mr. Regan. Yes.

Mr. Dawson. Does that mean that Arizona, getting Glen Canyon Dam, the big power producer, would be entitled to the revenues from Glen Canyon? That is about six miles across the line from Utah. Then Echo Park is about thirteen miles across the line, in Colorado.

Mr. Regan. It might have that effect.

Mr. Dawson. I am opposed to the amendment.

Mr. Regan. I move the adoption of the amendment. It is a very good and wholesome amendment.

Mr. Saylor. Mr. Chairman, I would like to concur in the statement of the gentleman from Texas. It is a wholesome amendment.

The Chairman. Are there any other comments? If not, the vote occurs on the amendment offered by Mr. Regan of Texas. Those in favor of the amendment signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary, "No".

(General response of "No".)

The Chairman. The Chair is in doubt.

Mr. Aspinall. Mr. Chairman, I ask for a roll call.

The Chairman. A roll call is called for. The Clerk will call the roll.

Mr. Huyck (The Clerk). Mr. Aspinall?

Mr. Aspinall. No.

Mr. Huyck. Mr. Bender? Mr. Bentsen?

Mr. Bentsen. Present.

Mr. Huyck. Mr. Berry?

Mr. Berry. No.

Mr. Huyck. Mr. Budge? Mr. Dawson?

Mr. Dawson. No.

Mr. Huyck. Mr. D'Ewart?

Mr. D'Ewart. No.

Mr. Huyck. Mr. Donovan?

Mr. Donovan. Aye.

Mr. Huyck. Mr. Engle?

Mr. Engle. No.

Mr. Huyck. Mr. Gross?

Mr. Gross. Aye.

Mr. Huyck. Mr. Haley?

Mr. Haley. Present.

Mr. Huyck. Mr. Harrison?

Mr. Harrison. No.

Mr. Huyck. Mr. Hosmer?

Mr. Pillion. "Aye" by proxy.

Mr. Huyck. Mr. O'Brien?

Mr. Regan. "Aye" by proxy.

Mr. Huyck. Mrs. Pfost?

Mrs. Pfost. No.

Mr. Huyck. Mr. Pillion?

Mr. Pillion. Aye.

Mr. Huyck. Mr. Regan?

Mr. Regan. Aye.

Mr. Huyck. Mr. Rhodes?

Mr. Rhodes. Aye.

Mr. Huyck. Mr. Rogers?

Mr. Rogers. Aye.

Mr. Huyck. Mr. Saylor?

Mr. Saylor. Aye.

Mr. Huyck. Mr. Shuford?

Mr. Shuford. Aye.

Mr. Huyck. Mr. Westland?

Mr. Westland. No.

Mr. Huyck. Mr. Wharton?

Mr. Wharton. Aye.

Mr. Huyck. Mr. Yorty?

Mr. Regan. "Aye" by proxy.

Mr. Huyck. Mr. Young?

Mr. Young. No.

Mr. Rhodes. Mr. Chairman, before the vote is announced

I would like to change my vote from "Aye" to "No".

Mr. Haley. Mr. Chairman, I would like to vote "Aye".

The Chairman. The Chair would like to examine the proxies that are offered. There were two or three proxies voted. Mr. Regan and Mr. Pillion voted proxies.

Mr. Budge. Mr. Chairman?

The Chairman. Mr. Budge.

Mr. Budge. A point of order. Am I entitled to vote on this motion?

The Chairman. The vote has not been closed. The gentleman is entitled to vote.

Mr. Budge. I wish to be recorded as voting "No".

The Chairman. The vote will be recorded. The Chair feels that the proxies are in order.

Mr. Westland. Mr. Chairman, I would like a typewritten copy of that amendment.

Mr. Saylor. Point of order, Mr. Chairman.

The Chairman. It is too late. The amendment is before the Committee.

The vote is 12 "Aye" and 11 "Nay".

The Chair votes "No". The amendment is lost for lack of a majority.

Is there any other amendment to be offered at this time?

Mr. Young. I have one more amendment, Mr. Chairman.

The Chairman. Mr. Young.

Mr. Young. Mr. Chairman, I would like to add a new section, to be known as Section 11, which will read as follows:

"Section 11. Section 2(d) of the Boulder Canyon Project Adjustment Act (Act of July 19, 1940, 54 Stat. 774), is amended by adding thereto the following:

"'Upon the commencement of operation of the Glen Canyon Power Plant, the payment from Hoover Dam power revenues of $500,000 per year into the Colorado River Development Fund shall cease, and thereafter the amounts payable annually to each of the states of Nevada and Arizona out of Hoover Dam power revenues in lieu of taxes shall be increased from $300,000 to $550,000.'"

The Chairman. The gentleman is recognized for five minutes.

Mr. Young. In 1940 with the enactment of the Boulder Canyon Project Adjustment Act the sum of $500,000 was given annually to the Upper Basin states for the purpose of investigation and development.

Mr. Rhodes. Mr. Chairman, a point of order. The Committee is not in order.

The Chairman. The point is well taken. We will ask that the Committee be in order.

You may proceed.

Mr. Young. With the enactment of the Boulder Canyon Project Adjustment Act of 1940 the sum of $500,000 annually was given to the Upper Colorado Basin for the purpose of investigation and development of reclamation on the Colorado River. I believe that terminates in 1955, and thereafter the $500,000 is distributed between the Upper and Lower Basin.

At the time of the enactment of the Boulder Canyon Project Adjustment Act it was my understanding that $300,000 was to be paid to Arizona and Nevada in lieu of taxes. In Nevada and Arizona you have Lake Meade, which contains some 30 million acre-feet and has a shore line of 550 miles.

In the State of Nevada you have Boulder City, which is federal property and not subject to taxation, which furnishes an additional burden upon the state.

The $300,000 was given to the State of Nevada in lieu of taxes, which could not be assessed or collected against federal property. The same is true, I understand, with respect to the State of Arizona.

In view of the inflation which has occurred during the past decade I feel it only fair that the in-lieu amount of $300,000 be raised to $550,000 and that now since the Upper Basin States will soon have the operation, I hope, of Glen Canyon, Echo Park, and other power producers in the future, it will no longer be necessary to pay to them the $500,000 each year for the purpose of development of the Upper Basin

region.

Therefore, I urge the adoption of this new section which would raise the in-lieu taxes or payments from $300,000 per year to $550,000; the sum, of course, to come from the $500,000, which now comes from revenues of Hoover Dam for development of the Upper Basin region.

Mr. Saylor. Mr. Chairman, I have a substitute amendment.

The Chairman. The gentleman may offer it.

Mr. Saylor. At the end of line 4 of the amendment offered by the gentleman, after the word "cease", place a period and strike the remainder of the paragraph. The effect of this would be that after the commencement of operation of Glen Canyon power unit the $500,000 shall be paid into the United States Treasury.

The Chairman. Any other comments?

Mr. Pillion. I would like to offer another amendment.

The Chairman. An amendment to the amendment?

Mr. Pillion. Yes, an amendment to the substitute amendment.

The Chairman. I think it would be in order.

Mr. Pillion. On the last line of the original amendment, instead of $550,000, substitute the sum of $400,000, which would give each of the states $100,000 and save the United States Government $300,000.

The Chairman. The vote occurs on the amendment offered

by the gentleman from New York, Mr. Pillion.

Mr. Bentsen. Does the gentleman want to withdraw his amendment?

The Chairman. Those in favor of the amendment signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary "No".

(General response of "No".)

The Chairman. The motion is defeated.

The vote now occurs on the amendment offered by the
11-51 gentleman from Pennsylvania, Mr.Saylor. Those in favor of the amendment signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary, "No".

(General response of "No".)

The Chairman. In the opinion of the Chair the "Noes" have it. The "Noes" have it.

The vote now occurs on the amendment offered by the gentleman from Nevada.

Mr. Aspinall. Mr. Chairman, I wish to speak in opposition.

The Chairman. The gentleman can be heard. According to the Chair's record there are four minutes left.

Mr. Aspinall. I just wish to say this to my colleagues: This amendment would come in good grace, it seems to me, after

Glen Canyon gets into operation and the revenues begin, but at the present time, without any definition here at all as to what is to be considered a commencement, or any study at all of how much revenue will come from the Glen Canyon Project when the wheels begin to turn, it seems to me that the gentleman from Nevada has lost sight of the fact that the Upper Basin has cooperated with the Lower Basin on the Boulder Canyon Project Adjustment Act. That was part of the philosophy behind the legislation.

Mr. Rhodes. Will the gentleman yield?

Mr. Aspinall. Yes.

Mr. Rhodes. Is it not true that the $500,000 was originally paid to more or less compensate the Upper Basin for the fact that the water was coming down the river and was being used to manufacture power in the Lower Basin? At such time as the Glen Canyon Dam begins to fill up the water which was coming down as surplus will no longer be coming.

Mr. Aspinall. I do not think that was the reason for it. I think the reason for it was the study of the Upper Basin, so that the Upper Basin interests could be harmonized with the Lower Basin interests in the development of each one of the areas.

Mr. Dawson. Would the gentleman yield to me?

Mr. Aspinall. I yield.

Mr. Dawson. Would it not be a more appropriate procedure to come in after these projects are in and then amend the Boulder Canyon Project Adjustment Act, which was a separate act entirely, rather than to come in with this new legislation and attempt to amend that act?

Mr. Aspinall. Of course.

Mr. Dawson. At that time you could see just what the needs were and what the equities were.

The Chairman. The vote now occurs upon the amendment offered by Mr. Young. Those in favor of the amendment signify by saying "Aye".

(General response of "Aye".)

The Chairman. Contrary, "No".

(General response of "No".)

The Chairman. In the opinion of the Chair the "Noes" have it. The "Noes" have it. The amendment is defeated.

Are there other amendments to the bill?

Mr. Saylor. Mr. Chairman, I move to strike out the last word.

The Chairman. The gentleman is recognized. Have you an amendment to offer?

Mr. Saylor. I have no amendment to offer at this time, Mr. Chairman, but I move to strike out the last word because on Friday of last week --

Mr. Dawson. Mr. Chairman, a parliamentary inquiry.

Mr. Saylor. I have the floor. I refuse to yield.

Mr. Dawson. I think a parliamentary inquiry is in order.

The Chairman. Will the gentleman yield the floor?

Mr. Saylor. No, I refuse to yield. I have only a few minutes and I will not take the time.

Mr. Dawson. A point of order, Mr. Chairman.

The Chairman. The gentleman has a point of order.

Mr. Dawson. The point of order is this: According to the ruling of the Chair and the concurrence of the Committee we were to vote on this measure at a quarter to 12:00. Is the gentleman from Pennsylvania going to be given all the time from now on until a quarter of 12:00, or will some of the rest of us be given an opportunity?

The Chairman. The time, the Chair must rule, was allocated for the presentation of amendments. Unless the gentleman from Pennsylvania has an amendment to offer he could hardly be recognized for five minutes.

Mr. Saylor. Very well, Mr. Chairman. I will offer this in the form of an amendment.

Mr. Engle. Mr. Chairman, I have a motion on an amendment.

The Chairman. The Chair asks if there are other amendments.

Mr. Engle. I have one.

Mr. Saylor. I have an amendment, Mr. Chairman, which I

asked to be recognized for.

The Chairman. There are approximately four minutes left. The gentleman from Pennsylvania is recognized for two minutes, and the gentleman from California, Mr. Engle, is recognized for two minutes, to present their amendments.

Mr. Saylor. Mr. Chairman, my amendment will have to do with the placing as a part of this bill of the letter or the paragraphs from the letter directed by Mr. Ralph A. Tudor, the Under Secretary of the Interior, to William A. Harrison, the Chairman of the Subcommittee on Irrigation and Reclamation.

Mr. Harrison. A point of order, Mr. Chairman.

Mr. Saylor. It has been pointed out --

Mr. Harrison. No amendment has been proposed at the present time, or designated by the gentleman from Pennsylvania, as to where the amendment would take place.

Mr. Saylor. After the last section, sir. I would be glad to put it in the last section. Add a new section, whatever the number is, and make it a new section.

It will take the form of a letter from the Secretary of the Interior. I would like to read it.

"On January 18, 1954, I appeared before your Subcommittee and testified on behalf of the Upper Colorado River Project. A part of that testimony was a recommendation that the Echo Park and Split

Mountain Dams be included in the project. These two dams have been opposed by persons and organizations interested in conservation. This Department recommended construction of the dams rather than other possible alternates for various reasons including lesser evaporation losses.

"On March 9 I advised you by letter of certain errors that had been made by me in my testimony, and I particularly advised you that if a high dam should be built at Glen Canyon in lieu of dams at Echo Park and Split Mountain the increased losses for evaporation will amount to 70,000 acre-feet per year."

The Chairman. The time of the gentleman from Pennsylvania has expired.

Mr. Saylor. I ask for a vote on it.

The Chairman. It is hardly an amendment to the bill. It was not designated as a new section.

Mr. Saylor. It has been designated as a new section at the end of the bill; add a new section.

Mr. Harrison. I raise a point of order, Mr. Chairman, that that is not an amendment.

The Chairman. The Chair will sustain it. It is not an amendment to the bill.

The gentleman from California is recognized for two

minutes.

Mr. Engle. Mr. Chairman, I move reconsideration of the vote whereby the Committee failed to adopt the amendment which I offered a few minutes ago. I will submit the motion and ask for yeas and nays.

Mr. Donovan. A point of order, Mr. Chairman. A point of order. I understand the parliamentary rule is that only a Member of the Committee who votes against the amendment can move for reconsideration.

The Chairman. The point of order will be sustained.

Let the Chair make one short statement before the final vote is taken on the bill. As Chairman of the full Committee I want to say publicly at this time I appreciate the fine attendance and interest this Committee has taken in not only this legislation but other legislation before the Committee, and the long time which Mr. Harrison's subcommittee has put in on the bill. We have tried to hammer out on the anvil of debate the big, tough problems confronting the country. The Chairman of the Committee appreciates the attention and zeal and earnestness in which amendments have been presented.

Mr. Saylor. Mr. Chairman?

The Chairman. Just before the preferential motion is made, or other motions are made, the Chair reminds the Committee that tomorrow at 10:30 there is a hearing before

the Rules Committee relative to Statehood for Hawaii and Alaska. I do not know how many people will be heard by the Rules Committee, but they have designated two or three people to be heard. I believe an hour's time is given the proponents and the opponents of Statehood for Alaska.

Let me make this statement: The Chair would also observe that we will not be able to finish the agenda placed on your desks. At some suitable time within the next week or two we will try to approach the problem of those bills with a full Committee hearing. Due notice will be given.

The Chair will recognize the gentleman from Pennsylvania, Mr. Saylor.

Mr. Saylor. I move that H. R. 4449 be recommitted to the Subcommittee on Irrigation and Reclamation. The basis for my motion, Mr. Chairman --

Mr. Aspinall. Mr. Chairman, a point of order.

The Chairman. The motion before the Committee is a preferential motion and is not open to debate. The motion occurs on a recommittal of H. R. 4449. Those in favor of a recommittal will signify --

Mr. Pillion. I ask for a roll call, Mr. Chairman.

The Chairman. The Chair will assume that a sufficient number have asked for a roll call. The Clerk will call the roll.

Mr. Huyck. Mr. Aspinall?

Mr. Aspinall. No.

Mr. Huyck. Mr. Bender?

Mr. Saylor. "Aye" by proxy.

Mr. Huyck. Mr. Bentsen?

Mr. Bentsen. No.

Mr. Huyck. Mr. Berry?

Mr. Berry. No.

Mr. Huyck. Mr. Budge?

Mr. Budge. No.

Mr. Huyck Mr. Dawson?

Mr. Dawson. No.

Mr. Huyck. Mr. D'Ewart?

Mr. D'Ewart. No.

Mr. Huyck. Mr. Donovan?

Mr. Donovan. Aye.

Mr. Huyck. Mr. Engle?

Mr. Engle. No.

Mr. Huyck. Mr. Gross?

Mr. Gross. Aye.

Mr. Huyck. Mr. Haley?

Mr. Haley. Aye.

Mr. Huyck. Mr. Harrison?

12-60 Mr. Harrison. No.

Mr. Huyck. Mr. Hosmer?

Mr. Pillion. "Aye".

Mr. Huyck. Mr. O'Brien?

Mr. Regan. "Aye".

Mr. Huyck. Mrs. Pfost?

Mrs. Pfost. No.

Mr. Huyck. Mr. Pillion?

Mr. Pillion. Aye.

Mr. Huyck. Mr. Regan?

Mr. Regan. Aye.

Mr. Huyck. Mr. Rhodes?

Mr. Rhodes. No.

Mr. Huyck. Mr. Rogers?

Mr. Rogers. Aye.

Mr. Huyck. Mr. Saylor?

Mr. Saylor. Aye.

Mr. Huyck. Mr. Shuford?

Mr. Shuford. Aye.

Mr. Huyck. Mr. Westland?

Mr. Westland. No.

Mr. Huyck. Mr. Wharton?

Mr. Wharton. No.

Mr. Huyck. Mr. Yorty?

Mr. Regan. "Aye".

Mr. Huyck. Mr. Young?

Mr. Young. No.

The Chairman. The "Yeas" are 12 and the "Nays" 13.

The "Nay" votes prevail and the motion is lost.

The Chair finds that he was in error in making the ruling on Mr. Engle's authority or right to resubmit the amendment that he lost, when he voted in the affirmative, and cites the rule in Section 813, on "Maker of the Motion to Reconsider":

> "Where the Yeas and Nays have not been ordered recorded in the Journal, any Member, irrespective of whether he voted with the majority or not, may make the motion to reconsider."

The vote was not recorded. The Chair will now place the motion of the gentleman from California, Mr. Engle. The Chair had felt that the vote had been recorded. Attention was called to the fact that it was not recorded. Since it was not recorded it can be reconsidered and presented by Mr. Engle.

The amendment was on page 25, line 2. I think the Members are all familiar with it.

Mr. Engle. A parliamentary inquiry, Mr. Chairman.

The Chairman. You may state it.

Mr. Engle. I wish to ask whether or not it is true that the vote occurs on the motion to reconsider the action of the Committee whereby the previous motion was lost. Then the vote will reoccur upon the amendment itself.

In other words, those who want to revote on this and who want the amendment to prevail should vote "Aye" for the motion

to reconsider and vote "Aye" for the amendment. Is that correct?

The Chairman. The gentleman is correct on his statement of the parliamentary situation.

Mr. Engle. Now, Mr. Chairman, I call for Yeas and Nays.

Mr. Gross. A parliamentary inquiry.

The Chairman. The gentleman may state it.

Mr. Gross. Is this a majority vote?

The Chairman. This is a majority vote.

Mr. Gross. Is this the lawyers' "justiciable issue" amendment?

The Chairman. I doubt whether that should be explained by the Chairman.

The roll call vote has been called for on reconsidering the vote taken on the Engle amendment. The Clerk will call the roll.

Mr. Huyck. Mr. Aspinall?

Mr. Aspinall. Aye.

Mr. Huyck. Mr. Bender?

Mr. Saylor. "No".

Mr. Huyck. Mr. Bentsen?

Mr. Bentsen. Aye.

Mr. Huyck. Mr. Berry?

Mr. Berry. No.

Mr. Huyck. Mr. Dawson?

Mr. Dawson. No.

Mr. Huyck. Mr. D'Ewart?

Mr. D'Ewart. No.

Mr. Huyck. Mr. Budge?

Mr. Budge. Aye.

Mr. Huyck. Mr. Donovan?

Mr. Donovan. Aye.

Mr. Huyck. Mr. Engle?

Mr. Engle. Aye.

Mr. Huyck. Mr. Gross?

Mr. Gross. Aye.

Mr. Huyck. Mr. Haley?

Mr. Haley. Aye.

Mr. Huyck. Mr. Harrison?

Mr. Harrison. Aye.

Mr. Huyck. Mr. Hosmer?

Mr. Pillion. "Aye".

Mr. Huyck. Mr. O'Brien? Mrs. Pfost?

Mrs. Pfost. Aye.

Mr. Huyck. Mr. Pillion?

Mr. Pillion. No.

Mr. Huyck. Mr. Regan?

Mr. Regan. Aye.

Mr. Huyck. Mr. Rhodes?

Mr. Rhodes. Aye.

Mr. Huyck. Mr. Rogers?

Mr. Rogers. No.

Mr. Huyck. Mr. Saylor?

Mr. Saylor. No.

Mr. Huyck. Mr. Shuford?

Mr. Shuford. Aye.

Mr. Huyck. Mr. Westland?

Mr. Westland. No.

Mr. Huyck. Mr. Wharton?

Mr. Wharton. No.

Mr. Huyck. Mr. Yorty?

Mr. Regan. "Aye".

Mr. Huyck. Mr. Young?

Mr. Young. Aye.

The Chairman. The Clerk will present the vote to the Chair.

Mr. Huyck. Mr. Chairman, there are 15 "Ayes" and 9 "Noes".

The Chairman. The motion to reconsider is carried. Now the vote occurs upon the amendment offered by the gentleman from California, Mr. Engle, on page 25, line 2.

Mr. Engle. I ask that the Chair call for Yeas and Nays.

The Chairman. The Chair will consider that a sufficient number have asked for Yeas and Nays, and Yeas and Nays are

ordered. The Clerk will call the roll.

Mr. Huyck. Mr. Aspinall?

Mr. Aspinall. Aye.

Mr. Huyck. Mr. Bender?

Mr. Saylor. "Aye" by proxy.

Mr. Huyck. Mr. Bentsen?

Mr. Bentsen. Aye.

Mr. Huyck. Mr. Berry?

Mr. Berry. No.

Mr. Huyck. Mr. Budge?

Mr. Budge. Aye.

Mr. Huyck. Mr. Dawson?

Mr. Dawson. No.

Mr. Huyck. Mr. D'Ewart?

Mr. D'Ewart. No.

Mr. Huyck. Mr. Donovan?

Mr. Donovan. Aye.

Mr. Huyck. Mr. Engle?

Mr. Engle. Aye.

Mr. Huyck. Mr. Gross?

Mr. Gross. Aye.

Mr. Huyck. Mr. Haley?

Mr. Haley. Present.

Mr. Huyck. Mr. Harrison?

Mr. Harrison. Aye.

Mr. Huyck. Mr. Hosmer?

Mr. Pillion. "Aye" by proxy.

Mr. Huyck. Mr. O'Brien? Mrs. Pfost?

Mrs. Pfost. Aye.

Mr. Huyck. Mr. Pillion?

Mr. Pillion. No.

Mr. Huyck. Mr. Regan?

Mr. Regan. Aye.

Mr. Huyck. Mr. Rhodes?

Mr. Rhodes. Aye.

Mr. Huyck. Mr. Rogers?

Mr. Rogers. No.

Mr. Huyck. Mr. Saylor?

Mr. Saylor. Aye.

Mr. Huyck. Mr. Shuford?

Mr. Shuford. Aye.

Mr. Huyck. Mr. Westland?

Mr. Westland. No.

Mr. Huyck. Mr. Wharton?

Mr. Wharton. No.

Mr. Huyck. Mr. Yorty?

Mr. Regan. "Aye".

Mr. Huyck. Mr. Young?

Mr. Young. Aye.

The Chairman. The Clerk will announce the vote.

Mr. Huyck. The "Ayes" 16; the "Noes", 7.

The Chairman. The amendment offered by Mr. Engle of California has been adopted.

Now the vote occurs upon the favorable report to the House of Representatives of H. R. 4449 as amended.

Mr. Harrison. I would like to make that motion, that H. R. 4449 be reported favorably by this Committee to the House as amended.

The Chairman. Is there a second?

Mr. Dawson. I second the motion.

The Chairman. The Chair presumes a roll call is demanded and a roll call is ordered.

Mr. Bentsen. This is on final passage?

The Chairman. This is on final passage by this Committee.

Mr. Huyck. Mr. Aspinall?

Mr. Aspinall. Aye.

Mr. Huyck. Mr. Bender?

Mr. Saylor. "No"by proxy.

Mr. Huyck. Mr. Bentsen?

Mr. Bentsen. Aye.

Mr. Huyck. Mr. Berry?

Mr. Berry. Aye.

Mr. Huyck. Mr. Budge?

Mr. Budge. Aye.

Mr. Huyck. Mr. Dawson?

Mr. Dawson. Aye.

Mr. Huyck. Mr. D'Ewart?

Mr. D'Ewart. Aye.

Mr. Huyck. Mr. Donovan?

Mr. Donovan. No.

Mr. Huyck. Mr. Engle?

Mr. Engle. Aye.

Mr. Huyck. Mr. Gross?

Mr. Gross. No.

Mr. Huyck. Mr. Haley?

Mr. Haley. No.

Mr. Huyck. Mr. Harrison?

Mr. Harrison. Aye.

Mr. Huyck. Mr. Hosmer?

Mr. Pillion. "No" by proxy.

Mr. Huyck. Mr. O'Brien?

Mr. Regan. "No" by proxy.

Mr. Huyck. Mrs. Pfost?

Mrs. Pfost. Aye.

Mr. Huyck. Mr. Pillion?

Mr. Pillion. No.

Mr. Huyck. Mr. Regan?

Mr. Regan. No.

Mr. Huyck. Mr. Rhodes?

Mr. Rhodes. Aye.

Mr. Huyck. Mr. Rogers?

Mr. Rogers. No.

Mr. Huyck. Mr. Saylor?

Mr. Saylor. No.

Mr. Huyck. Mr. Shuford?

Mr. Shuford. No.

Mr. Huyck. Mr. Westland?

Mr. Westland. Aye.

Mr. Huyck. Mr. Wharton?

Mr. Wharton. Aye.

Mr. Huyck. Mr. Yorty?

Mr. Regan. "No" by proxy.

Mr. Huyck. Mr. Young?

Mr. Young. Aye.

The Chairman. The Clerk will announce the vote.

Mr. Huyck. Mr. Chairman, the "Ayes", 13; the "Noes", 12.

The Chairman. The motion to report the bill favorably has been adopted. The Committee will stand adjourned to the call of the Chair for a full Committee meeting later on.

(Thereupon, at 11:58 a.m., Tuesday, May 18, 1954, an adjournment was taken to meet at the call of the Chairman.)

End Series

STENOGRAPHIC TRANSCRIPT OF

HEARINGS

BEFORE THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

UNITED STATES SENATE

Washington, D. C.

Saturday, July 24, 1954

S. 1555

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S. 1555

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SATURDAY, JULY 24, 1954

United States Senate,

Committee on Interior and
Insular Affairs,

Washington, D. C

The committee met pursuant to call, at 11:30 a.m., in Room P-38, The Capitol. Hon. Eugene D Millikin, presiding.

Present: Senators Millikin (presiding), Malone, Watkins, Kuchel, Crippa, Barrett, Murray, Anderson, and Daniel.

Also Present: Kirkley S. Coulter, Chief Clerk and Staff Director; Elmer K. Nelson, Staff Engineer; N. D. McSherry, Assistant Chief Clerk; and E. F. Bennett, Legislative Representative, Department of the Interior.

Senator Millikin The committee will come to order.

This hearing concerns S 1555, a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Go ahead with your explanation and let's give Senator Kuchel an answer to this

Mr Nelson May I suggest, Senator, that we are on the record and that the project as presented here in this bill has

been studied and is chiefly sponsored by the Upper Colorado River Commission.

Senator Kuchel. Are you answering the specific question I asked before we went on the record?

Mr. Nelson. I am coming to that in a moment. I would like to take another start.

Senator Millikin. Go ahead. When you come to that point, let us have a clear answer.

Mr. Nelson. This Commission is represented here by its chief counsel and secretary, and the Commission has been on this project for a number of years. It has presented testimony before this committee as well as before the House Committee, and I would like to ask you, Mr. Chairman, if it would not be well to have Mr. Will state in general terms concerning the bill Then we will come to these particular exceptions.

Senator Millikin. Speak right up loud so we can hear.

STATEMENT OF JOHN G. WILL, CHIEF COUNSEL AND SECRETARY, UPPER COLORADO RIVER COMMISSION

Mr. Will. This bill would authorize a series of so-called hold-over reservoirs named in the bill. They are the Cross Mountain, Curecanti, Echo Park, Flaming Gorge, Glen Canyon, and Navajo hold-over storage reservoirs It would authorize a series of so-called participating projects.

Senator Kuchel. Senator, I will abide by your wishes. There will be questions which will occur to me as this statement is being made. Do I have your permission to interrupt.

Senator Millikin. If it looks like a long controversy, we will withhold and come back to it because we ought to have the story.

Mr. Will. These participating projects are called participating because they participate in financial assistance from power revenues to pay out their irrigation costs. Those participating are spread among the four upper division states. There are certain projects in the State of New Mexico -- one the San Juan Chama and the other one the Navajo participating project -- which are mentioned in this bill but which will require further act of Congress before they are authorized. Initiation of construction on the participating projects may not be commenced until the Secretary of the Interior has re-evaluated their economics.

Senator Millikin. Which ones are subject to immediate action?

Mr. Will. All participating projects are subject to the condition that the Secretary shall re-evaluate their benefit-cost ratio after consultation with the Secretary of Agriculture and shall certify to the Congress that their benefits exceed their costs.

Senator Millikin. So no participating project can get started until it receives that treatment, is that correct?

Mr. Will. That is right.

Senator Millikin. Without exception.

Mr. Will. That condition also applies to one of the hold-over storage reservoirs; to wit, Curecanti, Colorado.

Then, as I said, the two New Mexico projects mentioned require further act of Congress.

Senator Millikin. Which New Mexico projects?

Mr. Will. The San Juan Chama and the Navajo participating project.

Senator Millikin. They have to come before the Congress?

Senator Malone. Name those again.

Mr. Will. San Juan Chama and Navajo participating.

Senator Malone. How many participating projects are there, and how many are you authorizing?

Mr. Will. I think there are eleven. Let me count them.

There are fourteen participating projects. That is on page 16, line eight, of the bill.

Senator Malone. How many of the others?

Senator Millikin. Main reservoirs?

Mr. Will. The hold-over storage reservoirs -- there are six.

Senator Malone. They are authorized by this bill?

Mr. Will. Yes, sir.

Senator Malone. All they need is an appropriation to get started?

Mr. Will Yes, sir. There are six of them, but one of those requires further act by the Secretary of the Interior but

in further action by the Congress.

Senator Millikin. That is Curecanti?

Mr. Will. Yes.

Senator Malone. What does he have to do?

Mr. Will. He has to certify it is feasible.

Senator Malone. You mean that is left to him?

Mr. Will. Yes, sir.

Senator Malone. But there are five that are authorized without any further action except by the Appropriations Committee?

Mr. Will. That is right.

Senator Millikin. Go ahead.

Senator Kuchel. I do not think that tells the whole story. The other fourteen are authorized so far as Congress is concerned. All that is necessary subsequently, as I understand the provisions of the bill, is for the Secretary to make certain findings administratively.

Mr. Will. That is right.

Senator Malone. Did you not say further action of Congress on these fourteen was necessary?

Mr. Will. Those on these two, the San Juan Chama and the Navajo participating project, they take further action by Congress.

Senator Millikin. What is the reason for that as distinguished from the other?

Mr. Will. The reason for that is there are negotiations now proceeding between New Mexico and the State of Texas. There are problems involving the right of land compact that are involved.

Senator Barrett. That would comply with the Flood Control Act of 1944; they are required to do so?

Mr. Will. Yes.

Senator Barrett. All that is necessary on all of these projects, seventeen of them -- or rather, eighteen, is for the Secretary of Agriculture to say they should be built, is that right? Then you go to the Appropriations Committee?

Mr. Will. That, no, sir. That would pertain only to the twelve participating projects. That is to say, those other than the San Juan Chama.

Senator Barrett. I have a wrong idea. Start over, please.

Mr. Will. There are twelve participating projects in this bill that will require no further act of Congress for their authorization, the only conditions for the initiation of their construction being that the Secretary of the Interior shall certify after consultation with the Secretary of Agriculture --

Senator Malone. Who certifies?

Mr. Will. The Secretary of the Interior after consultation with the Secretary of Agriculture that their benefits exceed their cost.

Senator Malone. We have not had very satisfying experiences

with either in the last fifteen or twenty years, the Secretary of the Interior or the Secretary of Agriculture.

Senator Millikin. Please speak louder.

Senator Malone. Our experience with the Secretary of the Interior and the Secretary of Agriculture for twenty years has not been very satisfactory. I have never heard of putting in their hands just the order to build something.

Mr. Will. Sir, they have that authorization under general reclamation law right now. Section 9 of the Reclamation Project Act authorizes the Secretary of the Interior --

Senator Malone. Without the action of Congress?

Mr. Will. Yes, sir.

Senator Millikin. As far as these participating projects are concerned that are in the bill, the Secretary has already looked after them, has found them to be feasible. We are asking him to take another look, is that right?

Mr Will. That is exactly right.

Senator Malone. Start over. I am reading Section 9(a). Maybe we have been spending too much time on projects.

Mr. Will. Shall I read Section 9(a)? That is the section which authorizes the Secretary to authorize projects finding them feasible.

"No expenditures for the construction of any division, new divisionary project, or new supplemental works on the project shall be made, nor shall estimates be submitted therefor by the

Secretary until after he has made an investigation thereof and has submitted to the President and to the Congress his report and findings on (1) the engineering feasibility of the proposed construction; (2) the estimated cost of the proposed construction; (3) the part of the estimated cost which can properly be allocated to irrigation and probably be repaid by the water users; (4) part of the estimated cost which can properly be allocated to power and probably be returned to the United States in net power revenues; (5) the part of the estimated cost which can properly be allocated to water supply or other miscellaneous purposes and probably be returned to the United States.

"If the proposed construction is found by the Secretary to have engineering feasibility and if the repayable and returnable allocations to irrigation, power, and principal water supply or other miscellaneous purposes found by the Secretary to be proper, together with any allocations of flood control or navigation made under Subsection (b) of this section, equal to total estimated cost of construction as determined by the Secretary, then the new project, new diversionary project or supplemental works on a project covered by his findings shall be deemed authorized and may be undertaken by the Secretary.

"If all such allocations do not equal said total estimated cost, then said new project, new division or new supplemental works may be undertaken by the Secretary only after provision

therefor has been made by act of Congress enacted after the Secretary has submitted to the President and the Congress a report and findings involved."

Senator Malone. He can build a project if these costs are to be written off and not collected from the people and they equal the cost of the project, is that right?

Mr. Will. Yes, sir.

Senator Malone. What becomes of it if the cost is more than that?

Mr. Will. Then he could not find it feasible. Therefore, he could not authorize it.

Senator Malone. It might be feasible, but he could not authorize it. It might be feasible if they repay certain money. I do not understand what you are talking about; that it could not be feasible if it could not be allocated to a Secretary that is not to be repaid.

Mr. Will. I misunderstood your question. I am sorry.

If the Secretary finds that these costs that are allocable under the reclamation laws can be repaid and the project has engineering feasibility or that the costs that are reimburseable can be repaid and the sum of those costs added to the costs for non-reimburseable purposes -- navigation and flood control -- equal the total cost of the project, then he can authorize the project by so-called finding feasibility.

Senator Malone. Without referring to Congress?

Mr. Will. Yes, sir.

Senator Malone. Who checks his allocation?

Mr. Will. There are various checks. In the first place, his report on a project would have to go to the Bureau of the Budget. It has been the practice for it to go to the Bureau of the Budget.

Senator Millikin. Aren't these things before Congress now?

Mr. Will. Yes.

Senator Millikin. The Secretary has the power, if he wanted to use the power, to authorize this whole project?

Mr. Will. Yes, with this qualification: If there has been objection by any affected state within the meaning of that term as used in Section 1 of the Flood Control Act, then he would not have that authorization. I believe there has been formal objection by one state, and therefore the Secretary would lack authority to authorize this by a finding of feasibility.

Senator Malone. You have just read a provision that a Secretary of Agriculture can estimate the cost of the project and then make his own allocation to flood control, to municipal costs, to perhaps navigation or any other costs that he sees fit.

Mr. Will. Except for this --

Senator Malone. Wait a minute. I want to get myself

straightened out. He can make this allocation without being checked by Congress. If in his judgment these allocations are correct and if they cover the cost, then he can declare the project to be feasible and authorize it. Then he has only to go to the Budget Director and to the Appropriations Committee and not Congress at all, is that right?

Mr. Will. He would have only to come to Congress for authorization for appropriations.

Senator Malone He has only to go to the Budget Bureau and then to the Appropriations Committee to bring it in among other projects on the Senate floor without any further authorization or checking of his allocation.

Mr. Will. That is true, with this one exception: On his allocations to flood control or navigation those are required to be made after consultation with the Secretary of the Army.

Senator Malone. But it is all in the administrative department He does not have to come to this committee or any committee of Congress to study his allocations and to discuss them on the Senate floor.

Mr. Will. That is right

Senator Malone. Go ahead.

Mr. Will. Section 2 of this bill looks to future development and lays down the criteria for additional projects.

Senator Malone. There are twelve of these projects that come under this provision you just read?

Mr. Will. Yes.

Senator Millikin. The answer is yes. There are twelve participating projects in the bill.

Senator Malone. What is the total cost?

Mr. Will. The total cost, including the San Juan Chama and the Navajo participating projects, is approximately a billion and a half. It is just a little less than a billion and a half. It is a billion four hundred some million.

Senator Malone. They are the projects that the Secretary of Agriculture can declare feasible without coming back to Congress for authorization?

Mr. Will. Yes, sir.

Senator Barrett That is not quite true. The entire project is included in one billion four hundred million dollars. We are finding five of them feasible in this bill. It is just the participating projects the Secretary determines to be feasible?

Mr. Will. That is right, the hold-over storage.

Senator Malone. What do they cost?

Mr. Will. The twelve participating projects?

Senator Malone. Just the projects we are not authorizing but we are allowing the Secretary of Agriculture to authorize at his discretion after he has allocated certain flood control projects.

Mr. Will. This will require me to have a little addition

done.

Senator Malone. You go right ahead, and you can insert it in the record.

(The information referred to follows):

Mr. Will. Section 33 provides that the Secretary shall be governed by the Federal reclamation laws. Certain specific exceptions are included in there for the Paonia and the Eden projects which are existing projects for which some excess financial assistance for irrigation cost will be derived from our revenues.

It is provided in Subsection (b) in the second part of the proviso to Section 3 that contracts for the repayment of irrigation costs shall be made with an organization as defined in Paragraph 2(g); that is, an organization satisfactory to the Secretary of the Interior, and it goes on to say "which has the capacity" --

Senator Malone. You are reading from the bill?

Mr. Will. Yes, sir; page 19, line twelve.

Senator Malone. What is this organization you are putting this in to determine feasibility?

Mr. Will. It is not connected with determining feasibility, Senator. This is just describing the type of organization which shall contract with the United States to repay the irrigation costs. It refers to organizations as defined in Paragraph 2(g) of the Reclamation Project Act of 1939. Paragraph 2(g) defines an organization as follows: The term "organization" shall mean any conservancy district, irrigation district, water users association, or any other organization which is organized under state law and which has capacity to enter into contracts with the United

States pursuant to the Federal Reclamation Law.

The third part of the proviso provides that contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of Section 9(c) of the Reclamation Project Act of 1939. Section 9(c), that last sentence, reads as follows: "No contract relating to municipal water supply for miscellaneous purposes or to electric power or power privileges shall be made unless in the judgment of the Secretary it will not impair the efficiency of the project for irrigation purposes."

Under the terms of this bill the Secretary would not be required to make a finding that a contract for municipal water supply would not interfere with the use of water for irrigation purposes.

There are certain exceptions as to Indian lands covered by the act.

Senator Barrett. Does the municipal include the industrial, too?

Mr. Will. Yes, sir.

Senator Barrett. I thought so, but I was not sure

Senator Kuchel. What you are doing here is, in effect, repealing the reclamation law's general applications; and with respect to the Upper Colorado River Basin States you are providing for a new kind of priority with respect to reclamation water, is that right?

Mr. Will. I would not put it quite that way. I think that is a little bit broad.

Senator Kuchel. Where is it broad?

Mr. Will. I think all we are doing here by that provision is saying that we are looking at this picture. There are going to be lots of uses of water for municipal and industrial purposes in the Upper Basin. There will be development of phosphates and so forth, shale. The Secretary ought to be able to enter into contracts for disposing of water for those purposes without first determining that such disposition will not unduly limit the use of water for irrigation.

Senator Kuchel It says "contracts relating to municipal water supply," and there I call attention to the Senator from Wyoming whether municipal does actually include industrial. That section of the bill, contracts relating to municipal water supply, may be made without regard to the limitations of the last section of Section 9(c) of the Reclamation Act of 1949. If I am wrong, I would like to be shown where I am wrong. I do not raise a question of policy. I want to raise a question of what the language means.

Is it not true that does mean that to the extent that this bill would apply to the states of the Upper Colorado River Basin a different form of allocation of reclamation water may be used by the Secretary of the Interior?

Mr. Will. I think that is proper.

Senator Anderson. Are all these states governed by the provisions of their state constitutions which say the first use shall be domestic, the second industrial?

Senator Bennett. The 1939 Act, so far as reclamation projects are concerned, has this provision we are dealing with in it. It does run contrary to state law in every one of the western states I can think of at the present time. In those states your water right is generally judged strictly by priority of time subject to a superiority of domestic water uses under which a junior domestic water need can be exercised in such a fashion as to condemn through eminent domain a senior right for irrigation purposes. So in effect this provision takes out, so far as this project is concerned, an inconsistency between Federal reclamation law and state law in the states that are interested in this project

Senator Kuchel. To turn it around, the inconsistency would still remain in the Lower Basin?

Senator Bennett. That is correct.

Senator Kuchel. Under that inconsistency, to the extent the Federal law as it reads today is applied, which takes priority, the reclamation law or the laws of the states?

Senator Barrett. The laws of the state

Senator Kuchel. Is that your answer, too?

Senator Bennett. You have this consideration. The 1902 Act gives state law a controlling effect on reclamation projects

and the uses of water under reclamation projects. But the 1939 Act, which has this section in it, was a later enactment of Congress. As far as projects constructed after 1939, the 1939 Act has not modified the original reclamation law rule of superiority of state law. That is an open question because it was a subsequent act of Congress.

Senator Barrett. I do not quite agree. I think the courts have upheld the rights of the several states to appropriate the water within their own confines. I do not believe we have surrendered that right to the Federal Government.

Senator Malone. The states would elect not to enforce their state law and just allow it to go along and be done on this basis regardless, even though the state law provides against it. What would then happen? Could any citizen bring it up? How does it operate?

Senator Bennett. That gets into a lot of questions I am not prepared to testify to off-the-cuff. This thing is complicated by a series of Federal statutes and different views as to what the effect of them is. I personally agree with Senator Barrett, but it so happens that there are attorneys in the Justice Department which right in the Arizona suit have intervened on an entirely different basis and said when the Federal Government uses water, appropriates water and uses it for reclamation projects, it is not limited by the state laws of the state constitutions

Senator Malone. What side are these government attorneys on in this suit?

Mr. Will. They are intervened. They are not on the side of either of the two states involved. In fact, their contentions will seriously affect the uses of water by either Arizona or California.

Senator Daniel. I want to say I am glad that has come out. I think it is one of the most serious things facing us in the West. I think this committee in the future somewhere is going to have to go into this completely because the Department of Justice has taken the same old position as taken by the past administration as to the ownership of the waters and the rivers in the West. I want to tell you it is a serious matter. I have been checking into it a little, and we are going to do something about it to straighten out this administration insofar as the Justice Department speaking for it.

Senator Watkins. I think we have got to take a broad view of this situation. The state constitutions were ratified, of course, and accepted by the Congress. The Federal Government in carrying out the reclamation program -- know this is a fact because I have gone through it time and time again through fourteen years of work in the reclamation field -- recognizes state law It files applications for the benefit of those who are to benefit from the project with the state engineer. It goes right right on through and complies with state law.

Now the waters that are to be diverted on these participating projects, that is the only way you can get water out for irrigation -- through the participating projects. Each of those projects take water out of the stream within the state where it is to be used. The filings will be made with the state engineers or state water boards just as we would in any case in the state recognizing the fact that the State of Utah owns the water, where it is in Utah.

The people can acquire the use of it through compiling with the state law. The Federal Government acts just as an individual acts; it goes right through with all of these applications, time for extension, proof of constructing the works, and all that sort of thing. That is all recognized. As a practical matter, the Government has not backed away from it yet. They are doing that continually.

Senator Barrett. The Flood Control Act of 1944 reiterated that position. We required them to go to the governments of the several states that are involved.

Senator Watkins. I think it is not as serious as it sounds, but I think Senator Daniel is right. A little later I think we ought to go into that and clear up ambiguity.

The 1922 compact which was approved by the Congress allocated the waters to the seven states. The 1938 or the Upper Colorado River Compact was ratified by the Congress, approving again the same principle. The water allocated to those states

-- 52 per cent to Colorado, 24 per cent to Utah, 14 per cent to Wyoming, and 11 per cent to New Mexico -- that belongs to those people in the states. The state government acts for them. The United States in building this project will comply with each one of those regulations they require for the filing of their water.

Senator Daniel. For over a hundred years the Federal Government did just that respecting the ownership of the submerged lands by the states, but then an Attorney General comes along in the court and in the name of the United States Government asserts a contrary position. This thing is serious when the Attorney General's office can go into the courtroom and assert in the name of this nation a position contrary to that recognized and asserted by the Congress. If he happens to get in a court that will follow him, then you have got the same kind of proposition we have had in other matters. That is why I say it is serious. That assertion is now being made in more than one case by the Justice Department. It is something we ought to watch out for

Senator Watkins. I have it up with the Department of Justice now in the cases out in Utah. It has been before the Supreme Court. Before we get through, the Department of Justice will change its view.

Senator Malone. Mr. Chairman, I go back about fifteen years further than the senior Senator from Utah in dealing with this Bureau. In 1927 and then subsequent to those years the Government has always asserted ownership to unappropriated waters, and the

question has never been decided by the Supreme Court.

When we had Dr. Meade as a Reclamation Commissioner, Dr. Meade wanted to build projects. He wanted to get along. I recall that I organized the western seventeen state engineers for the specific purpose of knocking the ears off of the Indian Bureau that was at that moment asserting ownership of water for the Indian tribes in South Dakota and a little notice that it would take precedent over the arid states when they said in that court that when they withdrew the Indian land in 1850 or 1860 that they automatically withdrew enough water to irrigate this land.

Therefore, no one subsequently could acquire rights superior to rights on this land. Every irrigation project in the West bonded themselves, and the bonds had been sold on the theory this water belonged to this land under the appropriation theory and could not be taken away. That constituted the only value the bonds had. So it was in Denver, I would say to the distinguished chairman of this committee and the junior Senator from Colorado, that they met for about a month.

About the third week the state engineer in Nevada -- now the junior Senator -- called this meeting and organized the seventeen western states. They did not know why we were doing it, and I did not say. We did it for interchange of information between state engineers. The state engineer of Wyoming was very cooperative. I was the first president of it, and after we

organized it, suddenly every Attorney General in those states appeared as friends of the court in South Dakota. They scared them out of South Dakota, So they dropped the thing temporarily.

I cannot tell you the ultimate result but they quit. It has been periodically claimed for a long time, and it has never been decided. I agree with the junior Senator from Texas it is a very serious thing and you cannot overlook it. In this bill apparently we are giving the Secretary of Agriculture and the Secretary of the Interior the power to do things there that would have scared a Senator to death twenty-six years ago.

Senator Millikin. It was the Senators twenty-six years ago that wrote it into law that the Secretary could do those things. The Secretary right now can, on his own authorization, go ahead with these projects.

Senator Malone. What I am trying to say is this: We are playing into the hands of the Justice Department by ignoring these things and then giving cabinet officers additional power.

Senator Barrett. Will the Senator yield?

Senator Malone. Yes.

Senator Barrett. It is the opposite of that.

Senator Malone. I do not see it.

Senator Barrett. Under the present law, Section 9(c), that was read a moment ago, the Secretary of the Interior can make an order allowing the district or the city or the community to use water for municipal purposes and industrial purposes only when

he finds that it will not interfer with the irrigation. This provision says the Secretary of the Interior may disregard that original law; and consequently, the effect of this law is to say that the constitutions in the western states, the statutes there, shall be respected and you can give preference to uses for municipal purposes or induatrial purposes over and above reclamation.

Will the Senator agree with me?

Senator Malone. We are getting entirely mixed up on it and taking no position at all, which means that the Attorney General is strengthening his position in any position he might take along the line of claiming the unappropriated water. What is the limit? I did not ask that a while ago. What is the limit to the size of the project that the Department of Agriculture can authorize on their own?

Mr. Will. They are all very small.

Senator Malone. There is a limit in the provision.

Mr. Will. The bill itself --

Senator Malone. Not the bill, the original act.

Mr. Will. There is no limit in the original act.

Senator Malone. In other words, you can authorize a billed project. All he has to do is allocate the money to something else.

Senator Barrett. Isn't there a regulation there? There is some restriction in there.

Senator Anderson. Not the Secretary of Agriculture. He has not any authority at all.

Senator Malone. Tell us the limit of this thing. Is there any limit to these cabinet officers' power?

Mr. Will. According to my best recollection, there is no limit in the statute that I read as to the size of the project the Secretary of the Interior could authorize by finding feasibility.

Senator Malone. All he has to do is get his own admission and the Bureau of the Budget to approve it?

Mr. Will. That is right. There is, in effect, a very strict limit in this bill on the participating projects that the Secretary can certify. The participating projects as to which he can certify and then initiate their construction are the participating projects named in this bill and no others.

Senator Malone. I understand that, but we do not know what the cost is, do we?

Mr. Will. Yes, we do. Extensive hearings are involved.

Senator Malone. What is the cost?

Mr. Will. I can now give you the figure you asked me for a moment ago. The cost of the twelve participating projects -- that is to say, exclusive of Navajo and San Juan Chama -- is $317,000,000 in round figures.

Senator Watkins. That is for within the four states?

Mr. Will. Yes, sir.

Senator Malone. Where does this money come from? Is there any allocation for irrigation and power?

Mr. Will. The costs would be allocated among irrigation, power, municipal water supply, and flood control. I can give you the totals.

Senator Barrett. Please give them to us.

Mr. Will. The total allocation to power is $603,921,000.

Senator Malone. Out of what amount?

Mr. Will. One billion four hundred some million dollars.

Senator Malone. About sixty per cent of it is to power, is that right?

Mr. Will. Yes. The total allocation to irrigation -- I am giving you the allocations of the storage units -- will be $217,347,000.

The irrigation allocation of the participating projects which would be made out of power revenues is $217,347,000.

Senator Malone. On what project?

Mr. Will. On the initial storage units. In other words, it would be Echo Park, Glen Canyon, Curecanti, Cross Mountain, Flaming Gorge, and Navajo.

Senator Kuchel. Whose figures are those?

Mr. Will. The Bureau of Reclamation.

Senator Millikin. Proceed.

Mr. Will. The balance of Section 3 of the bill provides that the operation of these participating projects and storage

units shall be subject to the apportionments of the use of water between the Upper and Lower Basins in accordance with the 1922 compact.

Section 4 of the bill is a section which deals with the financial setup. It sets up a basin fund in the Treasury. Into that basin fund there will be credited sums appropriated for the construction of the project, except as to appropriations made to carry out the reclamational developments at these several storage units.

Senator Millikin. Why is that omitted?

Mr. Will. Because it is a separate, distinct problem; separate and aside from the purposes of this bill. The principal purposes of the bill are to provide river regulation, irrigation, municipal water supply, and power.

Senator Millikin. Those are not reimburseable funds, are they?

Mr. Will. That is right.

Senator Millikin. So they should not be in here.

Mr. Will. That is right.

Revenues collected in connection with the operation of the project will be available, will be credited to this fund, and will be available for operation and maintenance of the project without necessity for appropriation but subject to such general limitations as are contained in the appropriation acts.

Senator Millikin. Just what does that mean?

Mr. Will. That means, sir, that while they do not have to come to the Appropriations Committees and to the Congress for appropriation, for operatin and maintenance of the project, nevertheless the Appropriations Committees will have an opportunity to write such limitations as they deem proper in connection with the use of those funds for operation and maintenance of this project.

Senator Millikin. Does that curtail the normal powers of Appropriations Committees?

Mr. Will. I do not think so. It gives them full jurisdiction to control the manner in which these funds shall be used.

Senator Millikin. What will be the role of the Appropriations Committees under this bill? Every year they will be asked for certain money, will they not?

Mr. Will. They will be asked for moneys for construction. They will not be asked for moneys for operation purposes.

Senator Millikin. Because that comes out of this basin fund which in turn is provided by revenues from the basin fund?

Mr. Will. That is right.

Senator Millikin. How do you connect up whatever the Appropriation Committees may want to do over this particular fund?

Mr. Will. The Appropriations Committee will have the benefit of annual reports from the Secretary of the Interior

as to the manner in which these operation funds are utilized.

Senator Millikin. So if the Appropriations Committee is not satisfied with the report, it can do its own business to make a better operation?

Mr. Will. That is correct.

Senator Watkins. Section (f) on page 23, line five,

"Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund."

Mr. Will. That is right.

The interest return on the power and municipal water supply, including interest during construction --

Senator Millikin. You are not talking about irrigation; you are talking about power and municipal supply?

Mr. Will. That is right. The amount of that interest will be determined by the Secretary of the Treasury according to a formula set forth in this bill.

Senator Millikin. That formula takes into account the average rates applying to Government securities, whether it is eleven years or longer?

Mr. Will. It is the cost to the Treasury of long-term money. As Senator Watkins said, there is a requirement for the submission of business-type budgets.

Senator Barrett. The long-term money, that is substantially what they do with other types of money? Is that the general rule?

Mr. Will. I would think that would be the general rule. You want to find out what it costs the Treasury to borrow money, so you would take the average long-term.

Section 5 provides for the allocation of costs of the project among the several purposes which I have already mentioned. It provides for an annual report by the Secretary to reflect accurately the Federal investment allocated to these several purposes and the project of return and repayment thereof.

Section 6 provides that hydro power plants authorized by the Act shall be operated in conjunction with other Federal power plants in order to provide the greatest amount of firm power. That is quite an important provision because it assures that the policy will be to cover as much revenue as practicable through the sale of firm power rather than the disposition of large quantities of secondary power.

Section 7 authorizes the Secretary to investigate and plan public recreational facilities in connection with these water areas that will be provided particularly at the hold-over storage reservoirs, and he is authorized ti enter into arrangements with states or subdivisions or agencies thereof in connection with the operation of those facilities.

Senator Millikin. That is more or less customary procedure, is it not?

Mr. Will. Yes, sir.

Section 8 provides that nothing in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the law of the river, naming the several statutes and the compacts.

Section 9 provides that expenditures for these hold-over storage reservoirs may be made without regard to the soil survey and land classification requirement of the Appropriation Act of 1954.

Section 10 authorizes appropriations.

Senator Millikin. What is Section 9 again?

Mr. Will. Section 9 makes it possible for the Secretary to proceed with construction of the hold-over storage reservoirs without making first the land classification and soil survey that is required in the Interior Department.

Senator Millikin. Why is that advisable for this bill?

Mr. Will. Because out of these hold-over storage reservoirs, except the Navajo, there will be no direct uses for irrigation purposes. Hence, there is no need for land classifications and soil surveys before they begin construction. They are river regulators and power producers.

Senator Watkins. Is it not true that when it comes to the irrigation features and the participating projects that those surveys have, for the most part, already been made?

Mr. Will. In many cases they have been made.

Senator Watkins. Or will be made before they go forward

with the projects.

Mr. Will. They will all be required to be made before the Secretary can initiate construction of any participating project.

Section 11 authorizes the conveyance to the city and county of Denver for a use as a part of its municipal water supply system of water rights acquired solely for the generation of power.

Senator Millikin. Has that been checked again since we talked yesterday? Have we the language so it is restricted to reservoirs?

Mr. Will. That is satisfactory here.

Senator Millikin. Let us see what you have for that.

Mr. Will. "The appropriate agencies of the United States are authorized to convey to the city and county of Denver, Colorado, for use as a part of its municipally owned water system, such interests in lands or water rights used or acquired by the United States solely for the generation of power and other property of the United States as shall be required in connection with the development or use of its project "

Senator Millikin. "And other property of the United States," does that mean water rights?

Mr. Will. That other property of the United States would not include water rights; water rights being named specifically prior to that.

Senator Millikin. Go ahead.

Mr. Will. Shall I read the balance of it?

Senator Millikin. Yes.

Mr. Will. " * * * and other property of the United States as shall be required in connection with the development or use of its Blue River project, upon payment by Denver for any such interest of the value thereof at the time of its acquisition by Denver, and provided that any such transfer shall be so limited as not to preclude the use of the property other than water rights for the necessary functions of the United States Government."

Senator Millikin. At this point tell us what are the rights of the United States as to the Blue River at the present time, what are the rights of Denver, so we can see what it is all about.

Mr. Will. The United States has certain direct flow rights in the Blue River at the Green Mountain site.

Senator Millikin. For power purposes?

Mr. Will. Yes.

Senator Millikin. Any other purposes?

Mr. Will. No. We are not trying to acquire any rights the United States may have for purposes other than power.

Senator Millikin. I have been told that the United States claimed the water rights for several purposes, including power; but since we are limiting it to power, it would exclude the

others.

Mr. Will. Section 7 --

Senator Millikin. Have you finished your discussion of the Denver situation?

Mr. Will. All I intended to say was that the only thing that Denver is trying to acquire here is direct flow rights. It does not propose to interfer with any other rights there may be at Green Mountain Reservoir. Nothing in this section can, in my judgment, be held to affect in any sense any questions that are the subject of pending litigation, both in the Colorado Supreme Court and the United States Supreme Court of Colorado.

Senator Millikin. Wouldn't what we are doing here be affected by the outcome of the litigation?

Mr. Will. Yes. There may be some effect. The question may well be how much, if anything, does Denver have to pay for these direct flow rights.

Senator Millikin. But Denver has to pay for them?

Mr. Will. Yes, if the United States has them.

Senator Millikin. That is subject t agreement between the Department and Denver, is that right?

Mr. Will. That would be subject to negotiation.

Senator Millikin. Tell me what the effect of Denver's rights would have on the claimed water rights of the western part of the state.

Mr. Will. Naturally, the western slope of Colorado is opposed to any further diversion by the City of Denver --

Senator Millikin. What would this diversion amount to?

Mr. Will. An average of 177,000 acre feet.

Senator Millikin. For power purposes?

Mr. Will. Yes, sir.

Senator Millikin. Does the western slope have a claim to those power purposes at the present time?

Mr. Will. The pending litigation may to some extent determine whether the western slope has any claim on those particular waters?

Senator Millikin. Does it involve the rights of the United States as well as Denver?

Mr. Will. It involves rights of the United States, rights of Denver, and rights of appropriators downstream.

Senator Millikin. Let us take the various alternatives then. Supposing that the decision should be in favor of the United States. What happens to Denver?

Mr. Will. Then Denver would have to pay the United States the value of those direct flow rights for power purposes. That compensation might be in money or in terms of power.

Senator Millikin. Give us an illustration of how it might be in terms of power.

Mr. Will. Making this diversion will probably afford the City of Denver an opportunity to develop power at one or two

sites on the eastern slope. It would be possible that the power thus developed might be used in part to compensate the United States for the value of the rights acquired.

Senator Millikin. If the reverse were true, if the entirely opposite effect of litigation happened, what would be the effect on the western slope? What would be the effect on Denver?

Mr. Will. The effect on the western slope would be to reduce flows by an average of 177,000 acre feet per annum. The effect on Denver would be that she would not have to compensate the United States for those power rights.

Senator Millikin. What are you really doing for Denver here?

Mr. Will. What we are doing for Denver here is merely authorizing the appropriate executive agencies to negotiate with Denver and sell, if they chose to do so, the rights that they have, rights of way and interests in lands. For instance, in connection with her proposed diversion, Denver will need certain lands that are under the jurisdiction of the Forest Service of the Department of Agriculture. The Secretary of Agriculture then, under the terms of this provision, would have authority to negotiate with Denver.

Senator Millikin. Denver would have to pay?

Mr. Will. Denver would have to pay. She might pay in comparison or by exchange, but --

Senator Millikin. But she would have to pay one way or the

other in terms satisfactory to the Secretary of the Interior, is that right?

Mr. Will. Or the Secretary of Agriculture, since those lands are under his jurisdiction.

Senator Millikin. How would the western slope be injured under what we are doing here?

Mr. Will. The western slope naturally would not like to see a provision in this or in any other measure which would afford Denver the possibility of making that diversion of 177,000 acre feet on the average, if that reduces the flows to the western slope.

Senator Watkins. However, Mr. Will, that water that is allocated to the State of Colorado under the Upper Basin Compact and the State of Colorado with its laws, subject to whatever rights we give Denver to acquire the facilities for doing the job, will make the decision?

Mr. Will. That is right.

Senator Watkins. In other words, it is not up to the Congress or anyone else to decide how Colorado will divide up its waters?

Mr. Will. No, sir.

Senator Millikin. The position of the western slope is largely influenced by her views of her future industrial and agricultural and other developments, is that correct?

Mr. Will. That is correct.

Senator Millikin. What percentage of the water that might be affected by this section and the pending litigation -- what is the percentage of that water toward the whole production of the stream?

Mr. Will. It is very small. Call it 200,000 acre feet just in round figures. The total use that Colorado is now making is about two million acre feet.

Senator Millikin. What is assigned for it under the Upper Colorado River Basin? How much water is Colorado entitled to under its allocation under the Upper Colorado River Basin?

Mr. Will. It is fifteen and three-quarters per cent of seven and a half million, about three and three-eights million.

Senator Millikin. How much of that Colorado water is being diverted to the eastern slope?

Mr. Will. I would have to supply that, Senator.

Senator Millikin. How much is now being diverted for the purposes of the Big Thompson Project?

Mr. Will. I will have to supply that.

Senator Millikin. Let us put that in the record, what we are taking out now and what will be taken out by the Frying Pan Arkansas; what is being taken out by private companies that are going over to the western slope for their water.

Mr. Will. I will supply that.

(The information referred to follows):

Senator Watkins. It is a small percentage.

Senator Millikin. Yes, but it is a large percentage under the viewpoints of the western slope which has great shale deposits, great coal deposits, and great mineral deposits. It naturally wants as much water available for its future development as it can get.

Senator Watkins. It all points up, no matter how much we get up the stream, we are still away short of water needed.

Senator Millikin. I was going to explain the diversion situation a little more, but everyone here understands diversion.

Senator Barrett. I am not sure I understand it all. I would like to ask this question: On the top of page 26, in the first line, it says that the interests or the water rights -- "interests in lands or water rights used or acquired by the United States * * *." Is it the contention by that phrase that the water in the Green Mountain Reservoir belongs to the United States?

Mr. Will. No, sir. This deals solely with direct flow rights.

Senator Barrett. Why would the United States own the direct flow rights?

Mr. Will. For power purposes. It claims certain rights for power purposes.

Senator Watkins. But not for a consumptive use?

Mr. Will. That is right.

Senator Barrett. I do not see what right the United States has to sell that water.

Mr. Will. It would not be selling the water, it would be disposing of any rights they may have by reason of filings for power purposes.

Senator Barrett. Denver is buying the water?

Mr. Will. Denver is buying the water rights. That is the difference. This is not buying the water; this is buying water rights.

Senator Barrett. If they are buying the water rights, who owns the water rights?

Mr. Will. The United States has made certain filings. Under its present claims it claims to have certain rights to use direct flow for development power. Just what the extent of those rights is will be determined by litigation now pending.

Senator Barrett. Their rights for developing power are such that they cannot interfer with the normal flow of that water after they use it for that purpose, is that not right?

Mr. Will. As they use the water for power, it goes downstream to the western slope.

Senator Barrett. What they are saying is that we are going to use that water for power and we are not going to let it run downstream, is that right?

Mr. Will. What this provision would do would be to authorize the Secretary of the Interior to convey those power rights of the United States to the City of Denver.

Senator Barrett. The Federal Government would not develop power there?

Mr. Will. They are at Green Mountain now.

Senator Barrett. After this legislation, are they surrendering their rights?

Mr. Will. Their right to develop power will be reduced to the extent necessary to enable Denver to make that average annual diversion of 177,000 acre feet.

Senator Barrett. The water really goes through the power plant, is that right?

Mr. Will. That is right.

Senator Barrett. Who gets the benefit of any compensation Denver might pay for the water rights?

Mr. Will. The Federal Treasury, I would suppose.

Senator Barrett. Who pays for the Green Mountain project?

Mr. Will. The Green Mountain Reservoir is part of the Colorado --

Senator Millikin. Tell Senator Barrett what is the function of the Green Mountain project so we can get this related.

Mr. Will. The Green Mountain Reservoir is a part of the Colorado Big Thompson project. The Colorado Big Thompson project involved a diversion from the west slope to the east slope.

Part of the purpose of Green Mountain Reservoir is to store water for replacement purposes.

Senator Millikin. Explain that and give us an illustration.

Mr. Will. What that means is that there is storage in Green Mountain Reservoir which is released to satisfy the requirements downstream for flow of the river. There are certain interests, including the Grand Valley Irrigation District, just east of Palisades and the Shoshone power plant of the Public Service Company of Colorado.

Senator Millikin. The point is that the former users and I suppose the present users from the supply that furnishes the water in Green Mountain wanted to be assured their supply would not be interferred with. So a part of the reservoir capacity is designated, or whatever the technical term is -- but a part of the reservoir capacity is to assure that the water they give up for this purpose will be replaced.

Mr. Will. That is right.

Senator Millikin. Do you have that figure?

Mr. Will. That storage for replacement purposes is around 50,000 acre feet.

Senator Millikin. So those people over on the western slope who are depending upon the Green Mountain, the protection they get will not be interferred with?

Mr. Will. It will not be affected by this at all.

Senator Millikin. It is limited that way in the bill?

Mr. Will. Yes, sir.

Section 12 of the bill requires the Secretary of the Interior to comply with the law of the river in the operation of these several works, and it waives the United States immunity from suit so that if any state claims that the operation of any of these works is contrary to the law of the river, that state may bring suit in the United States Supreme Court of the United States and the United States may be made a party.

Senator Millikin. In connection with this general Green Mountain project which serves the eastern slope in part, I wanted to call attention that under the Constitution as interpreted in Colorado and under our leading cases there it does not matter where the water originates if you do those things necessary to perfect a right to that water.

Mr. Will. That is right. The Supreme Court of Colorado held that back in the Coffin versus the Left Hand Inch case.

Senator Millikin. In the same way, I think there is a protection for diversion of that kind in the compact itself. For example, you could not use any Colorado River water in many cases where it is used in California if you paid strict attention to the Basin which serves the stream.

Mr. Will. The compact contemplates uses out of the Basin provided they are within the states of the Colorado River Basin.

Section 13 contains the definitions of several terms used in the bill.

That concludes the bill, Senator.

Senator Millikin. Any questions about the bill?

Senator Kuchel. Mr. Chairman.

Senator Millikin. Senator Kuchel.

Senator Kuchel. First of all, Mr. Will, did you participate in the drafting of this legislation? You are acquainted with the reasons why some changes were made in the committee print?

Mr. Will. Yes, I think I have some understanding of it.

Senator Kuchel. You say you participated in the drafting of this committee print?

Mr. Will. Yes, sir; I assisted.

Senator Kuchel. With respect to the eleven projects that are called participating projects, I think it is clear that so far as the Congress is concerned the Congress, under this legislation, would give approval to each of those projects and thereafter only an administrative act in the discretion of the Secretary of the Interior would be required to add any or all of the participating projects to those projects to be undertaken, is that right?

Mr. Will. Yes. All that is required under the terms of this bill as to those twelve participating projects is that the Secretary shall make the finding provided for. In other words, that finding is that, first, construction of the participating projects shall not be undertaken until the Secretary has

re-examined the economic justification of the project and accompanied by appropriate documentation in the form of a supplemental report as certified to the Congress through the President that in his judgment the benefits of such project will exceed its cost.

Senator Kuchel. Can you state why as a matter of policy the Congress should adopt that type of legislation where a blanket approval in advance of feasibility findings is made?

Mr. Will. I think there are reasons why that is thoroughly justified in this case, Senator. In the first place, each one of these participating projects has already been very thoroughly investigated. However, there has been contention between the Department of the Interior on the one hand and the specialists in the Department of Agriculture on the other regarding the means of determining certain benefits, direct agriculture benefits. The purpose was to afford the Secretary of Agriculture an opportunity to consult with the Secretary of the Interior so there might be an other determination on the subject.

Senator Millikin. Is it not a fact that every one of these participating projects, with the possible exception of Gooseberry, has already been reported on by the Department of the Interior?

Mr. Will. That is even true of Gooseberry.

Senator Millikin. I want to add, also reported on and found feasible and reported so to the Congress?

Mr. Will. Yes, that is correct.

Senator Millikin. With the exception of Gooseberry, which has been reported upon, but I do not know whether it has gone any further than that.

Senator Bennett. It is in the Bureau of the Budget.

Senator Millikin. Is that correct?

Mr. Will. Yes, sir.

Senator Daniel. May I ask if what you have said applies only to the first twelve of these participating projects and does not apply to San Juan Chama and Navajo?

Mr. Will. That is correct. It does apply to them.

Senator Daniel. What you have just said in reply to Senator Kuchel does not apply to San Juan Chama and Navajo?

Mr. Will. That is right.

Senator Watkins. That is, the participating projects known as Navajo?

Mr. Will. Yes.

Senator Kuchel. Is it not possible that the benefit to cost ratio that might be found by the Department of the Interior would be on a different basis for some indeterminate time in the future and might require the Congress to take a second look at it before it gives this blanket approval in this bill?

Mr. Will. That is a possibility. Let me suggest this: It is extremely remote because of the provision here for consultation with the Secretary of Agriculture. You have there an additional safeguard not contained in general law.

Senator Millikin. You have the safeguard of the Appropriations Committees, too.

Mr. Will. Yes.

Senator Watkins. Also the fact that the Secretary of the Interior has already certified the benefit-cost ratio of practically all of these participating projects.

Mr. Will. That is correct.

Senator Watkins. That has been done after some consultation with Agriculture. I happen to know that is the situation. Agriculture has been consulted along the line.

Senator Millikin. Proceed, Senator Kuchel.

Senator Kuchel. The draft of the bill retains that section that was previously in either the House or the Senate bill which set as a declaration of policy the Congress might add additional participating projects?

Mr. Will. That is in Section 2 on page 17, beginning line nineteen. It says that in order to achieve such comprehensive development as will assure the consumptive use in the states of the Upper Colorado River Basin of waters of the Colorado River system, the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact, and to each state thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of units of the Colorado River Storage Project of additional phases of participating projects authorized

in this act and of new participating projects as additional information becomes available and additional needs are indicated.

It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects including units or phases thereof (1) for the use in one or more of the states designated in Article 3 of the Upper Colorado River Basin Compact of waters of the Upper Colorado River system, the consumptive use of which is apportioned to those states by that article, and (2) for which pertinent data sufficient to determine a probable engineering and economic justification and feasibility shall be available.

It likewise delcares that to be the policy of the Congress -- that the costs of any participating project authorized in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this act and the Federal Reclamation Law.

Senator Kuchel. What is the legal effect of that?

Mr. Will. It does not authorize any project. It just sets forth a statement of policy which is not binding on any future Congress.

Senator Kuchel. So to that extent i constitutes surplusage?

Mr. Will. It does this, and I think it is quite important: When you look at these participating projects you see there is

provision for very small use -- in fact, I think Senator Millikin noted in the meeting of the subcommittee the other day that there were very few water use projects proposed for the State of Colorado in this bill.

Senator Millikin. It grieves me that is true.

Mr. Will. This gives those people who yearn for some development and who have waited many years for it hope that they will get some.

Senator Kuchel. Your statement is it would have no binding effect on any future Congress?

Mr. Will. None at all.

Senator Kuchel. It merely is a gratuitous expression of intent of this Congress and perhaps a hope by this Congress that future Congresses would find additional projects feasible and thus bring them into this over-all plan of development.

Mr. Will. That is correct.

Senator Watkins. One of the objectives would be to indicate that this program, the part which is authorized or will be authorized by this bill, is a part of the over-all possible development of the Upper Basin and a program by which if the Congress should authorize these additional projects in the future they might put to a beneficial use more of the water allotted to those states?

Mr. Will. Yes, sir.

Senator Kuchel. As you know, there are representatives

here of the state government in California and other public agencies that have viewed this proposed legislation with some apprehension as far as the interpretation of the Colorado River Compact is concerned, and I want to be assured that the bill would not have anything offensive to the Colorado River Compact. You agree with that general philosophy, I am sure.

Mr. Will. I think we have protected them fully, however, in that respect, don't you?

Senator Kuchel. That is the reason for a number of these questions I want to ask.

With respect to Section 3, going down to page 10, line nineteen, with respect to Indian lands within, under, or served by any participating projects, et cetera, as one of the bases for action by the Federal Government, during the hearings in the Senate Committee there was testimony to the effect that the Department of the Interior, through its agencies, was ruling both ways on the question of priority of rights of Indians to water. Do you recall that?

Mr. Will. Yes.

Senator Kuchel. So we have here a specific delegation that the Indian lands are going to be protected as far as their water rights are concerned, but we have testimony in the record that the administrative agency which would have the responsibility of

carrying this bill into effect if it became law has not made up its mind what legal rights the Indians have in this Colorado River Basin and has not taken a position, or rather has taken two positions on the matter. Do you recall that testimony?

Mr. Will. I recall that testimony.

Senator Watkins. Under the Levitt Act the project may be built and the charges for the project will be allotted to the Indians, but they are not required to pay it so long as it is in Indian lands.

Mr. Will. That is right. If it passes into White ownership, then payment of those accummulated charges is required.

Senator Watkins. That part of the cost will come out of the United States Treasury because that is for the wards of the Government.

Mr. Will. Yes, sir.

Senator Kuchel. To the extent Indian lands and rights are mentioned, your point is this subdivision of the bill has to do merely with --

Senator Anderson. With exactly the same thing that is going along on the Colorado River in California where the Colorado Indians and the Navajos are occupying lands there. The assessment is being made against the land. The charge goes against the land. So long as it remains in Indian ownership, no payment is made by the Indians.

Senator Watkins. That is the universal law that applies to

all the reclamation projects. We had one case in Utah where we passed the liberation bill for those Indians, and we had something like $60,000 of accummulated charges against those Indian lands. We just wiped it out in the bill. They said, "We won't hold you for it." Those Indians do not have to pay because some day they may transfer them over to White people.

Senator Kuchel. On the cost of the projects, can you supply the cost of the San Juan Chama project which is included in the bill?

Mr. Will. Yes, I can supply that.

Senator Anderson. I think you ought to supply the figure which was finally put in after taking out the power dams and generating facilities. It comes down to about $150 million or $160 million.

Mr. Will. Referring to the question asked of me by Senator Malone, the cost of the participating projects other than Navajo participating and San Juan Chama is $317,000,000 in round figures.

The cost of the Navajo participating project is estimated at $174,000,000. The cost of the San Juan Chama project is estimated at $144,000,000.

Senator Kuchel. Whose figures are those?

Mr. Will. These are Bureau of Reclamation figures.

Senator Kuchel. On the question of leave to sue the Secretary of the Interior, page 26, Section 12, particularly beginning at line nineteen, why was that provision put in?

Mr. Will. Here is the reason why that was put in, Senator. Of course, the United States as a sovereign is immune from suit. That being the case, you can have complete frustration of a state seeking in the Supreme Court redress against operation of one of these reservoirs contrary to the law of the river unless you can sue the United States. You haven't got the primary party in interest before the court.

Senator Kuchel. I think it is a good thing to have it in there. The reason I raise it is because Judge Brietenstein disagreed with your statement just now.

Mr. Will. I did not so understand him.

Senator Kuchel. On page 295 of the record, Mr. Brietenstein said, "That is right. There is another point I would like to make there. I am not trying to express my judicial opinions here, but in my opinion if the Secretary of the Interior or any of those under him in constructing or operating this project violated the law of the river, I think they could be stopped and the question of waver of immunity by the United States would be immaterial to that suit."

Mr. Will. Now I understand what you are referring to. Judge Brietenstein was talking in that case of the possibility that exists of bringing suit against the Secretary of the Interior personally. That can be done. That is not suing the United States; that is suing the Secretary of the Interior personally seeking to enjoin him from an improper operation of a reservoir.

That can be done. However, this provision seems highly desirable to expedite matters. You sue the Secretary of the Interior personally. District Court, up through various appeals, and perhaps eventually you get to the Supreme Court of the United States hence. By this provision you get to the Supreme Court of the United States immediately.

Senator Kuchel. So the purpose of this provision is to give any state in the Colorado River Basin, Upper Basin or Lower Basin, the right to file a lawsuit against the Secretary of the Interior in the United States Supreme Court if it alleges that it is aggrieved by his actions and he is violating either the bill before us or the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act. or the treaty with Mexico?

Mr. Will. That is substantially correct. The only respect in which I could not quite agree with you is that here this authorizes suit by a state against the United States as a sovereign, not just the Secretary of the Interior.

Senator Kuchel. And to that extent, in your judgment, it would be broader jurisdiction?

Mr. Will. This is much more positive protection.

Senator Kuchel. I must say, Mr. Chairman, I am glad the subcommittee recommended that provision which I have strongly urged in the bill.

Senator Millikin. Are there any other questions?

Senator Kuchel. There are some questions that I should

ask, and I do not know whether Mr. Will is the witness I should ask it of. I want to ask those questions based upon the testimony in the subcommittee by representatives of the State of California. Perhaps some other witness, however, would be better qualified to answer them.

Senator Millikin. We are about to vote on this bill.

Senator Kuchel. Do you have any more witnesses?

Senator Anderson. We have some up here that we are doing to deal with. The San Juan Chama Project has been the cause of some argument between the States of Texas and New Mexico. The Senator and I tried to work out a little language. This would be the language: that on page 17 after the other items are handled -- and I would like to make one other suggestion before that, but it does not matter. But when we get down to the end of line eighteen we would strike the period, add a comma and say, "provided further that with reference to the San Juan Chama project, it shall be limited to a single off-stream dam and reservoir to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission by the Bureau of Reclamation of the Department of the Interior."

I have not had a chance to check that with the Water

Commissioner, the water engineer, or the legal authority in the State of New Nexico, and I would like to agree to the language and then have an opportunity before we ever get to printing anything to consult with the Senator from Texas again, and if there is any small change, to submit it to the chairman with his approval and alter it before the language is printed.

Senator Millikin. We will be getting to the printing real quick, so settle your minds on that, gentlemen.

Senator Daniel. I would like to have the same privilege. I offer this with Senator Anderson with the same provision. I have not checked this draft with representatives of the State of Texas, either. So we understand that it will go in under those conditions. Is that the will of the committee?

Senator Millikin. Is the committee agreeable?

Without objection we will do it that way.

If the time for printing is not sufficient, we can cure it on the floor. I would rather not do it that way, but assuming you agree and the rest agree, we will do it that way.

Senator Daniel. We will go ahead with the printing as suggested.

Senator Anderson. And the words "and authorized" are to come up in the line, also.

Senator Millikin. We can fix it on the floor.

Senator Daniel. On page 17, line eighteen, after the word "approved" the words "and authorized" are to be inserted.

Senator Millikin. What is the significance of that?

Senator Daniel. It simply makes it clear that this particular project must not only be approved but it must have actual authority from the Congress.

Senator Bennett. I think it might be better if it read, "and approved by an act of Congress" or "authorized by an act of Congress." What you are thinking about is the possibility of two concurrent resolutions.

Senator Daniel. The main thing is we do not want this action to be interpreted as an authorization of the San Juan Chama project.

Mr. Will. That is a little too flat for Senator Anderson.

Senator Anderson. No; the people from the Lower Basin were worried that "approved" might have given them partial authorization. We said we wanted true authorization, and we do.

Senator Millikin. Let us leave that to the draftsmen. I think it will be cleaned up before we print it.

Senator Daniel. You have the words Senator Anderson and I agreed upon in line eighteen. We would like to have a definition of the Rio Grand Compact inserted after the definitions of the compacts since we are now referring to it. That would come at page 27 after line twenty-four. Add a paragraph which would define the Rio Grande Compact. We will give the words to the Clerk of the committee.

Senator Millikin. Is there any objection on that?

Senator Watkins. No, sir.

Mr. Will. No.

Senator Anderson. You define the Upper Colorado River Basin Compact. We just want the Rio Grande Compact.

Senator Millikin. You may fix that up.

Senator Kuchel. Mr. Chairman, I offer this amendment: "The Secretary of the Interior is directed to institute studies and to make a report to the Congress and to the states of the Colorado River Basin of the effect upon the quality of water available at Lee Ferry of all transmountain diversions of water of the Colorado River system and of all other storage and reclamation projects existing and proposed to be made in the Upper Colorado River Basin under full practicable development and use of water apportioned by the Colorado River Compact, including those proposed to be made under the authority of this Act."

Senator Millikin. Senator, if you will permit me to say so, personally I would have to oppose that very strongly because I think it is a recognition or an implication that you lend weight to, let's call it, the California theory that we have some responsibility to supply you water free of salinity or a certain degree of salinity. I would not want to see anything of that kind in the bill because I am afraid we would be building up implications that some of us in the Upper States are very strong against.

Senator Kuchel. I would respectfully state to the chairman that all this is is a directive to the Secretary of the Interior to make findings on the effect of the quality of water.

Senator Millikin. Senator, I think if you would walk over there and ask them to do it on your own, I think they would do something of that kind. I think you put it in the bill and it lends fire to the thought that there is some responsibility here for certain salinity delivered to the lower states by upper states, and I could not possibly agree to that. I am talking personally, of course. If you want to know, that is one thing. But to put it in the law as an implication of a principle, that is something entirely different.

I think, Senator, that you probably could get that information just by asking for it on your own.

Senator Watkins. I am advised that these studies are already underway by the Department of Agriculture and the Department of the Interior under existing law.

Senator Kuchel. If that is true, what possible implications could there be from adopting a simple amendment that on its face merely directs the Secretary to do that? I do not see you run into a question of implications.

Senator Millikin. Supposing we did this and these departments give a report. Let us take a leap into the imagination and say California came along and made certain claims. We do not need to argue them now, but claims as to salinity. Suppose

somebody said salinity does not enter into this. Then some Senator from California might say, "Well, if that be true, why put this provision in this important bill?" That argument would not be without strength.

Senator Watkins. By leaving it out we are not prejudicing either side.

Senator Kuchel. I attended the hearings of the Senate subcommittee, and the printed report of those hearings is in direct contradiction to any claim that studies are going on. We were unable to find from the Department of the Interior or from anyone else any information on the effect by diversions and otherwise on the quality of water.

I urged the Senator from Utah to listen to this once more. "The Secretary of the Interior is directed to institute studies and to make a report to the Congress and to the states of the Colorado River Basin of the effect upon the quality of water available at Lee Ferry of all trans-mountain diversions of water of the Colorado River system and of all other storage and reclamation projects existing and proposed to be made in the Upper Colorado River Basin under full, practicable development and use of water apportioned by the Colorado River Compact, including those proposed to be made under the authority of this Act."

If it is true that the Department is undertaking some of those inquiries, and certainly the record does not indicate any accumulation of knowledge by the Department on that subject,

then I most respectfully urge this is something that should be of a non-controversial nature. At any rate, that would be the position of the junior Senator from California.

Senator Millikin. I see no merit in that question at all, but I do see if there were merit in it, it would destroy our whole present system of the distribution of water, the obligations of upstream fellows to lower stream fellows not recognized in law now and never have been. I see a complete revolution in the management of our water systems throughout the West.

Therefore, and I may be a crank, but I do not want to give any recognition of any kind directly in a bill of this nature that we think there may be some obligation so far as salinity is concerned to lower states, I could never vote for anything of that kind. I think it would be destructive of our whole system.

Senator Kuchel. I want to deny the Chairman as a crank.

Senator Millikin. I am glad to hear you say that. After several nights without sleep, I should be.

Senator Kuchel. Number two, the question of quality of water is going to be put in issue in any decision that the United States Supreme Court renders in Arizona versus California. The State of Nevada has seen fit to intervene in that lawsuit Now suppose that the decision of the Supreme Court did find that questions of quality of water were important and were implicit in the Colorado River Compact. Then there would be a need for an accumulation of data on it.

Senator Millikin. The Supreme Court would either have its referees make a special study or the referees would ask the Departments to make a special study of it. If that ever is decided that it is important as a legal proposition, there would be no dearth of experts to appear on the subject, including the Department.

Again I am speaking personally and thinking of the Upper Basin states, but we certainly should not do anything in the way of any reclamation law that it might be important. I think it would be devastating if we were to admit this question of salinity could be a controlling question. How can you use water in the upper states without increasing salinity? It is unfortunate if someone does not get the purity of the water he would like to have if he were further upstream.

Senator Kuchel. My only point is there should be a technical, professional accumulation of knowledge on the effect of water because I think it is implicit in the compact that the water which will be delivered at Lee Ferry will be of a usable type. However, I believe I know the Chairman's position. I am firm on this. I do ask the Chairman if he would entertain a motion that this be adopted.

Senator Millikin. You have heard the motion. All in favor say aye.

Senator Kuchel. Aye.

Senator Millikin. Contrary?

The motion is lost.

Senator Anderson. I think what the Senator said about no information being available was absolutely correct, but I do not think we --

Senator Watkins. On page 157 of the hearing record before the Senate subcommittee there were some statements by Mr. Clyde who was testifying that the Geological Survey has been making those studies. Based on that information available to date, he gave it as his opinion there would be no effect of increasing salinity in the Lower Basin by reason of the upstream diversion to trans-mountain areas.

Senator Kuchel. If that were true, what possible harm could there be from directing the Secretary to supply that information?

Senator Millikin. Whether it is true or not, it remains to be determined, and I think we have already voted.

Senator Malone. The junior Senator from Nevada was listening to a 40,000 word speech by the senior Senator from Utah in 1928 that said the water out of Boulder Dam would not be fit for human consumption.

Senator Watkins. You must identify that Senator. It is Senator Smoot, I imagine.

Senator Malone. He was the only senior Senator we had.

Senator Watkins. Just so the record is clear.

Senator Kuchel. Mr. Will, I did not previously ask you this: Can you tell how many projects in the committee draft

here are included within the Bureau of the Budget draft?

Mr. Will. All except Gooseberry. You are talking about the participating projects?

Senator Kuchel. Yes.

Mr. Will. I think all except the Gooseberry have been cleared by the Bureau of the Budget, and Gooseberry is pending before the Bureau at the present time.

Senator Kuchel. The Bureau approved both Echo Park Dam and Glen Canyon?

Mr. Will. Yes.

Senator Watkins. In addition, the President of the United States.

Senator Kuchel. I would like to file a minority report. How much time might I have?

Senator Millikin. I want to suggest to you there would be no objection to doing that, but do it fast because we have got to move fast on this. Have it early Monday.

Senator Kuchel. It will be difficult with the night session here.

Senator Millikin. Monday at four o'clock.

Senator Kuchel. I will have it Monday.

Senator Malone. Mr. Chairman, may I ask if this bill we are considering is exactly like the bill that has been reported by the subcommittee to the full committee of the House?

Senator Millikin. To the House?

Senator Malone. The House Committee.

Mr. Nelson. No, it is not.

Senator Malone. Let me ask if there is a limitation, as there was in the original House bill, on the time that Nevada, Arizona, or any of the other states could purchase power from Glen Canyon or any other place. Is there a limitation to the number of years they can purchase power there in this bill?

Mr. Will. There is no such limitation in this bill.

Senator Malone. You understand what I am talking about. There was in the House bill.

Mr. Will. Yes, but there is none in this bill.

Senator Malone. What does it provide?

Mr. Will. It contains no provisions governing the disposition of power to customers in any state. In other words, the Secretary of the Interior is free under the terms of this bill to negotiate power contracts with anybody he wants to.

Senator Malone. For any time that he sees fit?

Mr. Will. Yes, sir. I think it says up to forty years.

Senator Malone. In accordance with the reclamation law?

Mr. Will. Yes.

Senator Malone. And the renewal is in accordance with the reclamation law?

Mr. Will. That is true.

Senator Malone. Will you read me the provision out of this bill?

Mr. Will. Here is the provision of this bill that is pertinent: "The hydroelectric power plants authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal power plants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act."

Senator Malone. Is that the only reference to the power contracts?

Mr Will. The other is the provisions the Federal reclamation laws apply except where they are specific exceptions.

Senator Malone. Will you read the provision and then the specific exceptions?

Mr. Will. It is in Section 3, page 18, beginning line twenty-one. "Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in Section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): Provided, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia

and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law * * *."

Senator Malone. What does it say about those projects?

Mr. Will. "Provided, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law."

Senator Millikin. By law we approved both of those projects have a longer life than fifty years.

Mr. Will. "(b) prior to construction of irrigation distribution facilities repayment contracts shall be made with an 'organization' as defined in Paragraph (j) of the Reclamation Project Act of 1939 (53 Stat. 1187, 43 U. S. C. 485) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States."

Senator Malone. This is in relation to power?

Mr. Will. No. There are no exceptions relating to power, Senator.

Senator Malone. This is a transmission line you are talking

about?

Mr. Will. No, sir. This does not even relate to transmission lines.

Senator Malone. It says, "provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law."

These are the only two exceptions in the whole project to the regular reclamation law governing the sale of power. Does this in any way limit the sale of power?

Mr. Will. No, sir. This has no connection with the sale.

Senator Malone. In the limitations and exceptions you noted these two projects when it says "except as otherwise provided in this Act, it has no reference to power at all."

Mr. Will. That is right.

Senator Malone. I will tell you why I am asking this. There was a limitation, I believe it was ten years, in the House bill that would limit Nevada or any other state outside of this Basin in contracting for power.

Mr. Will. Yes, sir.

Senator Malone. There is nothing with relation to that act, provision of the House act, in this bill at all?

Mr. Will. None at all.

Senator Malone. This does conform to the change that was

made in the House act?

Mr. Will. Yes, sir. As this has been reported by the Irrigation Subcommittee of this committee, it meets the objections that Congressman Young had on the House side to a number of provisions that were in the bill that the House was considering that would provide for recapture from the lower basin states of power disposed of.

Senator Malone. No money, unless it be Government -- of course, you can do anything with Government money and give that to foreign nations in large chunks. But no private money like the industrial center in Anderson, Nevada, and it is spreading through the county, could be secured to invest in machinery and plants to use a ten-year contract on power. So I am asking you the direct question now, if Nevada bidding for the power at Glen Canyon or any other project would be limited in securing that power in any other way by this act than it is limited by the Reclamation Act.

Mr. Will. No, sir; it would not.

Senator Anderson. I ask permission to leave with the reporter the exact words of this amendment as we have now worked it out. I would like to move it out.

Senator Millikin. The reporter will take that copy.

Senator Kuchel. Mr. Chairman, when the Bureau of the Budget originally approved the draft of the legislation, the bill provided for two immediate projects; Echo Park and Glen

Canyon. The bill before us now adds several more; to wit, Cross Mountain, Curecanti, Flaming Gorge, and Navajo.

Can you tell me why those were added?

Mr. Will. Yes, I think so. There was testimony before the committee that the most desirable and most efficient project would consist of this combination of hold-over storage reservoirs, including Cross Mountain, Flaming Gorge, Echo Park, Glen Canyon, and small Curecanti. I assume that is why the subcommittee added it.

Senator Kuchel. The bill recommended by the presidential departments is not the same, Senator Watkins, as we have before us now.

Senator Watkins. That is correct. It happened to be the judgment of the subcommittee --

Senator Millikin. The Department has approved the addition of these others.

Senator Watkins. They have not objected in any way. I would like to make a motion.

Senator Kuchel. There is testimony in the record from the Department of the Interior, at least, objecting to one of the projects. Your statement now is that there has been no objection. Do we have anything to indicate that the Department is in favor of this new draft, the Department of the Interior?

Mr. Nelson. Yes, we have.

Senator Kuchel. I wonder if that could be made a part of

the record.

Mr. Nelson. In other words, they are cooperating with us in the preparation of this bill.

Senator Malone. Get a letter.

Senator Watkins. There are many times we prepare bills up here that do not meet a hundred per cent the recommendations made by the Departments. That is the function of Congress, to go ahead and direct the kind of legislation it finally wants to write. There is no objection so far as I know to the inclusion of these features.

Senator Kuchel. I agree with your statement, but I did want the record to show when you suggested the President of the United States was for this legislation that the legislation which came to the committee from his Departments is considerably different than the judgment of the subcommittee on the legislation.

Senator Watkins. It includes more for initial authorization, that is true.

Senator Malone. May I ask one more question, Mr. Chairman?

Senator Millikin. Yes.

Senator Malone. I want to ask Mr. Bennett of the Department of the Interior if there is anything in this bill that limits the Secretary of the Interior in the coordination and the integration of the power units from Lee Ferry to Parker Dam in firming, in bringing about the maximum firm power in that area.

Mr. Bennett. No, nothing at all. As originally introduced

this bill did have a series of limitations on the marketing and the development of the power in this project. Those have all been deleted from this bill as it now stands before the committee.

Senator Malone. You are a lawyer?

Mr. Bennett. That is correct.

Senator Malone. Have you studied or do you understand the necessity of firming power to the greatest extent?

Mr. Bennett. Yes. As a matter of fact, it is very vital to the financial as well as the engineering feasibility of this project.

Senator Malone. You understand, then, the relationship between Glen Canyon and Bridge Canyon in the matter of the generation of power?

Mr. Bennett. That is correct, sir.

Senator Malone. What is it?

Mr. Bennett. Glen Canyon would be first in the series. Then you would have, presumably, in the ultimate plan Bridge Canyon and then you would have Hoover Dam below that. As your releases from Glen Canyon took place, if they were proper coordinated, those releases would be most economically beneficial if they could be worked into the generation of power at Bridge Canyon and then following that the development of power at Hoover Dam.

Senator Malone. And Davis and Parker?

Mr. Bennett. Yes, beyond that. Of course, they are coordinated with Hoover now, Parker and Davis.

Senator Malone. Do you understand if the power generated at Bridge Canyon, which is controlled by the storage of water in Glen Canyon, that Glen Canyon has a capacity of about twenty-five or twenty-six million acre feet?

Mr. Bennett. It is not named in the bill, but it is about that.

Senator Malone. You understand that the twenty-six million acre feet of storage coordinated with the ultimate construction of Bridge Canyon, which has only a storage of about theee million -- that the coordination or integration of the release of water from Glen Canyon through Bridge Canyon is absolutely important and necessary to make Bridge Canyon feasible. Then to bring about a maximum of firm power from Glen Canyon to Parker, it is necessary to integrate the storage and the power generation facilities through that whole area.

Mr. Bennett. I am very well aware of that.

Senator Malone. Does this bill provide for that?

Mr. Bennett. There is a provision here, Section 6 of the bill, on page 24 which deals with that subject. It begins on line one of page 24.

Senator Malone. Will you read it and explain it?

Mr. Bennett. "The hydroelectric power plants authorized by this Act to be constructed, operated, and maintained by the

Secretary shall be operated in conjunction with other Federal power plants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act."

Senator Malone. Is that possible?

Mr. Bennett. Yes.

Senator Malone. Is there any provision in the Upper Colorado River Basin Compact that would interfer with the Colorado River Compact or the Boulder Canyon Project Act?

Mr. Bennett. As I understand it, there are many questions of interpretation involved, but certainly the Colorado River Compact is the paramount authority. Any conflict between the Colorado River Compact and the Upper Colorado River Bas Compac must be resolved in favor of the Colorado River Compact so far the rights of parties to the Colorado River Compact are concerned where those parties are not also members of the Upper Colorado River Compact.

In other words, Nevada and California are not parties in any way to the Upper Colorado River Compact. Yet all the state that signed the Upper Colorado River Compact are parties to the Colorado River Compact. For that reason, ther, so far as Neva

and California are concerned their rights under the Colorado River Compact are superior to any competing claims of upper basin states which rest solely on the Upper Basin Compact.

Senator Watkins. Is it not a fact, then, that the Upper Colorado River Compact says it is in conformity with the 1922 Colorado River Compact?

Mr. Bennett. Yes.

Senator Malone. In case of a disagreement or a question between the provisions of the Upper Colorado River Basin Compact and the Boulder Canyon Act, how would that question be resolved?

Mr. Bennett. The Upper Colorado River Compact certainly would not be in a position to change the rights of any beneficiaries of the Boulder Canyon Project Act in my estimation.

Senator Malone. Would you object to a provision of that kind here?

Mr. Bennett. I do not think it is necessary, but at the moment without having an opportunity to think through all the ramifications, I do not see any particular objection.

Senator Malone. Since we are now passing a new act, nothing in the act shall interfer with carrying out the provisions of the Boulder Canyon Project Act.

Mr. Will. It is in Section 8.

Senator Watkins. "Nothing contained in this Act shall be construed to alter, amend, repeal, construe. interpret, modify, or be in conflict with any provision of the Boulder Canyon Proje

Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, or the Treaty with the United Mexican States."

Senator Malone. There is likely to be a difference, and that is you are now passing an act that is in conformance with the Upper Colorado River Basin Compact. So now is the time to discuss any conflict between the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Upper Colorado River Basin Compact. In other words, if there is a difference, how will the difference be resolved? We know the Upper and Lower Basin must conform to the Colorado River Compact. It is here, and I think properly so.

Senator Anderson. If there is a difference, there is a provision in the bill for a suit to be entered and you do not even ask the consent of the United States on it. That is granted by the bill. If there is the slightest conflict, it can be resolved in the courts immediately. This is the first time that legislation has been drawn that way that I know.

Senator Malone. We already have legislation now in the Lower Canyon Project Act. Now we are about to pass another act that could very easily have a conflict arise. Couldn't we have a provision here that in case of a conflict that it would be resolved in favor of the existing legislation?

Senator Anderson. There is provision for its resolution in

case there is conflict. There is a section that says that.

Mr. Will. Section 12, page 26.

Senator Malone. Read that and tell me where it covers that.

Mr. Bennett. "In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin.

"In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits."

Senator Watkins. It makes it very clear.

Mr. Bennett. The rest of it deals with another subject, but I will be happy to read it if you would like to have it.

"No right to impound or use water for the generation of power or energy, created or established by the building, operation or use of any of the power plants authorized by this Act,

shall be deemed to have priority over or otherwise operate to preclude or impair any use, regardless of the date of origin of such use, of the waters of the Colorado River and its tributaries for domestic or agricultural purposes within any of the States of the Upper Colorado River Basin."

Senator Watkins. Mr. Chairman, I move that the bill as reported by the subcommittee and as amended be reported favorably to the Senate.

Senator Anderson. I second the motion.

Senator Malone. That is all right, Mr. Chairman, but I have a question or two to ask.

Senator Millikin. All right.

Senator Malone. This is the first time that any of us have heard anything about this proposition.

Is this the first meeting of the main committee?

Senator Millikin. This is the first meeting of the main committee on this business. The subcommittee has already met.

Senator Malone. I thought with the rush of business and being on three or four committees, maybe I had overlooked something here.

Senator Malone. Would there be an objection to adding language to the section where it is evident that there will be a conflict or there could be a conflict? I am not cognizant of all of the provisions -- and there is no necessity for me being cognizant of these provisions on your division of water in the

Upper Basin states -- but I can see there can very easily be a conflict between the provisions of the Upper Colorado River Basin Compact and the provisions of the Boulder Canyon Project Act.

Section 6, then, could easily be in that event in conflict with Section 8 and might be ruled to be controlling.

If it would be accepted that in the event of a conflict between these two acts it would be resolved in favor of the existing act, I see no reason in view of the provisions of these other two sections why there would be any objection to it.

Senator Millikin. It is already covered. The whole question is covered.

Senator Malone. Here it is obvious that the Secretary of the Interior is to administer the act in conformance with all three of these acts and provisions. Then there is a provision some place there can be a suit brought if some state is not satisfied with his interpretation. If there is a conflict between these two acts or between these two compacts, or the compact and the act, if there would be some indication as to how that would be resolved, it would be very helpful.

Mr. Bennett. I have the answer to that, I think. The Boulder Canyon Project Act itself says that the rights of the United States in or to waters of the Colorado River and its tributaries, howsoever claimed or acquired, as well as the rights of those claiming under the United States, shall be

subject to and controlled by said Colorado River Compact.

In other words, the Colorado River Compact limits the Boulder Canyon Project Act. Then we start then from that point with the proposition that in this bill this bill is subject to the Colorado River Compact. As we previously said, the Upper Colorado River Compact is subject to the Colorado River Compact. So in the end, all of these things lead you right back to the Colorado River Compact in the event of any conflict.

Senator Malone. There is an obvious basis for interpretation here in this bill that is not in any other compact. Suppose the Lower Basin should arrive at a compact. I personally do not expect it, and I have been in it for twenty-two years and have always said that there probably would not be any. Let us suppose there were and there was a conflict with the Colorado River Compact and a conflict with the Upper Colorado River Basin Compact.

What you are throwing in here is a compact that was approved by the Senate, but the Senate had no part in it. They simply passed an act allowing the Upper Basin to get together on the division of water and then approved that compact. They would do the same with the Lower Basin Compact. They have already said we can get together. If we bring it back here, it will no doubt be approved. But there may be a conflict, so you are throwing in this bill for legislation by Congress something that

was never passed on; that is, a compact between the Upper Basin states.

Senator Watkins. Congress has already authorized the Upper Basin states.

Senator Malone. But it did not participate in the negotiations.

Senator Watkins. Any more than it did in the Colorado River Compact.

Senator Malone. But all of the states were in the Colorado River Compact and Congress passed on the Boulder Dam Project Act.

Senator Watkins. If there are any conflicts between any of the compacts that may be entered into, with the apparent law, the law of the river, which is the 1922 Colorado River Compact, they may arise; but we have provided the machinery. There is only one place that could be resolved. That is, in the court.

What I am trying to say is the only place it can be resolved will be in the Supreme Court. We have provided machinery so they do not have to get a resolution. The state can file its petition and ask for a ruling on the interpretation.

Senator Malone. You are an attorney, and I am merely pointing out to you if we had had a compact or if we subsequently get one -- suppose you added "any subsequent compact with the Lower Basin States." It would be just as reasonable to put that in.

Senator Watkins. We have not any right to predict.

Senator Malone. Then why not remove the Upper Colorado River Basin Compact from this paragraph? "Neither the Lower Basin states or" --

Senator Watkins. Do you see what that would do? It would make it so you could not sue us on that if you take that out.

Senator Malone. I move, Mr. Chairman, that it be taken out. There is no reason for it.

Senator Anderson. Let us go ahead on that. That is the only way you will straighten it out.

Senator Millikin. What is your motion?

Senator Malone. I do not see we should be pushed into this at this hour and minute. There are things here to be discussed that have a very grave bearing on the legislation already passed by the Congress. The reason that I made that motion was so we could discuss it here. You are putting in the Upper Colorado River Basin Compact and saying that nothing shall interfer with the Upper Colorado River Basin Compact, but the Congress has never discussed or authorized or passed or entered into this division of water. That is merely a division between the Upper Basin states that are entitled to a certain amount of water.

Senator Millikin. That again is subject to the Basin Compact.

Senator Malone. Then it seems to me if you are going to bring in the Upper Basin Compact we should include any compact

that the Lower Basin states might agree upon.

Senator Millikin. If the Lower Basin states come in with a compact, it has to be approved by the United States.

Senator Malone. I am not sure I am making my point clear. My point is we are including something here. By the Colorado River Compact all seven states were in. So when all seven states signed that, there is no question about the compact. Then there is only a question of what the compact means.

There would be five in the Lower Basin. If they agreed on a compact that had in that compact something that was inimical to the Upper Colorado River Basin Compact, the two things refer only to certain states in the Basin. The acts we pass here, after due consideration, I hope, to authorize certain legislation and investments being made on the basis of that authorization and legislation -- like the Boulder Dam Project Act -- very great investments have been made there.

If the Lower Basin states were in on the Upper Colorado River Basin Compact or if the Upper Basin states were in on the Lower Basin Compact, then that would be an entirely different complex. But you are inserting something in that legislation and making it on a basis, an equal basis, with the Colorado River Compact and the Boulder Canyon Project Act that I at the moment cannot see belongs there.

Mr. Bennett. I think I can give you part of the answer. Take Glen Canyon as an example. Presumably Glen Canyon would

the first unit constructed. If that is the case, you will have a dam and some very large power plants developed. In that process the United States, if it complies with Section 8 of the Reclamation Act, will apply for water rights to generate power. It will acquire water rights to generate power. In the absence of statutory or other provisions limiting the rights of the United States in that respect, it could demand at all times into perpetuity that prospective users of water upstream from Glen Canyon must allow all water to come down to satisfy those water rights.

The Upper Colorado River Compact as between the Upper Basin states says that the generation of power shall be a subservient use. This is a direction to the Secretary with respect to the apportionments of water to the Upper Basin states that he must comply with the provisions of the Upper Colorado River Compact insofar as any of the Upper Basin states have any rights or have set down any rules as between themselves for the use of water apportioned to them. So insofar as they are concerned, it becomes very important that the Upper Colorado River Basin Compact be included as one of the guide lines for the Secretary in the operation of these dams.

Senator Malone. Let me repeat one thing you have said, and I do not think it has anything to do with it. That is, the United States when they build Glen Canyon will acquire a right to do something with water that is not intended in the Colorado

River Compact.

Mr. Bennett. Oh, no; I did not say that.

Senator Malone. I said that, but you said it would acquire rights to take the water away from these Basin states.

Mr. Bennett. By compliance with state law, though. It will have to comply with state law under the Reclamation Act of 1902.

Senator Malone. That is one reason you have to pay the price. That is my present reaction; that if you build this Glen Canyon that you will acquire a right to operate a power plant in contravention of the rights of the Upper Basin states. They are required only to turn down a certain amount of water at Lee Ferry. They are not required to turn anything down through here, and the United States cannot acquire any rights to make them do it beyond the amount that is required in the Colorado River Compact. If they can, then I would like to have your idea about it.

Mr. Bennett. What I said was that the compacts themselves by direct inclusion in this bill make it certain that the United States cannot at some future date claim the acquired rights for power.

Senator Malone. You cannot possibly acquire any rights unless the Department of Justice is right.

Mr. Bennett. Interior is not going to help them.

Senator Malone. You do not know how long you are going to

be in there.

Mr. Bennett. That is right. They will be back at it again in the future.

Senator Malone. You are a temporary adjunct to that Department. Nobody knows, even the junior Senator from Nevada, how long you are going to be there. We hope for some time, but it does not look very good at the moment. So I am not questioning you as a person; I am questioning you as the Interior Department representative. I hardly know you, and I probably would not know you when you left there; but I will have to deal with somebody if I am still in the Senate. I am a temporary adjunct to the Senate. Only I realize it.

What I am asking you, then, is how you can possibly sit here and say that the Government of the United States, by building Glen Canyon, can acquire a right to make those Upper Basin states do something that the seven-state compact does not require them to do.

Mr. Bennett. I did not say that. I said in the absence

Senator Millikin. State what you said.

Mr. Bennett. I said by including the specific reference to compacts in this bill you set up certain guide lines and limitations on what the Secretary of the Interior can do in operating any of these stands, whether we are talking about Glen Canyon or Echo Park or the Central Utah or any of the others. By including those sections you make it indelibly

clear that he must comply with those provisions. It tends to avoid the very thing that you are fearing and I am fearing.

Senator Malone. You have proved what I have brought up is dangerous. In other words, by including this compact -- this was my point: that you inject something in here for the first time, taking cognizance of what you have done in the Upper Basin states and making it a part of the law of the land You have then injected something that should not be injected in this bill because I for one do not know what you have agreed on in the Upper Basin states and do not think it is of interest to me unless you make it paramount and the guiding principle in the interpretation of what the Secretary is going to do with these lower projects. That is the reason I do not like to see this.

Senator Millikin. Doesn't the Upper Basin Compact specifically make itself subservient to the other compact?

Mr. Bennett. That is right. Furthermore, even if it did not, it would be subservient so far as any rights in California or Nevada.

Senator Millikin. But it does?

Mr. Bennett. That is right.

Senator Malone. Why put it in here?

Senator Millikin. Just the same as why put in something else you want.

Senator Malone. It is not a question of me wanting it; it

is a question that this new legislation does not intend to interfer. I think you are entirely right; that you do not need to put the Colorado River Compact in here.

Senator Millikin. Because California insists that be in everything that touches the river. I think it should be.

Senator Malone. I agree. The Boulder Canyon Project Act should be in there because it is already passed. Investments are already made on the basis of it. But when you inject an agreement where the amendment itself may interfer with the proper carrying out of the Boulder Dam Project Act, then you inject the Upper Basin agreement but you inject nothing that might happen down below that could contravene some provision of the Boulder Canyon Project Act. It is a fifth wheel in ther

Senator Millikin. There are lots of things we might want to do with the Lower Basin, but we cannot do that because we want to.

Senator Malone. You are not saying in here you are going to make this conform to any agreement we make in the Lower Basin.

Senator Millikin. You do not ask us now. To anticipate what kind of an agreement in the future and conform this act to what you are going to do in the future --

Senator Malone. But you have something in here that may have provisions of conflict with the laws already passed.

Senator Millikin. This law says they should be consistent with the law of the river.

Senator Malone. It may be consistent with the Colorado River Compact and not be consistent with the Boulder Dam Project Act.

Senator Millikin. What other things does it have to be consistent?

Senator Malone. The very statement that Mr. Bennett just made that the Secretary of the Interior had to conform with this agreement you have made up there is a fifth wheel because you do have to conform to the Colorado River Compact. I think it is a good idea to have it with the Boulder Dam Project Act, but you might find something you could not conform to both of them.

Senator Millikin. We will just have to meet that when we come to it.

Senator Malone. Why do we buy a lawsuit? We have plenty.

Senator Millikin. I do not see there is an invitation for a lawsuit, but this makes it very clear. Those provisions are in there.

Senator Malone. I think Section 8 is all right. If this conforms to Section 8 --

Senator Watkins. It does.

Senator Malone. Your Colorado River Basin Compact is not in Section 8

Senator Watkins. Section 8 simply says in this law we are now going to pass that we cannot change any of those acts which

have been adopted.

Senator Malone. It says you cannot change the Upper Colorado River Basin Compact, too; where, as a matter of fact, if you have done something in that act that does not coincide with the Colorado River Compact or the Boulder Dam Project Act, you cannot interfer with it.

Senator Watkins. This says, "Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, or the Treaty with the United Mexican States."

Senator Malone. It is still injected in the thing.

Senator Watkins. We are not trying to undo any of these things that have been done in any of these acts. This law is not intended in any way to do those things.

Senator Malone. I am not belaboring the point, but I want the record to show what we are bringing into this thing for the first time is a compact formed by a portion of the states and saying that shall not be violative.

Senator Watkins. We cannot change the Colorado River Compact, the Adjustment Act. In this law we should not attempt to change the Upper Colorado agreement approved by the Congress. If there are any conflicts along the line, any interpretation,

we have provided the remedy so it makes it easy.

Senator Malone. I am arguing with two very good attorneys The Constitution of the United States provides that any compact between two or more states shall be approved by the Senate. I am not trying to quote it, but if it is, it brings it in the perview of the Constitution of the United States. It does not attempt to say whether the agreement made between these states is right or wrong. But it does say it gives its permission to make this compact and then approves the fact you have made a compact. It does not approve the equity of it.

When you come to the Columbia River Basin, the Senate does not care because all the states are in it. When you inject something that two or more states within the Basin make and you approve that by law and throw it in with the compact that has been made by the seven states, and then into a legislation passed by Congress and upon which investments have been made, you are inserting something there that merely is something new upon which you have to base a suit to get out of.

Senator Watkins. When any of these compacts come before the Congress, and if the Upper Basin Compact brought before the Senate for ratification had contained in it a provision that it made it absolutely conditioned upon the Colorado River Compact of 1922, you and the other states downstream would have been here in a minute and fought it.

Senator Malone. Did it have any provision in it that did

not interfer with the previous legislation passed by the Congre

Senator Watkins. I do not know it has with reference to the legislation, but the law of the river is the Colorado River Compact of 1922. Even the Adjustment Act and the Boulder Canyo Act are conditioned on them being in harmony with -- and cannot be in conflict with -- the 1922 compact.

Senator Millikin. All in favor of the amendment say aye.

Contrary, no.

The amendment is defeated.

Senator Watkins. I made the original motion that we report it.

Senator Malone. So this will be clear, the amendment was to take out the Upper Colorado Basin Compact out of Section 6.

Senator Millikin. Call the roll now, Miss McSherry.

Miss McSherry. Mr. Chairman?

Senator Millikin. Aye.

Miss McSherry. Mr. Malone?

Senator Malone. Aye.

Miss McSherry. Mr. Watkins?

Senator Watkins. Aye.

Miss McSherry. Mr. Dworshak?

Mr. Kuchel?

Senator Kuchel. No.

Miss McSherry. Mr. Barrett?

Senator Barrett. Aye.

Miss McSherry. Mr. Crippa?

Senator Crippa. Aye.

Miss McSherry. Mr. Murray?

Senator Anderson. Aye.

Miss McSherry. Mr. Anderson?

Senator Anderson. Aye.

Miss McSherry. Mr. Jackson?

Senator Anderson. Aye.

Miss McSherry. Mr. Daniel?

Mr. Lennon?

Senator Anderson. Aye.

Miss McSherry. Mr. Burke?

Senator Malone. Mr. Chairman, to make this a matter of record, I reserve the right -- and I do not want to interfer with any consistent legislation -- to bring this discussion to the Senate floor that I have already brought up here.

Senator Anderson. Mr. Long made the same reservation whe he asked me to vote for him. He said, "I think everything yo vote is all right."

Senator Millikin. Is there any further business before t committee?

Senator Watkins. May the other Senators who have not voted do so?

Senator Millikin. Yes.

Senator Kuchel. If I am unable to complete a report by

Monday afternoon, may I have the Chairman's permission to file it subsequently and have it printed separately?

Senator Millikin. Certainly.

(Whereupon, at 2:05 p.m., the committee recessed, subject to call.)

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EXECUTIVE SESSION

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H. R. 3383 AND RELATED BILLS

COLORADO RIVER STORAGE PROJECT

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MONDAY, JUNE 13, 1955

House of Representatives,
Subcommittee on Irrigation and
Reclamation of the Committee
on Interior and Insular Affairs,
Washington, D. C.

The subcommittee met, pursuant to call, at 10:05 a.m., in the committee room, New House Office Building, Honorable Wayne N. Aspinall (chairman of the subcommittee) presiding.

Mr. Aspinall. The Subcommittee on Irrigation and Reclamation will now be in session for the further consideration of marking up H. R. 3383.

At the time we closed our session on Friday the gentleman from California, Mr. Hosmer, had the time and was presenting certain amendments in which he is interested. The gentleman is recognized further for amendments at this time.

Mr. Hosmer. Will Mr. Abbott read the next amendment.

Mr. Abbott. Amendment proposed by Mr. Hosmer, which occurs on page 13, line 21 of H. R. 3383 in section 13 of the printed bill, to strike all of the balance of that section after the word "basin" down to and including all of line 2 on page 14

and substitute the following language:

"In the event that any State of the Colorado River Basin either on its own behalf or as parens patriae seeks to maintain an action in the Supreme Court of the United States to enforce any of the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, the Mexican Water Treaty or of this Act, consent is given to the joinder of the United States in such suit or suits.

"Consent is hereby given to joinder of the United States to any suit, action or proceeding brought in any court of competent jurisdiction upon any cause of action arising under any contract lawfully entered into by the United States pursuant to either of the Compacts or the Acts named in this section."

Mr. Hosmer. I move the adoption of the amendment.

Mr. Utt. Second.

Mr. Aspinall. You have heard the motion and the second. The gentleman of California is recognized for five minutes.

Mr. Hosmer. This provision, in my belief, cleans up and particularizes the provision relative to suits.

Those of you who were here remember during the questioning of Mr. Bennett as to the interpretations of the Department his discussion with me on the matter of suits in general and the particular question of parens patriae, where we have in this situation in the Lower Basin a number of public agencies and

subdivisions and parts of the State government of California -- and I presume the same would possibly be true in Nevada and Arizona. There is a general law that the States will have parens patriae responsibility in connection with water, but this specifies it and lays it out and, I think, resolves some of the questions that would be subject to procedural motions if there ever was a suit. You know as long as Arizona versus California has been going on they still have not gotten through with their procedural motions and down to the merits. I hope by this kind of an amendment to bring to quicker decision any suit that might be brought.

Of course, I do not want to intimate that I am threatening any suits on this, but we all recognize the possibility of lawsuits, particularly when it comes to water rights in the arid West, and the same would be true as to any action which might be entered into by Hoover contractors. But it does not authorize any actions to be taken by Hoover contractors that are not at the present time authorized and available to them should they feel that their contracts are not being carried out.

I realize there may be some opposition to this amendment and therefore I reserve the balance of my time.

Mr. Rhodes. Mr. Chairman?

Mr. Aspinall. The Chair recognizes the gentleman from Arizona, Mr. Rhodes.

Mr. Rhodes. Mr. Chairman. The background of the California

versus Arizona lawsuit is that from time to time the State of Arizona has tried to get into court on the suit and has been unable to do so because the United States would not become a party and also because at one time there was not a justiciable issue.

I think this amendment is far too broad, in that it gives a blank check to any State in the Basin to bring any kind of a lawsuit, and whether or not the United States is a necessary party the United States may be joined. In other words, we are in a position of saying, no matter what the facts of the suit are, no matter what the law involved might be, the United States may be joined as a party. I think that is a very bad approach. If the lawsuit is indeed filed and the United States may be a necessary party, then at that time the Congress should consider whether the United States should give consent to being joined.

Mr. Aspinall. If the gentleman will yield. It even goes further than that. It permits persons and individuals such as a power company who might wish to file a suit to come into the court and make such a request.

Mr. Rhodes. I believe that the wording of the amendment might preclude that. It says "in the event that any State of the Colorado River Basin" -- section 2 may well have that effect. I will say that to the chairman.

It seems to me it is far too broad, that we may be getting

the United States into a hornet's nest which she might not want to get into. It makes it possible for a multiplicity of suits to be filed because, of course, any state may file an action against the other states and possibly would do so if the United States could be joined immediately, and this would certainly enhance the possibilities and, in fact, the probabilities of being able to file a lawsuit on any particular ground to get into court.

Mr. Hosmer. Will the gentleman yield?

Mr. Rhodes. I yield.

Mr. Hosmer. I think it does do the contrary, in that it would bring in one lawsuit at one time all the parties and get it disposed of, rather than we have the current situation of a couple of states suing each other on a few issues and then some other states coming along and suing on some more. This will settle the thing once and for all, and there is nothing more important to the West and the States that are concerned with this river than for once and for all in one lawsuit to have the rights litigated and settled so they know where they stand instead of carrying on litigation for years and years and years, getting one suit out of the way, and then starting another case and having it go on forever.

Mr. Rhodes. The gentleman knows full well that in the case of Arizona versus California the State of California is even now trying to bring in the States of the Upper Basin, and

if this amendment were passed, then California could file another lawsuit agsinst the States of the Upper Basin on very similar grounds to those which are in the case of Arizona versus California, and the United States is a necessary party and would be joined under the provisions of this Act. Instead of providing for one quick lawsuit, you would probably have two lawsuits.

I will say, further, that the question of whether the Upper Basin States should be in this lawsuit or not is now before the Master and the Master is now considering the question, and if we were to pass this amendment it would be to preempt the field from the Master which has been appointed by the Supreme Court to determine that.

Mr. Engle. Will the gentleman yield?

Mr. Rhodes. Yes.

Mr. Engle. Does not the present bill provide for the joinder of the States in the Basin whenever they get in an argument?

Mr. Dawson. Will the gentleman yield?

Mr. Rhodes. I yield.

Mr. Dawson. I call my chairman's attention to page 13 of the bill where it says: "In the event of the failure of the Secretary of the Interior to so comply" -- that is, with the Compact, the Boulder Canyon Project Act and all of the Acts -- "In the event the failure of of/the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court

of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits."

Mr. Engle. Is that not the language presented by the California witnesses last year?

Mr. Dawson. That was their language and it was inserted at their request.

Mr. Rhodes. I think it is fairly obvious, Mr. Chairman, that the only motive back of this amendment is to broaden the suit and make it possible for the States of the Upper Basin to be sued on grounds other than those which might appear in this Act.

Mr. Aspinall. The time of the gentleman from Arizona has expired.

The Chair recognizes the gentleman from California, Mr. Engle.

Mr. Engle. I ask to be recognized to try to find out what is in this amendment and why it is preferable from California's standpoint to the language in the bill.

Last year when we had this project up I offered the amendment which had been written by the California people and it was adopted. If my recollection serves me, the purpose of the amendment was to prevent the Secretary of the Interior from entering in and upon a capricious management of the water of the river. With a whole string of reservoirs up and down the river, it was considered possible for an arbitrary Secretary of

the Interior to fluctuate the reservoirs in a way detrimental to the one Basin or the other. The case operated as well on one foot as it did on the other, because the Secretary of the Interior might turn all of the water down into the Lower Basin and not catch enough in the Upper Basin, or he might catch too much in the Upper Basin. But the standard of what he should do is set up in the basic Colorado River Compact, and our idea was to put any state in a position to challenge him in the event that they thought his administration of the river was capricious and in violation of the Colorado River Compact.

As I read this amendment, it goes further than that. The amendment to section 13 would automatically permit the Federal Government in any litigation between two of the states irrespective of what the Secretary of the Interior had done.

Mr. Dawson. Will the gentleman yield?

Mr. Engle. And the second provision would permit any power company that had a contract with the Federal Government to walk in the court and bring a suit. Is that right? Is that what it does?

Mr. Hosmer. Will the gentleman yield?

Mr. Engle. Yes.

Mr. Hosmer. The first section is largely designed to clear up -- I do not think the gentleman was here when we discussed the matter at length with Mr. Bennett -- clear up the

parens patriae business and --

Mr. Engle. Clear up the what?

Mr. Hosmer. And that is the reason concern is given for the joinder of the United States as a party to such suit. And here it is on page 14, the same language: "consent is given to the joinder of the United States as a party in such suit or suits".

So there is nothing mysterious about this first paragraph of the amendment. It takes care of the parens patriae business.

Mr. Engle. What is that?

Mr. Hosmer. When you have like the Metropolitan Water District. In our State, according to the law, the Metropolitan Water District can not come in and sue. The general law of the river is that the states can sue in behalf of their local subdivisions, but this specifies it so there is no question about it.

Mr. Engle. Let me get this straight. Where does it specify it?

Mr. Hosmer. (Reading.) "In the event any State of the Colorado River Basin either on its own bahalf or parens patriae".

Mr. Engle. I do not see that in the language before me.

Mr. Hosmer. It is the language read, and I am sorry if the copies were not corrected.

Mr. Engle. Do I have the right amendment -- the one that is pending?

Mr. Aspinall. Yes.

Mr. Engle. I do not see anything about "parens" or anything else.

Now I have a corrected copy.

Mr. Hosmer. It should be at the end of the first line.

Mr. Engle. There is a very clear distinction between this language and the language that is presently in the bill. The language that is presently in the bill permits the joinder when the Secretary of the Interior is not complying --

Mr. Hosmer. Can you conceive of any possibility that a lawsuit would be brought when it is not being done in compliance, when it is not a question of the Secretary of the Interior, because he is the one that is going to manage and operate this thing?

Mr. Engle. If that is the case, then the gentleman should have no objection to the language in the bill.

Mr. Hosmer. I do for the reasons explained, and the reasons brought out in the testimony of Mr. Bennett.

That is just an example of the illogic of proceeding in these hearings without a quorum. We had about three people here and --

Mr. Engle. You do not have to kick me. I can read English. But when the gentleman submitted his amendment it did not have that extra language in it. It has been penciled in.

Mr. Aspinall. The time of the gentleman has expired.

Mr. Metcalf. Mr. Chairman?

Mr. Aspinall. The Chair recognizes the gentleman from Montana, Mr. Metcalf.

Mr. Metcalf. I will yield to the gentleman from California and then I want to ask a couple of questions.

Mr. Engle. What I was going to say to the gentleman is, if this additional language that is penciled in the typewritten copy of the amendment were added to the language which is now in the bill, it would take care of his problems, would it not?

Mr. Hosmer. Not specifically, I think, because we reiterate there what compacts and treaties we are talking about and tie it down to those and do not leave it for a general speculation in any dispute that might arise on the river.

Mr. Engle. Those are all specified in the preceding sentence in section 13. As far as I can determine from a cursory reading of them, they are the same.

What I am trying to find out is what is the difference between what the gentleman has proposed and what is currently in section 13.

Mr. Hosmer. I just told you it adds the parens patriae portion, and it brings out the question that we discussed when we were asking about the law -- that the contractors at Hoover are not an unlimited group of people. They are a small group and they are limited to the signatories of that contract. We can foresee now that there may be litigation. It was admitted

that those people did not have adequate remedies under the present law, they had to resort to the Court of Claims and go through a tedious and long procedure. Inasmuch as we do have a specific small group of people who would be in a position to litigate, this is a situation in which we would anticipate the trouble and provide an adequate relief instead of leaving them to what was admitted by the Interior Department counsel to be inadequate relief.

Mr. Metcalf. I am not familiar with the doctrine of parens patriae. As I understand it, this is put in here so that some of these quasi municipal corporations can sue in the name of the state. Is that correct?

Mr. Hosmer. The state would sue in their behalf, except only as to people under the Hoover contracts who would be allowed to go ahead and sue on their own behalf.

Mr. Metcalf. The Attorney General of California would probably bring such suit in any event, could he not?

Mr. Hosmer. It is not certain he would, though, because he is bringing to the taxpayers of the State a terrific burden when he does that.

Mr. Metcalf. Under this language here in the bill at present, if the Secretary of the Interior arbitrarily and capriciously interferes in the storage and release of water to the detriment of one of the parties to the contract -- what is the name of the organization in Los Angeles?

Mr. Hosmer. The Metropolitan Water District.

Mr. Metcalf. And the Metropolitan Water District was damaged, could they not bring an action?

Mr. Hosmer. Under that language -- "arbitrary and capricious" -- think of the burden of proof you are going to have and the allegations of fact you are going to have to have to support arbitrariness and capriciousness. That is a lot more than "unreasonable", and it would probably preclude the people from coming into court if they had to make a pleading alleging that.

Mr. Metcalf. I inserted the "arbitrary and capricious." The Secretary is directed to comply, and if there is a breach of contract with relation to storage or release of water, then there is in the present bill a consent to sue.

Mr. Dawson. Will the gentleman yield to me?

Mr. Metcalf. Yes.

Mr. Dawson. On page 13 of the bill it says very plainly there is no limitation as to whether it need to be capricious or arbitrary.

Mr. Metcalf. No, any breach.

Mr. Dawson. (Reading.) "In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits."

Mr. Hosmer. Let us take just one further circumstance in connection with this.

Mr. Aspinall. The time of the gentleman from Montana has expired.

Mr. Engle. Will the gentleman from Oklahoma take some time?

Mr. Edmondson. Mr. Chairman?

Mr. Aspinall. The Chair recognizes the gentleman from Oklahoma, Mr. Edmondson.

Mr. Edmondson. I yield to the gentleman from California, Mr. Engle.

Mr. Engle. Getting back to what we are talking about here, it seems to me that the amendment submitted goes even further than the gentleman says. Anytime there is a hassle on the river, literally, the Federal Government can be hauled in and made a party to it. That is what it boils down to.

The language in the bill says that whenever the Federal Government is interfering with the rights of the parties that a suit can be brought and the Federal Government can be brought in. There is not anything to keep one state from suing another anyway, as far as that is concerned, and California can sue Arizona tomorrow in the Supreme Court if she wants to. She may get tossed out, too, but there is nothing to keep her from going in there.

The second part of this amendment, though, would permit

any private outfit that thought they had a claim to sue the Federal Government immediately, and it seems to me that is too broad.

In reference to the language in regard to parens patriae, in my opinion the states can bring that kind of a suit anyway. In other words, the language is surplus. So I do not know about this.

Mr. Rhodes. Will the gentleman yield to me?

Mr. Edmondson. Yes.

Mr. Rhodes. I think it is rather plain that this is nothing but an attempt to circumvent the ruling of the Master in the case of Arizona versus California. It is so broad that any suit could be brought against any state and the United States would have to be a party, which sets the stage exactly for the bringing of another suit by California against the States of the Upper Basin to do just what they are now trying to do in the case of Arizona versus California but without the necessity of getting a Master to rule that the other States are necessary.

Mr. Hosmer. Will the gentleman yield to me?

Mr. Edmondson. Yes.

Mr. Hosmer. It is impossible for the State of California to bring another action on this litigation because this pending litigation was negotiated by the State of Arizona. The gentleman has not analyzed the amendment in connection with the present lawsuit correctly.

Mr. Rhodes. Will the gentleman yield to me?

Mr. Edmondson. Yes.

Mr. Rhodes. The gentleman has failed to analyze what the gentleman from Arizona said. I did not say they would be brought into the suit of Arizona versus California but another lawsuit would be filed in much the same manner as the State of California is now attempting to litigate in that suit, and this would set the stage completely. All we have to do is pass this bill with this in it and we have got another lawsuit on our hands.

Mr. Hosmer. That is impossible because Arizona, as I pointed out, is the party plaintiff.

Mr. Rhodes. But not in the other lawsuit. You can bring any number of lawsuits.

Mr. Engle. Will the gentleman yield?

Mr. Edmondson. Yes.

Mr. Engle. I would like to say this: It is not unusual if this language, as I think it does, changes the entire position now from what it was last year. It was a year ago that the Colorado River Board people came in and testified in favor of the Fryingpan-Arkansas. Every state water agency of any importance from California testified in favor of Glen Canyon dam. Then they were right back here last year to the embarrassment of Californians who were trying to do a fair-minded job, with their colleague in this Congress, contradicting themselves

Now the language presently in the bill is the language which I offered at their request last year. Now I am trying to find out why they are coming back here and monkeying around with the language again. If it was good last year, why is it not good now?

Mr. Hosmer. Will the gentleman yield?

Mr. Edmondson. Yes.

Mr. Hosmer. The "they" in this particular instance who has come in here with this amendment happens to be myself. It is my amendment and I am offering it. It has nothing to do with the people to whom you refer as "they". It is an amendment I suggested and had drafted at my request and which covers a point I wanted to cover.

Mr. Aspinall. The time of the gentleman from Oklahoma has expired.

A vote has been called for. All those in favor of the amendment proposed by the gentleman from California say "Aye."

Those opposed will say "No."

The "Noes" appear to have it. The "Noes" do have it. The motion is declared lost and the amendment is not agreed to.

Mr. Hosmer. I have another amendment, Mr. Chairman.

Mr. Aspinall. The gentleman will propose his next amendment.

Mr. Hosmer. I will read it. It is a proposed new section 7.

"From the revenues of the project, reimbursement shall be made to those having rights under presently existing contracts with the United States for the delivery of falling water or electric energy at points on the Colorado River downstream from the project, for all damages suffered by them through loss of falling water or electric energy available at such downstream points occasioned by storage at the Storage Project hereby authorized of water not then reasonably required in order to fulfill the requirements of the consumptive uses for irrigation or domestic water supply purposes then being made in the Upper Basin, together with fulfillment of the obligation of the States of the Upper Division pursuant to Article III(d) of the Colorado River Compact."

I movethe adoption of the amendment.

Mr. Aspinall. You have heard the motion.

Mr. Utt. Second.

Mr. Aspinall. And the second. The gentleman is recognized.

Mr. Hosmer. This amendment attempts to take care of the situation where the Secretary of the Interior is anxious to fill these dams here and prevent water from coming down the river which should come down the river either under 3(d) of the contract or under the general law of the river which applies to use of water for power generation purposes, which is not included in the compact and subject to the law of prior appropriation.

This seeks to compensate those who may be suffering damages on account of the withholding of the water which should not be withheld in the upstream area. I reserve the balance of my time.

Mr. Pillion. Will the gentleman yield?

Mr. Hosmer. Yes.

Mr. Pillion. The reimbursement mentioned here, would that also include reimbursement, say, for loss by evaporation?

Mr. Hosmer. Only insofar as the evaporation in the upstream areas might go beyond what would be determined beneficial consumptive use, and I believe that any evaporation out of the upstream reservoirs which occurs prior to the time that the storage is needed in order to make the beneficial consumptive uses that the Upper Basin is entitled to under 3(a) would be in that category.

Mr. Edmondson. Will the gentleman yield for a question?

Mr. Hosmer. Yes.

Mr. Edmondson. Do I understand that it is contended there are some presently existing contracts with the United States for falling water or electrical energy in excess of the allotments of any particular state under the Colorado Compact? Is it contended by any of the states that there are contracts for supplies of the water the Compact allows or provides for?

Mr. Hosmer. In connection with the contracts at Hoover

Dam, they contemplate generating electricity with any of the water that is available, naturally. Now should a certain amount of that water be put to beneficial consumptive use and in accordance with the Compact in the Upper Basin, then of course it would not be available for power generation purposes in the Lower Basin. However, if it were withheld for another purpose, not for beneficial consumptive use, and withheld not under authority of the Compact, then it would be water to which the Lower Basin would be entitled for power generation purposes because of prior appropriation. It is water in that category, water that would not be withheld under the provisions of the Compact, but water withheld contrary or notwithstanding the provisions of the Compact that this particular clause seeks to compensate.

Mr. Edmondson. This section is to establish, then, a fund to reassure reimbursement of the States in the Lower Basin which might have its receipt of either power or of water reduced as a result of some other use upstream?

Mr. Hosmer. It does not seek to establish a fund to do that, but it seeks to provide where the money is coming from, and that is specifically under revenues of the project.

Mr. Dawson. Will the gentleman yield?

Mr. Hosmer. Yes.

Mr. Dawson. Would it be possible under this amendment to store any water in Glen Canyon dam?

Mr. Hosmer. I do not see why not. Any that is reasonable. As Mr. Bennett says, any water reasonably needed, if his theory is correct, to be stored today for beneficial consumptive uses in the Upper Basin for a reasonable time until used in the future under the exchange principle, can be stored.

Mr. Dawson. If the gentleman will yield further.

Mr. Hosmer. Yes.

Mr. Dawson. I understood you to say you do not recognize the exchange principle. You say that the water stored there and which is not being taken out of the reservoir for beneficial consumptive use must be released and sent on down the river.

Mr. Hosmer. Of course, that is one interpretation, and there is another interpretation, and the court may come up with a third. We do not know.

Mr. Aspinall. The time of the gentleman has expired.

Mr. Dawson. Mr. Chairman?

Mr. Aspinall. The Chair recognizes the gentleman from Utah, Mr. Dawson.

Mr. Dawson. I think the committee should understand exactly what is being attempted here. It is true there has been over 4 million acre-feet of water going over the dam at Hoover to generate secondary power, power which is being sold for approximately 1-1/2 mills, which is cheap power. That is Upper Basin water. And of course it has been going over the

dam, and under this amendment I think that the Federal Government would be liable for damages if they did not continue to let all of that water go over the dam and go to waste in the Pacific Ocean, for this simple reason: Under the interpretation of the gentleman from California of the Colorado River Compact we cannot store any waters in these compensating reservoirs for replacement purposes and have it considered as water being beneficially and consumptively used because that would be, as he says, water for power generation, which would mean that we would have to let the water go on down. So the effect of the amendment would be that the whole project would just go out of the window if this were adopted, and certainly his interpretation is not in line with the Colorado River Compact, and we would just simply be deprived of all of our water if we were required to, as he says, firm up these contracts.

I think the committee should also understand this fact: that the Federal Government is not under any firm commitment on these contracts to continue to let this water go down. It is written into every one of the contracts on secondary power that the water only go there as long as it is available, and anytime it is required by the Upper Basin States then the water and power shall not be delivered. That is in each one of the contracts.

Now by the terms of this amendment, if you did not let the

water go down there, then you would be bound to pay damages even though the contract says the water is not to come down if it is used in the Upper Basin States.

That is in simple terms the effect of the amendment. It would simply kill the bill if it were adopted.

Mr. Rhodes. Will the gentleman yield?

Mr. Dawson. I will be happy to yield.

Mr. Rhodes. Would you be willing to admit that the Upper Basin gets $500,000 a year for the use of this water which comes down from the Upper Basin that it is not now using?

Mr. Dawson. You are talking of the investigation fund?

Mr. Rhodes. The investigation fund which is paid from the proceeds from Hoover Dam.

Mr. Dawson. That is right, and that was written into the bill at the time the Hoover project was approved.

Mr. Rhodes. If this surplus water no longer comes down, then do you think that it would be fair that the $500,000 payment to the investigation fund should be discontinued?

Mr. Dawson. It is my understanding it will be discontinued --

Mr. Aspinall. This is the last year.

Mr. Dawson. Next year. This is the last year and it is through.

Mr. Rhodes. I thank the gentleman.

Mr. Hosmer. Will the gentleman yield?

Mr. Dawson. Yes.

Mr. Hosmer. I respectfully wish to differ from you in your statement that this will kill the project or anything like that. All this amounts to is to see that the project will be managed and operated in conformity with the contracts.

Mr. Dawson. I will be happy to give the gentleman the rest of my time if he will explain to this committee whether my interpretation of what his contention is on this storage basin is wrong. If I am wrong, I wish he would tell the committee, because I sat through it and that is exactly what you contended -- that any water held in these compensating reservoirs which is not taken out for the irrigators and used is not a consumptive use, and therefore it must be let on down the river, which would mean that there would be absolutely no need for the compensating reservoirs.

Mr. Hosmer. As the gentleman well knows, the only rights the Upper Basin has are those by 3(a) to beneficial use. What other rights they may have are over and above the Compact.

Mr. Dawson. What the gentleman is saying is that I am correct in my interpretation of how he views this Compact.

Mr. Aspinall. The time of the gentleman has expired. All those in favor of the amendment by the gentleman from California, Mr. Hosmer, signify by saying "Aye".

Those opposed will say "No."

The "Noes" appear to have it. The "Noes" do have it.

The motion is declared lost and the amendment is not

agreed to.

The gentleman will offer his next amendment.

Mr. Hosmer. The next amendment is to page 15. At line 16, strike the word "and", insert a period and all of lines 17 through 26.

I move the adoption of the amendment.

Mr. Aspinall. You have heard the motion.

Mr. Utt. Second.

Mr. Aspinall. And the second. The Chair recognizes the gentleman from California, Mr. Hosmer.

Mr. Hosmer. This merely takes out the language which violates the present reclamation law and seeks to extend the economic life of the project ad infinitum. That language is objectionable on any reasonable grounds and should be out of the bill to clean it up.

I reserve the balance of my time.

Mr. Dawson. Mr. Chairman?

Mr. Aspinall. The Chair recognizes the gentleman from Utah, Mr. Dawson.

Mr. Dawson. First, under the repayment plan that the gentleman from Colorado has inserted in his bill, which incidentally is different than the plan I have proposed, it is necessary to have a definition of the term "economic life."

If you will turn back to the repayment plan in the bill,

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starting at the bottom of page 7, the last line, "the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period of years not exceeding the expected economic life of such unit or participating project but not to exceed 100 years."

Now that necessitates the inclusion of a definition of the term "economic life." I might explain to the committee the difference in my proposal on a payout of this project and that of the gentleman from Colorado.

Under the Senate bill and under my bill this project would be paid out in 50 years' time by speeding up the power payments to irrigation features within approximately the last three years of the project. In other words, the power features of this project will pay out in approximately 47 years and during the remaining three years all of the revenues from power, less interest, would then go to pay the participating irrigation projects off, which would pay the whole thing off in 50 years.

Under the proposal of the gentleman from Colorado more of these payments would go to pay off power features during the early years of the project, and then when you get up to the 50-year period it would then extend some of those power payments off beyond the 50-year period.

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Mr. Aspinall. If the gentleman will yield right at that point?

Mr. Dawson. Yes.

Mr. Aspinall. That is not just exactly right. More of the revenues would be used to pay out the cost allocated to irrigation because all irrigation costs on each unit would have to be paid within 50 years after the development period. This then would cause to be held back for repayment more costs of the power construction facilities than otherwise would, and that without interest. In other words, what the gentleman from Colorado has tried to do is to firm up the interest-paying obligation to the Federal Government.

Mr. Dawson. That is exactly what I was trying to explain. Perhaps I was mixed up on it. But in any event it would mean less interest to the Government, I think, under the proposal of the gentleman from Colorado than it would under my proposal.

Mr. Aspinall. No. It would be more interest to the Government and less subsidy under my proposal than otherwise.

Mr. Dawson. When I say "more interest" I mean the Government would be out less money.

Mr. Aspinall. That is right.

Mr. Pillion. Will the gentleman yield?

Mr. Dawson. Yes.

Mr. Pillion. Under the definition of economic life on

page 15, what is the gentleman's estimate as to the number of years that will be translated into?

Mr. Aspinall. If the gentleman will yield?

Mr. Dawson. I yield.

Mr. Aspinall. The estimate is that it would go up to 100 years but not over a 100 years. The reason for going up that far is that private industry in its control of such projects, as you know, always continues on, they pay no attention to that but they issue their bonds just the same and keep issuing them without any consideration at all to the economic life. The project continues to produce as long as it can, and then they have to come in and rebuild. In other words, whether the Federal Government or private industry is managing this project, there should be certain sums laid aside to take care of replacement, repair and so forth.

Does that answer the gentleman's question?

Mr. Pillion. Yes, it does. It does not quite satisfy me, but it does answer me.

Mr. Aspinall. Let me ask you this: Is not the gentleman more satisfied with the proposal by the gentleman from Colorado than he is with the usual proposal in relation to payout as far as the use of Federal moneys?

Mr. Pillion. I understood that the normal repayment of these projects was over a 50-year maximum period.

Mr. Aspinall. That is right. But if you place all the

amount allocated to irrigation to be repaid in the last 5, 6 or 10 years, is not that more of a subsidy that the Federal Government is granting to users than if you make it necessary to follow the usual procedure usually entered into, paying out in annual equal payments within the 50 years and thereby retiring it right from the very beginning rather than wait to the end of the payout period to retire the allocation in non-interest bearing funds?

Mr. Pillion. I do not know. I just cannot follow the mathamatics. I am sorry. It is my fault.

Mr. Aspinall. Let me say to the gentleman, after this is over with I will be glad to come to the gentleman and show exactly where this varies from the usual procedure in the Collman or modified Collbran formula.

Mr. Hosmer. I move the previous question.

Mr. Aspinall. The previous question has been called for. All thos in favor of the motion signify by saying "Aye".

Those opposed will say "No."

The "Noes" appear to have it. The "Noes" do have it. The motion is lost and the amendment is not agreed to.

Does the gentleman have another amendment?

Mr. Hosmer. I do. This amendment is in the nature of a substitute, Mr. Chairman. Strike all after the enacting clause and substitute the following:

"Resolved, by the Senate and House of Representatives of

the United States of America in Congress assembled:

"The Secretary of the Interior is hereby authorized and directed to appoint a board of five eminent engineers and geologists, at least one of whom shall be an Engineer Officer of the Army, on the active or retired list, to examined the proposed sites of the dams and projects to be constructed under the provisions of S. 500 and H. R. 3383, 84th Congress, and review the plans and estimates made therefor, and to advise him prior to July 1, 1956, as to matters affecting the safety, the financial and engineering feasibility, and adequacy of the proposed structures and incidental works; and provided further that the work of construction shall not be commenced until plans therefor are approved by said special board of engineers. No authority hereby conferred on the Secretary of the Interior shall be exercised without the President's sanction and approval.

"Section 2. The report of the board shall be submitted to the Congress and to the Secretary of the Interior, and shall be printed as a House or Senate Document.

"Section 3. The appropriation of not to exceed $200,000 is hereby authorized for the purposes of this resolution."

Mr. Chairman, I move the adoption of the amendment.

Mr. Utt. Second.

Mr. Aspinall. You have heard the motion and the second.

The Chair recognizes the gentleman from California.

Mr. Hosmer. I do not expect it to be passed. It is

offered for the purpose of getting it on record. It would just tear up the bill and substitute a board of engineers to go by and take a look at the thing and see if they could come back with some answers to questions we have not been able to get answered by the Interior Department.

Incidentally, it is the same procedure that was adopted in connection with the Boulder Canyon Project. In other words, a board of engineers and geologists went out there, looked into the thing, and determined what should be done, the feasibility, and then the Congress acted. That is all I want to do by this amendment.

I yield back the balance of my time and move the previous question.

Mr. Aspinall. All those in favor signify by saying "Aye".

Those opposed will say "No."

The "Noes"appear to have it. The "Noes" do have it. The motion is declared lost and the amendment is not agreed to.

Mr. Hosmer. I have one final last amendment, Mr. Chairman.

I ask that the reading of the amendment be dispensed with.

It is a substitute bill to strike out all after the enacting clause, substitute the same board of engineers. Then if they found it was feasible to build Glen Canyon and the participating projects in the regular bill, less Central Utah, they would go ahead and that would be done, but it would be

done on the basis of the present reclamation law.

In the bill is included all these safeguards I tried to get for California, like the suit clause and the compensation for damages.

I want to get it on the record.

I move the previous question.

Mr. Aspinall. Just a moment. The gentleman made a request that the substitute will be considered read and open for discussion and amendment.

Is there any objection to the request of the gentleman?

Hearing none, it is so ordered and the substitute is now before the body.

(The substitute referred to follows:)

550606

H. R. 3383, 84th Cong.

Amendment in the
nature of a substitute

P. 1 line 2 Strike all of H. R. 3383 after the enacting clause, and substitute the following:

Board of Engineers

Sec. 1. The Secretary of the Interior is hereby authorized and directed to appoint a board of five eminent engineers and geologists, at least one of whom shall be an Engineer Officer of the Army, on the active or retired list, to examine the proposed sites of the Glen Canyon dam and power features and participating projects named in Section 5 of this Act and review the plans and estimates made therefor, and to advise him prior to January 1, 1956, as to matters affecting the safety, the financial, economic and engineering feasibility, and adequacy of such proposed dam, power features and participating projects; provided, that no work of construction shall be commenced nor money appropriated nor spent, until plans therefor are approved by said board of engineers, and the Congress has thereafter authorized said works. No authority hereby conferred on the Secretary of the Interior shall be exercised without the President's sanction and approval.

AUTHORIZATION FOR CONSTRUCTION OF GLEN CANYON DAM

Sec. 2 (a) The Secretary of the Interior, subject to a favorable report by the Board appointed pursuant to Section 1 of this Act, and subsequent authorization by the Congress and to the other terms and conditions of this Act, is authorized to construct, operate, and maintain a dam in the main stream of the Colorado River in or near Glen Canyon, Arizona, together with a power plant, incidental works and necessary main transmission lines to load centers, hereinafter referred to as the Glen Canyon Dam Project.

Allocations of Cost of Glen Canyon Dam

(b) The Secretary of the Interior, with the concurrence of the Board created under Section 1 of this Act, is directed to allocate the capital cost of the Glen Canyon Dam Project, upon the following basis:

1. Allocations which shall be non-reimbursable:

   (i) Flood control and navigation.

   (ii) Preservation of fish and wildlife.

2. Allocations which shall be recovered and paid into the Treasury with interest at 2 1/2% upon the unpaid balance, within 50 years from the date or dates of completion of the dam and of each unit of the power plant, out of revenues from the sale of electric power and energy generated at said Dam:

   (i) Commercial power.

3. Allocations which shall be recovered and paid into the Treasury without interest in 50 equal annual instalments commencing with the date of completion of the dam, out of revenues from the sale of such electric power and energy:

(i) Irrigation and reclamation

(c) The Secretary, with the concurrence of said Board, shall determine the rates and charges required for:

(1) Payment to the Treasury of the amounts required annually by subsection (b) of this section.

(2) Payment of the annual costs of operation and maintenance and provision for reasonable replacement reserves.

(3) Payment of a subsidy equal to one mill per kilowatt hour sold, to be applied in aid of recovery by the Treasury of its investment in the participating projects referred to in Section 5 of this Act.

(d) Before any money is appropriated for the construction of Glen Canyon Project, or any construction work done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this Act, adequate to insure payment of the aggregate of the amounts specified in subsection (c) of this Section 2, and to otherwise meet the revenue requirements of this Act.

CRITERIA IN THE OPERATION OF GLEN CANYON DAM AND RESERVOIR

Sec. 3. The following criterial shall govern the filling and operation of the reservoir to be created by the Glen Canyon Dam.

(a) During the initial filling of Glen Canyon reservoir, and until it shall first spill, only the water in excess of the natural flow at Lee Ferry of twelve million acre-feet in any one year shall be added to storage in said reservoir.

(b) Said reservoir shall be operated to conform with the requirements of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Mexican Water Treaty; provided, that unless and until beneficial consumptive use in the Upper Basin equals or exceeds 4,300,000 acre-feet per annum, Glen Canyon reservoir shall not be deemed to be required for the performance of Article III(d) of the Colorado River Compact.

(c) In conformity with Article IV(b) of the Colorado River Compact, the impounding, and use of water impounded, in Glen Canyon reservoir shall be subservient to the use and consumption of such water for agricultural and domestic purposes, and shall not interfere with or prevent use for such dominant purposes.

(d) In conformity with Article III(e) of the Colorado River Compact, neither the United States nor the States of the Upper Division shall withhold water in Glen Canyon reservoir which can reasonably be applied to domestic and agricultural uses in the Lower Basin.

(e) Until such time as the storage of water in Glen Canyon reservoir is required for the performance of Article III(d) of the Colorado River Compact, neither the United States nor the States of the Upper Division shall withhold in Glen Canyon reservoir any water required for the performance of any contract for the generation and sale of electric power and energy into which the United States has entered under the Boulder Canyon Project Act or the Boulder Canyon Project Adjustment Act.

DISPOSITION OF ELECTRIC ENERGY

Sec. 4. The Secretary of the Interior is authorized to dispose of the electric power and energy generated at the Glen Canyon Dam upon the following terms and conditions:

(a) The Secretary shall transmit and deliver to the Hoover Dam Power Plant so much energy as may be required to replace all energy which would have been generated at Hoover Dam Power Plant had the Glen Canyon Dam not been constructed. Such replacement energy shall be delivered under the contracts heretofore made under the authority of the Boulder Canyon Project Act or the Boulder Canyon Project Adjustment Act (Act of July 19, 1940, 54 Stat. 774) upon the same terms and conditions as though generated at the Hoover Dam Power Plant.

(b) All other energy shall be sold upon the criteria as to rates and charges and preferences to public agencies established by Section 5 of the Flood Control Act of 1944 (Act of _____, 1944, ____Stat. ____), to contractors who will pay the rates and charges necessary to meet the revenue requirements stated in this Act.

AUTHORIZATION FOR CONSTRUCTION OF PARTICIPATING PROJECTS

Sec. 5. (a) The Secretary of the Interior, subject to a favorable report thereon by the Board appointed pursuant to Section 1 of this Act, and subsequent authorization by the Congress, and to the other terms and conditions of this Act, is authorized to construct each of the following reclamation projects (hereinafter called "participating projects") in accord with the provisions of the Reclamation Law, except where such laws are inconsistent with this Act: Emery County, Florida, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt, Smith Fork.

(b) The Board established by Section 1 of this Act shall review the Secretary's plans for each participating project and shall report with respect thereto:

1. Its capital cost, in total and per acre

2. The probable annual cost of operation and maintenance and of a reasonable allowance for replacement reserves.

3. The amounts which the water users reasonably can be expected to pay for annual costs of operation and maintenance and replacement reserves and toward repayment of the capital cost, within 50 years in substantially equal annual payments after a ten year development period.

4. The amount of capital allocated to irrigation which will not be recovered from the water users.

5. The amount of such capital which will be recovered out of the subsidy from power revenues provided for in Section 2 of this Act, payable in substantantially equal annual installments concurrently with the payments under subsection (b) 3 of this Section 5.

6. The probable value of the land to be irrigated, before and after construction of the project.

7. The number of farms to be created or benefited, and the types of crops for which the land is suitable.

8. The increase in the national debt which will be occasioned by the construction of the project.

9. The net direct benefits which will accrue from the construction of the project.

(c) No participating project shall be authorized or constructed unless the Board shall find that

(i) The capital investment by the United States will be equalled by the amounts applicable thereto to be repaid by the water users plus the subsidy from powe r revenues under the provisions of subsection (b) 3 and (b) 5 of this Section 5, and

(ii) The net benefits will exceed the increase in the national debt to be occasioned by the project's construction.

LIMITATION ACT

Section 6. Except as to the carrying out of the provisions of Section 1 of this Act relative to the Board provided for therein, this Act shall not take effect and no authority shall be exercised hereunder and no work shall be begun and no moneys expended on or in connection with the works or structures provided for in this Act, and no valid rights shall be claimed or initiated hereunder, and no steps shall be taken by the United States or by others to initiate or perfect any claims to the use of water pertinent to such works or structures unless and until each of the States of Colorado, New Mexico, Utah and Wyoming, by acts of their respective legislatures, have each agreed irrevocably and unconditionally with the United States and for the benefit of the States of Arizona, California and Nevada, as an express covenant and in consideration of the passage of this Act, that (1) said State shall be bound by the decree in the case of Arizona v. California, et al., now pending in the United States Supreme Court; (2) that the aggregate annual consumptive use (diversions less returns to the river) of water of and from the Colorado River System by transmountain diversions out of the Colorado River Basin for use in said State, including all uses under contracts with the United States and all water necessary for the supply of any rights which may now exist, shall not exceed ten (10%) per centum of the waters, the use of which is apportioned to said State by the Upper Colorado River Basin Compact, such uses always to be subject to the terms of the Colorado River Compact; and (3) that no waters diverted out of the Colorado River Basin shall be made available to any

State not a party to the Colorado River Compact, either directly or by exchange, or by return flow, or otherwise.

CONSENT TO SUIT

Section 7. (a) In the event that any State of the Colorado River Basin seeks to maintain an action in the Supreme Court of the United States to enforce any of the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, the Mexican Water Treaty or of this Act, consent is given to the joinder of the United States as a party in such suit or suits.

(b) Consent is hereby given to joinder of the United States as a party to any suit, action or proceeding brought in any court of competent jurisdiction upon any cause of action arising under any contract lawfully entered into by the United States pursuant to either of the Compacts or the Acts named in this section.

APPROPRIATIONS

Sec. 8. The appropriation of not to exceed $ 671,008,300 for the purposes of this Act is hereby authorized, upon the terms and conditions of this Act.

Mr. Aspinall. The gentleman moves the previous question.

All those in favor of the previous question signify by saying "Aye".

Those opposed will say "No".

The motion is carried and the previous question is in order.

All those in favor of the substitute signify by saying "Aye".

Those opposed will say "No".

The "Noes" appear to have it. The "Noes" do have it. The motion is declared lost and the substitute is not agreed to.

Is that all of the amendments for the gentleman?

Mr. Hosmer. That is all I have at the present time.

Mr. Aspinall. The Chair would offer the following amendment.

(Discussion off the record.)

Mr. Aspinall. The staff member will read the amendment.

Mr. McFarland. (Reading) Page 12, line 25, strike the amount "$1,055,000,000" and substitute therefor the amount "$785,000,000."

Mr. Dawson. I move the adoption of the amendment.

Mr. Westland. Second.

Mr. Aspinall. It has been moved and seconded.

May the Chair state to his colleagues that this amendment proposes to bring the bill in line with the participating projects and units that have been so far agreed to, and it tends to reduce

the amount by almost 12-1/2 percent. The gentleman from Colorado thinks that 15 to 20 percent is too much of a contingent fund and it is not necessary in this instance, and he believes that a more realistic amount is the amount that has been proposed.

Also the gentleman from Colorado would advise his colleagues that there is an amount in here for the conditional project Curecanti and that the gentleman from Colorado has left Curecanti project authorization amount in the amount he has suggested to the committee; but it is his feeling that that amount is not going to be used forsome time, that if the project is authorized and approved by the President that it will be sometime, several years perhaps, before the Secretary is able to make a decision on Curecanti. Then, if it should appear that there are not sufficient funds at that time, they will have to come back in for Curecanti.

As far as I am concerned, I feel that this committee has a right to expect the Bureau of Reclamation or the Department of the Interior to stay within the amount for each individual project. They should not embarrass one project by using funds that are set forth in this study for that particular project in order to complete another project; and if the Bureau gets itself in that position, it should return to this committee and ask for further authorization.

This is nothing new even if the authorization were not

as much as the authorization to complete the whole project because, as I understand it, in the Missouri Valley Project they authorized a certain amount and have had to return to Congress in order to get further appropriation.

That is about all I have to say. It is realistic, I think, and it puts the bill in a better position as far as the public is concerned.

Mr. Sisk. Will the chairman yield for a question?

Mr. Aspinall. Certainly.

Mr. Sisk. I do not havethe figures in front of me, Mr. Chairman. What is the amount set aside for Curecanti?

Mr. Aspinall. The amount set aside for Curecanti is $49,305,000, which under the new proposal would only be a part of the amount that would be necessary in the ultimate, and that is the reason why I do not believe it is a realistic figure, as such; if the Curecanti is finally proposed, it will cost in the neighborhood it will cost in the neighborhood of $75,000,000.

Mr. Sisk. This $49,000,000, then, is actually or would be only a portion of what it would cost. Do you feel it is necessary to even leave that amount in there? What is the point, might I ask the chairman?

Mr. Aspinall. The only point is that I think it goes before the people a little firmer for Curecanti than if you leave it out entirely and they say, "We do not have anything here at all."

But if the Secretary of Interior comes back, Mr. Sisk, with an authorization that goes up to 65 or 75 million, he has got to come before the committee in order to confirm it.

Mr. Dawson. Will the chairman yield?

Mr. Aspinall. Yes.

Mr. Dawson. In view of that fact, would it not be better to leave it out entirely, if they are going to come back anyway. And certainly they are going to make an appraisal of it and get a feasibility report on it before they ever proceed. Would it not be better to leave it off?

Mr. Aspinall. If the gentleman wishes to offer an amendment, he may do so. I think I would have to more or less resist it, but if that is the feeling of the committee --

Mr. Dawson. If the chairman would not resist it very strongly, I would offer it.

Mr. Aspinall. Off the record.

(Discussion off the record.

Mr. Dawson. Mr. Chairman, I would like to offer an amendment to the amendment reducing the figure from $785,000,000 to $760,000,000.

The reason for that is this: In my opinion the $49,000,000 for the Curecanti should not be in this bill until such a time as that project is reported back by the Secretary as to its feasibility, and it would be a truer reflection on the actual

costs of the project not to have it included. By reducing it to $760,000,000 you would be taking the $49,000,000 out of the project and then reducing the overall by 10 percent rather than 12-1/2 percent.

It is true that there is a contingency section in the computations, but you also have a good many contingencies, too, that it is impossible to figure on at the time a project of this size is set up. But I think we could safely go to 10 percent and still be more realistic.

Now we have discussed this some, and I think the general feeling was that 10 percent would be a more realistic figure.

I offer that as an amendment to the amendment, and if my friend cares to, I will yield to him at this time to comment on it.

Mr. Aspinall. No.

Mr. Pillion. Will the gentleman yield?

Mr. Dawson. Yes.

Mr. Pillion. What is your amendment? I am sorry, I did not hear it.

Mr. Dawson. Reduce the amount from $785,000,000 to $760,000,000.

Mr. Pillion. That is not excluding Curecanti?

Mr. Dawson. That is excluding Curecanti.

Mr. Pillion. My opposition, Mr. Chairman, to excluding Curecanti is that it is part of the bill, and while it is

a conditional authorization, the contingency upon which it depends is not within the province of Congress to decide. If the Secretary of the Interior comes up with a favorable report, then we are committed regardless of any further action by Congress. And if we are committed to Curecanti as a project based only upon a report from the Secretary of the Interior, then certainly the money ought to be in here, the authorization for the money ought to be in here.

Dr. Miller. Will the gentleman yield?

Mr. Dawson. Yes.

Dr. Miller. Of course, we are not committed even though the Secretary of Interior finds a favorable report on Curecanti because it will require another authorization by this committee and by the Congress as presently being done in the Missouri Valley project. So in either case I believe if we follow the amendment adopted by the Appropriations Committee in this committee, it would be necessary to come back for the approval of the Secretarial authorization.

Mr. Pillion. But it will not be necessary to come back to this committee. And by law, and not by rule or regulation, by law, this committee has authorized Curecanti.

Dr. Miller. As I understand, there will be no Secretarial authorizations.

Mr. Dawson. I would like to add to that, we have had a

number of projects here on exactly this same basis, which, it is true, we do not have to reauthorize the project, but certainly under the interpretation of the Appropriations Committee we, in effect, have to do it because it has to come back here, and before they will give an appropriation they have to have a reapproval of the whole project, you see, by this committee.

We have done that on a number of them here this session.

Mr. Fillion. I still say it is not law; it is a matter of rule and conditions by the Appropriations Committee.

Mr. Dawson. But it is law as far as we are concerned because the Appropriations does not want to appropriate the money unless the whole thing is brought before this committee and we approve it.

Mr. Aspinall. Is there any further discussion.

If not, all those in favor of the Dawson amendment to the amendment signify by saying "Aye".

Those opposed will say "No."

The"Ayes" appear to have it. The "Ayes" do have it. The motion is declared carried and the amendment to the amendment is declared adopted.

All those in favor of the Aspinall amendment, as amended, by the Dawson amendment, signify by saying "Aye."

Those opposed will say "No."

The "Ayes" have it. The motion is carried. The amendment

is declared adopted.

Dr. Miller. Mr. Chairman?

Mr. Aspinall. The Chair recognizes the gentleman from Nebraska.

Dr. Miller. I would like to raise a question as to procedure. I understand there are no more amendments to be presented to the bill, unless there are some that grow up between now and tomorrow morning.

Mr. Aspinall. That is right.

Dr. Miller. I wondered if it would be possible tomorrow, since we meet at 9:30, and I believe the House meets at 11 o'clock, we might have agreement to vote, say, at 10:15 on the bill. I think we ought to try to give notice ahead of time so it will not be done at 9:31.

Mr. Aspinall. Does the gentleman make a unanimous consent request?

Dr. Miller. I ask unanimous consent that we vote tomorrow at ten-thirty.

Mr. Aspinall. Unanimous consent has been requested that we have a final vote on the bill tomorrow at ten-thirty.

Mr. Rhodes. A parliamentary inquiry. Could that be made on or before ten-thirty?

Mr. Aspinall. That is the reason why the request was made so there would be a time definite.

Without objection, the request is granted and it is so

ordered.

Dr. Miller. Are other amendments in order?

Mr. Aspinall. Other amendments will be in order.

Dr. Miller. Up to ten-thirty?

Mr. Aspinall. That is right.

The Chair would ask unanimous consent of the committee that the committee members do not make a point of order because of a lack of quorum before ten-thirty tomorrow. In other words, we do not want to meet and have nothing to do and have the members drifting away.

With that understanding, the request being granted as such, the committee stands adjourned.

(Whereupon, at 11:15 a.m., the subcommittee recessed, to reconvene at 9:30 a.m., Tuesday, June 14, 1955.)

1498-5

COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

EIGHTY-FOURTH CONGRESS

FIRST SESSION

ON

H. R. 270, H. R. 2836, H. R. 3383, H. R. 3384, and H. R. 4488

TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

PART 1

MARCH 9 AND 10, APRIL 18, 20, AND 22, 1955

Printed for the use of the Committee on Interior and Insular Affairs

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COLORADO RIVER STORAGE PROJECT

WEDNESDAY, MARCH 9, 1955

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to call, at 10:05 a. m., in the committee room, New House Office Building, Hon. Wayne N. Aspinall (chairman) presiding.

Mr. ASPINALL. The Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs will now be in session for the consideration of five bills for authorizing the Colorado River storage project and participating projects. These bills are H. R. 3383 and H. R. 3384, by Aspinall; H. R. 270, by Dawson; H. R. 2836, by Fernandez; and H. R. 4488, by Rogers of Colorado.

(H. R. 3383, H. R. 3384, H. R. 270, H. R. 2836, and H. R. 4488 read as follows:)

[H. R. 3383, 84th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin. the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities and appurtenant works: Curecanti, Echo Park, Flaming Gorge and Glen Canyon: *Provided,* That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Emery County, Florida, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy

Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works); Pine River extension, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo: *Provided*, That (a) no appropriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been approved and authorized by the Congress: *Provided further*, That with reference to the San Juan-Chama project, it shall be limited to a single off stream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission.

SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River System the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phase thereof)—

(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and

(2) for which pertinent data sufficient to determine their probably engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any participating project authorized in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law.

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

SEC. 4. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the "Basin Fund"), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts, (2) payment as required by subsection (d) of this section, (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act, and (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277): *Provided*, That revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period of years not exceeding the expected economic life of such unit or participating project but not to exceed one hundred years;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act in equal annual installments within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit, participating project, or separable feature thereof, or, in the cases of the Paonia project and of Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project or separable feature thereof the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation, and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1956, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with

other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, or any contract lawfully entered into under said Acts without the consent of the other contracting parties. Neither the impounding nor the use of water for the generation of power and energy at the plants of the Colorado River storage project shall preclude or impair the appropriation for domestic or argicultural purposes, pursuant to applicable State law, of waters apportioned to the States of the Upper Colorado River Basin.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shal be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty with the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the Flaming Gorge, Glen Canyon, Curecanti, and Echo Park initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 10. Construction of the projects herein authorized shall proceed as rapidly as is consistent with budgetary requirements and the economic needs of the country.

SEC. 11. There are hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, such sums as may be required to carry out the purpose of this Act but not to exceed $1,055,000,000.

SEC. 12. In planning the additional development necessary to the full consumptive use in the Upper Basin of the waters of the Colorado River system allocated to the Upper Basin and in planning the use of and in using credits from net power revenues available for the purpose of assisting in the pay-out of costs of participating projects herein and hereafter authorized in the States of Colorado, New Mexico, Utah, and Wyoming, the Secretary shall have regard for the achievement within each of such States of the fullest practicable consumptive use of the waters of the Upper Colorado River system consistent with the apportionment thereof among such States.

SEC. 13. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits.

SEC. 14. The Secretary of the Interior is directed to institute studies and to make a report to the Congress and to the States of the Colorado River Basin of the effect upon the quality of water of the Colorado River, of all transmountain

diversions of water of the Colorado River system and of all other storage and reclamation projects in the Colorado River Basin.

SEC. 15. As used in this Act—

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "Upper Basin", and "domestic use" shall have the meaning ascribed to them in article II of the "Upper Colorado River Basin Compact";

The term "States of the Upper Colorado Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming.

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785);

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understanding recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof; and

The term "economic life," as used herein in relation to repayment of costs allocated to power, shall mean the period during which the unit or project is expected to continue to provide the power and energy contemplated from the design and construction of the power facilities of the unit or project, due regard being given to historical experience with similar types of works, allowances included in "replacement costs" for replacing major items of equipment, and other pertinent factors which may affect the useful life.

[H. R. 3384, 84th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities, and appurtenant works: Curecanti, Echo Park, Flaming Gorge, Glen Canyon, Juniper, and Navajo: *Provided*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level, and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Emery County, Florida, Gooseberry, Hammond, LaBarge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River,

and other necessary works), Pine River Extension, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo, Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, Elkhorn, Kendall: *Provided*, That (a) construction of the participating projects set forth in this clause (2) shall not be undertaken until the Secretary has reexamined the economic justification of such project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of this Act can be met. The Secretary's supplemental report for each such project shall include, among other things, (i) a reappraisal of the prospective direct agricultural benefits of the project made by the Secretary after consultation with the Secretary of Agriculture; (ii) a reevaluation of the nondirect benefits of the project; and (iii) allocations of the total cost of construction of each participating project or separable features thereof, excluding any expenditures authorized by section 7 of this Act, to power, irrigation, municipal water supply, flood control or navigation, or any other purpose authorized under reclamation law. Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama, Navajo, Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, Elkhorn, and Kendall participating projects, not be applicable to such supplemental reports; and, (b) that no appropriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been authorized by the Congress: *Provided further*, That with reference to the San Juan-Chama project, it shall be limited to a single off-stream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission: *Provided further*, That no appropriation for or construction of the Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, Elkhorn, and Kendall participating projects shall be made or begun until reports thereon shall have been submitted to the affected States, pursuant to the Act of December 22, 1944, and said projects shall have been authorized by the Congress.

SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River system the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phases thereof)—

(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and

(2) for which pertinent data sufficient to determine their probable engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any participating project authorized in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law.

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

SEC. 4. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the "Basin Fund"), which shall remain available until expended, as hereinafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation Acts, (2) payment as required by subsection (d) of this section, (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act, and (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277): *Provided*, That revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit,

participating project, or separable feature thereof, or in the cases of the Paonia project and of Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project or separable feature thereof the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1956, upon the status of the revenues from and the cost of constructing, operating and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty with the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the Flaming Gorge, Glen Canyon, Navajo, and Echo Park initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 10. There are hereby authorized to be appropriated such sums as may be required to carry out the purposes of this Act.

SEC. 11. (a) In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits. No right to impound or use water for the generation of power or energy, created or established by the building, operation or use of any of the powerplants authorized by this Act, shall be deemed to have priority over or otherwise operate to preclude or impair any use, regardless of the date of origin of such use, of the waters of the Colorado River and its tributaries for domestic or agricultural purposes within any of the States of the Upper Colorado River Basin.

(b) In the operation of works under his jurisdiction for the storage and release of waters of the Colorado River System and in programing the storage and release of such waters, the Secretary of the Interior shall consult from time to time with an Integrating Committee consisting of one representative from each of the Colorado River Basin States, one representative of the Colorado River Board of California, one representative of the Upper Colorado River Commission, and one representative of the United States Section of the International Boundary Commission, United States and Mexico.

SEC. 12. As used in this Act—

The terms "Colorado River Basin," "Colorado River Compact," "Colorado River System," "Lee Ferry," "States of the Upper Division," "Upper Basin," and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by Commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785); and

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

[H. R. 270, 84th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation

of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities, and appurtenant works: Cross Mountain, Curecanti, Echo Park, Flaming Gorge, Glen Canyon, and Navaho: *Provided*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase), Emery County, Florida, Gooseberry, Hammond, LaBarge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo: *Provided*, That (a) construction of the participating projects set forth in this clause (2) shall not be undertaken until the Secretary has reexamined the economic justification of such project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of this Act can be met. The Secretary's supplemental report for each such project shall include, among other things, (i) a reappraisal of the prospective direct agricultural benefits of the project made by the Secretary after consultation with the Secretary of Agriculture; (ii) a reevaluation of the nondirect benefits of the project; and (iii) allocations of the total cost of construction of each participating project or separable features thereof, excluding any expenditures authorized by section 7 of this Act, to power, irrigation, municipal water supply, flood control or navigation, or any other purpose authorized under reclamation law. Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama and the Navajo participating projects, not be applicable to such supplemental reports; and, (b) that no appropriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been authorized by the Congress: *Provided further*, That with reference to the San Juan-Chama project, it shall be limited to a single off stream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission.

SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River system the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, or additional phases of participating projects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phases thereof)—

(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and

(2) for which pertinent data sufficient to determine their probable engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any participating project authorized in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law.

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to asist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d) as to Indian lands within, under, or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (treaty series 994).

SEC. 4. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriations acts; (2) payment as required by subsection (d) of this section; (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act; and (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277): *Provided*, That revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit, participating project, or separable feature thereof, or, in the cases of the Paonia project and of Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project, or separable feature thereof the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project, or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation, and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1956, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty with the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the Cross Mountain, Flaming Gorge, Glen Canyon, Navaho, and Echo Park initial units of the Colorado River storage project may be made without regard to the soil-survey and land-classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 10. There are hereby authorized to be appropriated such sums as may be required to carry out the purposes of this Act.

SEC. 11. The appropriate agencies of the United States are authorized to convey to the city and county of Denver, Colorado, for use as a part of its municipally owned water system, such interests in lands and water rights used or acquired by the United States solely for the generation of power and other property of the United States as shall be required in connection with the development or use of its Blue River project, upon payment by Denver for any such interest of the value thereof at the time of its acquisition by Denver: *Provided*, That any such transfer shall be so limited as not to preclude the use of the property other than water rights for the necessary functions of the United States Government.

SEC. 12. (a) In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin.

(b) In the operation of works under his jurisdiction for the storage and release of waters of the Colorado River System and in programing the storage and release of such waters, the Secretary of the Interior shall consult from time to time with an integrating committee consisting of one representative from each of the Colorado River Basin States, one representative of the Colorado River Board of California, one representative of the Upper Colorado River Commission, and one representative of the United States Section of the International Boundary Commission, United States and Mexico.

SEC. 13. As used in this Act—

The terms "Colorado River Basin," "Colorado River Compact," "Colorado River System," "Lee Ferry," "States of the Upper Division," "Upper Basin," and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by Commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785); and

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

[H. R. 2836, 84th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and

to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the upper basin to utilize, consistently with the provisions of the Colorado River compact, the apportionments made to and among them in the Colorado River compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities and appurtenant works: Cross Mountain, Curecanti, Echo Park, Flaming Gorge, Glen Canyon, and Navajo: *Provided*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceeds its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Emery County, Florida, Gooseberry, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo: *Provided*, That (a) construction of the participating projects set forth in this clause (2) shall not be undertaken until the Secretary has reexamined the economic justification of such project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of this Act can be met. The Secretary's supplemental report for each such project shall include, among other things, (i) a reappraisal of the prospective direct agricultural benefits of the project made by the Secretary after consultation with the Secretary of Agriculture; (ii) a reevaluation of the non-direct benefits of the project; and (iii) allocations of the total cost of construction of each participating project or separable features thereof, excluding any expenditures authorized by section 7 of this Act, to power, irrigation, municipal water supply, flood control or navigation, or any other purpose authorized under reclamation law. Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama and the Navajo participating projects, not be applicable to such supplemental reports; and (b) that no appropriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been approved and authorized by the Congress: *Provided further*, That with reference to the San Juan-Chama project, it shall be limited to a single off-stream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission.

SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River system the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado Rivert storage project, of additional phases of participating proj-

ects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phases thereof)—

(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and

(2) for which pertinent data sufficient to determine their probable engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any participating project authorized in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law.

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

SEC. 4. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts, (2) payment as required by subsection (d) of this section, (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act, and (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277): *Provided*, That revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act,

within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit, participating project, or separable feature thereof, or, in the cases of the Paonia project and of Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month on June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project, or separable feature thereof, the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project, or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation, and maintenance costs to authorize nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1955, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public in-

terest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty With the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the Cross Mountain, Flaming Gorge, Glen Canyon, Navajo and Echo Park initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 10. There are hereby authorized to be appropriated such sums as may be required to carry out the purposes of this Act.

SEC. 11. The appropriate agencies of the United States are authorized to convey to the city and county of Denver, Colorado, for use as a part of its municipally owned water system, such interests in lands and water rights used or acquired by the United States solely for the generation of power and other property of the United States as shall be required in connection with the development or use of its Blue River project, upon payment by Denver for any such interest of the value thereof at the time of its acquisition by Denver, and provided that any such transfer shall be so limited as not to preclude the use of the property other than water rights for the necessary functions of the United States Government.

SEC. 12. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits. No right to impound or use water for the generation of power or energy, created or established by the building, operation or use of any of the powerplants authorized by this Act, shall be deemed to have priority over or otherwise operate to preclude or impair any use, regardless of the date of origin of such use, of the waters of the Colorado River and its tributaries for domestic or agricultural purposes within any of the States of the Upper Colorado River Basin.

SEC. 13. As used in this Act—

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "Upper Basin", and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785); and

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

[H. R. 4488, 84th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the upper basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project consisting of dams, reservoirs, powerplants, transmission facilities and appurtenant works: Curecanti, Echo Park, Flaming Gorge, Glen Cayon, Juniper, and Navajo: *Provided,* That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or a reservoir of such greater capacity as may be acceptable to local interests in the vicinity of the city of Gunnison, Colorado, and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Cliff-Divide (consisting of eight project units), Dolores, Emery County, Elkhorn, Florida, Gooseberry, Gunnison River (consisting of eight project units), Hammond, Kendall, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Savery-Pot Hook, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo: *Provided,* That (a) construction of a participating project set forth in this clause (2) shall not be undertaken until the Secretary has reexamined the economic justification of such project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of this Act can be met. The Secretary's supplemental report for each such project shall include, among other things, (i) a reappraisal of the prospective direct agricultural benefits of the project made by the Secretary after consultation with the Secretary of Agriculture: (ii) a reevaluation of the nondirect benefits of the project; and (iii) allocations of the total cost of construction of each participating project or separable features thereof, excluding any expenditures authorized by section 7 of this Act, to power, irrigation, municipal water supply, flood control or navigation, or any other purpose authorized under reclamation law. Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama and the Navajo participating projects, not be applicable to such supplemental reports; and, (b) that no appropriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been approved and authorized by the Congress: *Provided further,* That with reference to the San Juan-Chama project, it shall be limited to a single off-stream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation

of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission.

SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River system the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phases thereof)—

(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and

(2) for which pertinent data sufficient to determine their probable engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any participating project authorized herein or in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law. Furthermore, participating projects authorized in the future shall be on a full equality with participating projects authorized herein with respect to all considerations including economic justification, appraisal of agricultural and other benefits, irrigation repayment contracts and obligations, interest charges, financial reimbursability requirements and payment, allocation of costs of construction to power, irrigation, municipal water supply, flood control and any other purpose or benefit authorized under reclamation law.

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) contracts shall be entered into which (except as otherwise provided for the Paonia and Eden projects) provide for repayment of the irrigation obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the upper and lower basins of the Colorado River and among the States of the upper basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

SEC. 4 (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury, and such funds shall be available for expenditures within the limitations of the provisions of this Act and of the provisions of the appropriations.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin

Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts, (2) payment as required by subsection (d) of this section, (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act, (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277), and (5) any remaining surplus to be available only for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to the extent required to return for that year—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit, participating project, or separable feature thereof, or, in the cases of the Paonia project and of the Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project, or separable feature thereof the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation, and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1955, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants and transmission facilities authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential,

so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act: *Provided*, That power produced pursuant to this Act shall be sold at the highest practicable price to enhance the development of the Upper Colorado River Basin and operation in conjunction with other powerplants shall not deprive the Basin Fund of revenues which it would receive in the absence of such joined operation.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest, and with due regard for any change in use that may occur at some future time. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty With the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the Curecanti, Echo Park, Flaming Gorge, Glen Canyon, Juniper, and Navajo initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 10. There are hereby authorized to be appropriated such sums as may be required to carry out the purposes of this Act.

SEC. 11. The appropriate agencies of the United States are authorized to convey to the city and county of Denver, Colorado, for use as a part of its municipally owned water system, such interests in lands and water rights used or acquired by the United States solely for the generation of power and other property of the United States as shall be required in connection with the development or use of its Blue River project, upon payment by Denver for any such interest of the value thereof at the time of its acquisition by Denver, and provided that any such transfer shall be so limited as not to preclude the use of the property other than water rights for the necessary functions of the United States Government.

SEC. 12. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits. No agency or official of the United States shall seek or accept a right to impound or use water for the generation of power or energy, created or established by the building, operation or use of any of the powerplants authorized by this Act.

SEC. 13. As used in this Act—

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "upper basin",

and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "upper basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785); and

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

Mr. ASPINALL. The Committee on Interior and Insular Affairs, during the 83d Congress, spent a total of 24 days considering this legislation. The Irrigation and Reclamation Subcommittee spent a total of 41 hours over a 10-day period in public hearings. The subcommittee spent an additional 16 hours over a 12-day period in executive session in amending and reporting a bill. The full committee spent 5 hours in 2 days on the legislation. Most of the members of this committee are familiar with it. The committee does not feel justified in going back into all the details of this development. Only new evidence, for the most part, should be submitted. It is the hope of the Chair to limit the hearings to 8 days, tentatively divided to give the Department 2 days to make a technical presentation, the proponents of the legislation 3 days, and those in opposition 3 days.

The five bills before the committee are all different with respect to plan. From 4 to 6 storage units are included for authorization and from 13 to 33 participating projects are included. The administration recommends 2 storage units and 11 participating projects for immediate authorization. For those participating projects where the planning has not advanced to the point where feasibility-type reports have been transmitted to the Congress, there is expected to be language in the bill providing for later congressional approval. Therefore, this committee will sometime in the future in another Congress consider these projects for authorization of construction. This being so, it is the Chair's position, approved by the chairman of the full committee, that this committee should not go into the engineering and economic details of these units but be advised only on the status of the planning with a few pertinent facts on the units themselves.

Now, with respect to the procedure to be followed by the committee, I would like to quote from the Legislative Reorganization Act of 1946, section 133, subsection (e), which reads as follows:

Each such standing committee shall, so far as practicable, require all witnesses appearing before it to file in advance written statements of their proposed testimony, and to limit their oral presentations to brief summaries of their argument.

With the approval of the chairman, this is the procedure which the committee desires to follow. I will ask that statements of the wit-

nesses, in 35 copies, be delivered to the staff prior to the beginning of the hearing on the date that the witness is scheduled to appear. It is expected that those witnesses who have detailed statements supporting their argument, which will require more than a few minutes to present, will limit their oral presentation to a brief summary of their argument. Each member of the committee will have a copy of the detailed statement.

We have scheduled today the Department witnesses and I believe Assistant Secretary Aandahl, Commissioner Dexheimer and Mr. Larson, Regional Director of the Bureau, are present. I understand Assistant Secretary Aandahl has a brief statement. I would hope that the members will not question Mr. Aandahl with respect to the engineering and economic details of the development but only with respect to broad, departmental policy. After Mr. Aandahl has made his brief statement, I would like for Commissioner Dexheimer and Regional Director Larson to come up together and such others of the staff as he wishes to have with him. I understand Commissioner Dexheimer has a brief statement and that Regional Director Larson will go into the details of the project. After Mr. Dexheimer makes his statement, I would appreciate it if the members will withhold questions so that he and Mr. Larson may be questioned together. I hope that Mr. Larson can summarize his statement. In order that we may keep straight on the development which is recommended for immediate authorization and construction by the administration, I am going to ask Mr. Larson in his statement to speak first only on the plan and on the units which the administration has recommended and at that time submit himself to questioning on that plan. After this procedure is completed, Mr. Larson could then describe the other units and projects in the plan, give us the status of the planning on these units and a few of the pertinent facts.

Mr. ENGLE. Mr. Chairman?

Mr. ASPINALL. Mr. Engle of California is recognized.

Mr. ENGLE. I would like to ask unanimous consent that the procedural arrangement stated by the Chair be approved and accepted and made the order of the committee.

Mr. SAYLOR. I object.

Mr. HOSMER. I object.

Mr. ENGLE. I so move, and desire to be heard briefly in support of the motion.

Mr. SAYLOR. Point of order.

Mr. ASPINALL. The gentleman from Pennsylvania makes a point of order. What is your point of order?

Mr. SAYLOR. I make the point of order there is no quorum present.

Mr. ASPINALL. The gentleman is sustained in his point of order. The Chair will ask that the staff members phone to the other members of the committee and ask them if they are going to present themselves.

(There was a short recess.)

Mr. ASPINALL. The committee will be in order. The Chair recognizes the gentleman from Pennsylvania.

Mr. SAYLOR. My understanding is that the gentleman from California will withdraw his motion and I will withdraw my point of order.

Mr. ASPINALL. The Chair wants to know if the gentleman from Pennsylvania will withdraw his point of order for the time being.

Mr. SAYLOR. For the time being, Mr. Chairman.

Mr. ENGLE. I ask unanimous consent to withdraw my motion.

Mr. ASPINALL. Are there any objections to the withdrawal of the motion by the gentleman from California?

Hearing none, it is so ordered.

The Chair would ask the committee at this time for unanimous consent for those sponsoring the different bills to be permitted to file a statement for the record at this place in the hearings. Are there any objections?

Mr. SAYLOR. By that, do you mean the sponsors or the proponents of this legislation, namely——

Mr. ASPINALL. I mean the sponsors.

Mr. SAYLOR. That is Mr. Dawson, Mr. Fernandez, yourself and Mr. Rogers of Colorado?

Mr. ASPINALL. That is right.

Mr. SAYLOR. No objection.

Mr. ASPINALL. Hearing no objection, it is so ordered.

At this time, the Chair would ask unanimous consent that any Member of Congress who wishes to file a statement to be placed in the record be permitted to do so on this legislation. Is there any objection?

Hearing none, it is so ordered.

Is there any objection to having the memorandum prepared by the committee staff filed at this point in the record, explaining the legislation before the committee?

Mr. HOSMER. I object, Mr. Chairman.

Mr. ASPINALL. Hearing the objection, it is sustained.

We have a report from the Department under date of March 8, 1955, explaining the Department's position on the legislation and with an explanation of the differences in the various bills before the committee. Is there any objection to having the departmental report made a part of the record at this place in the hearings?

Hearing none, it is so ordered.

(The report referred to reads as follows:)

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington 25, D. C., March 8, 1955.

Hon. CLAIR ENGLE,
Chairman, Committee on Interior and Insular Affairs,
House of Representatives, Washington 25, D. C.

MY DEAR MR. ENGLE: A report has been requested from this Department on H. R. 3383, a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes. You have also requested that we comment on H. R. 270, H. R. 2836, and H. R. 3384 to the extent to which they differ from H. R. 3383.

In his address to the Congress on the state of the Union, President Eisenhower said (H. Doc. No. 1, 84th Cong., p. 8):

"* * * the Federal Government must shoulder its * * * partnership obligations by undertaking projects of such complexity and size that their success requires Federal development. In keeping with this principle I again urge the Congress to approve the development of the upper Colorado River Basin to conserve and assure better use of precious water essential to the future of the West."

Likewise in his budget message (H. Doc. No. 16, 84th Cong., p. M65) the President said:

"I also recommend enactment of legislation authorizing the Bureau of Reclamation to undertake construction of two comprehensive river-basin improvements which are beyond the capacity of local initiative, public or private, but which are needed for irrigation, power, flood control, and municipal and industrial

water supply. These are the upper Colorado River Basin development in the States of Colorado, Utah, Wyoming, Arizona, and New Mexico, and the Fryingpan-Arkansas development in Colorado. The Colorado River development will enable the upper basin states to conserve floodwaters and to assure the availability of water and power necessary for the economic growth of the region. * * * Sale of power generated at these developments will repay the power investment within 50 years and will make a contribution toward repayment of other investments."

In the budget itself it was pointed out (p. 830) that the administration proposes to initiate construction of the Colorado River storage project during the next fiscal year if it is authorized and that the budget includes an item for funds to be requested for this purpose.

The substance of our views on the proper contents of a bill to implement the President's recommendation and particularly on those projects and units which should be covered in the initial legislation is contained in the draft of bill which was developed by the Bureau of the Budget in collaboration with this Department and submitted to your committee on April 1, 1954, in connection with H. R. 4449, 83d Congress, a predecessor of the present H. R. 3383.

We recommend that H. R. 3383 be examined in the light of the proposal there made in the light of the two letters dated March 18, 1954, from the Director of the Bureau of the Budget to the Senate Committee on Interior and Insular Affairs and to this Department which are reprinted in Senate Report No. 1983, 83d Congress, and that, with suitable amendments, H. R. 3383 be enacted.

The Bureau of the Budget has advised that there would be no objection to the submission of the above report to your committee. That office, however, has not yet had an opportunity to consider the attached comparative analysis of H. R. 3383, H. R. 270, H. R. 2836, and H. R. 3384. The comments made therein must not, for this reason, be regarded as representing any commitment with respect to their conformity to the program of the President.

Sincerely yours,

FRED G. AANDAHL,
Assistant Secretary of the Interior.

COMPARATIVE ANALYSIS OF H. R. 3383, H. R. 270, H. R. 2836, AND H. R. 3384, 84TH CONGRESS

Storage project units named

H. R. 3383: Curecanti, Echo Park, Flaming Gorge, Glen Canyon.

H. R. 270: Adds Cross Mountain and Navaho to above.

H. R. 2836: Same as H. R. 270.

H. R. 3384: Adds Juniper and Navaho to those covered in H. R. 3383.

Comment.—The Department of the Interior recommends that only Glen Canyon and Echo Park be authorized as storage units at this time.

Participating projects named

H. R. 3383: Central Utah (initial phase), Emery County, Florida, Hammond, La Barge, Lyman, Paonia (new works), Pine River extension, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navaho.

H. R. 270: Adds Gooseberry to above.

H. R. 2836: Same as H. R. 270.

H. R. 3384: Adds Gooseberry, Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery Pot Hook, Dolores, Fruitgrowers extension, Elkhorn, Kendall to those named in H. R. 3383.

Comment.—Department of the Interior recommends that the projects covered be limited to the 11 listed in the administration bill submited to the committee on April 1, 1954, viz, central Utah (initial phase), Emery County, Florida, Hammond, La Barge, Lyman, Paonia (new works), Pine River extension, Seedskadee, Silt, and Smith Fork.

Extent of authorization

H. R. 3383: Echo Park, Glen Canyon, and Flaming Gorge fully authorized; Curecanti subject to certification, on basis of further engineering and economic investigations, that its benefits will exceed its costs. All participating projects except San Juan-Chama and Navaho fully authorized; San Juan-Chama and Navaho subject to submission of coordinated reports to States under Flood Control Act of 1944 and to approval of and authorization by the Congress.

H. R. 270: Same as H. R. 3383 for storage units. All participating projects subject to reexamination by Secretary of the Interior with respect to their economic justification and to certification by him that their benefits will exceed their costs and that they meet reimbursement requirements of bill. Estimates of direct agricultural benefits to be made after consultation with Secretary of Agriculture. Provisions with respect to San Juan-Chama and Navaho substantially same as in H. R. 3383.

H. R. 2836: Virtually identical with H. R. 270.

H. R. 3384: Same as H. R. 3383 for storage units. Virtually the same as H. R. 270 for participating projects named in that bill but with respect to the other participating projects not named therein requires submission of planning reports to States under Flood Control Act of 1944 and authorization by Congress.

Comment.—The administration bill submitted to the committee on April 1, 1954, provided that authority to construct the participating projects named in it should not become effective until the Secretary of the Interior had reexamined their economic justification (his appraisal of the direct agricultural benefits to be made in cooperation with the Secretary of Agriculture) and had certified to the Congress that their benefits exceeded their costs. We adhere to the principles of the bill and, as has been said before, to the list of projects named therein. As among the four bills now before the committee, we prefer the provisions of H. R. 270, H. R. 2836, and H. R. 3384 with respect to actions to be taken prior to construction of participating projects to those of H. R. 3383 on this point.

Repayment

H. R. 3383: Irrigation allocations to be returned to Treasury in equal annual installments over a period of not more than 50 years (exclusive of development period) from completion of each unit, participating project, or separable feature thereof. Municipal water allocation to be returned to Treasury with interest over a period of not more than 50 years from completion of each unit, participating project, or separable feature thereof. Commercial power allocation to be returned to Treasury with interest over expected economic life of unit, participating project, or separable feature or within 100 years, whichever is shorter.

H. R. 270: Irrigation, municipal water, and commercial power allocations—the latter 2 with interest—to be returned to the Treasury within not more than 50 years plus, in the case of irrigation, a development period.

H. R. 2836: Same as H. R. 270.

H. R. 3384: Same as H. R. 270.

Comment.—The provisions of H. R. 270, H. R. 2836, and H. R. 3384 are, in this respect, like those of the administration bill of April 1, 1954. We adhere to these provisions and recommend that they be substituted for those of H. R. 3383.

Operation of powerplants

H. R. 3383: After providing for operation of the powerplants covered by the bill in conjunction with other Federal power facilities, the bill provides that no exercise of that authority "shall affect or interfere with the operation of any provision of the Colorado River compact, the upper Colorado River Basin compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, or any contract lawfully entered into under said Acts without the consent of the other contracting parties."

H. R. 270: Same as H. R. 3383 but omits express reference to contracts.

H. R. 2836: Same as H. R. 270.

H. R. 3384: Same as H. R. 270.

Comment.—The language of H. R. 3383 with respect to contracts appears to be superfluous but is otherwise unobjectionable.

Appropriability of water used for power purposes

H. R. 3383: Provides that "neither the impounding nor the use of water for the generation of power and energy at the plants of the Colorado River storage project shall preclude or impair the appropriation for domestic or agricultural purposes, pursuant to applicable State law, of waters apportioned to the States of the upper Colorado River Basin."

H. R. 270: Omits the above.

H. R. 2836: Has provision similar to that of H. R. 270, but extends to all powerplants authorized by bill.

H. R. 3384: Same as H. R. 2836.

Comment.—The provisions of H. R. 3383 are in this respect identical with those of the administration bill and are recommended for inclusion in the legis-

lation. Unless a great deal of excess storage capacity beyond that provided by Glen Canyon and Echo Park is authorized and constructed, the waters impounded in these reservoirs will, within a comparatively few years, be devoted almost entirely to fulfilling the obligations of the upper division States with respect to deliveries at Lee Ferry for lower basin and Mexican Treaty purposes. The generation of power will be a byproduct of release for these purposes. Payout studies have been based upon the assumption that the upper basin depletion of the stream contemplated by this provision will occur in any event.

Soil survey and land classification exemption

H. R. 3383: Exemption applicable to four storage project units covered in bill.

H. R. 270: Exemption applicable to five storage project units covered in bill; not applicable to Curecanti.

H. R. 2836: Same as H. R. 270.

H. R. 3384: Exemption applicable to four storage project units covered in bill; not applicable to Curecanti, Juniper, and Navaho.

Comment.—It is believed that the exemption should be commensurate with whatever storage project units are ultimately covered by the bill.

Authorized appropriations

H. R. 3383: Limits authorized appropriations to $1,055 million.

H. R. 270: Omits limitation.

H. R. 2836: Omits limitation.

H. R. 3384: Omits limitation.

Comment.—The Department of the Interior would have no objection in this case to specifying the amount authorized to be appropriated. If such a limitation is spelled out in the bill, as it is in H. R. 3383, the text should make clear, as that of H. R. 3383 does not, that the sum specified is for construction costs only and is not inclusive of initial operation and maintenance costs.

Future planning

H. R. 3383: Section 12 of this bill provides that "in planning the additional development necessary to the full consumptive use in the upper basin of the waters of the Colorado River system allocated to the upper basin and in planning the use of and in using credits from net power revenues available for the purpose of assisting in the payout of costs of participating projects herein and hereafter authorized in the States of Colorado, New Mexico, Utah, and Wyoming, the Secretary shall have regard for the achievement within each of such States of the fullest practicable consumptive use of the waters of the upper Colorado River system consistent with the apportionment thereof among such States."

H. R. 270: Omits above.

H. R. 2836: Omits above.

H. R. 3384: Omits above.

Comment.—The Interior Department has no objection to the inclusion of the provision of H. R. 3383 quoted above. It would, in any event, seek to achieve the end specified. If this provision is included, however, it suggests that Arizona be added to the other States named in the bill since it is an upper basin State and is apportioned a small quantity of upper basin water by the upper Colorado River Basin compact.

Litigation and consultation

H. R. 3383: Provides that the Secretary of the Interior shall, in the storage and release of water from reservoirs under his jurisdiction anywhere in the Colorado River Basin, "comply with the applicable provisions of the Colorado River compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the treaty with the United Mexican States." Provides further that, in the event of his failure so to comply "any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section" and gives the consent of the United States to its joinder as a party in any such suit.

H. R. 270: Directs compliance with the applicable provisions of the documents referred to above in the operation and maintenance of all Federal facilities in the Colorado River Basin under his jurisdiction. Provides further for consultation with an "integrating committee consisting of 1 representative from each of the Colorado River Basin States, 1 representative of the Colorado River Board of California, 1 representative of the Upper Colorado River Commission, and 1 representative of the United States section of the International Boundary Com-

mission, United States and Mexico" on the storage and release of waters from works under his jurisdiction.

H. R. 2836: Similar to H. R. 270.

H. R. 3384: Includes provisions similar both to those in H. R. 3383 and to those in H. R. 270.

Comment.—(*a*) Unless extraordinary circumstances so require, it would seem unwise to single out the Colorado River for special treatment with respect to litigation. Moreover, assuming that the Secretary will be directed (as all of the bills provide in various places) to comply with the Colorado River compact and related documents, there is no apparent reason for the waiver of the immunity of the United States from suit in the Supreme Court. There is ample in the other parts of the bills, we believe, on which to found an action against the Secretary alone in case he exceeds the authority given him under their terms. But if it is the desire of the committee to include such a provision as that contained in H. R. 3383 and H. R. 3384 on this subject and if it is restricted (as those bills now provide) to litigation with respect to the storage and release of water, we will not object. We suggest, however, that it be made clear that the waiver runs only in favor of a State adversely affected by the storage and release spoken of in order to forestall the provisions being looked upon as an open invitation to anyone to institute harassing, even though fruitless, litigation at any time it chooses to do so. We suggest also that the committee bear in mind that this provision, if enacted, will necessarily be read in conjunction with section 208 (c) of the Justice Department Appropriation Act, 1953 (66 Stat. 549, 560, 43 U. S. C., sec. 666) and that it is unlikely, therefore, that it will be usable except in quite extraordinary circumstances.

(*b*) We would have no objection, if the committee wishes to include such in the bill that it reports out, to a provision for an "integrating committee" along the lines of that set out in H. R. 270 and H. R. 3384. Its creation would not be in derogation of the ultimate responsibility of the Secretary of the Interior in the management of the works covered by it, but it could assist him in securing the advice of representatives of the States concerned and would furnish them with a forum in which to discuss and, it is to be hoped, iron out certain, and perhaps many, of their problems. The creation of such a committee might well assist its members in taking an overall view of the Colorado River and in treating its problems as of basinwide importance. It would also be a useful supplement to, and would perhaps supplant, the advisory provisions of section 16 of the Boulder Canyon Project Act. One of the objects of these provisions was to further "any comprehensive plan formulated hereafter for the control, improvement, and utilization of the resources of the Colorado River system" and to assure treatment of the works authorized by that Act "as a unit in such control, improvement, and utilization * * *." We have no suggestions to make on the composition of the "integrating" committee.

Quality of water studies

H. R. 3383: Direct the Secretary "to institute studies and to make a report to the Congress and to the States of the Colorado River Basin of the effect upon the quality of water of the Colorado River, of all transmountain diversion, of water of the Colorado River system and of all other storage and reclamation projects in the Colorado River Basin."

H. R. 270: Omits the above.

H. R. 2836: Omits the above.

H. R. 3384: Omits the above.

Comment.—No objection if the committee sees fit to include a provision along the lines of that included in H. R. 3383.

Denver diversions

H. R. 3383: Omits.

H. R. 270: Authorizes conveyance to the city of Denver of such lands and water rights used or acquired by the United States solely for the generation of power as may be required by Denver in connection with the development and use of its Blue River project, payment for the value of the rights acquired to be made by Denver to the United States.

H. R. 2836: Same as H. R. 270.

H. R. 3384: Omits.

Comment.—The terms of the provision in H. R. 270 are such as not to require objection from this Department. It should be understood, however, that maintenance of the integrity of the Colorado-Big Thompson project, including fulfill-

ment of its obligations to western slope water users in Colorado under Senate Document No. 80, 75th Congress, whatever those obligations may be, will be ultimately involved in the administration of this provision and that, for this reason, among others, no commitment can be made at this time concerning the exercise of the authority which its enactment would confer upon this Department.

Mr. ASPINALL. At this time, the Chair calls to the witness stand a former member of this commitee, Hon. Fred G. Aandahl, Assistant Secretary of the Interior, who will make a statement for the administration. Mr. Aandahl, we are glad to have you before the committee.

STATEMENT OF FRED G. AANDAHL, ASSISTANT SECRETARY OF THE INTERIOR

Mr. AANDAHL. Mr. Chairman, we appreciate the privilege of appearing before your committee.

I have a very brief statement I would like to read, indicating the support of the executive branch of the Government for the legislation that is now before the committee.

On January 18, 1954, representatives from the Department of the Interior were before a previous session of this committee to explain in detail the Department's recommendations concerning the proposal and the legislation for the Colorado River storage project and participating projects. Our purpose here today is to reiterate those recommendations which remain essentially unchanged.

I will not attempt to restate our recommendations and will leave the details to those who will follow me. However, I wish to bring to your attention some recent items which I believe are important in your consideration of the legislative bills before you.

The proposed development of the upper Colorado River Basin received the personal attention of President Eisenhower during his visit last fall in the West. The need for and the great benefits to be derived from this development so impressed the President that he included in his address to the Congress on the state of the Union the following:

> * * * the Federal Government must shoulder its * * * partnership obligation by undertaking projects of such complexity and size that their success requires Federal development. In keeping with this principle, I again urge the Congress to approve the development of the upper Colorado River Basin to conserve and assure better use of precious water essential to the future of the West.

Likewise in his budget message the President said:

> I also recommend enactment of legislation authorizing the Bureau of Reclamation to undertake construction of two comprehensive river-basin improvements which are beyond the capacity of local initiative, public or private, but which are needed for irrigation, power, flood control, and municipal and industrial water supply. These are the upper Colorado River Basin development in the States of Colorado, Utah, Wyoming, Arizona, and New Mexico, and the Fryingpan-Arkansas development in Colorado. The Colorado River development will enable the upper basin States to conserve floodwaters and to assure the availability of water and power necessary for the economic growth of the region. * * * Sale of power generated at these developments will repay the power investment within 50 years and will make a contribution toward repayment of other investments.

The Administration proposes to initiate construction of the Colorado River storage project during the next fiscal year if it is author-

COLORADO RIVER STORAGE PROJECT

1498-5

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

EIGHTY-FOURTH CONGRESS

FIRST SESSION

ON

H. R. 270, H. R. 2836, H. R. 3383, H. R. 3384, and H. R. 4488

TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

PART 2

MARCH 11, 14, 16, 17, 18, 19, AND 28, 1955

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COLORADO RIVER STORAGE PROJECT

WEDNESDAY, MARCH 16, 1955

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to recess, at 9:30 a. m., in the committee room, New House Office Building, Hon. Wayne N. Aspinall (chairman) presiding.

Mr. ASPINALL. The Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs will now be in session for the further consideration of legislation having to do with the upper Colorado River program.

When we adjourned our hearings last Monday afternoon, we had before the committee at that time for questioning Charles J. Fain, representing the REA. Is he present this morning? Is anybody here for the REA?

(No response.)

Mr. ASPINALL. Mr. David Moffat of the Utah Power & Light Co.; Mr. L. R. Patterson, of Public Service Co. of Colorado. Will you two gentlemen be seated before the witness table and we will hope that Mr. Fain makes his appearance in the next few minutes, in accordance with our request. Here he comes.

The time from now until 10 o'clock has been set aside for questioning the witnesses now before the committee. The Chair recognizes the gentleman from Pennsylvania, Mr. Saylor.

QUESTION PERIOD OF CHARLES J. FAIN, DAVID MOFFAT, AND L. R. PATTERSON

Mr. SAYLOR. Thank you, Mr. Chairman. The first series of questions I have I will direct to Mr. Fain since he was the first witness.

Mr. Fain, do I gather from your statement that your organization is in favor of construction of parallel transmission lines throughout this entire area?

Mr. FAIN. I would not say that we would be in favor of parallel transmission lines, especially if those transmission lines were of the same size. When we talk about parallel transmission lines there are different size transmission lines to carry different loads that must be taken into consideration. And if the lines were of a comparable size, Congressman Saylor, and if proper agreement could be arranged so that the energy could be carried over the lines that are already existing, then I would say that certainly in that case we would not be in favor of duplicating those lines if such duplication meant a greater

Considerable doubt has been expressed by people of other areas as to the feasibility of applying water to the lands of such high altitudes where the growing season is so short.

To begin with, I wish to point out that we have many very productive meadows at altitudes up to 8,500 feet in both Wyoming and Colorado. Our proposed projects are all at altitudes below 6,500 feet.

In Wyoming we are in an extremely favorable position to prove our productivity. We did not just jump into this reclamation scheme without first checking up on our capabilities. 'Way back in the 1920's the first phase of the Eden project was created encompassing 9,000 acres right out in the middle of the Little Red Desert at an altitude of from 6,600 to 6,700 feet.

This tract of worthless desert land has developed into a very prosperous community. Most of the land is owned by the original settlers or their families. They are prosperous and happy. Their children and their children's children are attending our State university where they will become even better equipped to reap benefits from the soil.

The main crops are alfalfa, barley, and oats; crops that have been sorely needed during our disastrous drought. We produce from 3 to 4 tons of alfalfa per acre in this area and produce oats and barley that will compare well with those from any of our Western States. We have produced some oats and barley on our ranch ever since it was first started and we have never had a crop failure caused by frost.

While our production per acre is favorable another measure even more important in the arid West that we should keep in mind is the production per acre-foot of water. At our high altitude where the growing season is short, our irrigation season is also short, evaporation is at a minimum and all of the water not actually consumed by the plants finds its way back to the streams of the basin where it can be used over and over again on its way to the ocean.

The authorization of the upper Colorado River storage project is essential to the development of this area, because without the storage that it will provide, we cannot even hope for an uninterrupted or dependable water supply. You cannot ask a man to settle on a project that does not have such a supply.

We hope that this committee and the Members of Congress will give favorable consideration to this project. Do not fear that the authorization of this project will add to our surplus problems. It will be many years before the participating projects are actually producing food for our rapidly growing Nation. By that time, in all probability we shall be dealing with shortages.

Mr. ASPINALL. The next witness appearing for Wyoming is Paul Rechard, chief of water development, Wyoming Natural Resource Board.

We are very glad to have you with us this morning.

STATEMENT OF PAUL RECHARD, CHIEF OF WATER DEVELOPMENT, WYOMING NATURAL RESOURCE BOARD

Mr. RECHARD. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, my name is Paul Rechard and I am chief of water development for the Wyoming Natural Resource Board. I am here to speak for the board in favor of the Colorado River storage project and participating projects.

Four participating projects mentioned in the various bills before this committee are in Wyoming. Besides these units, we also have some other projects which we hope will some day be constructed. One of these is the Elkhorn project in Sublette County of Wyoming. I understand that the Bureau of Reclamation has chosen to call it the Buckskin division of the Sublette project. This development would irrigate lands along the east side of the Green River from the town of Pinedale to the Big Sandy.

Wyoming would also like to have Kendall Reservoir included as part of the Seedskadee project or as an initial storage unit since it would be on the headwaters of the Green River.

If Wyoming and the other upper basin States are to be able to develop their potential lands, holdover storage is a necessity. None of the storage dams included in the proposed legislation are in Wyoming; even so, we are wholeheartedly in favor of constructing these large units, such as Glen Canyon and Echo Park, and in starting them now. It will take a number of years before these units are completed and even longer before water can be put on the lands for irrigation. The storage projects are a vital and necessary part of this proposed development at the present time. The statement has been made that 58 percent of the water allocated to the upper basin could be utilized without providing holdover storage. Gentlemen, this is purely a theoretical assumption and must be recognized as such.

With good conscience, no person could ask a rancher or farmer to settle on a project, work his heart out preparing the land, planting the seed, and constructing his home when water cannot be guaranteed for his lands. In fact, any person with the knowledge of this business would not attempt to settle on the land even if someone would have the nerve to ask him to.

We are going to live within the terms of the laws of the river which include the 1922 and 1948 compacts. By these instruments we were given the opportunity to develop our water resources to the fullest practicable extent, providing the flow of the Colorado River at Lee Ferry were not depleted below 75 million acre-feet in any continuing 10-year period. The only way we can do this is to have large holdover storage reservoirs in the upper basin which will be filled in years of plentiful supply. The water would then be released in drought periods to the lower basin to satisfy our commitment as mentioned above.

If we proceed on the theory, and let me emphasize that it must only be theory, that the upper basin could develop 58 percent of the water allocated to us without the storage reservoirs, we find that the development of the remaining 42 percent could only be done with greatest difficulty. At the present time we are only utilizing about 33 percent of our water. Right now California is objecting to our stopping some of the water in Echo and Glen Canyon Reservoirs. I cannot believe that they would feel any more kindly 25 years from now when the additional 25 percent has been developed. During the interim more sediment would have been deposited behind Hoover Dam and then during a filling period power generation would be curtailed. But most important a delay would almost preclude the States of Colorado, New Mexico, Utah, and Wyoming from ever being able to use the water to which we are entitled. I believe that this committee of rea-

sonable persons would not want us to violate the law of the river, but neither would they want California to violate not only the law of the river but their solemn word as given to the upper division States during the negotiations of the 1922 compact.

I cannot believe that the people of California are no longer interested in western reclamation which has been such a great factor in the building of our country, nor can I believe that they are selfish to the extent that they are only interested in reclamation for themselves. Rather, I feel the true sentiment was expressed earlier in these hearings by the Congressman from California when to protect this great reclamation program he voiced vigorous disapproval of those who sponsor vicious and untruthful propaganda that tends not only to discourage this project but all western reclamation.

Not only are the storage projects needed now, but they will be needed from now on. Actually the storage in these reservoirs is as valuable below irrigation as above. The water will be used for irrigation upstream just as surely as we know money that is deposited in a bank account and withdrawn by check is used; the actual paper or water is different but the effect is the same.

We in the upper basin are ready and most anxious to proceed with this development—all we need is the opportunity as afforded by the legislation now before you.

Mr. ASPINALL. Thank you very much, Mr. Rechard.

Mr. RECHARD. Mr. Chairman, I would also like to introduce into the record two letters which have been sent to me by residents of the area explaining the need for water in their particular area.

Mr. ASPINALL. Will you show the Chair the letters, please?

(The documents were handed to the chairman.)

Mr. ASPINALL. Members of the committee, the request of Mr. Rechard is for introduction of a letter by Mr. Micheli, of Fort Bridger, Wyo., and Mr. Gradert, of Fort Bridger, Wyo.

As I understand, Mr. Rechard, these are in support of the upper Colorado River project?

Mr. RECHARD. Yes, sir.

Mr. ASPINALL. Is there any objection?

Hearing none, it is so ordered.

(The letters referred to follow:)

MICHELI HEREFORD RANCH,
Fort Bridger, Wyo., February 14, 1955.

Mr. PAUL A. RECHARD,
Natural Resource Board,
Cheyenne, Wyo.

DEAR SIR: This letter is in regard to some information on the effects of the 1954 drought in this area, which will long be remembered by the ranchers and farmers of this section as a disaster year.

I will confine my remarks only to the Black and Smith Fork area, but I am sure that similar conditions prevailed in other parts of the Green River Basin.

This valley comprises approximately 50,000 acres of land that has some degree of irrigation water at the present time. However, few indeed are the years that this acreage can properly be irrigated. Of the 50,000 acres, about half is in hay meadows, a little acreage in small grains, and the rest in pasture. In an average year, the meadows will yield approximately 1 ton to the acre or about 25,000 tons. I am sure that in the drought year of 1954 the yield was less than 8,000 tons, the grain reduced in the same proportion; plus the fact that the carrying capacity of the pasture was less than one-third of normal.

In the event of water development in this valley, it could be very feasible to increase the total irrigated acreage to 100,000 acres with the additional land as good or better than what is now irrigated.

I hope this gives you some idea of the great need for water development in this area and that the information given will be of some help.

Yours truly,

JOSEPH MICHELI.

FORT BRIDGER, WYO., *February 12, 1955.*

NATURAL RESOURCE BOARD,
Cheyenne, Wyo.

(Attention of Mr. Paul A. Rechard, chief of water development)

GENTLEMEN: In support of water storage development in the Green River system basin in Wyoming, I wish to state that by virtue of being superintendent of Water Division No. 4 of the State of Wyoming, and it being the foremost of my duties to supervise the distribution of waters for irrigation and other uses, I naturally come into closer contact than perhaps any other person with the water user or irrigator himself and do, therefore, know of the difficulties experienced by the water users in the Green River system.

The season of 1953 was what must be considered a season of inadequate water supply owing to the below normal snowfall during the winter of 1952–53 and insufficient rainfall during the irrigation season of 1953, and while considerable shortage of crops in some localities was brought to my attention, the damage was not extensive, but shortage of water supply had a tendency to lay the foundation through drying out the lands and the consequent lowering of the natural water table for the disastrous insufficiency of water supply during the drought of the 1954 season.

Again, the snowfall during the winter of 1953–54 was far below normal and with the exception of a little of the upper portion of the Green River Basin, in Wyoming, little, if any, rainfall occurred, and in consequence many of our water users along the tributaries of said Green River raised much below average crops of forage, many ranchers in Uinta County, Wyo., having harvested no crops of hay and but scant pasturage and, therefore, have been forced to dispose of half-fat livestock at competitive prices in order to save their stock from starvation during this winter of 1954–55.

My heart indeed goes out to those unfortunate ones who, after years of toil and privations having built up what they considered a livelihood for their later years, and through no fault of theirs, were forced to thus sacrifice.

When one has experienced such a disaster, it certainly brings to attention the fact that water storage should be brought about in accordance with the plan set up under the Colorado River compacts, wherein it was intended to construct storage reservoirs in the Colorado River Basin, including Green River Basin, had we people in the counties of Uinta, Sweetwater, and the southern portion of Sublette County had access to stored water that could have been stored in standby reservoirs during past flood stages, such catastrophies could have been avoided on farms and ranches now in existence and many thousands of new acres yet undeveloped could have been brought under cultivation and thus affording homes and livelihoods for many now looking for help through welfare or kindred setups and bringing about more payments in taxes from well-tilled lands now only capable of supporting 1 sheep on 7 or 8 acres and 1 cow on 25 to 30 acres.

We cannot but know that water in these semiarid regions of the United States is the lifeblood of the land and its people and such lifeblood should not be allowed to flow uselessly into the Gulf of Mexico, and I, therefore, urge that all interested in building and developing our western lands get behind the movement to get approved the Colorado River project as first intended.

Yours most respectfully,

EMIL C. GRADERT,
Superintendent of Water Division No. 4.

Mr. ASPINALL. The Chair would advise the committee, at the time Mr. Person appeared before the committee there was also given to each member of the committee a six-page statement, with attached map, on the subject of utilizing Colorado River water which originates above Lee Ferry. It is the wish of the Wyoming group that the questioning of the witnesses whose statements have already been made be undertaken at this time and Mr. Person be allowed to make

his other presentation upon the conclusion of the questioning of the witnesses now before us.

Is there any objection?

Hearing none, it is so ordered.

I have one question, Dean Person. In your statement you spoke of three participating projects—LaBarge, Lyman, and Seedskadee. You do not mean to overlook the Eden, which is already authorized and being constructed and will receive a part of its construction costs from the proposed project now beforethe committee?

Mr. PERSON. That is right. The Eden project is a participating project from the standpoint of its participating in power revenues.

Mr. ASPINALL. The Chair recognizes the gentleman from North Carolina, Mr. Shuford.

Mr. SHUFORD. No questions.

Mr. ASPINALL. The gentleman from Utah, Mr. Dawson.

Mr. DAWSON. I will be glad to yield my time to the gentleman from Wyoming, Mr. Thomson.

Mr. THOMSON. It it would please the Chair, I would like to ask just a couple of questions.

Mr. ASPINALL. Certainly.

Mr. THOMSON. In the first place, I would like to ask of Mr. Budd, you mentioned in your statement that the principal crops to be raised are alfalfa, oats, and some barley. That is the essence of it, is it not?

Mr. BUDD. That is correct.

Mr. THOMSON. And these will not go into surplus. Are these products needed in this area at the present time for use within the area as seed there?

Mr. BUDD. They are definitely needed. As I imagine most of the members of the committee are informed, we are having quite a disastrous drought in the State of Wyoming, and we need these crops sorely at the present time and would have use for them continually.

Mr. THOMSON. In other words, we are not only trying to create something new here, but more than that, we are taking care of the needs to stabilize the economy of this area as it presently exists. Is that correct?

Mr. BUDD. That is correct.

Mr. THOMSON. Has that economy varied with the flow of the upper Colorado River, from your ranching activity and the ranching activity of your family here for many, many years?

Mr. BUDD. I think if you would check the record of the flow of the Colorado River, you would have a pretty good record as to how the bank accounts have fluctuated in our particular area.

Mr. THOMSON. Does that also refer to the purchasing power of your particular area and the income-tax returns from your particular area?

Mr. BUDD. That is definitely true. In years that we are short of water, we just do not raise feed for our livestock and naturally do not have money to spend for machinery and automobiles and other necessary equipment.

Mr. THOMSON. When this river hit its low spot in 1934, what were you doing?

Mr. BUDD. I was engaged in the ranching business, but in the fall of 1934 I acted as assistant appraiser on the drought relief buying program.

Mr. THOMSON. Do you know how many cattle, or approximately how many cattle, were purchased and shipped out of that area and slaughtered there because of the competitive conditions that existed?

Mr. BUDD. In our particular county, the Federal Government bought 14,000 head of cattle. We killed 1,400 head of them right out on the ranches.

In the State of Wyoming the Federal Government bought two-hundred-eighty-four-thousand-some-odd cattle, of which, as I recall, at least 10 percent were slaughtered. It amounted to over 25 percent of all the cattle in Wyoming that were purchased by the Federal Government to help us through that.

Mr. THOMSON. And about 10 percent of them were just slaughtered on the range there?

Mr. BUDD. That is right. They were in such condition that they could not even be shipped to market where the other cattle were put in pens.

Mr. THOMSON. How long did it take the area to recover from that shock and become a worthwhile cog in our economic setup in this country?

Mr. BUDD. A large majority of the ranchers just did not recover. They were forced to sell out. Everyone was fighting to retain their ranches for the rest of the thirties. In fact, the economy was definitely strained. I guess we might say that we were in all probability just saved by the war.

Mr. THOMSON. It was not until after World War II came along that the numbers of your cattle recovered from that 1934 drought?

Mr. BUDD. That is right; they held at practically the numbers we were left with.

Mr. THOMSON. And a lot of the ranchers were forced into bankruptcy?

Mr. BUDD. Yes; a great number.

Mr. THOMSON. Then the point is that we need this project to stabilize present existing economy just as a flood-control project stabilizes existing economy; is that correct?

Mr. BUDD. That is definitely true.

Mr. THOMSON. In the last year we spent five or six hundred thousand dollars of Federal money trying to overcome the hay situation out there. This area stands to be, and in good years is, a source of supply for hay for the entire area, the entire State?

Mr. BUDD. Yes; it has been and will be.

Mr. THOMSON. And will stabilize the activities of the entire grazing industry and ranching industry in the entire State?

Mr. BUDD. It will stabilize the entire economy.

Mr. THOMSON. You mentioned frost there. What is the effect of frost in this higher altitude? I think your ranch sits right along the top in about the coldest spot there.

Mr. BUDD. It is very peculiar. I know that people read of our extremely low temperatures and the frequent occurrence of frost in that particular area, and they just feel we should be unable to grow anything. Apparently in that high, dry area it takes a much lower temperature, as recorded by the thermometer, to create crop damage than it does in a lower altitude because, as I said in my statement, in all the years we have produced oats and barley on our ranch,

we have never lost a crop due to frost. We have lost some because of lack of water.

Mr. THOMSON. Dean Person, you have been a civil engineer for several years, have you not?

Mr. PERSON. Yes, sir.

Mr. THOMSON. And you have worked with the Bureau of Reclamation and cooperated in working with them on various projects?

Mr. PERSON. I have worked in cooperative work, working with the State of Wyoming.

Mr. THOMSON. Yes. You have cooperated with the Bureau. You are familiar with this Glen Canyon site, are you?

Mr. PERSON. Yes, sir.

Mr. THOMSON. Are you concerned at all, or do you have any concern with the safety of a 700-foot structure proposed by the Bureau of Reclamation to be built at Glen Canyon?

Mr. PERSON. I have enough confidence in the Bureau of Reclamation and their records in building dams that, if they say you can build a 700-foot dam, you can build it.

Mr. THOMSON. You are also familiar with the fact that this area is developing as far as atomic energy is concerned, very rapidly?

Mr. PERSON. Yes.

Mr. THOMSON. And I believe in and around Lander they are looking forward to a uranium mill—and in the DuBois area uranium has been discovered—and the Colorado Plateau. Are you familiar with the electrical requirement in order to develop that atomic energy to make it available

Mr. PERSON. I know they are very short of power at the present time. The whole area.

Mr. THOMSON. In the development of atomic energy or uranium, it does require a great deal of electricity, does it not?

Mr. PERSON. It does that.

Mr. THOMSON. And that has been one of the principal reasons for the growth of the country as a whole?

Mr. PERSON. That is right.

Mr. THOMSON. Senator Crippa, you were a United States Senator last year?

Mr. CRIPPA. Yes, sir.

Mr. THOMSON. Did you vote for the flood-control project that passed, almost a billion dollars?

Mr. CRIPPA. Yes, sir.

Mr. THOMSON. Did you try to compute the interest that would accumulate on that compounded for the next 100 or 200 or 500 years?

Mr. CRIPPA. I am afraid I could never do that.

Mr. THOMSON. Why was it you voted for something like that which meant absolutely nothing directly to the benefit of Wyoming?

Mr. CRIPPA. Mr. Congressman, I feel this way: When I was in the United States Senate I felt it was the duty of the Congress of the United States to take care of and do the things that the people themselves cannot do. If private industry can do them, I am willing to go along with private industry. But I find in flood control that is almost out of the hands of private enterprise. You are spending a great deal of money, that is true, but you are also saving lives, saving farms, everything else, where you have an abundance of water with no control over it. It is a much different issue than we have out in

Wyoming where we are now fighting to try to conserve what we have by building reclamation dams. That is one of the reasons I am fully convinced, if I had the opportunity to be in the United States Senate again today, I would vote for flood control and also insist upon reclamation for the West.

Mr. THOMSON. I think Senator Duff, of Pennsylvania, sat beside you as your colleague at that time.

Mr. CRIPPA. Yes.

Mr. THOMSON. And you told him that if it was good for another area of the country, it will be good for the country as a whole, and you would support it.

Mr. CRIPPA. I did; I told that to Senator Duff. As a matter of fact, I happened to be one of the few Senators in the United States Senate who had never been in Pennsylvania. I listened to Senator Duff. He told me it was a very good idea and thought it was needed. From what I have been able to read, where we have disasters I think it is the duty of the Congress to take care of those things, and I also felt he should go out and visit with us and see our problems where we have a shortage of what they have an overabundance and no control over.

Mr. THOMSON. Thank you. Thank you, Mr. Chairman.

Mr. SHUFORD (presiding). Mr. Dawson, do you have any further questions?

Mr. DAWSON. That is all I had, except, Mr. Chairman, to commend the witnesses for a fine presentation. I think it is a good picture of the situation in Wyoming.

I particularly want to commend Mr. Rechard for the fine statement he has made, particularly in reference to the 58 or 56 percent doctrine that has been enunciated here by some of the opponents of this project. I think that is a very clear statement of what the facts are.

Mr. ASPINALL (presiding). The Chair recognizes the gentleman from Arizona, Mr. Udall.

Mr. UDALL. I have no questions, Mr. Chairman.

Mr. ASPINALL. The gentleman from California, Mr. Hosmer.

Mr. HOSMER. No questions.

Mr. ASPINALL. The gentleman from California, Mr. Sisk.

Mr. SISK. Yes; I have one comment to make, Mr. Chairman.

With reference to Mr. Rechard's statement on page 3, as a Representative from California, I wish to commend him for the fact that he does not believe that certain statements that have been rather promiscuously tossed around do represent the views of the people of California. I want to assure him, as one Representative to the State of California, they do not.

I would like to say, we very strongly believe in reclamation. I happen to come from the central part of the great State of California, and we are certainly in need of further reclamation projects, and particularly in northern and central California we are desirous that they continue.

I would like to commend the gentlemen from Wyoming, from that great State, for the excellent presentation that they have made here this morning.

I, for one, am anxious to see that they, along with other States of the West, have an opportunity to develop and to use reclamation and irrigation for the development of that great area. I heartily disagree with some of the propaganda that has been presented by, what I feel

to be, a small group of rather perverse thinkers in our area. But I can assure you that the State of California is interested in being completely fair to the West and to the Nation as a whole.

So far as I am concerned, in my particular area we stand shoulder to shoulder with the development of the West.

Thank you, Mr. Chairman.

Mr. DAWSON. Will the gentleman yield?

Mr. HOSMER. Will the gentleman yield on that point?

Mr. ASPINALL. Does the gentleman yield?

Mr. SISK. I will yield to my colleague from California.

Mr. HOSMER. I think my colleague from California has made a very fair statement in expressing to this committee that the State of California does believe in reclamation and does believe in the upper Colorado River development.

Our only concern is that it be carried on in such manner as not to trample upon the water rights of the State of California, and so as not to withhold in the upper basin water which is reasonably necessary for us to carry on our existing uses in the lower basins.

The kernel of the nut in this whole controversy is whether or not this project will permit sufficient water to pass Lee Ferry to carry on these uses, and whether or not the project is so conceived and designed and is proposed to be constructed and operated in such a manner as to observe these rights of the lower basin acquired by appropriation, contract, and compact.

Mr. DAWSON. Will you yield to me there?

Mr. HOSMER. There is in the rivers of the Colorado system sufficient water to permit reasonable development in the upper basin and to permit reasonable uses in the lower basin. That amount of water is undoubtedly, to my mind, fixed and determinable. So at any time the proponents of the projects in the upper basin will admit that fact and come to the figure and agree to it, and keep it, we have no objection to the upper basin development. But we see before this committee a constant series of people coming in proposing some developments, and then some of the other witnesses in the upper basin come in and disagree with them, and they want other developments, and then we have other bills for additional developments in the upper basin, and as reasonable men we do not know where it will stop. But, as reasonable men, we know you can build those projects within the live-and-let-live doctrine, which for the first time I heard announced by an upper-basin proponent this morning, Senator Barrett, of Wyoming.

All we are trying to do is live and let live on that river, and any time the upper basin will decide and agree upon that doctrine, I doubt if they will have any opposition whatsoever from the lower basin.

I yield back.

Mr. SISK. I yield to the gentleman from Utah.

Mr. DAWSON. I want to commend the gentleman from California, Mr. Sisk, for a very fair statement, and I can assure him it is reassuring to those of us in the upper basin States who are only asking for our fair share of this water, to find such a fair attitude on the part of the Representative from California.

And to my friend on this side of the aisle, I simply want to remind him once again there is written in this bill in a number of places the provision that nothing shall be done in the development of these waters which will in any way violate the terms of the Colorado River com-

pact, which in itself is a guaranty that your rights are going to be protected.

Mr. HOSMER. Will you yield on that point?

Mr. DAWSON. Yes; I will be happy to yield.

Mr. ASPINALL. Gentlemen, the Chair wants to be fair. We would like to have a statement from Mr. Person, if possible. Of course, these arguments will come before the committee later on.

Will the gentleman yield to the gentleman from California?

Mr. SISK. Yes.

Mr. HOSMER. That is all right. I will yield back. I do not want to interrupt the progress of the hearings.

Mr. SISK. That is all.

Mr. ASPINALL. The Chair recognizes the gentleman from California, Mr. Utt.

Mr. UTT. I have nothing to say but to associate my feelings with those of my colleague, Mr. Sisk, in an effort to cooperate and still defend our own position.

Mr. ASPINALL. The gentleman from Oklahoma, Mr. Edmondson.

Mr. EDMONDSON. I also would like to commend my colleague from California, Mr. Sisk, for his very fine statement of the purposes and principles in the use of the Nation's water resources, and his emphasis on the need for teamwork among the States in developing the water resources of the entire West. I am sure the people of Oklahoma feel exactly as Mr. Sisk has expressed the sentiments of California to be—that reclamation is something that affects the welfare of the entire area, the entire West. I am sure that if that is the spirit in which we proceed we can accomplish a wonderful future for this Nation.

That is all.

Mr. ASPINALL. The Chair recognizes the gentleman from Texas, Mr. Rutherford.

Mr. RUTHERFORD. No questions.

Mr. ASPINALL. Thank you very much for your statements and your appearance, gentleman, and at this time we shall listen to the statement by Dean Person, a statement which has already been handed to us, on utilizing Colorado River water that originates above Lee Ferry.

You may proceed, Mr. Person.

STATEMENT OF H. T. PERSON, DEAN OF ENGINEERING, UNIVERSITY OF WYOMING, LARAMIE, WYO.—Resumed

Mr. PERSON. Virgin flow: Analysis of the streamflow records and the available data on uses of water in the upper Colorado River Basin indicates that the average annual flow of the Colorado River at Lee Ferry (the dividing point between the upper and lower basin) under virgin conditions would have been about 15½ million acre-feet during the 40-year 1914–53 period. Of this total average annual flow, 7½ million acre-feet are apportioned to the lower basin and 7½ million acre-feet to the upper basin by the 1922 Colorado River compact. Constructed and authorized projects in the upper Colorado River Basin will use consumptively about 2½ million acre-feet per year. This leaves 5 million acre-feet of consumptive use per year still to be realized in the upper basin States, before full development of the water resources is attained under the 1922 compact apportionment.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
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10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	**27**	**AV, AW, AX**
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
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Calendar No. 131

84TH CONGRESS, 1st Session | SENATE | REPORT No. 128

COLORADO RIVER STORAGE PROJECT

REPORT

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

UNITED STATES SENATE

TOGETHER WITH

SEPARATE AND MINORITY VIEWS

TO ACCOMPANY

S. 500

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS IN THE STATES OF ARIZONA, COLORADO, NEW MEXICO, UTAH, AND WYOMING

MARCH 30 (legislative day MARCH 10), 1955.—Ordered to be printed

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Calendar No. 131

84TH CONGRESS, 1st Session | SENATE | REPORT No. 128

COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

MARCH 30 (legislative day, MARCH 10), 1955.—Ordered to be printed

Mr. ANDERSON, from the Committee on Interior and Insular Affairs, submitted the following

REPORT

[To accompany S. 500]

The Senate Committee on Interior and Insular Affairs, to whom was referred the bill (S. 500) to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects in the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, having considered the same, report favorably thereon with amendments, and with the recommendation that the bill, as amended, do pass. Senate 500 was introduced by Mr. Anderson and sponsored by the following nine other Senators: Mr. Allott, Mr. Barrett, Mr. Bennett, Mr. Chavez, Mr. Goldwater, Mr. Hayden, Mr. Millikin, Mr. O'Mahoney, and Mr. Watkins.

Public hearings on S. 500 were held by the Committee on February 28, March 1, 2, 3, 4, and 5, 1955. Some 57 witnesses appeared, including Members of the Senate and House of Representatives, the Secretary of the Interior, the Governor of Colorado, and many officials from other interested States. Testimony and exhibits submitted to the committee during the hearings comprise 734 printed pages.

1. PURPOSE OF THE BILL

S. 500, as amended, has four principal purposes. First, it would authorize a series of holdover storage reservoirs, with hydropower plants and incidental works. Second, it would authorize a number of consumptive use irrigation projects. Third, it would recognize, with a view to laying a foundation for eventual further action by the Congress, certain units and projects in several stages of planning, but plans for which are not sufficiently advanced to warrant final and unconditional authorization. Finally, the bill recognizes that the works authorized constitute only an initial phase of a comprehensive develop-

ment of the water resources apportioned to the Upper Basin and that the specific authorizations in this bill are not intended to limit or preclude the consideration and authorization by Congress of other projects for the use of waters apportioned under the compacts as additional needs are indicated.

2. BACKGROUND

The Colorado River Compact of 1922 divides the Colorado River Basin into two parts, the Upper Basin, comprising those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming—

within which and from which waters naturally drain into the Colorado River system above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry (Colorado River Compact, art. II f)—

and the Lower Basin, comprising—

those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry (Colorado River Compact, art. II g).

Article III (a) of the compact apportions to each basin in perpetuity—

the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum * * *.

Article III (d) of the compact provides that the—

States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years * * *.

The Colorado River Compact and the Boulder Canyon Project Act (45 Stat. 1057) became effective in 1929 upon ratification of the compact by all States other than Arizona, the enactment of the California Limitation Act, and proclamation by the President.

The Upper Colorado River Basin Compact of 1948 apportions among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming the consumptive use of waters apportioned to the Upper Basin by the Colorado River Compact of 1922.

Lower Basin development has proceeded at a rapid pace with the construction of Hoover Dam and the Boulder Canyon project, Parker Dam, Davis Dam, and other works. Large populations in cities such as Los Angeles and San Diego, and extensive agricultural areas served by the Imperial Irrigation District, the Palo Verde District, and others create expanding uses of the waters of the Colorado River for domestic, industrial, and agricultural purposes.

Development in the Upper Basin States of the consumptive use of water awarded to that area by the original compact has been retarded while a comprehensive plan for the most efficient use of their waters has been in preparation, while the investigation and selection of the best dam sites has been under way, and while engineering and economic problems have been considered. The Upper Basin comprises an area of some 110,000 square miles. On its fringes lie such large centers of population as Albuquerque, Denver, and Salt Lake City and their environs, each of which has experienced rapid growth in

recent years; each of which anticipates additional significant growth, with ever more urgent need for water and power. In Wyoming, there are several counties in the southwestern part of the State also on the fringes of the basin, which are rich in natural resources. The Upper Basin proper has been primarily an agricultural area. Beginning with the Green River and its tributaries in Wyoming, it contains, however, important resources of uranium, vanadium, iron, and other metals, coal, oil, oil shale, and phosphates. It stands, the committee believes, on the verge of great industrial growth, with consequent increase in need for water for domestic, industrial, and agricultural purposes, as well as for power.

The Colorado River is an erratic stream. The periods of high flow do not coincide with the periods of greatest demand on its waters. If, therefore, any substantial uninterrupted uses of available water are to be made by the upper division States (Colorado, New Mexico, Utah, Wyoming), in addition to those small projects constructed prior to adoption of the compact, there must be provided a series of holdover storage reservoirs, which will assure compliance with article III (d) of the 1922 Compact and, at the same time, permit the Upper Basin States to achieve ultimate development of waters apportioned to them. As these waters are released, they will generate hydroelectric power, which can be used to advantage and for which there is a ready market throughout all the Colorado River Basin States. These reservoirs can at the same time provide recreational areas comparable to Lake Mead behind Hoover Dam.

3. DESCRIPTION OF THE BILL

The repayment provisions of the bill, following very closely recommendations made by the President, the Bureau of the Budget, and the Secretary of the Interior, are designed to achieve, so far as practicable, the concurrent return of expenditures for power and irrigation and municipal and industrial water supply purposes, insofar as expenditures therefor are made concurrently. The power and municipal and industrial water supply expenditures are returned with interest. All reimbursable costs are returnable within 50-year periods, and this is specifically required by section 4 of the bill as amended.

The committee considered whether litigation now pending in the Supreme Court of the United States between Arizona and California et al. raises any question affecting the advisability or propriety of the authorization at this time of the works herein recommended. The committee is convinced that nothing in such pending litigation warrants delay in authorization of the works proposed in the bill, and that such is the case even if Colorado, New Mexico, Utah, and Wyoming should be impleaded.

The works recommended by the Upper Colorado River Commission for the States of Colorado, New Mexico, Utah, and Wyoming are fully justified because they are designed only to make effective part of the perpetual apportionment of 7,500,000 acre-feet annually made to the Upper Basin in the Colorado River Compact, and partake of the character of works heretofore authorized under the Federal reclamation program. The committee concludes that the authorization of this plan of development, being plainly within the Upper Basin apportionment, cannot and should not be construed as detri-

mental in any respect to the rightful interests of Arizona, California, or Nevada, as lower basin States, whether as litigants or otherwise. However, the committee calls attention to section 12 of the bill which makes it possible for any Colorado River Basin State to institute litigation promptly in the Supreme Court of the United States, in the event questions arise regarding the legality of the operation of any works herein authorized or of any other works on the river. Possible frustration of efforts effectively to litigate such questions is avoided by waiver of the immunity of the United States from such a suit. Thus, all States of the Colorado River Basin are fully protected against the operation of any works on the Colorado River system in contravention of the Colorado River Compact of 1922, the Boulder Canyon Project Act, and the Mexican treaty. Furthermore, the provision contained in the bill (sec. 12 (b)) for consultation with an Advisory Committee in connection with the operation of works on the river will tend, as a practical matter, to obviate misunderstanding and to reduce occasions for litigation.

The Committee concluded that it was satisfactorily established by the evidence that the aggregate of the consumptive use of water that will be made, if all of the works hereby proposed to be authorized are eventually constructed after meeting the various conditions imposed, when added to consumptive use already being made in the upper division States, will amount to less than two-thirds of the apportionment made to the upper basin under the compact. When all storage units and participating projects named in this bill are constructed, the aggregate of all consumptive uses in the Upper Basin would not exceed 4.8 million acre-feet of water per annum. This would leave an unused apportionment of 2.7 million acre-feet of the 7.5 million acre-feet apportioned to the Upper Basin to meet any contingencies arising out of litigation over varying interpretations of the compact. In the circumstances, the continuity of the water supply for the Lower Basin would be assured.

The evidence showed that the difference in Upper Basin uses, derived, on the one hand, from the application of the diversions-less-returns method and, on the other, from the application of the inflow-outflow method of measuring consumptive use, accepting the most extreme estimates, cannot exceed half a million acre-feet. Therefore, the committee concluded that existing differences of opinion as to which theory or method of measuring uses should prevail have no bearing on the consideration of S. 500. The same conclusion was reached in connection with other questions, the answers to which depend on interpretation of the Colorado River Compact, the construction of treaties with Indian tribes, construction of the Boulder Canyon Project Act, or construction of the treaty with the United Mexican States. The evidence showed that even if all of the questions so raised by opponents of this measure were to be resolved against the upper division States, the requirements of the consumptive use projects authorized or proposed to be authorized would be well within the Upper Basin's apportionment.

Legislative proposals made in connection with the Colorado River storage project and participating projects are in general accord with the established policy followed by the Congress in connection with Federal reclamation projects for the last 50 years. In some respects such proposals are more conservative than established policy. Nor are they, in some respects, as generous as the Federal reclamation

legislation under which the Central Valley of California has prospered and hopes for further development. They are similar to the policies under which the Boulder Canyon project was developed. The understandable desire of certain Lower Basin entities for continuation of the status quo on the Colorado River cannot justify the Congress in longer delaying legitimate Upper Basin development.

The Committee concludes that the use of holdover storage reservoirs for river regulation is contemplated by the Colorado River compact. To accept the argument against holdover storage would be a negation of the compact itself. The committee's conclusions in this connection are amply supported by repeated statements by Hon. Herbert Hoover and other negotiators of the compact showing beyond doubt that river regulation through storage is implicit in the compact and that article III (e) of the Colorado River Compact relates only to arbitrary withholding of water.

The Committee likewise concludes that the suggestion that the compact requires the upper division States to deliver water of a particular quality is without merit. In any event the additional use of water involved in S. 500 will have no marked effect on the quality of water delivered to the Lower Basin. There may, in fact, be some improvement therein as a result of such development. So far as mineral content is concerned, exhaustive studies show that, as Mr. Julian Hinds, general manager and chief engineer of the Metropolitan Water District of Southern California said in 1950:

> Under the most unfavorable future conditions, (mineral content) will be lower than the average of waters diverted and successfully used in the Yuma and Imperial Valleys prior to the construction of Hoover Dam (p. 13, report of Metropolitan Water District of Southern California, October 1950).

4. PROJECT WORKS

Features in the plan for developing the Upper Colorado River Basin are divided into two categories: storage units and participating projects. This bill would authorize the initial phase of the plan. In this initial phase are the following storage units: Curecanti, Echo Park, Flaming Gorge, Glen Canyon, Juniper, and Navajo; and the following participating projects: Central Utah (initial phase), Emery County, Florida, Gooseberry, Hammond, LaBarge, Lyman, Paonia (including the Minnesota unit), Pine River extension, Seedskadee, Silt, Smith Fork, and, subject to further approval and authorization by Act of Congress, of feasibility reports before construction of the following additional participating projects: Battlement Mesa, Bluestone, Bostwick Park, Dallas Creek, Dolores, Eagle Divide, East River, Fruit Growers' Extension, Fruitland Mesa, Grand Mesa, Navajo, Ohio Creek, Parshall, Rabbit-Ear, San Juan-Chama, Savery-Pot Hook, Sublette, Tomichi Creek, Troublesome, West Divide, and Woody Creek.

Brief descriptions of the physical features of these storage units and participating projects follow:

5. STORAGE UNITS

Curecanti (modified plan)

The Curecanti unit would consist of a reservoir on the Gunnison River formed by the Blue Mesa Dam below the town of Gunnison,

Colo., and of three downstream reservoirs respectively referred to as the Narrow Gauge, Morrow Point, and Crystal Reservoirs. The bill limits the water-surface elevation of the reservoir formed by Blue Mesa Dam to 7,520 feet. At this water-surface elevation, the capacity of the reservoir is estimated at 940,000 acre-feet. The three downstream reservoirs would be primarily for the development of power head with only nominal active storage capacities. Sufficient active capacity would be provided at the Morrow Point site for some seasonal regulation of stream inflows below Blue Mesa Dam.

Echo Park

The Echo Park Dam would be located in Colorado, on the Green River, about 3 miles east of the Utah-Colorado State line and 3 miles below the junction of the Green and Yampa Rivers. The Echo Park Dam is in the power market area of the Upper Basin States. Because of its strategic location below the junction of the Yampa and Green Rivers, and the large and efficient reservoir created by it, the construction and operation of the Echo Park unit would increase the effectiveness of supplementary storage and power developments at the Flaming Gorge and Juniper units and of the future Split Mountain and Gray Canyon units. The Echo Park Dam would be a curved, gravity type, concrete structure rising 690 feet above bedrock. The reservoir would have a storage capacity of 6,460,000 acre-feet, and the powerplant a generating capacity of 200,000 kilowatts.

The Committee recognizes that the opposition to Echo Park Dam stems from individuals who sincerely believe that the authorization of this dam would be an "invasion" of Dinosaur National Monument and constitute a precedent detrimental to other units of the national parks system. However, the committee and the Congress have been provided with documentary evidence which shows conclusively that a tremendous acreage—virtually the complete course of the Green and Yampa Rivers and bordering lands—within the present monument boundaries was reserved for water and power development from 13 to 34 years before the 2,500-fold extension of Dinosaur Monument in 1938. Furthermore, these reservations for water resource development are still valid and in effect today—clearly exempted by the language of the 1938 Dinosaur Monument proclamation; this language is unique in proclamations and laws pertaining to parks and monuments. These documents, some of which were introduced in the House hearings in 1954, have not been refuted.

The Echo Park Dam site has many advantages as a component of the initial phase of the project. To deny now the use of the Echo Park site for that purpose would amount to a breach of faith on the part of the Government. Such denial would tend to weaken reclamation and power reservations now applying to public lands on many other streams in the western United States.

After hearing much testimony on both sides of the question, the committee concludes that there is no invasion of national park or monument areas. In view of these legal and historical precedents for priority use of the Green and Yampa Rivers for water resource development, and in view of the obvious fact that water is so precious in the semiarid Colorado River Basin, the decision must be in favor of the selection of that site (Echo Park) where evaporation losses are reduced by a significant amount. Furthermore, there is urgent need

for the orderly development of the land and water resources of the Colorado River Basin.

Flaming Gorge

The principal feature of the Flaming Gorge unit is the dam, which will be located on the Green River in Utah, about 32 miles north of Vernal, and which would be a concrete, gravity-type structure rising 440 feet above the river. Flaming Gorge Reservoir formed by the dam would have a total capacity of 3,940,000 acre-feet. The powerplant at the dam would have a capacity of 72,000 kilowatts.

Glen Canyon

The Glen Canyon Dam would be located on the Colorado River in northern Arizona, about 13 miles downstream from the Utah-Arizona State line and 15 miles upstream from Lee Ferry—the division point between the lower and upper basins. It would be a concrete, curved, gravity-type structure rising 700 feet above bedrock. The reservoir, with a total capacity of 26 million acre-feet, would provide final regulation for deliveries to the lower basin under the Colorado River compact. The powerplant would be located near the toe of the dam. It would have a total installed capacity of 800,000 kilowatts.

Juniper

This storage and diversion unit is substituted for Cross Mountain Dam in the development plan. The dam would be located on the Yampa River 24 miles downstream from Craig, Colo., and 10 miles upstream from Maybell, Colo. The reservoir would have a capacity of 1,500,000 acre-feet, and a powerplant of 25,000 kilowatt capacity would be installed. Diversions through a canal would irrigate approximately 29,000 acres of new land in Colorado and 61,000 acres of new land in Utah between the Yampa and White Rivers.

Navajo

The Navajo Dam would be located on the San Juan River in northwestern New Mexico about 34 miles east of the town of Farmington. The dam would be a rolled, earth-filled embankment rising 335 feet above stream bed. Navajo Reservoir would have a total capacity of 1,450,000 acre-feet. The dam and reservoir will provide for gravity diversion for white and Indian lands to be irrigated under the Navajo project. Also, in connection with the San Juan-Chama project, the reservoir would constitute a source of supply for downstream irrigation users in exchange for natural flow diverted upstream.

6. PARTICIPATING PROJECTS

Central Utah

The Central Utah project (initial phase) is located in the eastern Bonneville Basin in central Utah and in the Uinta Basin, part of the Colorado River Basin in northeastern Utah. The plan would include construction of the Strawberry aqueduct along the south slope of the Uinta Mountains for intercepting Uinta Basin streams as far east as Rock Creek, enlargement of the Strawberry Reservoir by construction of the Soldier Creek Dam, enlargement of the Strawberry Reservoir outlet tunnel, construction of five powerplants with a combined generating capacity of 61,000 kilowatts, and construction of a number of other reservoirs for regulation, storage, and water exchanges.

The Wasatch aqueduct, canals, and distribution system would be constructed as necessary to deliver and utilize the increased water supply. Drainage would be provided where necessary. The project would irrigate about 28,540 acres of new land. It would also supply supplemental water for about 131,840 acres and furnish 48,800 acre-feet of municipal water.

Emery County

The Emery County project is located in east-central Utah along the San Rafael River. The project works would include a dam and reservoir, a diversion dam, a canal, and laterals and drains. The project would irrigate about 3,630 acres of new land and furnish supplemental water for about 20,450 acres.

Florida

The Florida project is in southwestern Colorado, in the Florida River Valley. Project works would include a dam and reservoir, a diversion dam, enlargement and extension of existing canal, and distribution laterals and drains. The project would irrigate about 6,300 acres of new land and furnish supplemental water to about 12,650 acres.

Gooseberry

The Gooseberry project would be located in central Utah. It would consist of a storage reservoir on Gooseberry Creek, a tributary to the Colorado River, having a capacity of 17,200 acre-feet, a 2½-mile tunnel to San Pete Valley in the Bonneville Basin, a diversion dam and high-line canal to deliver the water to existing distribution systems. It would furnish supplemental water for 16,400 acres of irrigated lands now having an inadequate water supply.

Hammond

The Hammond project is in northwestern New Mexico along the San Juan River. The project works would include a diversion dam, a canal, and distribution laterals and drains. The project would irrigate about 3,670 acres of new land.

LaBarge

The LaBarge project is in southwestern Wyoming in the upper end of the Colorado River Basin. It extends approximately 40 miles along the west side of Green River. Project works would include a diversion, a conveyance canal, and distribution laterals. About 7,970 acres of new land would be irrigated by this project.

Lyman

The Lyman project is in southwestern Wyoming, just above the Utah-Wyoming State line. It lies along Blacks Fork, a tributary of the Green River. Project works include a reservoir, conveyance canals, and drainage facilities. Supplemental water would be furnished to about 40,600 acres.

Paonia

The Paonia project is located in west-central Colorado on the North Fork of the Gunnison River. This project was previously authorized and is partially constructed. It would, however, be extended by this reauthorization. The project works include a dam and reservoir, canals, and siphon. As reauthorized, the area to be served would

include 17,040 acres, of which 2,210 would be new land and 14,830 acres would be furnished supplemental water.

Pine River extension

The Pine River extension is in southwestern Colorado and northwestern New Mexico, on Pine River, 20 miles east of Durango, Colo. The project works include a diversion dam, the enlargement and extension of canals, and a number of distribution laterals. The project would irrigate about 15,150 acres of new land. Storage water is to be obtained from existing Vallecito Dam and Reservoir on Pine River.

Seedskadee

The Seedskadee project is in southwestern Wyoming along the Green River below the LaBarge project. Project works would include a diversion dam, conveyance canals, and distribution laterals. About 60,720 acres of new land would be irrigated by the project.

Silt

The Silt project is located in west-central Colorado between Rifle and Elk Creeks. The project works include a dam, and reservoir pumping system, rehabilitation of existing canal, and construction of some new laterals and drains. The project would irrigate about 1,900 acres of new land and would furnish supplemental water for about 5,400 acres.

Smith Fork

The Smith Fork project is located in west-central Colorado along Smith Fork, a tributary of the Gunnison River. The project works would include a dam and reservoir, diversion dam, canals, and laterals. The project would irrigate about 2,270 acres of new land and furnish supplemental water for about 8,160 acres.

PARTICIPATING PROJECTS CONDITIONALLY AUTHORIZED

The following participating projects would be authorized now, conditioned on approval of feasibility reports by Act of Congress before construction could begin:

A brief description of these projects is as follows:

Battlement Mesa, Colorado
Bluestone, Colorado
Bostwick Park, Colorado
Dallas Creek, Colorado
Dolores, Colorado
Eagle Divide, Colorado
East River, Colorado
Fruit Growers' Extension, Colorado
Fruitland Mesa, Colorado
Grand Mesa, Colorado
Navajo, New Mexico
Ohio Creek, Colorado
Parshall, Colorado
Rabbit Ear, Colorado
San-Juan Chama, New Mexico
Savery-Pot Hook, Colorado and Wyoming
Sublette, Wyoming
Tomichi Creek, Colorado
Troublesome, Colorado
West Divide, Colorado
Woody Creek, Colorado

Battlement Mesa

The Battlement Mesa project in Mesa County, west-central Colorado, would regulate the surplus runoff in Buzzard Creek of the Upper Colorado River drainage and two branches of Muddy Creek

of the Gunnison River drainage to provide for the irrigation of 6,780 acres of full service land and 50 acres of supplemental service land located on the south slope of Battlement Mesa near the town of Collbran, Colo. The project would also aid in fishery and wildlife conservation.

Bluestone

The Bluestone project in Garfield and Mesa Counties, west-central Colorado, would divert water from Colorado River to provide for the irrigation of 8,660 acres of new land and 2,215 acres of supplemental service land located in the Colorado River Valley between the town of Rifle and the head of De Beque Canyon near De Beque, Colo.

Bostwick Park

The Bostwick Park project would provide a water supply for 1,040 acres of arable nonirrigated lands and supplemental water for 5,830 acres of presently irrigated lands. The lands are located along the west side of Cimarron Creek below the existing Cimarron Canal and in Bostwick and Shin Parks which lie about 10 miles east of the city of Montrose and also obtain their water supply through the Cimarron Canal. The source of the water supply for the project would be Cimarron Creek, a tributary of Gunnison River in the Upper Colorado River Basin.

Dallas Creek

The Dallas Creek project would provide an irrigation supply for 15,750 acres of arable nonirrigated lands and supplemental water for 6,190 acres of irrigated lands. The lands are located in the drainage basin of the Uncompahgre River, a tributary of Gunnison River in the Upper Colorado River Basin. The water supply for the project would be made available through utilization of surplus flows of Uncompahgre River and two of its tributaries, Dallas Creek and Cow Creek.

Dolores

The Dolores project is planned primarily to store and divert waters of Dolores River to supply irrigation water for 66,000 acres of land in the San Juan River Basin in southwestern Colorado. The lands include 30,550 acres presently irrigated with only a partial water supply and 35,450 acres not now irrigated. The project lands lie near the towns of Cortez and Dove Creek, Colo.

Eagle Divide

The Eagle Divide project in Eagle County, northwestern Colorado, would regulate surplus runoff in Piney River, tributary to the Colorado River, and would divert surplus flows from several small streams, tributaries to the Piney and Colorado Rivers below the planned reservoir, to provide for the irrigation of 8,990 acres of new land and 1,885 acres of supplemental service land. The project lands are located on the divide between the Eagle and Colorado Rivers in the vicinity of the following towns: Eagle, Wolcott, McCoy, and Burns. The project would increase fishery, wildlife, and recreational values of the area.

East River

Development of the potential East River project would provide for irrigation of 1,780 acres of nonirrigated lands and would provide

supplemental water for 970 acres of presently irrigated lands north of the town of Gunnison in the Upper Colorado River Basin. The water would be made available through construction of the 5-mile East River Canal which would divert from East River, one of the upper tributaries of Gunnison River. No storage facilities would be required to provide an adequate water supply for lands of the project.

Fruit Growers' Extension

The Fruit Growers' Dam project extension would utilize surplus flows of Grand Mesa tributaries of the Gunnison River in the Upper Colorado River Basin to provide supplemental irrigation water for 2,000 acres of presently irrigated lands and a new water supply for 1,850 acres of nonirrigated lands.

Fruitland Mesa

The Fruitland Mesa project would provide a water supply for 11,700 acres of arable nonirrigated land and supplemental water for 7,700 acres of presently irrigated land between the town of Crawford and the Black Canyon of the Gunnison National Monument. The water supply would be made available from Sapinero, Curecanti, Crystal, and Iron Creeks, tributaries of Gunnison River in the Upper Colorado River Basin.

Grand Mesa

The Grand Mesa project would provide a water supply for 11,070 acres of arable nonirrigated land and supplemental water for 14,230 acres of irrigated land in the Gunnison River drainage of the Upper Colorado River Basin. These acreages include nearly all of the lands along the south slope of Grand Mesa except lands included in the service areas of the potential Paonia project and the Fruit Growers Dam project extension. The water supply for the project would be made available from Muddy Creek and other Grand Mesa tributaries of Gunnison River.

Navajo

The Navajo project (formerly called the Shiprock and south San Juan projects) is in northwestern New Mexico along the San Juan River. The project would provide for the irrigation of 151,000 acres of new lands in the vicinity of the towns of Bloomfield, Farmington, and Shiprock. Of that total, 122,000 acres are located in the Navajo Indian Reservation and 29,000 acres are outside the reservation. A main high-line canal from the Navajo Reservoir would extend 28 miles to a drop and direct-connected turbine pump for service of highlands and then 60 miles to serve the major portion of the lands by gravity. A distribution system and drains also are planned. With respect to the authorization of this project, see section 2 of the bill.

Ohio Creek

The Ohio Creek project would provide for the irrigation of 6,200 acres of arable nonirrigated land and 10,710 acres of irrigated land in need of additional water. The source of the water would be Ohio Creek, a Gunnison River tributary in the Upper Colorado River Basin.

Parshall

The Parshall project would provide for the full irrigation of 24,410 acres of new land and would supply supplemental water to 3,100 acres of partially irrigated land along Williams River, Little Muddy Creek, and the lower east side of the Blue River Valley in the vicinity of the communities of Parshall and Kremmling, Grand and Summit Counties in north-central Colorado. The project would also aid in fishery and wildlife conservation.

Rabbit Ear

The Rabbit Ear project in Grand County, north-central Colorado, would regulate surplus runoff of Muddy Creek, tributary to the Colorado River near Kremmling, Colo., to provide for the irrigation of 13,955 acres of new service land and 5,235 acres of supplemental service land. The project lands are located in the Muddy Creek drainage, south and west of Kremmling. The project would also provide some flood-control benefits and also increase fishery and wildlife values.

San Juan-Chama

The San Juan-Chama project would be located in northern New Mexico partly in the San Juan Basin of southern Colorado and partly in the Rio Grande and Canadian River Basins in northern New Mexico. This project would provide for a maximum diversion of 235,000 acre-feet of water annually from the headwaters of the San Juan River through a collection system and a tunnel to the headwaters of the Chama, a tributary of the Rio Grande. An off-channel holding and regulatory reservoir would be provided on the Chama watershed. The water would be delivered to the agricultural users through the distribution systems of existing projects. With respect to the authorization of this project, see section 2 of the bill.

Savery-Pot Hook

The Savery-Pot Hook project would provide supplemental irrigation water for 13,230 acres of presently irrigated lands and a new supply for 18,380 acres of nonirrigated lands located in northwestern Colorado and south-central Wyoming. The additional water would be made available through utilization of surplus flows of streams of the Little Snake River Valley, a part of the Upper Colorado River Basin.

Sublette

The Sublette project is planned to store and divert waters of the upper Green River and its tributaries to supply irrigation water for about 72,000 acres of undeveloped lands and 12,000 acres of lands presently irrigated with an inadequate supply. The plan also includes a small hydroelectric powerplant. The project would be located in the Green River Basin in Sublette County, western Wyoming. Although reconnaissance studies to date indicate that the project would consist of two independent divisions (Buckskin and West Side divisions), the data presented herein are for the overall project.

Tomichi Creek

The Tomichi Creek project would provide supplemental irrigation water for 15,400 acres of presently irrigated land and a new supply

for 12,180 acres of arable nonirrigated land located east of the town of Gunnison near the Continental Divide. Water would be made available from Tomichi and Quartz Creeks, tributaries of Gunnison River in the Upper Colorado River Basin.

Troublesome

The Troublesome project in Grand County, north-central Colorado, would regulate surplus runoff in East Troublesome Creek, tributary to the Colorado River, and would divert surplus flows of the Williams River at the existing Williams Reservoir to provide for the irrigation of 8,990 acres of new land and 4,650 acres of supplemental service land. The project lands are located in the Troublesome Creek Valley and on river benches north of the Colorado River between the towns of Parshall and Kremmling, Colo. The project would also increase fishery, wildlife, and recreational values of the area.

West Divide

The West Divide project would regulate and divert surplus runoff of Crystal River, Thompson Creek, West Divide Creek, and Mamm Creek and would divert surplus runoff of several tributaries of the Roaring Fork and Colorado Rivers in order to provide for the irrigation of 40,500 acres of new land and 25,110 acres of supplemental service land. The lands are located along the west side of the Roaring Fork drainage in the vicinity of Carbondale and Glenwood Springs, Colo., and along the south side of the Colorado River Valley in the vicinity of the towns of New Castle, Silt, Rifle, Grand Valley, and DeBeque, Colo. The project area is contained in Pitkin, Garfield, and Mesa Counties, west-central Colorado.

Woody Creek

The Woody Creek project would provide an average of 3,900 acre-feet of water annually for the irrigation of 645 acres of new service land and 2,320 acres of supplemental service land located along the east side of the Roaring Fork River Valley and north of the town of Aspen, Pitkin County, west-central Colorado.

7. OTHER FEATURES OF THE BILL

The Committee recognizes that it may be found desirable to authorize additional storage in the upper reaches of the Colorado River and its tributaries above Grand Junction, Colo., and of additional participating projects in the several upper division States (see sec. 2 of the bill); but it recommends deferment of any commitment by the Congress thereto, due to the fact that engineering reports are not complete.

The bill contains a provision authorizing the appropriate agencies of the United States to convey for value to the city and county of Denver, Colo., water rights and interests in lands required for the enlargement of that city's municipal water supply.

The Committee believes that the Colorado River storage project and participating projects plan is financially sound. It has been subjected to the most rigid economic and financial analyses. Less than 3 percent of the total cost is nonreimbursable for flood control, fish and wildlife, and recreation.

The entire cost of the power and municipal water features will be returned to the United States Treasury with interest not only on the capital investment but also with interest accruing during their construction. Interest would be computed at the going rate for long-term Treasury obligations. The irrigation costs do not bear interest, pursuant to the 50-year-old policy of the reclamation law. The Federal Government has recognized that the development of irrigated lands stabilizes the agricultural economy and is a good public investment.

Section 3 of the bill, relating to water conservancy districts, takes into account the indirect benefits that will accrue to the general areas served by these projects. Indirect beneficiaries in the service areas of these projects would thereby aid in the repayment of irrigation costs. The irrigation farmers would be assesssed, according to their ability to pay over a 50-year period, and the balance of the costs allocated to irrigation would be repaid by power revenues. Safeguards are contained in the bill to obviate initiation of construction of participating projects prior to a thorough review of their economic justification.

The committee concurs in the view expressed by the Civil Defense Administrator, that the Colorado River storage project will be an important factor in an industrial and human dispersal program in the event of a national emergency. This vital factor gives added nationwide importance to this development, in addition to broadening the Federal tax base, increasing purchasing power, and thereby providing an expanding home market for the products of American manufacturing and other enterprises.

The committee's position on power marketing of the project is that the area to be served shall be governed only by economical transmission distance direct or through interconnections with other plants either in the Upper or Lower Basin. This policy is necessary to the economic and financial health of the project. This policy in the committee's opinion accords with established practice and policies of reclamation power operations. The committee intends that full equality of treatment be accorded to both Upper and Lower Basin power customers. Established preferences and sound business principles in accordance with existing reclamation law are intended to be applied in the marketing of power from the project, and it is not intended that Lower Basin customers should be discriminated against in any respect.

The principal amendments recommended are for the purpose of clarification only and relate, first, to the inclusion of 19 additional participating projects in Colorado and Wyoming which can be constructed only after submittal of feasibility reports, and approval and authorization by the Congress. Section 2 is revised to declare that it is not the intention of Congress by authorizing only certain designated projects at this time to preclude future comprehensive water resource developments in the Upper Basin. A provision is included for consultation by the Secretary of the Interior with an Advisory Committee in connection with the operation of works in the Colorado River.

Section 12 of the bill would grant consent to suits against the United States in the Supreme Court by States in the Colorado River Basin to enforce the provisions of specifically named compacts,

projects, Federal statutes, and treaties relating to the release of water from reservoirs in the basin. In order to make certain that the immunity waiver would permit such suits both in a State's own quasi-sovereign capacity and on behalf of those of its political subdivisions that might have water rights under the compacts, projects, or statutes enumerated, the committee amended the section to give legislative recognition to the established judicial doctrine of *parens patriae*.

The waiver of the sovereign immunity of the United States goes only to suits brought by the basin States and not to suits by any other political entity; action would have to be brought by the State itself, and determination as to whether to bring action as *parens patriae* would rest with the State.

For an exposition of the *parens patriae* doctrine, as it relates to the original jurisdiction of the Supreme Court, reference is made to such cases as *Georgia* v. *Pennsylvania Railroad Co. et al.* (324 U. S. 401; 1945); *Kansas* v. *Colorado* (206 U. S. 46; 1906); or *Missouri* v. *Illinois* (180 U. S. 208; 1900).

8. ESTIMATED OVERALL CONSTRUCTION COSTS

The estimated overall construction costs of the projects under each of the several categories set forth in S. 500, as amended, are as follows:

Storage units:	
Authorized for construction (5)	$733, 578, 000
Authorized subject to report to Congress (1)	49, 305, 000
Total storage units (6)	782, 883, 000
Participating projects: Authorized subject to supplemental reports (12)	310, 116, 800
Total projects authorized in S. 500, as amended	1, 092, 999, 800
Participating projects:	
Subject to further approval and authorization by Congress (21)	558, 173, 300
Total all participating projects in S. 500, as amended	868, 290, 100
Project, previously authorized, participating in revenue (1)	7, 287, 000
Total all participating projects (34)	875, 577, 100
Grand total, all projects in S. 500, as amended	1, 658, 460, 100

9. SUMMARY, CONSTRUCTION COSTS AND ALLOCATIONS, COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

Project	State	Construction costs					Repayment of reimbursable costs [2]	
		Total [1]	Nonreimbursable	Reimbursable allocations			By water users [2]	By power
				Power	Municipal water	Irrigation		
Storage units:								
Authorized for construction under S. 500:								
Echo Park	Colorado-Utah	$176,426,000		$128,383,000		$48,043,000		$176,426,000
Glen Canyon	Arizona-Utah	421,270,000		370,974,000		50,296,000		421,270,000
Juniper	Colorado	16,348,000		16,348,000				16,348,000
Flaming Gorge	Utah-Wyoming	82,942,000		52,042,000		30,900,000		82,942,000
Navajo Dam	New Mexico	36,592,000	$1,298,000			35,294,000		35,294,000
Subtotal		733,578,000	1,298,000	567,747,000		164,533,000		732,280,000
Authorized subject to report to the Congress:								
Curecanti (940,000 acre-feet)	Colorado	49,305,000		41,205,000		8,100,000		49,305,000
Total storage units		782,883,000	1,298,000	608,952,000		172,633,000		781,585,000
Participating projects:								
Authorized subject to supplemental reports:								
LaBarge	Wyoming	1,673,300				1,673,300	$495,000	1,178,300
Seedskadee	do	23,272,000				23,272,000	4,785,000	18,487,000
Lyman	do	10,564,000				10,564,000	2,255,000	8,309,000
Silt	Colorado	3,356,000	73,600			3,282,400	1,020,000	2,262,400
Smith Fork	do	3,367,000	24,000			3,343,000	1,045,000	2,298,000
Paonia	do	[4] 6,944,000	152,400			6,791,600	2,414,000	4,377,600
Florida	do	6,941,500	437,900			6,503,600	1,711,500	4,792,100
Pine River project extension	Colorado-New Mexico	5,027,000				5,027,000	2,045,000	2,982,000
Emery County	Utah	9,865,500	229,000			9,636,500	3,715,000	5,921,500
Central Utah (initial phase)	do	231,044,000	5,991,000	46,699,000	45,500,000	127,354,000	[5] 60,691,000	[6 7] 158,862,000
Hammond	New Mexico	2,302,000				2,302,000	370,000	1,932,000
Gooseberry	Utah	5,760,500	33,000			5,727,500	2,375,000	3,352,500
Subtotal		310,116,800	6,940,900	46,699,000	45,500,000	205,476,900	82,921,500	[7] 214,754,400
Total projects authorized in S. 500, as amended		1,092,999,800	8,238,900	655,651,000	45,500,000	378,109,900	82,921,500	996,339,400

Participating projects subject to further approval and authorization by the Congress:								
Navajo irrigation project	New Mexico	175,445,300				175,445,300	30,730,000	144,715,300
San Juan-Chama	do	134,369,000	470,000		26,775,000	107,124,000	54,665,000	79,234,000
Savery-Pot Hook	Colorado-Wyoming	10,814,000				10,814,000	1,390,000	9,424,000
Dolores	Colorado	24,633,000				24,633,000	1,533,000	23,100,000
Sublette, Gunnison River projects	Wyoming	37,099,000		953,000		36,146,000	1,350,000	35,749,000
Fruit Growers Dam extension	Colorado	1,690,000				1,690,000	470,000	1,220,000
Bostwick Park	do	2,634,000				2,634,000	695,000	1,939,000
Dallas Creek	do	10,330,000				10,330,000	950,000	9,380,000
East River	do	212,000				212,000	95,000	117,000
Fruitland Mesa	do	11,551,000				11,551,000	1,060,000	10,491,000
Grand Mesa	do	20,164,000				20,164,000	30,000	20,134,000
Ohio Creek	do	3,402,000				3,402,000	35,000	3,367,000
Tomichi Creek, Cliffs-Divide projects	do	11,523,000				11,523,000	0	11,523,000
Battlement Mesa	do	5,853,700				5,853,700	645,000	5,208,700
Bluestone	do	3,329,900				3,329,900	370,000	2,959,900
Eagle Divide	do	3,411,700				3,411,700	305,000	3,106,700
Parshall	do	11,881,900				11,881,900	1,420,000	10,461,900
Rabbit Ear	do	4,733,500				4,733,500	760,000	3,973,500
Troublesome	do	5,243,000				5,243,000	725,000	4,518,000
West Divide	do	79,675,600				79,675,600	5,960,000	73,715,600
Woody Creek	do	177,700				177,700	177,700	0
Subtotal		558,173,300	470,000	953,000	26,775,000	529,975,300	103,365,700	454,337,600
Total all participating projects in S. 500, as amended.		808,290,100	7,410,900	47,652,000	72,275,000	735,452,200	186,287,200	[7] 669,092,000
Eden project (previously authorized)	Wyoming	7,287,000				7,287,000	1,500,000	5,787,000
Total all participating projects		875,577,100	7,410,900	47,652,000	72,275,000	742,739,200	187,787,200	[7] 674,879,000
Grand total, all projects in S. 500, as amended.		1,658,460,100	8,708,900	656,604,000	72,275,000	915,372,200	187,787,200	[7] 1,456,464,000

[1] Exclusive of nonreimbursable Colorado River development fund expenditures for investigations.

[2] Costs allocated to power and municipal water are repaid with interest, including interest during construction.

[3] Repayment by water users toward construction costs over 50-year repayment period beyond a reasonable irrigation development period except 60-year period for Eden project and 68-year period for Paonia project.

[4] Includes $2,035,000 expended on construction of the previously authorized Paonia project.

[5] Includes $15,191,000 in irrigation revenues and $45,500,000 from municipal and industrial water users.

[6] Includes $27,838,000 of excess power revenues from the Central Utah project powerplants accruing during the irrigation repayment periods of this project.

[7] Exclusive of $5,500,000 allocable to purposes of the ultimate phase of Central Utah project.

10. EXECUTIVE REPORTS

The comments of the Departments of the Army, Interior, and Agriculture, including endorsements by the President, the Bureau of the Budget, and the Federal Power Commission are made a part of this report, as follows:

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington 25, D. C., February 25, 1955.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington 25, D. C.

MY DEAR SENATOR MURRAY: A report has been requested from this Department on S. 500, a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

In his address to the Congress on the state of the Union, President Eisenhower said (H. Doc. No. 1, 84th Cong., p. 8):

"* * * the Federal Government must shoulder its * * * partnership obligations by undertaking projects of such complexity and size that their success requires Federal development. In keeping with this principle I again urge the Congress to approve the development of the upper Colorado River Basin to conserve and assure better use of precious water essential to the future of the West."

Likewise in his budget message (H. Doc. No. 16, 84th Cong., p. M65) the President said:

"I also recommend enactment of legislation authorizing the Bureau of Reclamation to undertake construction of two comprehensive river-basin improvements which are beyond the capacity of local initiative, public or private, but which are needed for irrigation, power, flood control, and municipal and industrial water supply. These are the Upper Colorado River Basin development in the States of Colorado, Utah, Wyoming, Arizona, and New Mexico, and the Fryingpan-Arkansas development in Colorado. The Colorado River development will enable the upper basin States to conserve floodwaters and to assure the availability of water and power necessary for the economic growth of the region. * * * Sale of power generated at these developments will repay the power investment within 50 years and will make a contribution toward repayment of other investments."

In the budget itself it was pointed out (p. 830) that the administration proposes to initiate construction of the Colorado River storage project during the next fiscal year if it is authorized and that the budget includes an item for funds to be requested for this purpose.

The substance of our views on the proper contents of a bill to implement the President's recommendation and particularly on those projects and units which should be covered in the initial legislation is contained in the draft of a bill which was developed by the Bureau of the Budget in collaboration with this Department and submitted to your committee on April 1, 1954, in connection with S. 1555, 83d Congress, a predecessor of the present S. 500.

We recommend that S. 500 be examined in the light of the proposal there made and in the light of the two letters dated March 18, 1954, from the Director of the Bureau of the Budget to your committee and to this Department which are reprinted in Senate Report No. 1983, 83d Congress, and that, with suitable amendments, S. 500 be enacted.

The Bureau of the Budget has advised that there would be no objection to the submission of this report to your committee.

Sincerely yours,

FRED G. AANDAHL,
Assistant Secretary of the Interior.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington 25, D. C., March 17, 1955.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington 25, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge Mr. Stewart French's letter of January 20, 1955, requesting the views of the Bureau of the Budget on S. 500,

a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

Enactment of legislation authorizing the Colorado River storage project was recommended by the President both in his state of the Union message and his budget message this year. The views of this Bureau concerning the details of such legislation were expressed in letters of March 18, 1954, to your committee and to the Secretary of the Interior, which are printed in Senate Report No. 1983, 83d Congress, 2d session. On April 1, 1954, a draft bill, which was developed in collaboration with the Department of the Interior, was submitted to your committee.

With respect to the detailed provisions of S. 500, this Bureau has the following comments:

1. In the absence of new information justifying their inclusion at this time we have no basis for reappraising the merits of those projects heretofore considered and not recommended for authorization either by the Secretary of the Interior or the Bureau of the Budget. Similarly, in the absence of detailed planning reports for those projects not heretofore considered by the Bureau of the Budget, including data on engineering, financial, and economic feasibility, detailed estimates of costs and benefits, and sufficient other pertinent information necessary for a complete understanding of the justification and necessity for the work, there is no adequate basis for appraising the merits of such projects. For these reasons we believe that the authorizations for the Cross Mountain, Flaming Gorge, Curecanti, and Navajo units, and the Gooseberry, San Juan-Chama, and Navajo participating projects should be deferred until the necessary information justifying such action has been submitted to the Congress in accordance with established procedures.

2. There would appear to be ample justification for the closest cooperation between the Departments of Agriculture and Interior concerning the agricultural aspects of the participating projects. The use of the word "consultation" on page 3, line 25, would therefore be understood to mean consultation in its broadest sense.

3. Section 7 and reference to it in section 1 (2) (a) (iii) is interpreted to mean that all costs for improvements in fish and wildlife, as well as mitigation of losses not attributable to the construction of the project, shall be nonreimbursable and nonreturnable and shall be financed by the agencies responsible for these programs. However, the cost of preventing damages attributable to the construction of the project should be treated as a part of the cost and allocated to the various purposes in the same manner as other damages. The addition of clarifying language would avoid misinterpretations.

4. The inclusion of section 10 in our draft bill referred to above, namely, "Construction of the projects herein authorized shall proceed as rapidly as is consistent with budgetary requirements and the economic needs of the country," would appear to be a desirable addition to S. 500, since this would be the principal consideration in determining rate of construction and development.

5. It is considered that the authorization should be limited to $950 million, as proposed in the draft bill, in order to give the Congress a greater measure of control over the extent of the development and an opportunity to review the program from time to time.

6. Since we do not have detailed information concerning the city of Denver's proposed Blue River project or the effects of the provisions of section 11 of S. 500 on the interests of the Federal Government or on pending litigation, we are not in a position to comment on this section at this time, and have requested the Department of Justice to review this section.

7. The Bureau of the Budget also is not in a position to comment on section 12, until we have received the views of the Department of Justice on this section.

8. It is recommended that the title be amended to read, "To authorize the Secretary of the Interior to construct, operate, and maintain initial units of the Colorado River storage project and participating projects, and for other purposes."

Accordingly, it is recommended that S. 500 be amended as outlined above.

Sincerely yours,

DONALD R. BELCHER,
Assistant Director.

FEDERAL POWER COMMISSION,
Washington 25, March 25, 1955.

Re S. 500, 84th Congress, 1st session.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington 25, D. C.

DEAR MR. CHAIRMAN: In response to your request there are enclosed three copies of the report of the Federal Power Commission on the bill S. 500, 84th Congress, to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

We have just been advised that there is no objection by the Bureau of the Budget to the presentation of this report to your committee.

Sincerely yours,

JEROME K. KUYKENDALL, *Chairman.*

FEDERAL POWER COMMISSION REPORT ON S. 500, 84TH CONGRESS

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

Section 1 of the bill would authorize the Secretary of the Interior to construct, operate, and maintain the Cross Mountain, Curecanti, Echo Park, Flaming Gorge, Glen Canyon, and Navajo initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities, and appurtenant works, provided that the authority to construct the Curecanti Dam shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs. The Commission believes that such conditional authorization of the Curecanti project is highly desirable, and that it would be desirable to amend the bill to likewise require conditional authorization with respect to undertaking construction of the Cross Mountain, Flaming Gorge, and Navajo projects.

Based upon a consideration of the power features involved, it is believed that authorization of the Echo Park and Glen Canyon Dam and Reservoir projects, as provided for in the bill, is desirable for inclusion in the initial program for future development of the Colorado River Basin. The Echo Park project is favorably located to assist in serving power loads of the northerly part of the Upper Colorado River Basin, and the Glen Canyon project is favorably located for assisting in serving power loads to the south.

Section 1 of the bill would also authorize 14 enumerated participating reclamation and power projects provided that the construction of the participating projects shall not be undertaken until the Secretary has reexamined the economic justification of each project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of the bill can be met. Such supplemental reports, except for San Juan-Chama and the Navaoj projects, would not, however, be subject to section 1 (c) of the Flood Control Act of 1944 (58 Stat. 887) which provides that the Secretary of the Interior, in making investigations and reports for irrigation and purposes incidental thereto, shall give the affected State or States opportunity to cooperate in the investigations. The Commission agrees that authorization of these participating reclamation and power projects should be made conditional on the findings and recommendations of supplemental detailed reports dealing with their economic and engineering feasibility, as provided for in the bill, but it does not feel that the public interest requires or justifies the exemption of such supplemental reports from the opportunity for State cooperation afforded by section 1 (c) of the Flood Control Act of 1944.

Section 2 of the bill declares it to be the intent of Congress to authorize further units of the storage project and new participating projects upon the basis of the data which may be made available to it in the future in accordance with this bill and also in conformity with beneficial consumptive use provisions of article III

of the Upper Colorado River Basin compact. The costs of any participating projects thus authorized shall be amortized in accordance with the Federal reclamation law and this bill.

Section 4 provides that revenues in excess of operating needs shall be paid annually to the general fund of the Treasury to return the costs of each unit, participating project, or any separable feature thereof which are allocated to commercial power within a period not exceeding 50 years from the date of completion of such unit, participating project, or separable feature thereof. It also provides that revenues in excess of operating needs shall be paid annually to the general fund of the Treasury to return interest on the unamortized balance of the investment (including interest during construction) in the commercial power features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. These repayment provisions correspond generally with the Commission's established practice in analyzing and evaluating Federal multiple-purpose power projects of assuming amortization of power investments in not to exceed 50 years from the in-service date, with interest, usually at the rate of 2½ percent.

Section 5 provides that upon completion of each unit, participating project, or separable feature thereof, the Secretary of the Interior shall allocate the total costs (excluding certain nonreimbursable costs for recreation and fish and wildlife) of constructing said unit, project, or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. The Commission believes that the bill should provide for such cost allocations to be made in conformity with those standards and procedures which may have been established for interagency use at that time.

Section 5 also provides that the Secretary would be required to report to the Congress, on January 1 of each year beginning with the fiscal year 1956, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report would be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment. This requirement of periodic detailed reports on the financial aspects of the proposed improvements appears to be highly desirable.

In several statutes (e. g., sec. 5, act of December 22, 1944, 58 Stat. 887, 890; act of July 31, 1950, 64 Stat. 382) Congress has provided that the rate schedules for power sales from certain Federal power projects shall be subject to approval by the Federal Power Commission. The Commission is of the opinion that similar rate control should be provided in this instance and that it should be authorized not only to approve the initial rate schedules, but should have authority to review the rates at appropriate intervals and prescribe those rates which will return to the United States the costs which are properly chargeable to power under the criteria laid down by Congress. It should be noted that the Commission is not an operating agency, but was created by Congress to act as its agent to perform functions directly related to the rate supervision here recommended.

The Commission believes that the authority to determine the portion of the investment in multiple-purpose projects allocable to electric power should rest with the agency responsible for the approval of electric power rates. In this connection, the Commission points out that it has been given authority to make cost allocations for the Bonneville and McNary projects on the Columbia River, the Fort Peck project on the Missouri river, and four proposed projects on the lower Snake River.

If the Congress should see fit to enact this legislation, it is recommended that the Commission be given jurisdiction over rates for the sale of power from the projects in the Colorado River Basin and authority to allocate the costs of such projects among the several project purposes. The Commission also recommends that authorization to undertake construction of the Cross Mountain, Flaming Gorge, and Navajo projects be made conditional upon supplemental investigation reports by the Secretary of the Interior, and that section 1 (c) of the Flood Control Act of 1944, relating to opportunity for State participation, be made applicable to supplemental reports of the Secretary on participating projects.

FEDERAL POWER COMMISSION,
By JEROME K. KUYKENDALL,
Chairman.

DEPARTMENT OF AGRICULTURE,
Washington 25, D. C., March 28, 1955.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate.

DEAR SENATOR MURRAY: This is in reply to Mr. Stewart French's letter of January 21, 1955, requesting a report by this Department on S. 500, a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

Since S. 500 relates primarily to Department of the Interior authority, this Department takes no position regarding enactment of the bill. However, in the event favorable consideration is given to such legislation, we recommend (1) that it provide for cooperation by the Secretary of Agriculture with the Secretary of the Interior in the appraisal, before authority to construct projects becomes effective, of the prospective direct agricultural benefits of each proposed project that is expected to produce such benefits; and (2) that it provide that the Secretary of Agriculture shall be granted the same authorities as the Secretary of the Interior under the provisions of section 7 when any unit or project is within or partly within the boundary of a national forest.

The bill would authorize the Secretary of the Interior to construct, operate, and maintain 6 specified initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities, and appurtenant works and, after reexamination of the economic justification of each such project including a reappraisal of the prospective direct agricultural benefits after consultation with the Secretary of Agriculture, 14 other specified participating projects. It would declare the intent of the Congress to authorize additional units of the Colorado River storage project and additional participating projects. It also would authorize the Secretary of the Interior to plan, construct, operate, and maintain public recreational facilities on lands withdrawn or acquired for Colorado River storage project units and participating projects.

In reporting to the Committee on Interior and Insular Affairs on June 30, 1954, on S. 1555 we referred to a substitute draft bill submitted to the Congress by the Secretary of the Interior on April 1, 1954. It provided for a reappraisal of the prospective direct agricultural benefits of the project, made by the Secretary of the Interior in cooperation with the Secretary of Agriculture. We consider that provision to more clearly express the relationship that should prevail in such a reappraisal than the provision for consultation included in S. 500.

The Department of Agriculture has a responsibility, commensurate with its national responsibilities, in the agricultural phases of the development, conservation, and utilization of land and water in the Upper Colorado River Basin which would be authorized by such bills. This includes the furnishing of reports to the President and the Congress on the agricultural aspects concurrently with reports by other agencies on other aspects of the proposed developments and the planning, operation, and maintenance of public recreational facilities on those portions of storage project units or participating projects that are within national forest boundaries.

The Bureau of the Budget advises there is no objection to the submission of this report.

Sincerely yours,

TRUE D. MORSE, *Under Secretary.*

DEPARTMENT OF THE ARMY,
Washington 25, D. C., April 6, 1955.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate.

DEAR MR. CHAIRMAN: Reference is made to your request for the views of the Department of the Army with respect to S. 500, 84th Congress, a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

The Department of the Army has considered the above-mentioned bill. The purpose of the bill is to authorize the principal features of the Colorado River storage project and participating projects of the Bureau of Reclamation.

Comments on four of the major units (Cross Mountain, Flaming Gorge, Navajo, and Curecanti) in the comprehensive plan covered by S. 500 and on the participating projects are not practicable from an engineering and economic standpoint

without an up-to-date engineering and economic report. However, with respect to the two remaining major units (Echo Park and Glen Canyon), the Department of the Army has reviewed a report of the Department of the Interior and has advised that Department that these two storage projects appear to be justified.

Although the Department of the Army is authorized to undertake certain examinations and surveys in the Upper Colorado River Basin and has an interest in the Rio Grande Basin which is involved in the bill to the extent of the diversion contemplated in one of the participating projects, there appears to be no basic conflict between the project units proposed in the bill and any which the Department now has or might have an interest in as a result of future investigation or construction. However, because of the departmental interest in flood control and navigation, it is recommended that the bill be amended in the following manner:

(1) In section 1, page 4, lines 8–10, strike the portion beginning with the comma in line 8 and extending through the word "not" in line 10 in order that section 1 (c) of the Flood Control Act of 1944, having to do with consultation with affected States and the Secretary of the Army and providing for comment by those parties, will be made applicable to supplemental reports on participating projects;

(2) In section 1, page 4, line 15 after "affected States", insert "and the Secretary of the Army";

(3) In section 3, page 6, line 12, after "*Provided,*" insert "That allocation of costs to flood control or navigation as nonreimbursable costs shall be determined by the Secretary after consultation with the Chief of Engineers and the Secretary of the Army and any necessary investigations or studies therefor may be performed under a cooperative agreement with the Secretary of the Army: *Provided further,*".

In connection with S. 500, the attention of your committee is invited to draft legislation which was submitted by the Secretary of the Interior to the 83d Congress on April 1, 1954, and which is set forth at pages 13–16 of Senate Report 1983 on S. 1555 of the 83d Congress. The draft bill was intended to bring proposed authorizing legislation into correlation with the project report referred to above in that it would authorize only the Echo Park and Glen Canyon storage units, and, as S. 500 does, would grant provisional authorization only for certain of the participating projects. To the extent that the bill authorizes only these two major storage units, the Department of the Army considers the draft bill as being preferable to S. 500 and offers no objection to the authorization of the improvements proposed in the draft legislation. However, the suggestions in (1) and (3) above would apply as well to the draft bill, with the exception that the language in (3) would be inserted in the fifth line of section 3 at page 14 of the above-mentioned Senate report, and an appropriate deletion similar to (1) above would be made in the last line of section 1 at page 13 of the Senate report.

The Bureau of the Budget advises that there is no objection to the submission of this report.

Sincerely yours,

CHARLES C. FINUCANE,
Acting Secretary of the Army.

11. THE COMMITTEE AMENDMENTS

For the information of the sponsors of S. 500 and for the other Members of the Senate, the text of the measure as introduced with each change shown in *italic* is set forth below. The specific amendments are numbered and each is explained individually immediately following the text of the amended bill.

(S. 500 as introduced is shown in Roman type. Amendments by the Committee on Interior and Insular Affairs to S. 500 as introduced, are numbered and shown in *italic.*)

[S. 500, 84th Cong., 1st sess.]

[Omit the part struck through and insert the part printed in *italic*]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the

Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, [1] ~~making it possible for the States of the Upper Basin to utilize~~ *commencing a program for utilization in the States of the Upper Basin*, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities and appurtenant works: [2] ~~Gross Mountain,~~ Curecanti, Echo Park, Flaming Gorge, Glen Canyon, [3] *Juniper*, and Navajo: *Provided*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level [4] *and approved by the Colorado Water Conservation Board*, and that construction thereof, [5] *and of the Juniper unit*, shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of [6] ~~such~~ each unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of [7] ~~such~~ *each* unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Emery County, Florida, Gooseberry, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo, [8] *Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, and Sublette*: *Provided*, That [9] ~~(a)~~ construction of the participating projects set forth in this clause (2) shall not be undertaken until the Secretary has reexamined the economic justification of such project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of this Act can be met. The Secretary's supplemental report for each such project shall include, among other things, (i) a reappraisal of the prospective direct agricultural benefits of the project made by the Secretary after consultation with the Secretary of Agriculture; (ii) a reevaluation of the nondirect benefits of the project; and (iii) allocations of the total cost of construction of each participating project or separable features thereof, excluding any expenditures authorized by section 7 of this Act, to power, irrigation, municipal water supply, flood control or navigation, or any other purpose authorized under reclamation law. [10] ~~Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama and the Navajo participating projects, not be applicable to such supplemental reports; and, (b) that no appropriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been approved and authorized by the Congress~~ *Except as hereinafter provided, section 1 (c) of the Flood Control Act of 1944 shall not be applicable to such supplemental reports: Provided further, That with respect to the San Juan-Chama, Navajo, Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, and Sublette participating projects no appropriation for or construction of such participating projects shall be made or begun until coordinated reports thereon shall have been submitted to the affected States (which in the case of*

the San Juan-Chama and Navajo participating projects shall include the State of Texas), pursuant to the Act of December 22, 1944, and such participating projects shall have been approved and authorized by Act of Congress: Provided further, That with reference to the San Juan-Chama project, it shall be limited to a single off stream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission.

[11] ~~SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River system the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phases thereof)—~~

~~(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and~~

~~(2) for which pertinent data sufficient to determine their probable engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any participating project authorized in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law.~~

[12] *SEC. 2. It is not the intention of Congress, in authorizing only those projects designated in section 1 of this Act, to limit, restrict, or otherwise interfere with such comprehensive developments as will provide for the consumptive use by States of the Upper Colorado River Basin of waters, the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, nor to preclude consideration and authorization by the Congress of additional projects under the allocations in the compacts as additional needs are indicated.*

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) **[13]** ~~irrigation repayment~~ contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the **[14]** *irrigation* obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

SEC. 4. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter

referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury, **[15]** *and such funds shall be available for expenditures within the limitations of the provisions of this Act.*

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts, (2) payment as required by subsection (d) of this section, (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act, and (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277): *Provided*, That revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act. **[16]** *After repayments to the United States of all money required to be repaid under this Act, such revenue shall be available for expenditures within the Upper Colorado River Basin as may hereafter be authorized by Congress.*

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit, participating project, or separable features thereof, or, in the cases of the Paonia project and of Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project of separable feature thereof the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year **[17]** ~~1955~~ *1956*, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project

and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants [18] *and transmission lines* authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided [19] *for*, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty With the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the [20] ~~Cross Mountain,~~ Flaming Gorge, Glen Canyon, [21] *Juniper*, Navajo and Echo Park initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 10. There are hereby authorized to be appropriated such sums as may be required to carry out the purposes of this Act.

SEC. 11. The appropriate agencies of the United States are authorized to convey to the city and county of Denver, Colorado, for use as a part of its municipally owned water system, such interests in lands and water rights used or acquired by the United States solely for the generation of power and other property of the United States as shall be required in connection with the development or use of its Blue River project, upon payment by Denver for any such interest of the value thereof at the time of its acquisition by Denver, and provided that any such transfer shall be so limited as not to preclude the use of the property other than water rights for the necessary functions of the United States Government.

SEC. 12. [22] (*a*) In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, [23] *the Upper Colorado River Basin Compact*, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States, [24] *either on its own behalf or as parens patriae*, to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits. No right to impound or use water for the generation of power or energy, created or established by the building, operation or use of any of the powerplants authorized by this Act, shall be deemed to have priority over or otherwise operate to preclude or impair any use, regardless of the date of origin of such use, of the waters of the Colorado River [25] ~~and its tributaries~~ *System* for domestic or agricultural purposes [26] ~~within any of the States of the Upper Colorado River Basin.~~

[27] (b) *In the operation of works under his jurisdiction for the storage and release of waters of the Colorado River system and in programing the storage and release of such waters, the Secretary of the Interior shall consult from time to time with an advisory committee consisting of one representative appointed by each of the Colorado River Basin States, one representative of the Colorado River Board of California, one representative of the Upper Colorado River Commission, and one representative of the United States Section of the International Boundary Commission, United States and Mexico.*

SEC. 13 As used in this Act—

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "Upper Basin", and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785); and

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

12. EXPLANATION OF AMENDMENTS

[1] Strike out "making it possible for the States of the Upper Basin to utilize", and insert in lieu thereof *commencing a program for utilization in the States of the Upper Basin,* .

[1] Clarifying amendment. This substitution of language is to make it clear that this is the commencement of a program for utilization of Colorado River waters in the States of the Upper Basin, and does not in any way bar the States of the Upper Basin from subsequent utilization of additional waters through other projects.

[2] and [3] Strike out "Cross Mountain", and insert in alphabetical order *Juniper.*

[2] and [3] Gov. Edwin C. Johnson, of Colorado, in his testimony before the Committee, advised there would be serious flooding of irrigated areas if the Cross Mountain Dam were to be built. It was his opinion that the Juniper Dam, although a smaller project, would be more desirable and could be supplemented by other dams on the Yampa River.

[4] After the words "sea level" insert *and approved by the Colorado Water Conservation Board,* .

[4] Inasmuch as the Colorado Water Conservation Board is the official water agency of the State, this amendment was recommended.

[5] After the word "thereof," insert *and of the Juniper unit,* .

[5] A detailed feasibility report has not yet been completed by the Interior Department on this unit. The above amendment requires the Secretary to certify to the Congress that the project meets

feasibility requirements from engineering and economic standpoints before its construction can be started.

[6] and [7] Strike out "such" and insert *each.*

[6] and [7] Perfecting amendment necessary by the addition of the Juniper unit.

[8] After the word "Navajo" insert *Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, and Sublette.*

[8] These participating projects as listed are in the form recommended by the Upper Colorado River Commission and agreed to by all the States participating as members of the commission.

[9] Strike out "(a)".

[9] Perfecting amendment.

[10] Beginning with the word "Section" in line 14, page 4, strike out all of lines 15 to 24, inclusive, and the words "approved and authorized by the Congress" in line 1, page 5, and insert in lieu thereof the following:

Except as hereinafter provided, section 1 (c) of the Flood Control Act of 1944 shall not be applicable to such supplemental reports: Provided further, That with respect to the San Juan-Chama, Navajo, Parshall, Troublesome, Rabbit Ear, Eagle Divide, Woody Creek, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, and Sublette participating projects no appropriation for or construction of such participating projects shall be made or begun until coordinated reports thereon shall have been submitted to the affected States (which in the case of the San Juan-Chama and Navajo participating projects shall include the State of Texas), pursuant to the Act of December 22, 1944, and such participating projects shall have been approved and authorized by Act of Congress:

[10] The language was stricken because of the inclusion of the additional projects listed in amendment No. 8. At the top of page 5 the new language inserted beginning on line 1 reads as follows:

Except as hereinafter provided, section 1 (c) of the Flood Control Act of 1944 shall not be applicable to such supplemental reports:

That part of the new language refers to the requirements of the O'Mahoney-Millikin amendment of the Flood Control Act of 1944, which requires that project plans be submitted to the States affected before submittal by the Interior Department to the Congress.

The preceding language to which this exception refers provides for supplemental reports by the Secretary evaluating the direct and indirect benefits of the participating projects named in the bill. Each of the participating projects which are named on page 3, with the exception of the additional ones listed beginning on line 4 of page 5, have already been submitted to the States in the form of project reports presenting an evaluation of benefits.

The language dealing with the requirement for supplemental reports was inserted to make doubly sure, under the circumstances involved in the upper basin, that the first evaluation of direct benefits was

accurate before Federal funds are actually expended in the construction of the projects.

The language beginning on line 4, page 5, requires that reports on those participating projects listed beginning at that point must be submitted to the States in accordance with the Flood Control Act of 1944 since no feasibility reports on the projects in this category have been reviewed by the States of the Colorado River Basin.

Beginning on line 13, page 5, there is a specific provision requiring that the reports on San Juan-Chama and Navajo participating projects be submitted to the State of Texas. This requirement recognizes the interest of the State of Texas in the waters of the Rio Grande Basin, including those exported from the Colorado River Basin into the Rio Grande Basin. Because of the interest of Texas over the years in this question, the amendment affords Texas an opportunity to review the project plans of the San Juan-Chama and Navajo which have not been submitted to any of the affected States either in the Rio Grande Basin or in the Colorado River Basin.

[11] and **[12]** Strike out all of section 2 and insert in lieu thereof the following:

SEC. 2. It is not the intention of Congress, in authorizing only those projects designated in section 1 of this Act, to limit, restrict, or otherwise interfere with such comprehensive developments as will provide for the consumptive use by States of the Upper Colorado River Basin of waters, the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, nor to preclude consideration and authorization by the Congress of additional projects under the allocations in the compacts as additional needs are indicated.

[11] and **[12]** The new language in section 2 deals with future developments in the Upper Colorado River Basin. It sets forth that it is not the intention of the Congress, in authorizing only those projects designated in section 1 of this act, to limit, restrict, or otherwise interfere with such comprehensive developments as will provide for the consumptive use by the States of the Upper Colorado River Basin of waters, apportioned to the Upper Colorado River Basin by the Colorado River Compact of 1922, and to each State thereof by the Upper Colorado River Basin Compact of 1948, nor to preclude consideration and authorization by the Congress of additional projects within the allocation made in the Colorado River Compact of 1922 as additional needs are indicated.

[13] On page 7, line 24, after "(a)" strike out "irrigation repayment".

[14] On page 8, line 2, after the words "repayment of the", insert *irrigation*.

[13] and **[14]** Perfecting amendments.

[15] After "Treasury," insert *and such funds shall be available for expenditures within the limitations of the provisions of this Act.*

[15] Perfecting amendment to make clear intent that construction funds appropriated by Congress may be expended after crediting to the basin fund.

[16] After "Act" insert:

After repayments to the United States of all money required to be repaid under this Act, such revenue shall be available for expenditures within the Upper Colorado River Basin as may hereafter be authorized by Congress.

[16] This amendment is to clarify the intent of Congress that net project revenues will be available for additional projects consistent with comprehensive upper basin development and within compact apportionments, after repayment of all obligations pursuant to this act, subject to future authorization by Congress. This is not an exclusive earmarking of these funds, however, and is designed only to establish conclusively that this bill is not intended to preclude future development in the upper basin from project revenues as may be authorized by Congress.

[17] Strike out "1955" and insert in lieu thereof *1956,*.

[17] Perfecting amendment.

[18] After "powerplants" insert *and transmission lines.*

[18] Perfecting amendment. Inadvertently omitted.

[19] After the word "provided" insert the word *for.*

[19] Perfecting amendment.

[20] and [21] Strike out "Cross Mountain" and insert after "Glen Canyon" the word *Juniper,*.

[20] and [21] This change was made to conform to amendments (2) and (3).

[22] After "SEC. 12." insert (*a*).

[22] Perfecting amendment.

[23] After "Colorado River Compact," insert *the Upper Colorado River Basin Compact,*.

[23] Perfecting amendment.

[24] After "United States," insert *either on its own behalf or as parens patriae,*.

[24] The words, *either on its own behalf or as parens patriae* are added to waive the sovereign immunity of the United States to actions brought by basin States in the Supreme Court of the United States under the judicial doctrine of *parens patriae* on behalf of one of their cities or other political subdivisions to enforce the requirements of section 12. The Committee recognizes that the Congress cannot restrict or enlarge the original jurisdiction of the Supreme Court under Article III of the Constitution.

[25] After "Colorado River" strike out "and its tributaries" and insert *System.*

[25] Perfecting amendment in order to conform to other necessary legislation.

[26] After the word "purposes" insert a period and strike out "within any of the States of the Upper Colorado River Basin."

[26] This was stricken to protect power generation against other uses.

[27] Insert a new subsection under Section 12 as follows:

(*b*) *In the operation of works under his jurisdiction for the storage and release of waters of the Colorado River system and in programing the storage and release of such waters, the Secretary of the Interior shall consult from time to time with an advisory committee consisting of one representa-*

tive appointed by each of the Colorado River Basin States, one representative of the Colorado River Board of California, one representative of the Upper Colorado River Commission, and one representative of the United States Section of the International Boundary Commission, United States and Mexico.

[27] Provides for appointment of an Advisory Committee representing the States concerned and for consultation with the Secretary of the Interior.

JAMES E. MURRAY, *Chairman.*
CLINTON P. ANDERSON.
RUSSELL B. LONG.
HENRY M. JACKSON.
JOSEPH C. O'MAHONEY.
W. KERR SCOTT.
ALAN BIBLE.
RICHARD L. NEUBERGER
(with reservations expressed in Separate Views).
EUGENE D. MILLIKIN.
ARTHUR V. WATKINS.
FRANK A. BARRETT.
BARRY GOLDWATER.

II

SEPARATE VIEWS

OF

SENATOR RICHARD L. NEUBERGER, OF OREGON, ON S. 500, THE UPPER COLORADO RIVER STORAGE PROJECT

I concur with the majority of the committee in the recommendation that the Upper Colorado project be authorized for construction by the Federal Government, but I oppose the construction of Echo Park Dam on the Green River. I hope that the Senate will delay authorization of this phase of the project until adequate consideration has been given to alternative undertakings which will produce equivalent multipurpose benefits without encroaching on the scenic grandeur of a national park or monument.

ECHO PARK DAM A THREAT TO NATIONAL PARK SYSTEM

The Echo Park Dam site is within the boundaries of Dinosaur National Monument. In my opinion, construction of this dam would constitute a serious threat to the future integrity of our great national park system. It would set a fatal precedent for other inroads on our natural recreational reserves for economic purposes. If the pressure for such encroachments is to be resisted, the task, under the present administration, falls upon the Congress to resist it.

Our national park system represents one of the most valuable natural properties which we possess. It contributes today to the physical, inspirational, and educational well-being of our people, nearly 50 million of whom visited the system last year. As our population expands, and the tensions of urban culture and industrialized civilization increase, we shall need more sanctuaries where our people can relax the tightened nerves that come with modern living. Only in our national park system and a few other areas have we preserved a remnant of the natural treasury that once covered this continent, and only here will our children be able to know America as our forefathers knew it.

The lands reserved in our national parks and monuments are dedicated to their wisest use, and their essential contributions are directly dependent on strict preservation of their natural conditions without distortion by human activity. Their benefits cannot be measured solely in dollar return, but they are the keystone of the vast tourist industry.

PROTECTION OF PARKS AND MONUMENTS IS TRADITIONAL

Ever since the National Park Service was established in 1916, Congress has consistently refused to enact legislation which would violate the protection given our national parks and monuments, in spite of constant pressures to do so. Construction of Echo Park Dam not only would set a ruinous precedent, but it would specifically

destroy the features and qualities that led to reservation from commercial use of the great canyons of the Green and Yampa Rivers.

The beauty of the Dinosaur National Monument has been left in its undisturbed natural condition. The majesty of the canyon walls, the intricate pattern of eroded cliffs, their colors and shadows, present an unparalleled example of our Nation's original tranquil wilderness. This section of the Green and Yampa Rivers has some of the most beautiful scenery in the world.

We are promised the expenditure of millions of dollars to make a more accessible recreational area of the reservoir which will fill the precipitous gorges of the Green and Yampa Rivers. Yet to those who love the silent, pristine isolation of our primitive wilderness, this is little comfort. The wisest use of Dinosaur National Monument is to preserve inviolate for the future its wild beauty, a value worthy of as much consideration as the purely utilitarian objectives of S. 500.

In spite of the mass of testimony about Echo Park Dam, no concrete evidence has been presented that Echo Park Dam is necessary. Asserted justifications for it have changed repeatedly, as one or another contention has been found to be invalid. It is difficult to understand why the sponsors of the Colorado storage project are so insistent that Echo Park Dam be built here and now, rather than defer recommendation for authorization while thorough studies are made of the possibility of revising the project to secure the desired benefits without the damage this dam would do. The House Subcommittee on Irrigation and Reclamation has requested further information from the Bureau of Reclamation about feasible alternative methods of constructing the project, and this information should be made available to the Senate before final consideration is given this legislation.

In the absence of undeniable proof that Echo Park Dam is necessary to the welfare of the Nation as a whole, this feature of the project should be deleted from the present authorization.

The question is not a choice between preserving a national monument or securing water benefits. Rather, it is how to adjust the present plans to utilize the water and secure the desired power in such a way as to reaffirm the primary values embodied by our national park system.

ECHO PARK COULD SET A PERILOUS PRECEDENT

Once the inviolability of that system is ignored in the Dinosaur Monument, it will be imperiled everywhere. Certain lumber operators hope to harvest the fir and spruce rain forests of the Olympic National Park. Irrigationists have hungrily eyed the waters of the Yellowstone. Some groups would like to construct a dam across a river within Glacier National Park.

To the values of conservation, it makes little difference whether the encroachment is by public or private enterprise. Once the traditional policies of the National Park Service are sacrificed at Echo Park, a coordinated onslaught by private interests against the boundaries of national parks and national monuments will begin all over the land.

If the reclamation service can cross the frontier of Dinosaur National Monument, why should not timber operators in the Olympics insist that a similar privilege be accorded them? What about sheep and stock ranchers eyeing the lush meadows of the Yellowstone or

the rangelands of Grand Canyon National Park? Will there be pressure to cut the pine forests of Crater Lake National Park in Oregon? Echo Park is the test. If the beauties of Dinosaur National Monument can be sacrificed for Echo Park Dam, then other national monuments and national parks are in danger of commercial exploitation justified by reasons which will be made to sound equally compelling.

An attempt has been made by supporters of Echo Park Dam to belittle the opposition to the project by people who place the contemplation and enjoyment of unspoiled natural grandeur above values which can be measured in dollars and cents. Yet, many illustrious Americans have shared their preference, and it is wrong to minimize the extent of the popular rallying in defense of Dinosaur National Monument, which extends across the length and breadth of our country.

AMERICAN CONSERVATION GROUPS QUESTION WISDOM OF ECHO PARK

Let me refer only to the statement of policy, appearing on page 689 of the committee's hearings on S. 500, which was adopted by representatives of more than 20 conservation organizations, called into emergency meeting in November of 1954 by the National Parks Association:

1. The national park system, established by law, is urgently needed and is increasingly being enjoyed and supported by millions of people. The conservationists represent the public interest in the preservation of these areas. That is what brings us together in this crisis.

2. We are opposed to any legislation that would authorize building the proposed Echo Park Dam in the Dinosaur National Monument in northwestern Colorado and northeastern Utah—or any other dam that would flood any portion of any national park or monument.

3. We are mindful of the extreme importance of water in the West. And we are sincerely interested in any sound Upper Colorado water development that can effectively utilize the water without threatening the national park system. We point out that the necessity for Echo Park Dam has never been demonstrated. It has only been asserted. We also point out that the alternatives to Echo Park Dam have never been adequately studied by the Bureau of Reclamation, and have never been proved inferior.

4. We invite all citizens to join with us to make sure that areas set aside for preservation in the national park system are not needlessly invaded or destroyed.

(Signed) The American Museum of Natural History.
The American Nature Association.
The American Planning and Civic Association.
The Conservation Department, Yale University.
The Conservation Foundation.
The Council of Conservationists.
The Dartmouth Outdoor Club.
The Emergency Conservation Committee.
The Garden Club of America.
The General Federation of Women's Clubs.
The Izaak Walton League of America.
The National Audubon Society.
The National Conference on State Parks.
The National Council of State Garden Clubs.
The National Life Conservation Society.
The National Parks Association.
The National Wildlife Federation.
The North American Wildlife Foundation.
The Outdoor Writers Association of America.
The Sierra Club.
The Wilderness Society.
The Wildlife Management Institute.

The inundation of part of the Dinosaur National Monument by the proposed Echo Park Dam is opposed, in summary, by virtually all the organizations which traditionally have fought to protect what remains of our original scenery and outdoor grandeur. Yet I call to the attention of the Senate the constructive and openminded nature of this statement. It does not attempt to discredit the entire Upper Colorado project, opposed though these conservation groups may be to one phase of the project. It simply suggests that the project be undertaken without that single feature which would imperil national park standards.

ONLY ECHO PARK PHASE OF PROJECT IS OPPOSED

Because I share this view, I have joined the majority of the committee in voting to report S. 500 out for consideration by the Senate. Although I oppose the Echo Park phase of the project, I do not agree with those few conservation groups, such as the California Academy of Sciences, which launched an all-out attack against the entire project. I regard this as shortsighted and not within the general purview of our conservation organizations. The inclusion of Echo Park Dam does not condemn the entire Upper Colorado project. It merely means that Echo Park Dam should be eliminated because of its location within a national monument.

The present national administration has endorsed the Upper Colorado project. Many of the administration's political backers in the Congress have sought to carry out this endorsement through the enactment of the present bill.

Yet this same administration opposes the Hells Canyon project in the Pacific Northwest on the grounds that Hells Canyon would be a drain on the Federal Treasury.

In the Upper Colorado River Basin the administration proposed full Federal financing of the multipurpose projects, but in the Columbia River Basin its spokesmen advocate "partnership" with the profit-making power facilities going to the electric utility partner. The incongruities and inconsistencies in this approach to development of water resources are obvious.

UPPER COLORADO A HIGH-COST PROJECT

The energy to be developed at the sites in the Columbia River Basin such as Hells Canyon will be marketed for approximately 2.5 mills per kilowatt-hour. For this low-cost energy there is certain to be vast demand—for manufacturing, for business payrolls, for farms, for homes.

The cost of Upper Colorado power, delivered at load centers, will be approximately 6 mills per kilowatt-hour, substantially more than twice the cost of current from the Federal sites in the Columbia Basin. Demand for Upper Colorado energy, particularly for industry, will be far less than in the Pacific Northwest. Few industries would seek Upper Colorado energy at 6 mills when Columbia Basin kilowatts can be purchased for 2.5 mills. Other factors being equal, the competitive factor alone rules out the use of Upper Colorado energy for any manufactured product which could be made more cheaply elsewhere in the country.

I am not opposing the Upper Colorado project as a government undertaking. I merely am posing what to me seems an obvious question: Is it not curious that this national administration, supposedly dedicated to financial integrity, favors the Upper Colorado project and yet, in the same breath, opposes Federal development of the power sites in the Columbia Basin which are economically far more feasible?

This administration would reserve the 6-mill waterpower locations as government projects, but it willingly abandons the 2.5-mill choice power sites to the electric utilities.

WHY "YES" ON UPPER COLORADO BUT "NO" ON THE COLUMBIA?

Is an administration responsive to the public welfare when it saves for government the marginal aspect of any resource and abandons the choice features to private corporations?

It is not my purpose to indict or embarrass the Upper Colorado project. Its $1,659 million total cost probably can be justified on the grounds that underdeveloped areas of our vast country long have needed capital improvements. The economy of the intermountain region will gain by having its agricultural economy strengthened and its energy resources increased. Echo Park is not justified, because it threatens our national park system, but I refuse to join with those who use that argument to condemn the remainder of the Upper Colorado River project.

The balance between commercial development and resource conservation must be carefully maintained in this country. Too great an emphasis in either direction can lead to serious consequences.

EX-SECRETARY OSCAR CHAPMAN WITHDREW ECHO PARK ENDORSEMENT

During preliminary discussion of the Upper Colorado project on the floor of Congress, an effort has been made to convince the public that former Secretary of the Interior Oscar L. Chapman, a prominent and leading conservationist, favored construction of a dam within the boundaries of the Dinosaur National Monument, at Echo Park.

In this connection, I call attention to a letter from ex-Secretary Chapman to the President of the United States, written on December 4, 1952, shortly before both Mr. Chapman and President Truman were succeeded in office, respectively, by Douglas McKay and Dwight D. Eisenhower.

Mr. Chapman modified previous recommendations regarding the Upper Colorado project, to bring about—

> deletion of the recommendation for immediate authorization of the Echo Park unit and the deletion of the recommendation for inclusion of the Split Mountain unit in the plan of development for later authorization.

Both Echo Park and Split Mountain would create reservoirs within the Dinosaur borders.

In this letter, Secretary Chapman made it explicit that alternative sites should be studied and decided upon. Portions of Mr. Chapman's letter of December 4, 1952, make clear his belief further study was needed. The letter said, in part:

> Attached for your consideration is my report on a proposed plan for the development and utilization of a portion of the water resources of the Upper Colorado

River Basin by construction of the Colorado River storage project and participating projects.

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Proposals are made in the report for authorization of a series of dams and reservoirs in the Upper Colorado River Basin for river regulation and the generation of hydroelectric power and for authorization or reauthorization of a number of related irrigation projects. Construction of the storage project would aid the States of the Upper Colorado River Basin to achieve the benefits contemplated under the Upper Colorado River Basin Compact, to which the consent of the Congress was given by the act of April 6, 1949 (63 Stat. 31). The report also proposes the establishment of an Upper Colorado River Account. This would furnish a basis for uniform power rates and would aid in accounting for the return of the reimbursable costs of the participating irrigation projects.

This report as approved by me on January 25, 1951, as my proposed report for transmittal to the interested States and Federal agencies for comment, included a recommendation for authorization of the Echo Park unit and a proposal for the inclusion of the Split Mountain unit in the recommended plan of development for later authorization. Both of these units would encroach on the Dinosaur National Monument.

I am acutely aware of the controversy surrounding the issue between those who favor full development of the water and power resources of the Colorado River and those who oppose reservoir encroachments on the canyons of the Green and Yampa Rivers within the Dinosaur National Monument. It must be recognized that there exists no adequate measure by which the merits of the opposing views in this controversy may be gaged. Among other things, exceptionally important intangible values must be weighed against very real economic needs and potentials. The formulation of my recommendation required very careful consideration of the following points:

1. Need for a reservoir development at Echo Park versus the national value of the monument.
2. Effect of Echo Park Reservoir upon the monument.
3. Presidential order of 1938 enlarging the Dinosaur National Monument and its legal and implied interpretations.
4. Possible alternative reservoirs and their relationship to river basin development.

I have now concluded that the terms of the recommendations of the report should be modified in respect to these two units. Accordingly, the report as modified by the letter of June 29, 1951, of the Commissioner of Reclamation is further modified by the deletion of the recommendation for immediate authorization of the Echo Park unit and the deletion of the recommendation for inclusion of the Split Mountain unit in the plan of development for later authorization. In lieu of the recommendation of the Echo Park unit, I recommend that the Secretary of the Interior be authorized to construct and operate facilities, at Echo Park or at an alternate site, to serve the purposes intended to be served by the Echo Park unit. This authorization should be made subject to the requirement that the Secretary give further consideration to studies of alternate sites and subject also to a finding by the Secretary, prior to the submission of requests for appropriations to initiate construction, as to the site best adapted for development in the light of all factors involved.

* * * * * * *

As so further modified, the report as modified by the Commissioner's letter of June 29, 1951, is adopted and approved as my report.

ECHO PARK ONLY ONE OUT OF 39 SEPARATE UNITS

The Upper Colorado project consists of many individual units. The total number, in fact, is 6 storage projects, 12 participating projects, and 21 which are subject to further authorization.

Echo Park is merely one of these separate undertakings. In my opinion, it should be eliminated—certainly for the time being. If the population of the intermountain region ever is so large that needed hydroelectric power can be obtained only at Echo Park, then the time may be at hand when the scenic values of a national monument must be sacrificed to make way for an expanding civilization. Of

course, we must always weigh the quantity of added power against the conservation values destroyed or lost.

This rule should govern all regional development, everywhere in the West. Nor should it apply exclusively to dams. Certain lumber interests, for example, would like to bring about the breaching of the national park system on the Olympic Peninsula so these mills can cut trees within the borders of the Olympic National Park in the State of Washington.

America someday may be at the stage when these trees, magnificent though they are, are imperative to national survival or to the basic comforts of America's people. If that hour is reached, then the rain forests of the Olympics may have to succumb to ax and saw. But, so long as other sources of commercial timber remain, I believe it would be little short of criminal to log and harvest one of the last remaining museums of the original coastal evergreens which once flourished in such abundance along the Pacific slope.

In essence, such a philosophy was substantiated as recently as the 83d Congress, when the Atomic Energy Act was amended to prohibit prospecting or mining of fissionable material in national parks or monuments, except when the President, by Executive order, declares that the requirements of national defense make such action necessary. Certainly if the Congress believes the boundaries of national parks must be defended from invasion even during the present search for such a vital defense product as fissionable material for atomic energy, then it cannot in good conscience endorse partial flooding of the Dinosaur National Monument for electric energy, especially when such action is not required for the defense and security of the country.

WILL THERE BE A STEADY MARKET FOR 6-MILL POWER?

Indeed, there probably is available in the Upper Colorado region a great deal more potential energy than can be used in the foreseeable future, particularly at the delivered rate of 6 mills a kilowatt-hour—a rate which precludes extensive use for competitive manufacturing. Why, then, sacrifice the most scenic parts of a national monument to build Echo Park, thus jeopardizing conservation principles which have grown up with our national park system? This is not necessary today. It may not be necessary tomorrow, or for many tomorrows.

The last projects to be undertaken for commercial development—whether by the Government or by private enterprise—should be those which imperil conservation values.

The power and storage at Echo Park are not essential to the prosperity of the intermountain West, today. Why not preserve a national monument as long as no compelling or immediate reasons dictate a different course? Urgency is not presently a prevailing factor.

I believe Echo Park Dam, inside the Dinosaur National Monument, should be eliminated from the general authorization for the Upper Colorado project until adequate consideration has been given to alternative dam sites which will produce equivalent multipurpose benefits without invading a national park or monument.

RICHARD L. NEUBERGER,
United States Senator from Oregon.

III

MINORITY VIEWS

OF

SENATOR THOMAS H. KUCHEL, OF CALIFORNIA, ON S. 500, THE UPPER COLORADO RIVER STORAGE PROJECT

After painstaking study of the bill and close analysis of the testimony, I believe that S. 500 is an unsound measure and I am forced to recommend its rejection.

The bill, which is put forward in an earnest attempt to promote the development of natural resources of the Upper Colorado River Basin, is based on interpretations of the Colorado River Compact and related documents making up the law of the river which are, at the very least, strained. Certainly, they are challenged and contested. Furthermore, enactment at this time would be premature in view of the absence of much essential data about the cost, operation, and effect of the numerous projects embodied in an open-ended program that undeniably will require an outlay of billions of dollars from the Federal Treasury.

I cannot believe that the Senate will consider it wise action to approve legislation of such proportions which raises so many complex questions of policy, establishes precedents which radically depart from tested principles of natural resources development, and is characterized by grave uncertainty about eventual results.

The impact of this legislation on the future growth and progress of the western part of our Nation might well amount to revolutionary changes in interstate relations, nullification of solemn pacts between various units of government, destruction of the foundations of agricultural and industrial economy over a wide area, and jeopardizing of the welfare of tremendous numbers of people.

Sound and orderly utilization of all resources of the Colorado River system and basin is essential to the expanding prosperity of a vast section of our Nation. Assuredly, it would benefit the entire country. However, S. 500 is an ill-advised and hazardous way to try to reach this commendable goal.

Extended hearings before the Committee on Interior and Insular Affairs in both the 83d Congress and the 84th Congress unmistakably demonstrated that there are widely differing schools of thought about the most efficient and productive courses to bring about maximum development of natural resources of the Upper Colorado River Basin. It would be foolhardy to sidestep these differences of opinion by enacting a statute which employs a flexible yardstick for measuring economic and financial feasibility, which virtually writes a blank check on the United States Treasury, which delegates to administrative agencies authority and responsibility clearly imposed upon the Con-

gress, and which brushes aside grave issues involved in complex litigation currently pending in the highest court of this Nation.

The proposed program of development in S. 500 goes far beyond the recommendations of the President of the United States. Nevertheless, this costly and difficult undertaking is advanced with only a fragment of the extensive engineering, financial, economic, agricultural, and other data which should receive the most thorough analysis and examination before the Congress approves investment of immense sums of taxpayers' money on projects of the character envisioned.

As presented to the Senate, S. 500 contemplates an intricate network of dams, powerplants, and irrigation-reclamation works the ultimate cost of which cannot be conjectured. Specifically, the measure would authorize 6 major storage projects and 33 participating projects for the impounding, diversion, and delivery of water, and for the generation of hydroelectric power. Only the scantiest preliminary estimates are available about the cost of many of these works. The bill contains no definite limit on the amounts of public funds which may be expended for this ambitious plan. The minimum outlay admittedly would exceed $1.5 billion, while the aggregate charges for interest on the capital expenditure would be more than double this prodigious figure.

Virtually all of the objections raised in the 83d Congress against the predecessor to S. 500 apply with undiminished force. Many additional challenges have been presented in the present Congress which merit the most serious deliberation by the Senate before a decision is reached upon this proposal.

The principal arguments which I feel compelled to present to the Senate may be summarized generally in three categories. These are: legal, economic, and policy questions.

GRAVE LEGAL QUESTIONS

The proposed projects and the contemplated basis of operating them bring squarely before the Congress sharp conflicts about interpretations of the Colorado River Compact and the law of the river. Assumptions underlying the legislation would constitute encroachment upon and veritably rewrite the basic seven-State agreement negotiated in 1922 to make possible development of this great stream, its tributaries, and the vast, varied territory embraced in its watershed.

Pending before the Supreme Court of the United States is the case of *Arizona* v. *California* (No. 10 Original, October Term 1953) which presents no less than eight fundamental and sharply contested issues which cannot be ignored in the consideration of any legislation dealing with further development of the Colorado River system.

In the 83d Congress, attention was drawn to the direct implications of this lawsuit. Recently, the Supreme Court has referred to its special master the question of whether to include the States of the Upper Basin as essential and affected parties. It is impossible to forecast the effect this litigation may have on the rights of those States. The final decisions which will be forthcoming in the case may well exercise a profound influence on plans for additional works and compel fundamental changes in suggested undertakings designed to benefit New Mexico, Colorado, Utah, and Wyoming.

All parties concerned about Upper Basin development concur that the practicality and feasibility of the Colorado River storage project turn directly upon the availability of water in the system to generate the hydroelectric power contemplated and to supply the agricultural and domestic needs which would be served by the projects to be authorized.

A vital question presented in *Arizona* v. *California* is the method of measurement of consumptive use. Availability and use of water are interwoven questions which cannot be separated.

The controversy over this point has gained steadily in importance with mounting indications the Colorado River system in actuality contains only about three-quarters of the volume of water that framers of the seven-State compact believed it contained and could be employed and enjoyed. The intention and meaning of several related portions of the compact dealing with diversion, distribution, and utilization of water are the heart of the litigation now before the Supreme Court.

In view of decided differences of thought about measurement of "beneficial consumptive use," grave and far-reaching uncertainty now exists about the effect of almost all of article III of the compact. This article is the very foundation upon which rest all present and proposed works to realize the potential benefits of the entire Colorado River system.

These doubts embrace language of the compact which (1) apportioned in perpetuity the right to utilize 7.5 million acre-feet per annum in each basin; (2) which permitted use of 1 million acre-feet annually of so-called surplus water in the lower basin; (3) which specified the manner of providing water for Mexico now required by the Mexican Water Treaty ratified over the stern protests of California 10 years ago; (4) which is a promise by Upper Basin States they will not diminish the flow at Lee Ferry below an aggregate of 75 million acre-feet in any 10-year period; and (5) which stipulates the Upper Division will not withhold and the Lower Division will not compel delivery of water which could not reasonably be put to domestic and agricultural use.

The significance of the dispute about interpretations of various features of article III has been demonstrated by doubts expressed about the meaning and obligations of the compact by a respected former colleague, Gov. Edwin C. Johnson, of Colorado. While eager to obtain congressional approval for ambitious plans for development of the Upper Basin, Governor Johnson candidly testified before the committee that he is gravely apprehensive concerning provisions of article III (d) and III (e) relating to the guaranteed flow to the Lower Basin and possible withholding by the Upper Basin.

Former Senator Johnson last December publicly asked a series of questions stemming from his uncertainty about the intent and effect of specific provisions of the compact. During his appearance before the committee more than 2 months later, he still was not satisfied the Upper Colorado Basin States could withhold the water which is proposed in this bill.

I call attention to page 237 of the transcript of committee hearings, where the following discussion is reported:

Senator KUCHEL. Yes; I was quoting the Governor's words there in that last paragraph.

Then on page 12, Governor, again your own language:

"I am compelled to keep emphasizing that whatever water is stored in the Glen Canyon and Echo Park Reservoirs will be surplus to the agricultural and domestic needs of the Upper Basin and must be delivered to the Lower Basin to satisfy the award of 1.5 million acre-feet to Mexico and 1 million acre-feet to the Lower Basin.

"Furthermore, should the Lower Basin require an additional supply of water for agricultural and domestic purposes the water stored in these reservoirs must be released."

On the basis of that comment, Governor, I first ask if those views of yours are the same today as when you gave them to the press in December of last year.

Governor JOHNSON. Those views are all in the nature of a question and I have had not the answer to that question. So the question is still bothering me.

This whole document is in the nature of a question and I am anxious to know the answer. I understand that the members of this committee do not feel that the questions have the merit which I gave them, but, nevertheless, I am still seeking answers to this whole document.

In the event the final decision of the Supreme Court in *Arizona* v. *California* sustains interpretations of the compact as are contended by California, the fears voiced by Governor Johnson will have been justified. A ruling in consonance with California's position will mean that availability of water for two key features of the project—Glen Canyon and Echo Park Dams—will be reduced to the point where the entire basis for the Upper Basin storage project will have been eliminated.

Another feature of the compact is involved in the pending lawsuit in a fashion which throws further doubt on the availability of water to generate the power to provide revenues to make the entire project feasible and to supply the more than 1.1 million acres intended to be furnished with new or supplemental quantities. The Supreme Court has been asked to rule on the meaning and effect of article VII which relates to rights of Indian tribes in the basin.

In the pending controversy, the Department of Justice has made claims which seem to involve over 1.7 million acre-feet of water of the system and seriously reduce the allocations of 7.5 million acre-feet to each basin. During the 1954 hearings, Judge Jean S. Breitenstein, who for years was attorney for the Colorado Water Conservation Board, acknowledged the ultimate scope of the question about Indian rights is itself disputed. Judge Breitenstein conceded that if the Supreme Court upholds a theory that Indian claims constitute a first demand upon the water—

then every right to the use of water of the Colorado River and its tributaries is of doubtful validity.

The committee was unable to obtain a clear statement of the attitude which the United States takes in regard to quantities of water to which the Indian tribes may eventually be entitled. Officials of the Department of the Interior, while maintaining the Indian rights issue is immaterial to S. 500, could not state what priorities are claimed on behalf of the tribes resident in the basin. The question is, at the very least, confused and clouded since the compact declares nothing in the way of allocations to individual States shall impair obligations of the United States to Indian tribes.

In the present situation, the Department of Justice asserts superior rights for Indian tribes, yet the Department of the Interior cannot testify concerning the amounts of water which are involved. Apparently the issue is so debatable there is difference of opinion within

the Interior Department and reluctance on the part of that agency to agree with the Justice Department contention.

The broad question of measurement of water has an undeniable impact on the distant future welfare of the entire Lower Basin, just as it does on possible development of the Upper Basin. The aggregate capacity of the storage reservoirs proposed in S. 500 is more than 40 million acre-feet. The average flow of the stream at Lee Ferry, according to studies over 40 years, is 15.4 million acre-feet annually. On this basis, in the opinion of experts, an estimated 20 years would be required to fill the reservoirs and make possible the generation of the hydroelectric power which is essential to provide revenues by which the entire project would be feasible. If the Supreme Court finds the water may not be withheld, the financial foundation of the whole project crumbles.

My colleagues of the majority of the committee are disposed to minimize the relationship between *Arizona* v. *California* and this legislation. They contend that the issues involved in the litigation are inconsequential except as they will determine disposition of Lower Basin problems. I cannot agree.

The whole concept of the Upper Colorado River storage project is based on interpretations of the law of the river by proponents of the legislation and by the Department of the Interior which would administer it. I submit that operation of the Upper Basin development plan would be directly influenced by findings of the Supreme Court on such points as the meaning of "per annum" in article III (a) relative to apportionment of water between the two basins, the extent of "rights which may now exist," the availability of III (b) water in the Lower Basin, the means of carrying the Mexican treaty burden, the status of Indian claims, and the respective rights of Upper and Lower Basins to withhold or require delivery of water.

Prudence and conscientiousness seemingly would dictate the obtaining of final answers to the many far-reaching questions before the United States proceeds to expend upwards of $1.5 billion and assume a burden that eventually could reach $4 billion for a network of projects whose feasibility is so largely contingent upon revenues from key powerplants. Only after the questions in the suit are settled, and not while they remain unanswered, would enactment of a measure authorizing future expensive works on the Colorado River be warranted and sensible procedure.

SERIOUS FISCAL PROBLEMS

The financial and economic problems involved in this legislation are equally important and complex.

This program is described as in accord with recommendations of the President. However, in its present form, S. 500 goes far beyond the program submitted to the Congress by the Department of the Interior which President Eisenhower termed "well-conceived."

The development plan as outlined by the administration consisted of 2 major storage dams—Echo Park and Glen Canyon—and 11 new participating irrigation and reclamation projects. The Interior Department did not recommend the bill before us, has reservations about the benefits and feasibility of certain of the works sought to be undertaken, and can supply only rough estimates of cost and repayment in

reports on reconnaissance investigations into 15 of the participating projects enumerated in S. 500 as it emerged from our committee.

The Department proposed the construction of works which would create reservoirs with storage capacity of 32,460,000 acre-feet, costing $597,696,000, together with 11 new participating projects, costing $304,356,000, to provide new and supplemental water supplies for 366,290 acres.

The works proposed by S. 500 comprise 6 storage dams, capable of storing 40,390,000 acre-feet of water and costing $821,886,000 plus 33 participating projects, calling for an investment of $874,281,800 to supply 1,208,645 acres with new and supplemental water.

Thus, the development envisioned by S. 500 would require expenditures nearly twice the total deemed feasible by the Interior Department, impounding more than 21 percent more water, and supplying over three times as many acres of land.

The ultimate aggregate cost of this legislation cannot be even guessed, inasmuch as only preliminary and partial studies have been made of 17 of the 33 participating projects. The interest charge which eventually will be paid by the Nation's taxpayers obviously will amount to several billions of dollars, since the Interior Department has advised the comparable burden imposed by those works it originally recommended will amount to a total of $1,153 million in the year 2032.

The fundamental economics of the entire program are subject to challenge and depart from precedent. Although this venture would be built under the reclamation laws, its success from a financial viewpoint will be determined by the sale of power proposed to be produced at the six main reservoirs.

Of the aggregate $1,696,147,800 construction cost of the 33 participating projects and 6 storage dams, the agricultural water users would repay only $108,212,200, according to Reclamation Bureau estimates. The taxpayers' prospects of getting back investment costs rest on the soundness of predictions about the market for power and the willingness of consumers to pay prices for hydroelectricity which are substantially above the level established at comparable other developments constructed by the Interior Department.

The statistics furnished the committee by the Bureau of Reclamation show the estimated income over the payout period from sales of power from the six major storage works would be $909,152,300. The revenue is based on an assumption of a ready market for energy at the high price of 6 mills per kilowatt-hour. As indicated in the portion of this report dealing with legal issues, the availability of water to generate this electricity is by no means certain.

The idea of justifying such an ambitious undertaking by forecasting prospective power revenues is in itself extraordinary in view of the conditions surrounding this program. In the case of the first venture on the Colorado River, Hoover Dam, firm contracts for power sales were consummated in advance of construction. In the instant case, the extent of the market in many areas has been merely estimated in reconnaissance studies while the population is widely distributed with an average density of only 3 persons per square mile compared to the national average of approximately 51. The committee received only general assurances that, subject to conditions which have not been

worked out, private utilities stand ready to purchase "large blocks" of energy.

To illustrate the premature nature of this bill, the committee was unable to get any estimate of revenues from the proposed Juniper Dam and powerplant, although engineering plans call for generating and transmission features costing $5,834,000. Initial energy output was estimated at 125 million kilowatt-hours.

The basis on which the Congress and the Federal Government have undertaken a variety of public works in the past has included consideration of what is known as a cost-benefit ratio. In one form or another, such a figure is applied against proposed river and harbor improvements, flood prevention works, and all irrigation-reclamation developments. This program embraces a number of projects with widely varying cost-benefit ratios.

Disregarding the actual value of lands to be served and such questions as the type of crops to be raised, the evidence before the committee about the project costs is such that Congress should weigh carefully the lengths to which the United States goes in underwriting such developments.

Let me make this clear. I do not condemn so-called high-cost projects per se and I acknowledge that this Nation has virtually constructed all of the low-cost developments which appear feasible.

Nevertheless, I am disturbed at the variations from $210 to $749 per acre for construction costs of the initial projects and from $77 to $1,530 per acre for the participating projects added by the committee. As I have noted in other connections, the estimates for many of these latter projects are extremely preliminary, coming from what are termed by the Reclamation Bureau "reconnaissance reports."

Besides relying on power revenues to substantiate arguments that the entire development is "feasible," proponents of S. 500 have endorsed a remarkable and novel repayment plan. The reimbursements would be greatly delayed, with much of the repayment not scheduled to begin until 50 years after completion of construction. A substantial amount of the outlay is assigned arbitrarily to irrigation features, thus reducing the interest charge against the program and transferring an additional load to all of the Nation's taxpayers.

The allocation of construction costs to irrigation is exceedingly difficult to accept in the case of the main storage dams. Little water for agricultural use would be withdrawn from the reservoirs behind these structures, yet a high percentage of the investment would be charged against irrigation and reclamation. This is especially true in the case of the two biggest units, Echo Park and Glen Canyon. The Reclamation Bureau assigns $48,043,000 of $176,426,000 and $50,296,000 of $421,270,000, respectively, to irrigation and reclamation, but not a dollar of repayment of the costs would be received from water users.

Another reason for the utmost caution is the possible effect of Upper Basin development on the financial structure of Lower Basin developments. Revenues from Hoover Dam would be jeopardized if, because of dry cycles or other factors, water should not be available for the downstream powerplant. The committee, in other hearings on a related matter concerning the Colorado River, recently was advised that the hydroelectric output in the Lower Basin had been curtailed because of inadequate water.

The optimism of proponents of the Upper Basin program was questioned by an expert consultant for one of the States which expects to benefit. Raymond A. Hill, consulting engineer retained by Colorado, declared that even if the Upper Colorado River storage project, on the modest scale proposed by the Interior Department, had been built a quarter-century ago and put in operation as soon as the seven-State compact was consummated—

there would not have been enough water since then for the beneficial consumptive uses in the Upper Basin permitted by that compact.

CONSIDERATIONS OF POLICY

The foregoing discussion implies some of the broad policy matters that are inherent in legislation of the sort of S. 500. I believe that it is unwise to make decisions on fundamental principles in piecemeal fashion. Some aspects of those questions are being studied and weighed by the Commission on Organization of the Executive Branch of the Government which Congress specifically created to ponder issues of the type here presented.

The bill seeks to bypass certain obligations presently recognized by both Congress and the executive branch of the Government. By implication, Congress would commit itself as far as is legally possible to a long-range plan of comprehensive developments in the Upper Colorado River Basin.

The thoroughness of essential engineering investigations is open to question. Apprehension exists about the geological characteristics of the site chosen for Glen Canyon Dam while a possibility exists that Rainbow Natural Bridge would be impaired. The rock in the Glen Canyon area, the Reclamation Bureau admits, is "poor" compared with the strata underlying other big structures.

Extra steps to insure safety and efficiency of the Glen Canyon unit will increase the cost but there is no assurance that seepage will not result in water losses that will upset all operating plans. The Bureau intends, even while recommending this structure, "to carry out further experiments, to see if we could not solidify that foundation a little more by chemical grouting." Protection of Rainbow Natural Bridge by a dike is contemplated, yet backing up water behind Glen Canyon concededly will make access to this scenic rarity "more difficult." Indeed, there is question whether Glen Canyon should be erected at all on the site selected.

Evaporation losses behind the major dams will be substantial and an undeniable drain on a river system already threatened with excessive burdens. In order to generate the power required to finance the project, reservoirs will be created from which 1,065,000 acre-feet annually will be lost forever through evaporation. Certainly Congress should face squarely the question whether it is desirable to accept each year an irrecoverable loss equivalent to two-thirds of the quantity of water the United States has guaranteed to deliver to Mexico. Incidentally, the manner in which the Interior Department, even during the course of hearings in 1954, modified estimates of evaporation losses and revised computations is reason for honest question as to whether they may be the sound and final answers.

A major policy problem inherent in this legislation has been foreshadowed in the section of this report dealing with some economic

aspects. In passing on this proposal, Congress should consider whether it wishes to adopt a rubber yardstick for evaluating such developments. This point becomes important since one of the participating units will not result in a single dollar of repayment by water users and the investment ranges so greatly, from $77 to $1,530, on the basis of areas benefited.

An unusual delegation of authority would result from enactment of this bill. In the case of at least 12 of the participating projects, Congress is asked to accept without further review results of reexaminations and reappraisals by the Interior Department. A return of this kind to the blank-check procedure which encumbered the Federal Government and short-circuited Congress in past years is deplorable.

Inadequate study has been given, as was noted last year, to the possible effect of water diversions out of the Upper Basin on the quality of water remaining for downstream users. Undeniably exportation of water at higher elevations, where purity is greatest, will impair the quality in lower reaches. There is about 1 ton of salts in each acre-foot of water now coming to the Lower Basin. The effect of the impounding and diversion through works proposed in S. 500 certainly merits more investigation than has been carried out to date.

Conflicting interests in national resources have been cited in connection with this contemplated development. Sincere protests have been registered about the effect of Echo Park Dam on the Dinosaur National Monument and uneasiness shown about the consequences of Glen Canyon Dam to Rainbow Natural Bridge. Surely the historic policy of preserving scenic and historical wonders should not be altered without earnest deliberation.

CONCLUSION

The measure as reported in some regards is a definite improvement over the original proposals for development of the Upper Basin but the willingness of the committee to add projects which have not been thoroughly examined and investigated is cause for alarm.

I cannot concur, however, in the judgment of the majority that the time has come to authorize expenditures of such proportions and establish precedents of such far-reaching consequences, especially when the intended safeguards leave much to chance and the ostensible disclaimer of intent to construe the law of the river is in effect contradicted by testimony concerning the plan of operation of this project.

For the reasons recited in this report, I believe that S. 500 should not be passed.

THOMAS H. KUCHEL,
United States Senator from California.

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84TH CONGRESS } HOUSE OF REPRESENTATIVES { REPORT
2d Session } { No. 1950

AUTHORIZING THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

MARCH 27, 1956.—Ordered to be printed

Mr. ENGLE, from the committee of conference, submitted the following

CONFERENCE REPORT

[To accompany S. 500]

The committee of conference on the disagreeing votes of the two Houses on the amendments of the House to the bill (S. 500) entitled "An Act to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes," having met, after full and free conference, have agreed to recommend and do recommend to their respective Houses as follows:

That the Senate recede from its disagreement to the amendment of the House, and agree to the same with an amendment, as follows:

In lieu of the matter inserted by the House amendment insert the following: *That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods, and for the generation of hydroelectric power, as an incident of the foregoing purposes, the Secretary of the Interior is hereby authorized (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities and appurtenant works: Curecanti, Flaming Gorge, Navajo (dam and reservoir only), and Glen Canyon: Provided, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level, and that construction thereof shall not*

be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Emery County, Florida, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt and Smith Fork: Provided further, That as part of the Glen Canyon Unit the Secretary of the Interior shall take adequate protective measures to preclude impairment of the Rainbow Bridge National Monument.

SEC. 2. In carrying out further investigations of projects under the Federal reclamation laws in the Upper Colorado River Basin, the Secretary shall give priority to completion of planning reports on the Gooseberry, San Juan-Chama, Navajo, Parshall, Troublesome, Rabbit Ear, Eagle Divide, San Miguel, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, Animas-La Plata, Yellow Jacket, and Sublette participating projects. Said reports shall be completed as expeditiously as funds are made available therefor and shall be submitted promptly to the affected States, which in the case of the San Juan-Chama project shall include the State of Texas, and thereafter to the President and the Congress: Provided, That with reference to the plans and specifications for the San Juan-Chama project, the storage for control and regulation of water imported from the San Juan River shall (1) be limited to a single offstream dam and reservoir on a tributary of the Chama River, (2) be used solely for control and regulation and no power facilities shall be established, installed or operated thereat, and (3) be operated at all times by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission. The preparation of detailed designs and specifications for the works proposed to be constructed in connection with projects shall be carried as far forward as the investigations thereof indicate is reasonable in the circumstances.

The Secretary, concurrently with the investigations directed by the preceding paragraph, shall also give priority to completion of a planning report on the Juniper project.

SEC. 3. It is not the intention of Congress, in authorizing only those projects designated in section 1 of this Act, and in authorizing priority in planning only those additional projects designated in section 2 of this Act, to limit, restrict, or otherwise interfere with such comprehensive development as will provide for the consumptive use by States of the Upper Colorado River Basin of waters, the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, nor to preclude consideration and authorization by the Congress of additional projects under the allocations in the compacts as additional needs are indicated. It is the intention of Congress that no dam or reservoir constructed under the authorization of this Act shall be within any national park or monument.

SEC. 4. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): Provided, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564): Provided further, That for a period of ten years from the date of enactment of this Act, no water from any participating project authorized by this Act shall be delivered to any water user for the production on newly irrigated lands of any basic agricultural commodity, as defined in the Agricultural Act of 1949, or any amendment thereof, if the total supply of such commodity for the marketing year in which the bulk of the crop would normally be marketed is in excess of the normal supply as defined in section 301 (b) (10) of the Agricultural Adjustment Act of 1938, as amended, unless the Secretary of Agriculture calls for an increase in production of such commodity in the interest of national security. All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

SEC. 5. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 8.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 8, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts: Provided, That with respect to each participating project, such costs shall be paid from revenues received from each such project; (2) payment as required by

subsection (d) of this section; and (3) payment as required by subsection (e) of this section. Revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 6 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 6 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (f), and interest due shall be a first charge; and

(4) the costs of each storage unit which are allocated to irrigation pursuant to section 6 of this Act within a period not exceeding fifty years.

(e) Revenues in the Basin Fund in excess of the amounts needed to meet the requirements of clause (1) of subsection (c) of this section, and to return to the general fund of the Treasury the costs set out in subsection (d) of this section, shall be apportioned among the States of the Upper Division in the following percentages: Colorado, 46 per centum; Utah, 21.5 per centum; Wyoming, 15.5 per centum; and New Mexico, 17 per centum: Provided, That prior to the application of such percentages, all revenues remaining in the Basin Fund from each participating project (or part thereof), herein or hereinafter authorized, after payments, where applicable, with respect to such projects, to the general fund of the Treasury under subparagraphs (1), (2), and (3) of subsection (d) of this section shall be apportioned to the State in which such participating project, or part thereof, is located.

Revenues so apportioned to each State shall be used only for the repayment of construction costs of participating projects or parts of such projects in the State to which such revenues are apportioned and shall not be used for such purpose in any other State without the consent, as expressed through its legally constituted authority, of the State to which such revenues are apportioned. Subject to such requirement, there shall be paid annually into the general fund of the Treasury from the revenues apportioned to each State (1) the costs of each participating project herein authorized (except Paonia) or any separable feature thereof, which are allocated to irrigation pursuant to section 6 of this Act, within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such participating project or separable feature thereof, or, in the case of Indian lands, payment in accordance with section 4 of this Act; (2) costs of the Paonia project, which are beyond the ability of the water users to repay, within a period

prescribed in the Act of June 25, 1947 (61 Stat. 181); and (3) costs in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277).

(f) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(g) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 6. Upon completion of each unit, participating project or separable feature thereof, the Secretary shall allocate the total costs (excluding any expenditures authorized by section 8 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. In the event that the Navajo participating project is authorized, the costs allocated to irrigation of Indian-owned tribal or restricted lands within, under, or served by such project, and beyond the capability of such lands to repay, shall be determined, and, in recognition of the fact that assistance to the Navajo Indians is the responsibility of the entire nation, such costs shall be nonreimbursable. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1957, upon the status of the revenues from, and the cost of, constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 7. The hydroelectric powerplants and transmission lines authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but in the exercise of the authority hereby granted he shall not affect or interfere with the operation of the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act and any contract lawfully entered unto under said Compacts and Acts. Subject to the provisions of the Colorado River Compact, neither the impounding nor the use of water for the generation of power and energy at the plants of the Colorado River storage project shall preclude or impair the appropriation of water for domestic or agricultural purposes pursuant to applicable State law.

SEC. 8. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is author-

ized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of, and improve conditions for, the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 9. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with the provisions of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty with the United Mexican States (Treaty Series 994).

SEC. 10. Expenditures for the Flaming Gorge, Glen Canyon, Curecanti, and Navajo initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 11. The Final Judgment, Final Decree and stipulations incorporated therein in the consolidated cases of United States of America v. Northern Colorado Water Conservancy District, et al., Civil Nos. 2782, 5016 and 5017, in the United States District Court for the District of Colorado, are approved, shall become effective immediately, and the proper agencies of the United States shall act in accordance therewith.

SEC. 12. There are hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, such sums as may be required to carry out the purposes of this Act, but not to exceed $760,000,000.

SEC. 13. In planning the use of, and in using credits from, net power revenues available for the purpose of assisting in the pay-out of costs of participating projects herein and hereafter authorized in the States of Colorado, New Mexico, Utah, and Wyoming, the Secretary shall have regard for the achievement within each of said States of the fullest practicable use of the waters of the Upper Colorado River system, consistent with the apportionment thereof among such States.

SEC. 14. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of

the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

SEC. 15. The Secretary of the Interior is directed to continue studies and to make a report to the Congress and to the States of the Colorado River Basin on the quality of water of the Colorado River.

SEC. 16. As used in this Act—

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "Upper Basin", and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948 by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785);

The term "Treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States, signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

And the House agree to the same.

CLAIR ENGLE,
WAYNE N. ASPINALL,
LEO W. O'BRIEN,
WILLIAM A. DAWSON,
JOHN P. SAYLOR,
Managers on the Part of the House.

CLINTON P. ANDERSON,
HENRY M. JACKSON,
JOSEPH C. O'MAHONEY,
EUGENE D. MILLIKIN,
ARTHUR V. WATKINS,
Managers on the Part of the Senate.

STATEMENT OF THE MANAGERS ON THE PART OF THE HOUSE

The managers on the part of the House at the conference on the disagreeing votes of the two Houses on the amendment of the House to the bill (S. 500) to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes, submit the following statement in explanation of the effect of the language agreed upon and recommended in the accompanying conference report. The language incorporates the recommendations of the conference committee with respect to each of the differences between the Senate and House bills.

SCOPE OF THE PROJECT

With respect to the scope of the project, the conference committee agreed to retain in the bill for authorization only the four storage units and eleven participating projects in the House-approved bill.

The matter of retaining intact our national park system was an important issue in the consideration by Congress of this legislation. The House-approved bill—

(1) deleting the Echo Park storage unit;

(2) requiring "protective measures to preclude impairment of the Rainbow Bridge National Monument"; and

(3) expressing the "intention of Congress that no dam or reservoir constructed under the authorization of this Act shall be within any national park or monument"—

makes clear the intention of the House that there be no invasion or impairment of the national park system by the works authorized to be constructed under this legislation. The conference committee upheld the House position and adopted the House-approved language.

The Juniper project would have been authorized as a storage unit by the language in the Senate bill. The House language would have required the Secretary to give priority to completion of a planning report on the Juniper unit in the event he found the Curecanti unit infeasible. The conference committee adopted substitute language, which requires that priority be given to completion of a planning report on the Juniper project but removes the contingency in the House language and does not specify whether the Juniper project is to be a storage unit or a participating project.

The conference committee adopted House language requiring the Secretary to give priority to completion of planning reports on certain participating projects including those, except Woody Creek, which would have been conditionally authorized by the language in the Senate bill.

The sum of $760 million remains in the bill as the amount authorized to be appropriated. However, the conference committee, in retaining this amount in the bill, agreed that it should not be earmarked project-wise and that there is no prohibition against the use of such funds for the construction of the Curecanti unit, subject to the certification by the Secretary required in section 1 of the act.

REPAYMENT PLAN AND BASIN FUND

With respect to the repayment plan incorporated in the legislation, the conference committee agreed to and adopted language in the Senate bill, which requires the repayment with interest of costs allocated to power in not to exceed 50 years—a requirement that is in accordance with presently established policy.

The House-approved bill contained language setting out certain accounting and funding requirements to be made applicable to the basin fund. The conference committee adopted the language of the House bill, which provides for the establishment, from surplus power revenues of the storage project, of credits, within the basin fund, to each State of the upper basin for financial assistance to irrigation development in such State. It should be understood that the revenues thus credited to the States are only for use, within the individual States, in assisting the construction of Federal reclamation projects and shall not be used for any other purpose.

INDIAN LANDS

The House-approved bill contained language making nonreimbursable the costs allocated to irrigation of Indian lands which are beyond the capability of such lands to repay. The conference committee agreed to and adopted substitute language limiting this provision to the Navajo participating project. This language was adopted in recognition of the fact that assistance to the Navajo Indians is the responsibility of the entire Nation and not just the upper basin States.

OPERATION OF POWER FACILITIES

Section 7 of the House-approved bill, containing a grant of authority to the Secretary of the Interior relating to operation of the power facilities authorized to be constructed by S. 500, has been amended by the conference committee in two respects.

The first sentence of section 7, directing the Secretary to operate such facilities so as to produce the greatest amount of power and energy that can be sold at firm rates, has been amended through adoption of substitute language which relates to the grant of authority to the Secretary, and provides that such operation—

> * * * shall not affect or interfere with the operations of the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act and any contract lawfully entered into under said Compacts and Acts.

This language has been adopted to make clear the intent that all of the instruments constituting the law of the Colorado River shall be read together by the Secretary of the Interior in the operation of the power facilities authorized to be constructed, operated, and maintained by this legislation.

In a similar vein, the conference committee has adopted an amendment in the nature of a substitute for the House-approved language contained in the second sentence in section 7. The language of this sentence, which deals with the impounding and use of water for the generation of power and energy at the plants of the Colorado River storage project, has been rewritten to make clear the intent of Congress that, subject to the provisions of the Colorado River compact,

such impounding and use shall be subservient to the appropriation of water for domestic or agricultural purposes.

APPROVAL OF FINAL COURT DECREE RELATING TO BLUE RIVER WATER

The Senate bill contained language authorizing conveyance to the city of Denver of certain water rights used for the production of power at Green Mountain Dam on the Blue River in Colorado. The conference committee adopted substitute language. These water rights have been the subject of prolonged litigation between the United States, Denver, and water users on both the eastern and western slopes of Colorado in the consolidated cases of the *United States of America* v. *Northern Colorado Water Conservancy District, et al.*, in the United States District Court for the District of Colorado. Since the Senate action on S. 500, agreement has been reached between representatives of the eastern slope and western slope of Colorado, and a final decree has been filed by the United States district court in this matter. Copies of the final decree and stipulations have been submitted to the Congress. The substitute language adopted by the conference committee gives immediate congressional approval to the final judgment, final decree and stipulations and instructs the proper agencies of the United States to act in accordance therewith.

PLANNING OF FUTURE PROJECTS

With respect to House language in section 13 of the bill, relating to the planning of future projects by the Secretary, the conference committee adopted substitute language which does not change the intended purpose of this section. The intention of the language is to require the Secretary, in planning additional developments in the upper basin, to give consideration to achievement, within each of the States, of the fullest practicable use of the water apportioned to each State. Since, under section 5, revenues to assist irrigation development are apportioned to the States on the basis of the estimated percentages of upper-basin water remaining to be developed in each such State, the intention of this section could also be stated as requiring the Secretary, in planning future projects, to give consideration to the revenues which it is anticipated will be available for repayment of such projects.

CONSENT TO SUIT OF UNITED STATES

Section 14 of the bill, which gives consent to joinder of the United States as a party to an action or actions by any State of the Colorado River Basin asserting noncompliance with the provisions of law made applicable by this section, has been amended to make clear the intent of Congress that the United States may be joined as a party thereto as a defendant or otherwise.

QUALITY-OF-WATER STUDIES

The House-approved bill included language in section 15 requiring the Secretary of the Interior to make certain quality-of-water studies. The conference committee adopted substitute language which, al-

though not as specific, accomplishes the same purpose and recognizes that such studies are already required by law and are underway.

OTHER DIFFERENCES BETWEEN HOUSE AND SENATE LANGUAGE

With respect to all other major differences between the House and the Senate bills not discussed hereinbefore, the conference committee concurred in and adopted the House language.

In conclusion, one additional observation appears in order: Throughout the hearings and deliberations of the House Committee on Interior and Insular Affairs on this legislation, in floor presentation and debate, and in the several sessions of the conference committee, there has existed unity of understanding and agreement on the purpose of this legislation. That purpose is to authorize the construction of the Colorado River storage project and participating projects and to provide for the operation of the facilities thereof in accordance with the law of the Colorado River.

CLAIR ENGLE,
WAYNE N. ASPINALL,
LEO W. O'BRIEN,
WILLIAM A. DAWSON,
JOHN P. SAYLOR,
Managers on the Part of the House.

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85TH CONGRESS
2d Session

SENATE

DOCUMENT
No. 101

FINANCIAL AND ECONOMIC ANALYSIS

COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

A STUDY

PREPARED BY THE

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

FEBRUARY 1958

MAY 21, 1958.—Ordered to be printed

UNITED STATES
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25927 WASHINGTON : 1958

S. Res. 302

IN THE SENATE OF THE UNITED STATES,
May 21, 1958.

Resolved, That a study entitled "Financial and Economic Analysis, Colorado River Storage Project and Participating Projects, February 1958", prepared by the Department of the Interior, be printed with illustrations as a Senate document, and that two thousand additional copies be printed for the use of the Committee on Interior and Insular Affairs.

Attest:

FELTON M. JOHNSTON,
Secretary.

By EMERY L. FRAZIER,
Chief Clerk.

LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D. C., April 15, 1958.

Hon. RICHARD M. NIXON,
President of the Senate,
Washington, D. C.

DEAR MR. PRESIDENT: With my letter of December 30, 1957, I transmitted to you the first annual report on the status of the Colorado River storage project and participating projects as required by section 6 of the authorizing act of April 11, 1956 (70 Stat. 105).

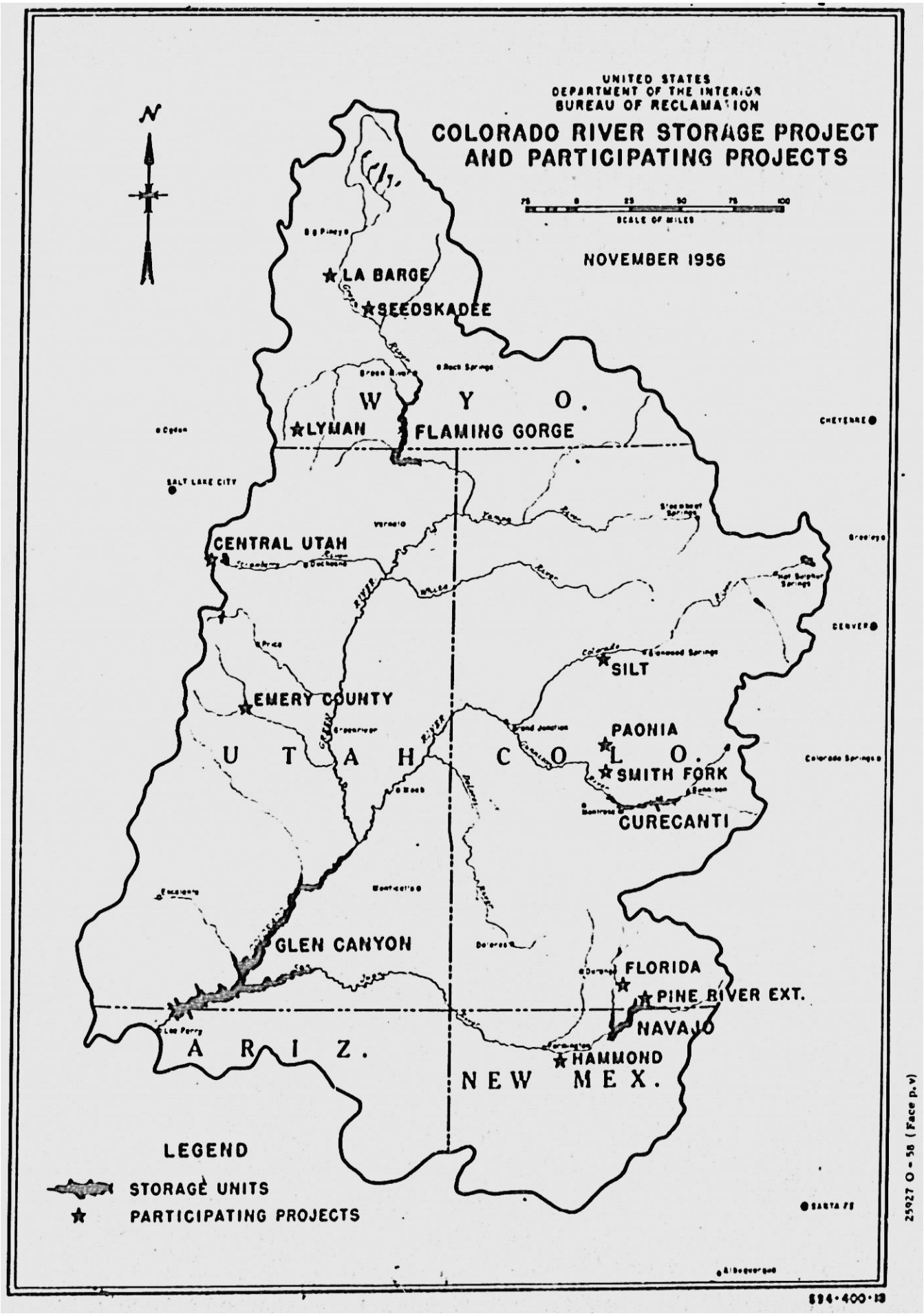
The preliminary repayment studies, referred to in that letter, have been completed and a copy of the study entitled "Financial and Economic Analysis, Colorado River Storage Project and Participating Projects, February 1958," is transmitted herewith for the information of the Congress.

This analysis is intended to be used as a reference and guide by those having responsibility for carrying out the water resource development program in the Upper Colorado River Basin.

With construction just starting on initially scheduled units, this first analysis is based largely on planning estimates with such refinements as are possible in a few instances from detailed preconstruction estimates and from bids on construction work. The analysis will be reviewed and revised periodically as detailed investigations and construction of the development progress, and as new data becomes available.

Sincerely yours,

FRED A. SEATON,
Secretary of the Interior.


UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
AND PARTICIPATING PROJECTS
NOVEMBER 1956
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FLAMING GORGE
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FINANCIAL AND ECONOMIC ANALYSIS

Colorado River Storage Project and Participating Projects

Introduction

An extensive program for the development of water resources in the Upper Colorado River Basin was initiated by the act of April 11, 1956 (70 Stat. 105). Authorized for construction were four initial units of the Colorado River storage project on the main river or its larger tributaries, primarily for river regulation and power production. Also authorized were 11 participating projects for irrigation and other related purposes, including the partially constructed Paonia project in Colorado. The entire development is linked financially through the Upper Colorado River Basin fund which was established by the act. The largely constructed Eden project in Wyoming was also made a participant in the basin fund.

The economic and financial analysis reported in this volume is intended to be used as a reference and guide by the Bureau of Reclamation and others having responsibility in carrying out the authorized development program in the Upper Colorado River Basin. With construction just starting on initially scheduled units, this first report is based largely on planning estimates with such refinements as are possible in a few instances from detailed preconstruction estimates and from bids on construction work. The report will be revised periodically as progress is made in detailed investigations and construction and as new data become available.

The estimates of power production at the authorized storage units involve assumptions on the future depletion upstream from these units and resultant regulated annual releases. Utilization of any of the assumptions underlying the basic water supply studies does not carry with it any actual or implied finding of legal restrictions or limitations.

Water Compact and Treaty Obligations

DIVISION OF WATER

Water of the Colorado River was divided between the Upper and Lower Colorado River Basins by the Colorado River compact, which was signed in 1922 by a commissioner of each of the seven States of the river basin and by a representative of the United States and which was subsequently approved by the Congress and the President of the United States. The dividing point on the river between the upper and lower basins is at Lee Ferry near the northern border of Arizona below the mouth of the Paria River. Among other things, the compact apportions to the upper basin the beneficial consumptive

use of 7,500,000 acre-feet of water per annum. The compact provides also that

> The States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years * * *

The compact prescribes the manner in which waters of the Colorado River system may be made available to Mexico under any water rights recognized by the United States. The Mexican Treaty of 1945 provides basically for an annual delivery by the United States to Mexico of 1,500,000 acre-feet of Colorado River water. Of the many provisions in the Colorado River compact and the Mexican Treaty concerning the use of the water of the Colorado River system, those briefed above are of particular importance to the program now being initiated in the upper basin.

Water allocated to the upper basin by the Colorado River compact was further apportioned to the individual States of the upper basin by the Upper Colorado River Basin compact which was signed in 1948. Under the terms of this compact Arizona is permitted to consume 50,000 acre-feet of water annually from the upper Colorado River system and the remaining water allocated to the upper basin is apportioned to other States in the following percentages.

	Percent		*Percent*
Colorado	51.75	Utah	23.00
New Mexico	11.25	Wyoming	14.00

The upper-basin compact created the Upper Colorado River Commission, an interstate administrative agency. The commission consists of a representative of each of the States of Colorado, New Mexico, Utah, and Wyoming, and the Federal Government.

STORAGE REQUIREMENT

The flow of the Colorado River is extremely erratic, historical flow varying from 4,400,000 to 22,000,000 acre-feet annually at Lee Ferry. The extreme drought of recent years has accentuated the problems of river regulation and use. In prolonged dry periods there is not enough flow to permit the upper basin to consume its apportioned water and at the same time to meet its obligations to the lower basin and to Mexico. In wetter periods, however, flows are more than sufficient for these purposes. Large holdover storage reservoirs are thus needed to provide additional water when needed for compact fulfillment during prolonged periods of drought. Favorable opportunities for such reservoirs are provided by the deep canyons of the Colorado River and its principal tributaries in the upper basin.

Further information on the water-supply situation is presented later in this report.

PROJECT PLAN

A plan for the Colorado River storage project and an initial group of participating projects has been formulated by the Bureau of Reclamation in cooperation with other Federal agencies and with the States of the Upper Colorado River Basin. The project report prepared in 1950 and a supplemental report prepared in 1953 were printed as House Document No. 364, 83d Congress, 2d session. Reports on the participating projects in the initial group, supplemental

to the 1950 report, were also completed in 1950 and 1951. Since its introduction in the 1950 report, the project plan has been subject to modifications as shown in the 1953 supplement, in the authorizing act, and in definite plan studies.

COLORADO RIVER STORAGE PROJECT

The various dams and reservoirs of the Colorado River storage project will regulate the flow of the river, thus permitting an expansion of irrigation and other water use in the upper basin within the limits of the Colorado River compact. In most instances powerplants and switchyards will be installed at the dams and transmission lines will be provided to transmit the power to load centers. Facilities will be provided as appropriate for recreation and to mitigate losses of, and improve conditions for, the propagation of fish and wildlife. Minor flood control and other benefits, largely unevaluated at present, are anticipated from the storage project.

The Colorado River storage project as outlined in the 1950 report included 10 storage units. Four of these were authorized for construction by the act of April 11, 1956. It is anticipated that additional units will be authorized as they become needed. The four authorized units are the Glen Canyon, Flaming Gorge, Navajo, and Curecanti. Together they will provide about 34,670,000 acre-feet of reservoir capacity and about 1,167,000 kilowatts of installed generating capacity. More than three-fourths of both capacities will be provided by the Glen Canyon unit alone.

Brief descriptions of the four authorized units and their common transmission system appear below. Data on reservoir and powerplant capacities and stream depletions are summarized in the table on page 8.

Glen Canyon unit

Glen Canyon Dam will be on the Colorado River in northern Arizona, about 13 miles downstream from the Utah-Arizona State line and 16 miles upstream from Lee Ferry. It is the only one of the authorized dams that will be on the Colorado River proper.

Glen Canyon Dam will be a gravity arch concrete structure that will rise 700 feet above its foundation and 573 feet above the river. It will have a crest length of 1,500 feet. The dam will be the fourth highest in the world and second in height only to Hoover Dam in the United States. The reservoir will have a capacity of 28,040,000 acre-feet. When full, it will cover about 163,000 acres and will extend 186 miles up the Colorado River, nearly to the mouth of Green River, and 71 miles upstream on the tributary San Juan River. About 6,535,000 acre-feet of the reservoir capacity will be inactive and will be useful for sediment accumulation, to protect fish, and to provide the power head at the dam. A powerplant and switchyard will be constructed at the dam. The powerplant will include 8 generating units with a total installed capacity of 900,000 kilowatts. An access road and a bridge across the canyon about 900 feet downstream from the dam site will be constructed to Federal highway standards.

Measures will be taken to protect the Rainbow Bridge National Monument at one of the side bays of the Glen Canyon Reservoir.

Flaming Gorge unit

Flaming Gorge Dam will be on the Green River, a major tributary of the Colorado, in northeastern Utah about 6 miles south and 20 miles west of the corner common to Utah, Wyoming, and Colorado. The dam will be a concrete thin-arch structure rising about 495 feet above its foundation and about 445 feet above the river. It will have a crest length of 1,270 feet. The reservoir will have a total capacity of about 3,930,000 acre-feet and an area of about 42,000 acres. It will extend upstream 93 miles, nearly to the town of Green River, Wyo. About 330,000 acre-feet of the reservoir capacity will be inactive. The powerplant at the dam will consist of 3 generating units with a total installed capacity of 108,000 kilowatts. A switchyard will be constructed nearby.

Navaho unit

Navaho Dam will be constructed on the San Juan River in New Mexico about 34 miles east of Farmington. The dam will be an earth-fill structure about 385 feet high above the river and nearly 3,800 feet long at the crest. Navaho Reservoir will provide water for the Navaho Indian irrigation project, when that project is authorized and constructed, and also will provide water directly or indirectly for other potential projects in New Mexico. The reservoir will have a total capacity of 1,700,000 acre-feet and an inactive capacity of 672,000 acre-feet, of which about 70,000 acre-feet will be dead storage. The reservoir when full will inundate 15,300 acres and will extend approximately 34 miles up the San Juan River. Although the outlet works are such that a powerplant could be installed at a later date, no powerplant is included in the present plan. Recreational facilities will be provided at the reservoir.

Curecanti unit

The Curecanti unit will develop storage and power possibilities along part or all of a 40-mile stretch of a deep canyon section of the Gunnison River above the Black Canyon of the Gunnison National Monument and below the town of Gunnison, Colo. In order to prevent the inundation of land near the town, the authorizing legislation provides that—

> * * * the Curecanti Dam (now called Blue Mesa Dam) shall be constructed to a height which will impound not less than 940,000 acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at 7,520 feet above mean sea level. * * *

The act also requires that construction shall not be undertaken until further engineering and economic investigations have been made and until the Secretary of the Interior has certified to the Congress and the President that in his judgment the benefits of the unit will exceed its costs.

Bureau of Reclamation reconnaissance studies indicate that a favorable plan, consistent with the authorizing act, would include a series of four dams, reservoirs, powerplants, and switchyards. The developments in order moving downstream would be known as the Blue Mesa, Narrow Gauge, Morrow Point, and Crystal. Collectively, the reservoirs would have a capacity of about 1 million acre-feet. The powerplant, with an installed generating capacity of about 159,000 kilowatts, would develop a maximum of about 940 feet of static power head.

The Blue Mesa Dam, located 30 miles downstream from Gunnison, would be the largest of the series in the Curecanti unit. It would be an earth-fill structure about 350 feet high above its foundation and about 820 feet long at its crest. The reservoir would have a capacity of about 940,000 acre-feet at a high-water elevation of 7,520 feet. About 200,000 acre-feet of the reservoir capacity would be inactive. The active capacity would provide the principal seasonal river regulation for the unit powerplants. Recreational facilities would be provided at the reservoir.

Investigation and planning of the Curecanti unit are continuing in more detailed scope as required by the authorizing act.

Transmission division

The authorizing act of April 11, 1956, provides that project powerplants and transmission facilities shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates. To carry out the provisions of the law, a high-voltage transmission and grid will be constructed to interconnect the plants of the authorized units of the storage project and to effect interconnection with other existing Federal powerplants and utility systems in the area.

The transmission division includes the high-voltage lines from storage unit switchyards to substations at major load centers and points of interconnection and the substations at those points. Facilities of the transmission division will be extended as necessray to provide interconnections with future units of the storage project and with Other Federal plants and to provide for interconnection of future participating project transmission lines with the high-voltage grid. The extent and location of the high-voltage transmission grid will depend on the market area requirements for project power, the desires of power users to purchase project power, points of interconnection with other systems, and the final allotments of power to various users.

PARTICIPATING PROJECTS

Participating projects are those which will consume water of the upper Colorado River system for irrigation and other purposes and which will require assistance from power revenues of the storage project in the repayment of irrigation costs. An initial group of 11 participating projects was authorized by the act of April 11, 1956. These include the Paonia, Smith Fork, Florida, and Silt projects in Colorado; the Pine River extension in Colorado and New Mexico; the Hammond project in New Mexico; the central Utah project (initial phase) and Emery County project in Utah; and the Seedskadee, La Barge, and Lyman projects in Wyoming. The projects combined will provide water for a total of about 365,100 acres, including about 132,800 acres of full service land and about 232,300 acres of supplemental service land.

Brief descriptions of the 11 initial participating projects appear below. Data on irrigable area, reservoir storage capacity, and water supply are summarized in the table on page 8.

Paonia project

The Paonia project on the North Fork of the Gunnison River in west-central Colorado was partially constructed under the authorizing act of June 25, 1947. It was reauthorized by the act of April 11, 1956, and the entire development was linked with the basin fund as a participating project. The project will provide water to 2,200 acres of full-service land and 13,100 acres of supplemental-service land. It will provide incidental benefits to fish and wildlife, recreation, and flood control.

The Fire Mountain Canal was enlarged and partially extended under the intial authorization. Work yet to be accomplished under the 1956 reauthorization includes construction of the Paonia Reservoir on Muddy Creek to a capacity of 21,000 acre-feet, further extension of the Fire Mountain Canal, and rehabilitation of critical sections of the previously enlarged canal.

Pine River project extension

An extension will be constructed to the existing Pine River project, located in southwestern Colorado and northwestern New Mexico about 20 miles east of Durango, Colo. The extension will provide irrigation water for about 15,200 acres of full-service land, of which about 1,940 acres are within the Pine River Indian irrigation project. The extension will involve enlargement and extension of eight canals and ditches diverting from Pine River, a new diversion dam, and several small distribution laterals.

Smith Fork project

The Smith Fork project will be constructed in west-central Colorado along the Smith Fork of Gunnison River near Crawford. It will provide water for about 2,300 acres of full-service land and 8,200 acres of supplemental-service land. Recreational opportunities also will be provided. Construction features will include the Crawford Reservoir with 14,000 acre-feet of capacity, a diversion dam, feeder canals, and laterals.

Florida project

The Florida project will be constructed in southwestern Colorado on the Florida River. It will provide a full supply of water for about 6,300 acres of land and a supplemental supply for about 12,700 acres. Construction features will include the Lemon Reservoir with a capacity of about 23,000 acre-feet, a diversion dam, and distribution and drainage systems. An existing canal also will be enlarged. Operation of the project also will provide flood control and some enhancement of fish and wildlife values in the area.

Silt project

The silt project will provide water for about 1,900 acres of full-service land and 5,400 acres of supplemental-service land between Rifle and Elk Creeks in west-central Colorado. The project also will enhance fish and wildlife values in the area. Construction features will include the Rifle Gap Reservoir of 10,000-acre-foot capacity, a pumping plant, diversion dam and feeder canal, and laterals and drains. Some existing works will be rehabilitated.

Hammond project

The Hammond project in northwestern New Mexico will divert San Juan River water for irrigation of about 4,000 acres of full-service land along the river in the vicinity of Farmington and Bloomfield. Principal features of the development will be a diversion dam, distribution canal, pumping plant, and lateral and drainage systems.

Central Utah project (initial phase)

The central Utah project (initial phase) will be an extensive undertaking to develop water resources of the Uinta Basin, a segment of the Colorado River Basin in northeastern Utah. Part of the developed water will be conveyed westward for use in the Bonneville Basin in central Utah and the remainder will be used in the Uinta Basin. Reservoirs with a total capacity of about 1,663,000 acre-feet will make water available for about 28,600 acres of full-service land and about 131,800 acres of supplemental-service land. Four project powerplants will have a combined installed capacity of 61,000 kilowatts. Approximately 48,800 acre-feet of water will be provided annually for municipal, industrial and miscellaneous uses. The project will provide recreational benefits and will have value in flood and sediment control.

The potential Strawberry aqueduct will intercept flows of Rock Creek and streams west of Rock Creek. It will convey the water to the existing Strawberry Reservoir on Strawberry River which will be enlarged through donstruction of Soldier Creek Dam downstream from the present dam. The existing outlet tunnel from the reservoir will be enlarged. This tunnel conveys water westward through the Wasatch Mountain divide to the Bonneville Basin. In descending the west slope of the Wasatch Mountains, the water will pass through a series of four powerplants. In the Bonneville Basin the water will be used in an area extending from Salt Lake City south 80 miles to Nephi. Part of the use will be effected by exchanges involving the waters of Utah Lake, Provo River, and other streams. These exchanges will require construction of Bates Dam on Provo River, Hobble Creek Dam on Little Hobble Creek, and the Front Dam near Salt Lake City. Transmission lines will be constructed to serve local market areas and to interconnect with the main grid transmission system.

New project works to provide water for replacement and expanded irrigation and municipal use in the Uinta Basin will include Hanna Reservoir on the north fork of the Duchesne River, Starvation Reservoir on Strawberry River with a feeder canal from the Duchesne River, the Upalco Reservoir off-stream from Lake Fork River, the Stanaker Reservoir with feeder canal from Ashley Creek, and a service canal (Vernal unit), and Tyzack Reservoir on Brush Creek.

Emery County project

The Emery County project will be in the headwaters of the San Rafael River in east-central Utah. It will provide irrigation water for about 3,600 acres of full-service land and 20,500 acres of supplemental-service land and will provide for recreational opportunities. Joes Valley Reservoir with a total capacity of 57,000 acre-feet, a diversion dam, canal, laterals, and drains will be the principal features of the project.

Seedskadee project

The Seedskadee project will be constructed in southwestern Wyoming along the Green River below the authorized La Barge project. Principal works under the present tentative plan include a diversion dam on the river, conveyance canals, pumps, and distribution laterals. Such works will provide an irrigation water supply for about 60,700 acres of full-service land.

Modifications of the plan to provide storage and fish and wildlife facilities are being investigated. As the studies are still incomplete, however, the modifications are not included in the project data used in this report.

Lyman project

The Lyman project will be constructed in southwestern Wyoming along Blacks Fork of the Green River near the Wyoming-Utah boundary. It will supplement the irrigation water supply for about 40,600 acres of land. Bridger Reservoir will be constructed on Willow Creek to a capacity of 43,000 acre-feet. Other features will include feeder canals to the reservoir, return canals to distribute the reservoir releases, improvement of the Willow Creek channel, drainage, and improvement of the existing irrigation system.

La Barge project

The La Barge project will divert water directly from the Green River in southwestern Wyoming to provide irrigation water for about 8,000 acres of full-service land. Project works will include a diversion dam, conveyance canal, distribution laterals, and drains.

Summary of irrigation and power data: Colorado River storage project and participating projects

Units and projects	Irrigable area			Total reservoir storage capacity	Installed power-plant capacity	Average annual water supply	
	Full-service land	Supplemental service land	Total			Increase in usable irrigation supply	Increase in stream depletion
STORAGE UNITS	*Acres*	*Acres*	*Acres*	*Acre-feet*	*Kilowatts*	*Acre-feet*	*Acre-feet*
Glen Canyon				28,040,000	900,000		576,000
Flaming Gorge				3,930,000	108,000		62,000
Navaho				1,700,000			39,000
Curecanti				1,000,000	159,000		14,000
Subtotal				34,670,000	1,167,000		691,000
PARTICIPATING PROJECTS							
Paonia, Colo	2,200	13,100	15,300	21,000		20,100	9,800
Pine River extension, Colorado and New Mexico	15,200		15,200			45,450	28,300
Smith Fork, Colo	2,300	8,200	10,500	14,000		13,650	7,500
Florida, Colo	6,300	12,700	19,000	23,000		23,200	12,900
Silt, Colo	1,900	5,400	7,300	10,000		10,100	5,800
Hammond, N. Mex	4,000		4,000			18,400	9,300
Central Utah (initial phase), Utah	28,600	131,800	160,400	1,663,000	61,000	[1] 175,200	189,400
Emery County, Utah	3,600	20,500	24,100	57,000		32,400	15,500
Seedskadee, Wyo	60,700		60,700			225,800	110,400
Lyman, Wyo		40,600	40,600	43,000		32,500	
La Barge, Wyo	8,000		8,000			24,300	14,200
Subtotal	132,800	232,300	365,100	1,831,000	61,000	621,100	403,100
Total	132,800	232,300	365,100	36,501,000	1,228,000	621,100	1,094,100

[1] In addition, an average of 48,800 acre-feet annually will be made available for municipal, industrial, and miscellaneous uses under the initial phase of the central Utah project.

Project Costs and Construction Schedule

COST ESTIMATES

Construction costs

The total construction cost of the 4 initial units and transmission division of the Colorado River storage project and the 11 initial participating projects, including costs of past and future investigations, is estimated at $992,174,000. Of the total, $677,382,000 represents the cost of the storage units and transmission division and $314,792,000 the cost of the participating projects. The cost estimate is the latest official estimate of the Bureau of Reclamation and cooperating agencies. It is based generally on the price level of January 1957 except that bid prices were used where available and actual costs of past investigations and construction were used. Since the location of facilities in the transmission division has not been definitely determined, the construction cost of such facilities was estimated on the basis of an average of about $135 per kilowatt of installed powerplant generating capacity. The cost estimates will be revised periodically to include costs of completed work, changes in estimates resulting from future modifications in plans, and latest available data including bid prices.

Operation, maintenance, and replacement costs

Operation, maintenance, and replacement costs are estimated at $7,729,000 annually, including $6,282,000 for the storage units and transmission division and $1,447,000 for the participating projects. The operation and maintenance costs were estimated at price levels of the 3-year period 1954–56 and the replacement costs were based on current construction cost estimates. The estimates shown above, which were used in the repayment analysis, include replacement costs computed at 2⅞ percent interest over a 100-year period.

Summary

The table on the following page summarizes construction costs and annual operation, maintenance, and replacement costs for each storage unit, the transmission division, and each participating project. For convenience in the economic and financial analysis in later sections of the report, the table also itemizes expenditures through June 30, 1957, the costs used as a basis for the benefit-cost analysis, and the costs to be allocated.

Summary of project costs: Colorado River storage projects and participating projects

[In thousands of dollars]

Units and projects	Total construction costs [1]	Total contributed funds [2]	Costs through June 30, 1957									Total costs through June 30, 1957	Cost base for benefit-cost analysis (col. 2 minus sum of cols 3, 4, 5, and 6)	Costs to be allocated (col. 2 minus sum of cols. 3 and 5)	Annual operation, maintenance, and replacement costs [3]
			Expended for investigations					Expended for construction							
			From reclamation fund	From Colorado River development fund	From Upper Colorado River Basin fund	From contributed funds	Total costs of past investigations	Construction appropriation	From Upper Colorado River Basin fund	From contributed funds	Total costs of past construction				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
STORAGE UNITS															
Glen Canyon	325,704	2,295	344	615	----	60	1,019	----	5,378	494	5,872	6,891	322,450	322,794	2,736
Flaming Gorge	66,591	----	60	86	----	----	146	----	597	----	597	743	66,445	66,505	405
Navajo	[4] 42,579	----	6	39	----	----	45	----	221	----	221	266	[4] 42,534	[4] 42,540	24
Curecanti	[5] 84,963	----	103	97	94	----	294	----	----	----	----	294	[5] 84,669	[5] 84,866	749
Transmission division	157,545	----	50	100	----	----	150	----	38	----	38	188	157,395	157,445	2,367
Subtotal	677,382	2,295	563	937	94	60	1,654	----	6,234	494	6,728	8,382	673,493	674,150	6,282
PARTICIPATING PROJECTS															
Paonia, Colo	7,813	----	8	49	185	----	242	1,997	----	----	1,997	2,239	7,571	7,764	23
Pine River extension, Colorado and New Mexico	5,539	----	54	53	48	----	155	----	----	----	----	155	5,384	5,486	21
Smith Fork, Colo	3,533	----	29	72	16	----	117	----	----	----	----	117	3,416	3,461	12
Florida, Colo	7,433	----	12	22	65	----	99	----	----	----	----	99	7,334	7,411	16
Silt, Colo	3,548	----	55	17	13	----	85	----	----	----	----	85	3,463	3,531	12
Hammond, N. Mex	2,441	----	63	8	107	----	178	----	----	----	----	178	2,263	2,433	18
Central Utah (initial phase) Utah	235,850	62	273	1,068	306	62	1,709	----	----	----	----	1,709	[6] 228,391	234,720	1,040
Emery County, Utah	9,913	1	13	18	10	1	42	----	----	----	----	42	9,871	9,894	40
Seedskadee, Wyo	25,470	----	41	410	259	----	710	----	----	----	----	710	24,760	25,060	183

Lyman, Wyo	11,436	---	52	66	1	---	113	---	---	---	---	113	11,323	11,376	62
La Barge, Wyo	1,816	---	21	65	---	---	86	---	---	---	---	86	1,730	1,751	20
Subtotal	314,792	63	621	1,842	1,010	63	3,536	1,997	---	---	1,997	5,533	305,506	312,887	1,447
Total	992,174	2,358	1,184	2,779	1,104	123	5,190	1,997	6,234	494	8,725	13,915	978,999	987,037	7,729

[1] Based on January 1957 price level except that bid prices were used where available and actual costs of past investigation and construction were used.

[2] Contributed funds, some of which have been expended to date, include $60,000 from city of Los Angeles for investigation of Glen Canyon Dam site; $1,635,000 from State of Arizona and $600,000 from Bureau of Public Roads for improvement of Glen Canyon bridge and access road to meet Federal highway standards; and $63,000 from the State of Utah and private groups for investigation of the central Utah and Emery County projects.

[3] Operation and maintenance costs are based on 1954–56 price levels and replacement costs on current prices. Figures shown include replacement costs at 2+ percent interest for use in the repayment analysis.

[4] Includes $207,000 for recreational facilities at Navajo unit.

[5] Includes $452,000 for recreational facilities at Curecanti unit.

[6] Excludes $5,750,000 for construction of certain central Utah project features to ultimate phase capacity.

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CONSTRUCTION SCHEDULE

Expenditures by the Bureau of Reclamation for advance planning and construction of the authorized storage units and participating projects are tentatively programed as shown in the schedule on the following page. Construction already has been started on the principal features of the Colorado River storage project, except those of the Curecanti unit. The first participating projects programed are the Paonia, Hammond, and Seedskadee projects and the Vernal unit of the central Utah project, all of which are scheduled for the start of construction in fiscal year 1961.

The advance planning and construction schedule has been followed in the economic and financial analysis discussed later in this report. The program as now outlined could be substantially modified, however, as actual progress will be determined by congressional appropriations. It will be desirable for work on the storage project to follow the general rate established by contracts now in force and to be awarded in fiscal year 1958. Any slowdown in the rate established would increase costs of interest during construction and in the case of the Glen Canyon and Flaming Gorge units would delay availability of power revenues to assist in repayment of irrigation costs.

WATER SUPPLY

Water supplies available for development by authorized units of the Colorado River storage project and participating projects have been estimated on the basis of recorded flows, with consideration given to downstream uses and past and anticipated upstream depletions. It is not within the scope of this report to summarize the water-supply studies made for each participating project. A brief summary of the water supply available to the Upper Colorado River Basin and units of the storage project is presented in the following paragraphs, however, in view of the importance of water supply as related to project power production and revenues.

STREAMFLOWS

Three terms are commonly used to define flows of the Colorado River. Historical flows are those which have actually occurred. Virgin flows are the estimated flows which would have occurred without man-made depletions. Present modified flows are those which would have occurred in the past had the present level of development and depletions been in full effect.

Average annual historical and present modified flows at units of the storage project have been estimated as shown in the following table.

Average annual flows for 1914–1945 period [1]

[In acre-feet]

Unit	Historical flow	Present modified flow
Glen Canyon	13,763,000	13,064,000
Flaming Gorge	1,636,000	1,615,000
Navaho	1,260,000	1,244,000
Curecanti (Morrow Point Dam site)	1,270,000	1,270,000

[1] Period adopted in negotiations for the Upper Colorado River Basin compact as representative of longtime flow conditions.

Schedule of construction and advance planning 1/
Colorado River Storage project and participating projects
(Unit--$1,000)

Units and projects	Estimated total cost	Total to June 30, 1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Balance to complete
Storage units																					
Glen Canyon	325,704	6,891	24,624	29,669	48,460	56,600	55,600	43,860	29,806	18,056	12,138										
Flaming Gorge	66,591	743	2,200	2,567	6,995	10,075	12,135	13,935	10,928	7,013											
Navajo	2/42,372	266	906	26	20	1,700	9,500	13,200	10,000	6,754											
Curecanti	3/84,511	294	69	107	35	0	0	0	0	1,400	4,765	8,000	7,300	7,990	7,350	13,400	11,242	9,084	8,200	5,275	
Transmission division	157,545	188	110	205	1,885	7,700	22,730	28,000	35,942	23,000	17,785	6,400	1,400	1,600	1,700	2,000	2,000	2,000	1,600	1,300	
Subtotal	676,723	8,382	27,909	32,574	57,395	76,075	99,965	98,995	86,676	56,223	34,688	14,400	8,700	9,590	9,050	15,400	13,242	11,084	9,800	6,575	
Participating projects																					
Paonia, Colo.	7,813	2,239	62	0	0	500	1,665	2,336	1,011												
Pine River extension, Colo. and N. Mex.	5,539	155	127	9	6	0	0	510	1,147	2,000	1,585										
Smith Fork, Colo.	3,533	117	87	2	0	0	0	737	1,091	1,347	152										
Florida, Colo.	7,433	99	84	81	6	0	0	0	0	0	750	1,700	2,400	2,313							
Silt, Colo.	3,548	85	57	28	7	0	0	0	0	0	1,000	1,773	598								
Hammond, N. Mex.	2,441	178	104	2	0	500	1,100	557													
Central Utah, Utah	235,850	1,709	448	250	318	968	2,570	2,437	2,849	6,066	7,347	11,428	12,286	13,941	15,965	21,967	23,613	21,534	9,744	9,330	71,080
(Vernal unit)	(6,956)	(432)	(100)	0	0	(500)	(2,100)	(2,100)	(1,000)	(300)	(300)	(124)									
Emery County, Utah	9,913	42	24	52	81	68	0	0	0	0	1,188	3,200	3,253	2,005							
Seedskadee, Wyo.	25,470	710	346	74		500	1,180	2,989	4,307	4,713	4,928	2,355	1,852	1,136	380						
Lyman, Wyo.	11,436	113	14	124	178	81	0	0	1,248	2,497	3,683	2,758	740								
LaBarge, Wyo.	1,816	86	5	18	80	46	0	0	0	0	0	693	700	188							
Subtotal	314,792	5,533	1,358	640	676	2,663	6,515	9,566	11,653	16,623	20,633	23,907	21,829	19,583	16,345	21,967	23,613	21,534	9,744	9,330	71,080
Total	991,515	13,915	29,267	33,214	58,071	78,738	106,480	108,561	98,329	72,846	55,321	38,307	30,529	29,173	25,395	37,367	36,855	32,618	19,544	15,905	71,080

1/ The construction program is underlined. This table presents cost figures which relate to but are not identical with the appropriation and obligation data shown in program documents.
2/ Does not include $207,000 for recreational facilities.
3/ Does not include $452,000 for recreational facilities.

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At a point 15 miles below Glen Canyon Dam site, the Paria River contributes an average of about 25,000 acre-feet annually to the Colorado River, but the flow is erratic from year to year. For all practical purposes the flow at Glen Canyon approximates the flow at Lee Ferry, 16 miles downstream, the dividing point on the river between the upper and lower basins. The average annual virgin flow at Lee Ferry over the 1914–45 period is estimated at about 15,640,000 acre-feet.

STREAM DEPLETIONS

Annual man-made depletions in the Upper Colorado River Basin from existing developments and developments authorized prior to 1949, the year the Upper Colorado River Basin compact became effective, are estimated to average about 2,550,000 acre-feet. A number of years will be required for full development of projects authorized prior to 1949. The 2,550,000-acre-foot depletion is therefore used in this report as also applying to fiscal year 1963, when initial operation of the storage project is scheduled and is also referred to as the present depletion. On the basis of the annual depletion of 2,550,000 acre-feet, the upper basin is utilizing only about one-third of the consumptive use apportioned to it by the Colorado River compact.

As a basis for evaluating the Colorado River storage project and participating projects, a projection was made of future stream depletions estimated to occur in the upper basin during the 100-year period from fiscal year 1963 through fiscal year 2062. It was estimated that the depletions by 2062 would total about 6,191,000 acre-feet annually, consisting of 2,550,000 acre-feet from existing developments, 691,000 acre-feet from evaporation from the authorized storage units, and 2,950,000 acre-feet from new projects including the authorized participating projects and other future Federal and non-Federal developments. The 2,950,000-acre-foot depletion from new projects expressed as a weighted average amount over the 100-year period approximates 1,800,000 acre-feet, a figure used hereinafter in the project economic analysis. Assumed average depletions are summarized in the table below.

Projected depletions [1]

[In thousand acre-feet]

Fiscal year	Depletion from existing and new projects in upper basin	Average evaporation losses from storage units [2]	Total
1963	2,550	Negligible	2,550
1970	3,150	691	3,841
2020	4,750	691	5,441
2062	5,500	691	6,191

[1] Based on averages for runoff period 1914 to 1945, inclusive.
[2] Estimated average stream depletions due to evaporation from Glen Canyon, Flaming Gorge, Navaho, and Curecanti storage units.

REPLACEMENT STORAGE

The holdover reservoirs in the Upper Colorado River Basin are designed to impound water in years of high runoff and release such water during prolonged dry periods to permit the upper basin to

increase its uses and still meet its compact obligations for flows at Lee Ferry for the benefit of the lower basin and Mexico.

The estimated total active storage capacity available in fiscal year 2062 in the four authorized units after sediment encroachment is shown in the following table. This available capacity may be appropriately referred to as replacement storage capacity since it will be used, among other things, to replace to the lower basin an appropriate part of the natural streamflow consumed upstream in the upper basin during prolonged drouth periods.

Estimated active storage capacities in fiscal year 2062

[In thousand acre-feet]

Unit	Fiscal year of initial storage	Initial active active storage capacity	Sediment deposition to end of fiscal year 2062		Remaining active storage capacity in fiscal year 2062
			In dead storage capacity	In active storage capacity	
Glen Canyon	1963	21,505	5,260	4,180	17,325
Flaming Gorge	1964	3,600	70	130	3,470
Navaho [1]	1964	1,028	250	80	948
Curecanti	1969	720	10	20	700
Total		26,853	5,590	4,410	22,443

[1] The storage capacity at the Navaho unit may be needed ultimately by the potential Navaho irrigation project and other local developments and hence may not be available to meet compact obligations. This situation will be reviewed when the Navaho irrigation project is authorized.

RESERVOIR OPERATIONS

Two studies were made of the coordinated operation of the four authorized units of the storage project. The first was an initial reservoir filling study to bring the reservoirs to power operating levels and to roughly determine power production potentialities to March 31, 1971. The second was a more detailed study covering coordinated reservoir operations to estimate annual power production after March 31, 1971.

The initial filling study was based on average streamflow conditions for the 32-year period 1914–45. The average flow was progressively modified throughout the filling period in accordance with the projected schedule of upstream depletions. Allowances were made for reservoir evaporation and for increases in storage at upstream reservoirs. Each reservoir was first filled to the minimum power operating level in order that power generation might be obtained as early as practicable. Thereafter additional storage was progressively accumulated at all reservoirs from available storable supplies. The filling study indiactes that Glen Canyon, the first reservoir scheduled for completion, would start filling at the beginning of fiscal year 1963. All the reservoirs would fill to reasonable operating levels by March 31, 1971, and the major part of the system power output at the three storage units would then be attained. An annual summary of the initial filling operation for the Glen Canyon Reservoir with allowance for filling of the storage project upstream reservoirs is shown on the following page.

The post-filling reservoir operation study was based on several repetitions of a runoff cycle similar to the 32-year runoff period 1914 to 1945. Data corresponding to the 32 years in sequence were inserted in the study for fiscal year 1971 through fiscal year 2002 and the process was repeated for each 32 years thereafter with proper adjustments for increased depletions. Annual releases for system

energy generation were made in varying amounts in accordance with normal operating and forecast procedures. The monthly pattern of releases for energy generation followed the pattern of energy requirements estimated for 1980 in the project power market area.[1] Additional releases made in anticipation of later spills were also utilized in the generation of energy.

Expected operation of Glen Canyon Reservoir during initial filling period

[In million acre-feet]

Year beginning Apr. 1 [1]	1914-45 average annual present modified flow at Glen Canyon Dam	Adjustments for new upstream uses		Assumed inflow to Glen Canyon Reservoir	Losses	Release from Glen Canyon Reservoir	Total storage in Glen Canyon Reservoir at end of year
		Increase in consumptive use including reservoir evaporation	Increase in storage at upstream reservoirs				
1961	13.1	----------	----------	13.1	----------	13.1	0
1962	13.1	0.1	----------	13.0	----------	11.5	1.5
1963	13.1	.1	0.2	12.8	0.1	8.7	5.5
1964	13.1	.1	.6	12.4	.2	8.8	8.9
1965	13.1	.2	.7	12.2	.3	8.9	11.9
1966	13.1	.3	.6	12.2	.4	9.0	14.7
1967	13.1	.4	.7	12.0	.4	10.4	15.9
1968	13.1	.5	.6	12.0	.5	10.4	17.0
1969	13.1	.6	.5	12.0	.5	10.4	18.1
1970	13.1	.7	.4	12.0	.5	10.5	19.1

[1] Annual summary is based on years beginning Apr. 1 when Lake Mead and Glen Canyon Reservoir will normally be at lowest stage.

Power Production and Marketing

POWER MARKET AREA AND REQUIREMENTS

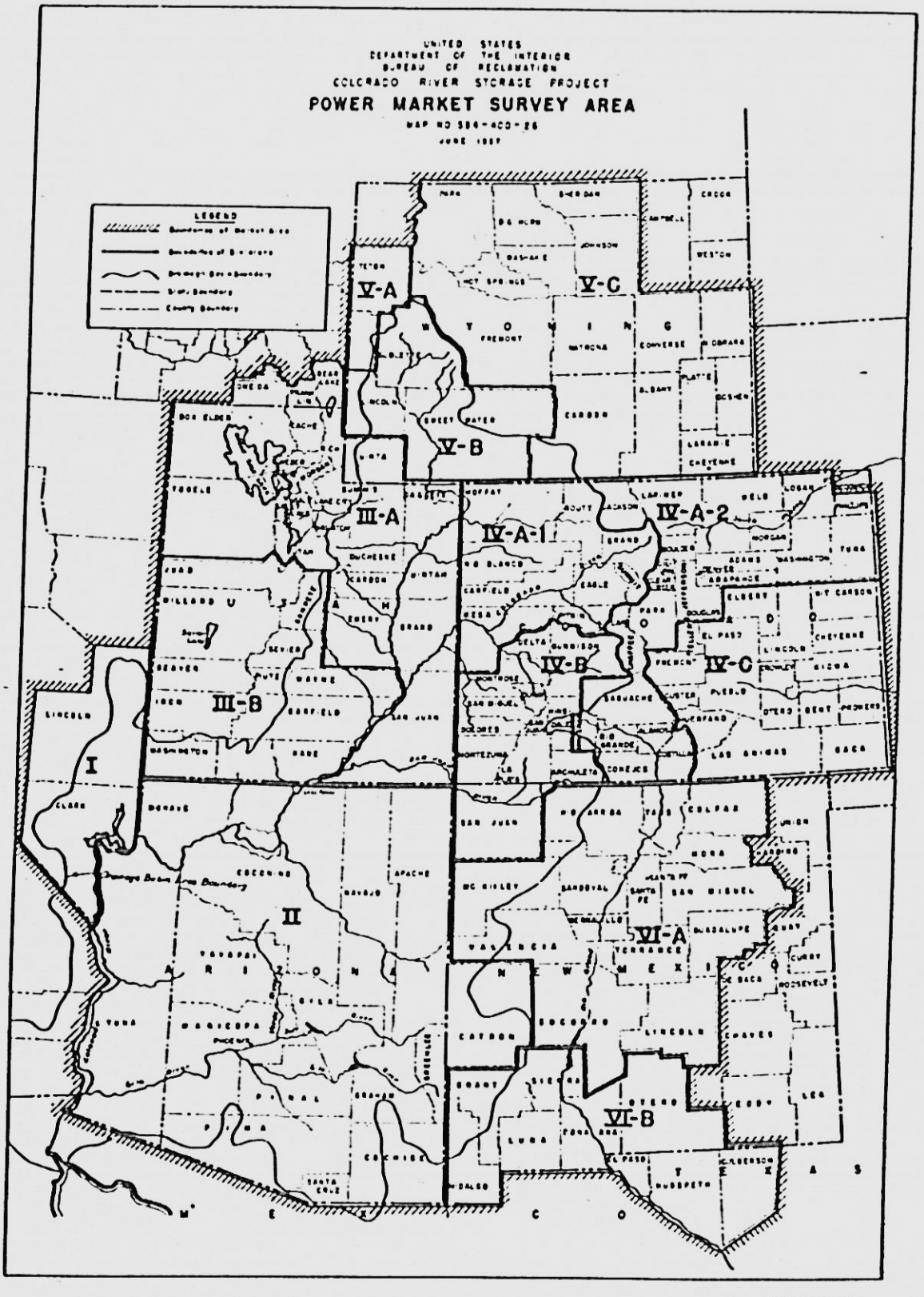
The Federal Power Commission is currently making a power market survey for the Colorado River storage project. The market area covered by the survey is shown on the map on the following page.

It is estimated that in addition to capacity and generation from existing and scheduled plans in the market area, not including scheduled plants of the Colorado River storage project, about 3,659,000 kilowatts of generating capacity and 14,313 million kilowatt-hours of generation will be needed by 1970 to meet new power requirements throughout the market area. The estimated additional requirements for 1970 and 1980 are summarized below.

Additional power and energy requirements

Division number	Principal State	1970		1980	
		Thousand kilowatts	Million kilowatt-hours	Thousand kilowatts	Million kilowatt-hours
I	Nevada	228	1,247	500	2,783
II	Arizona	954	2,871	2,806	11,770
III	Utah	936	4,612	1,881	9,942
IV	Colorado	1,146	4,708	2,538	12,134
V	Wyoming	194	674	478	2,170
VI	New Mexico	201	201	496	1,802
	Total	3,659	14,313	8,699	40,601

[1] Pattern of energy requirements was taken from preliminary data for a power market survey that is being made by the Federal Power Commission for the Colorado River storage project.


UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
POWER MARKET SURVEY AREA
LEGEND
V-A
V-C
V-B
III-A
IV-A-1
IV-A-2
IV-B
IV-C
III-B
I
II
VI-A
VI-B
WYOMING
ARIZONA
NEW MEXICO
COLORADO

POWER PRODUCTION

Powerplants are presently planned at 3 of the 4 authorized units of the Colorado River storage project and at the central Utah participating project. The total installed generating capacity will be 1,228,000 kilowatts, with the installed capacity at each powerplant as tabulated on page 8. With allowances made for peak-load transmission losses, an estimated 1,109,000 kilowatts of power can be delivered to load centers.

Future power production has been estimated on the basis of coordinated reservoir operation studies as previously discussed. In accordance with the operation studies, power production will commence at the beginning of fiscal year 1965 at the Glen Canyon and Flaming Gorge units, in fiscal year 1970 at the Curecanti unit, and in fiscal year 1974 at the central Utah project. All powerplants will be completed and in full production by about the end of fiscal year 1985. The schedule of estimated energy deliverable to load centers is shown in the table below.

Estimated energy deliverable to load centers from power plants—Colorado River storage project and Central Utah project

[In million kilowatt-hours]

Fiscal year	Colorado River storage project			Central Utah project	Total		
	Glen Canyon	Flaming Gorge	Curecanti		Firm	Nonfirm	Total
1965	2,835	315	----------	----------	1,500	1,650	3,150
1966	3,082	268	----------	----------	2,950	400	3,350
1967	3,450	300	----------	----------	3,200	550	3,750
1968	3,952	298	----------	----------	3,750	500	4,250
1969	4,049	401	----------	----------	3,950	500	4,450
1970	4,079	480	241	----------	4,250	550	4,800
1971	4,066	540	294	----------	4,250	650	4,900
Average 1972-81	5,303	529	782	236	5,700	1,150	6,850
Average 1982-91	4,534	402	804	360	5,550	550	6,100
Average 1992-2001	3,412	360	718	360	4,850	0	4,850
Average 2002-11	4,825	497	866	[1] 362	5,400	1,150	6,550
Average 2012-21	4,397	449	792	362	5,200	800	6,000
After 2021 [2]	3,674	388	776	362	4,850	350	5,200

[1] Annual amounts of energy from the central Utah project are assumed to remain constant after 2001.
[2] For the Colorado River storage project, the annual amounts of energy after 2021 are assumed to be constant and equal to the 20-year average obtained by continuing the study from the year 2022 through 2041.

The average annual energy deliverable to load centers, adjusted to account for time-value considerations in determining the average equivalent energy over a 100-year period after each plant is in full production, is 5,920 million kilowatt-hours. This includes 5,558 million kilowatt-hours for the units of the Colorado River storage project and 362 million kilowatt-hours for the central Utah project. The average annual equivalent capacity for a 100-year period when adjusted in the same manner as the energy is 1,095,000 kilowatts, including 1,036,000 kilowatts for the storage project and 59,000 kilowatts for the central Utah project.

During the filling period, firm energy for each year is considered to be all the energy that can be utilized within the monthly load pattern to meet the annual load growth estimated for the power market area by the Federal Power Commission. Beginning with the post-filling operation of the reservoirs, annual firm energy has been

determined for each subsequent 10-year period to be the average annual generation for each period within the monthly load pattern estimated by the Federal Power Commission. Data from the study indicate that the installed capacity of 1,228,000 kilowatts is required in the initial decades to market power and energy at the estimated load factor for the market area of the study. When stream depletions increase in later years, project power could be marketed at lowerload factors than the area load factor. Marketing the power initially at the load factor for the area and later at lowerload factors will result in utilizing the project plants most effectively to supply the requirements of the area when operated in conjunction with other power systems.

Preliminary data from the power market survey indicate that project-produced power and energy can be readily absorbed in the market area as it becomes available from the project powerplants. The estimated requirement by 1970 for 3,659,000 kilowatts of new generating capacity and 14,313 million kilowatt-hours of generation can only be partially satisfied by the 1,109,000 kilowatts of capacity and 6,850 million kilowatt-hours of energy deliverable to load centers from the authorized units of the Colorado River storage project and the central Utah participating project.

POWER RATES

As shown in the preliminary repayment study on page 48, an average rate of 6 mills per kilowatt-hour for firm energy and 2.5 mills per kilowatt-hour for nonfirm energy will provide sufficient revenues to repay all reimbursable power costs and additional revenues to assist in repayment of irrigation costs as required by the authorizing legislation. Definite rate schedules for firm and nonfirm power and energy will be developed in accordance with departmental policy and marketing criteria when costs are more firmly established and a need for such schedules exists.

Summary of Procedures for Economic and Financial Analysis

Procedures adopted for the economic and financial analysis of the Colorado River storage project and participating projects are consistent with present policies of the Bureau of Reclamation and with the provisions of the project authorizing act of April 11, 1956. Salient information concerning the procedures is listed below.

(1) Analyses were made of the storage project units and participating projects in the following combinations:

(*a*) The four storage units were analyzed separately and jointly for benefit-cost comparisons and jointly for cost allocations and repayment.

(*b*) The 11 participating projects were each analyzed separately.

(*c*) The 4 storage units and 11 participating projects were analyzed jointly to show the overall expenditure and repayment requirements.

(2) Construction cost estimates are the latest official estimates of the Bureau of Reclamation and cooperating agencies and are based on the January 1957 price level except that bid prices are used where

available and actual costs of past investigations and construction are included.

(3) Operation and maintenance cost estimates are based on 1954–56 price levels. Replacement costs are based on current construction cost estimates.

(4) A 100-year period is used in the benefit-cost and cost-allocation analyses.

(5) Water supply, power production, and related studies are based on the assumption that average annual stream depletions from projects in the upper basin will increase from an average of 2,550,000 acre-feet at present to an average of 5,500,000 acre-feet by the end of the 100-year period from fiscal year 1963 through fiscal year 2062. In addition depletions due to evaporation losses from the 4 authorized storage units are estimated to average 691,000 acre-feet at the end of the 100-year period.

(6) Benefits for use in the benefit-cost and cost-allocation analyses are determined for all project purposes in accordance with existing procedures of the Bureau of Reclamation. Irrigation benefits are evaluated as direct, indirect, and public and are based on anticipated agricultural conditions without and with the development. Benefits from power and municipal and industrial water are based on the cost of the most economical single-purpose alternative that is likely to be developed in the absence of the project and that would provide benefits comparable to those of the project. Flood control, recreation, and fish and wildlife benefits are evaluated by the Corps of Engineers, National Park Service, and Fish and Wildlife Service, respectively.

(7) A 2½-percent interest rate is used in the benefit-cost and cost-allocation analyses, except that an interest rate of 6¼ percent for private financing is used in estimating alternative power costs and annual power benefits.

(8) Taxes are included in the estimated cost of the most economical alternative for project power in evaluating power benefits. Accordingly an amount equal to the taxes is included in the cost of project power in benefit-cost comparisons. No provision for payment of a tax equivalent is made in power repayment studies.

(9) All costs of past investigations and construction costs paid from contributed funds are excluded from the benefit-cost analysis. Contributed funds and expenditures from the Colorado River development fund are excluded from the cost allocation and repayment analyses.

(10) In the benefit-cost analysis a share of the cost of the storage project is apportioned to irrigation and other water-consuming uses initiated subsequent to 1949, the year the Upper Colorado River Basin compact became effective.

(11) Costs are allocated by the separable cost-remaining benefits method except that only separable costs are allocated to recreation and fish and wildlife.

(12) Repayment of all reimbursable costs of units and participating projects is based on a 50-year period following completion of each unit, project, or separable feature thereof, with appropriate development periods in the case of irrigation. The exceptions to this are in the repayment of the Paonia and Eden projects for which repayment

periods of 68 and 60 years, respectively, have been authorized. The costs allocated to flood control, recreation, and fish and wildlife are nonreimbursable. Irrigation costs are repayable without interest. Costs allocated to power and municipal and industrial use, including interest during construction, are repayable with interest. In this study an interest rate of 2⅞ percent is used in the repayment calculations in all instances where costs are repayable with interest. This rate has been officially determined in the manner prescribed by law as applicable to the Glen Canyon, Flaming Gorge, and Navaho units. An official determination of rates applicable to the Curecanti unit and to participating projects has not yet been made.

(13) Average rates of 6 mills per kilowatt-hour for firm energy and 2.5 mills per kilowatt-hour for nonfirm energy are used in this analysis. These rates are estimated to be required to return enough revenue to pay, under the provisions of the authorizing act, the following construction costs in addition to the annual operating costs:

(*a*) Costs allocated to power with interest.

(*b*) Storage unit costs allocated to irrigation without interest.

(*c*) Costs of participating projects that are allocated to irrigation and that are beyond the repayment ability of the irrigators, without interest.

(14) Anticipated revenue collections from conservancy-type districts are included as participating project revenues.

Benefit-Cost Analysis

The economic desirability of developing the Colorado River storage project and participating projects was measured by a comparison of anticipated benefits from a national standpoint and the Federal costs of development. Both benefits and costs were converted to average annual equivalent values at 2½ percent interest over a 100-year period beginning with the initial operation of each individual storage unit and participating project.

BENEFITS

The benefit-cost comparisons were based on consideration of all benefits from the authorized developments that could be evaluated in monetary terms, including substantial benefits from irrigation and power and smaller amounts of benefits from municipal and industrial water, flood control, fish and wildlife conservation, recreation, and other project services.

Irrigation benefits

Irrigation benefits are estimated to average $15,464,000 annually over the 100-year period of analysis. About $6,712,000 represents storage benefits assignable to future participating projects, and about $8,752,000 represents benefits estimated for the 11 initial participating projects.

The irrigation benefit used in the cost allocation of the storage project is $9 million annually. This estimate is the sum of the $6,712,000 for future participating projects and $2,288,000 representing the value of regulatory storage to the 11 participating projects.

Benefit-cost comparison for Colorado River Storage project and participating projects
(100-year period of analysis with 2 1/2 percent interest rate)
(Unit--$1,000)

Units and projects	Economic costs: Investment: Construction costs exclusive of contributed funds and costs of past investigations	Investment: Interest during construction at 2 1/2 percent	Investment: Total	Annual equivalent of total	Annual operation, maintenance, and replacement costs	Assigned annual costs of replacement storage[1]	Annual tax revenues foregone because of public power investment	Total annual equivalent costs	Annual benefits: Irrigation[2]: Direct	Irrigation[2]: Indirect	Irrigation[2]: Public	Irrigation[2]: Total	Power	Municipal and industrial water	Flood control	Fish and wildlife	Recreation	Sedimentation control	Total	Benefit-cost ratios: Direct benefits	Benefit-cost ratios: Total benefits
Storage units[3]																					
Glen Canyon	453,189	32,866	486,055	13,275	4,893		6,775	24,943				3,930	31,216						35,146		1.4:1
Flaming Gorge	77,230	4,796	82,026	2,240	590		816	3,646				1,170	3,510						4,680		1.3:1
Navajo	42,534	2,403	44,937	1,227	25			1,252				[4]/1,400			31		130		1,561		1.2:1
Curecanti	100,540	4,694	105,234	2,874	1,027		1,215	5,116				212	5,663				86		5,875		1.1:1
Subtotal	673,493	44,759	718,252	19,616	6,535		8,806	34,957				[5]/6,712	40,389		31		216		47,262		1.4:1
Participating projects																					
Paonia, Colo.	7,571	289	7,860	215	23	20		258	318	322		640			2	4	3		649	1.3:1	2.5:1
Pine River extension, Colo. and N. Mex.	5,384	359	5,743	157	21	56		234	216	183	110	509				-2			507	.9:1	2.2:1
Smith Fork, Colo.	3,416	141	3,557	97	12	16		125	107	43		150					3		153	.9:1	1.2:1
Florida, Colo.	7,334	314	7,648	209	16	26		251	170	128	43	341			6	6			353	.7:1	1.4:1
Silt, Colo.	3,463	134	3,597	98	12	12		122	109	73	16	198				2			200	.9:1	1.6:1
Hammond, N. Mex.	2,263	62	2,325	64	18	18		100	91	83	28	202							202	.9:1	2.0:1
Central Utah (initial phase), Utah	[6]/228,391	11,384	239,775	6,549	1,040	378	502	8,469	2,063	1,196	866	4,125	2,423	1,437	85		428	2	8,500	.8:1	1.0:1
Emery County, Utah	9,871	297	10,168	278	40	32		350	269	117	40	426				-1	48		473	.9:1	1.3:1
Seedskadee, Wyo.	24,760	1,230	25,990	710	183	220		1,113	615	639	313	1,567				-10			1,557	.5:1	1.4:1
Lyman, Wyo.	11,323	475	11,798	322	62			384	277	75	36	388				-4			384	.7:1	1.0:1
La Barge, Wyo.	1,730	48	1,778	49	20	28		97	74	92	40	206							206	.8:1	2.1:1
Subtotal	305,506	14,733	320,239	8,748	1,447	806	502	11,503	4,309	2,951	1,492	8,752	2,423	1,437	93	-5	482	2	13,184	.8:1	1.1:1
Total	978,999	59,492	1,038,491	28,364	7,982	806	9,308	46,460	4,309	2,951	1,492	[7]/15,464	42,812	1,437	124	-5	698	2	60,446		1.3:1

1/ Estimated at $2 per acre-foot of increased stream depletion.
2/ Adjusted for development period.
3/ Costs of Transmission division have been prorated among the units of the storage project.
4/ Benefits from the Navajo Indian irrigation project have been assigned to the Navajo unit in the proportion that the cost of the Navajo Reservoir bears to the total cost of the Navajo project including Navajo Reservoir.
5/ Storage benefits assignable to future participating projects.
6/ Excludes $5,750,000 for construction of certain Central Utah project features to ultimate phase capacity.
7/ Includes storage benefit of $6,712,000 for future projects and $2,288,000 included in the benefits of the 11 participating projects.

INTERIOR - - RECLAMATION, SLC, UTAH

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Benefit-cost comparison for Colorado River Storage project and participating projects
(50-year period of analysis with 2 1/2 percent interest rate)
(Unit—$1,000)

Units and projects	Economic costs: Investment: Construction costs exclusive of contributed funds and costs of past investigations	Investment: Interest during construction at 2 1/2 percent	Investment: Total	Annual equivalent of total	Annual operation, maintenance, and replacement costs	Assigned annual costs of replacement storage 1/	Annual tax revenues foregone because of public power investment	Total annual equivalent costs	Annual benefits: Irrigation 2/: Direct	Irrigation 2/: Indirect	Irrigation 2/: Public	Irrigation 2/: Total	Power	Municipal and industrial water	Flood control	Fish and wildlife	Recreation	Sedimentation control	Total	Benefit-cost ratios: Direct benefits	Total benefits
Storage units 3/																					
Glen Canyon	453,189	32,866	486,055	17,137	3,994		6,885	28,016				3,930	31,957						35,887		1.3:1
Flaming Gorge	77,230	4,796	82,026	2,892	550		824	4,266				1,170	3,559						4,729		1.1:1
Navajo	42,534	2,403	44,937	1,584	25			1,609				4/1,400			31		130		1,561		1.0:1
Curecanti	100,540	4,694	105,234	3,710	969		1,216	5,895				212	5,683				86		5,981		1.0:1
Subtotal	673,493	44,759	718,252	25,323	5,538		8,925	39,786				5/6,712	41,199		31		216		48,158		1.2:1
Participating projects																					
Paonia, Colo.	7,571	289	7,860	277	23	20		320	335	336		671			2	4	3		680	1.1:1	2.2:1
Pine River extension, Colo. and N. Mex.	5,384	359	5,743	202	21	56		279	244	207	124	575				-2			573	.9:1	2.1:1
Smith Fork, Colo.	3,416	141	3,557	125	12	16		153	110	45		155					3		158	.7:1	1.0:1
Florida, Colo.	7,334	314	7,648	270	16	26		312	178	134	45	357			6	6			369	.6:1	1.2:1
Silt, Colo.	3,463	134	3,597	127	12	12		151	114	76	17	207				2			209	.8:1	1.4:1
Hammond, N. Mex.	2,263	62	2,325	82	18	18		118	102	93	32	227							227	.9:1	1.9:1
Central Utah (initial phase), Utah	6/228,391	11,384	239,775	8,454	1,040	378	502	10,374	2,165	1,255	909	4,329	2,423	1,437	85		428	2	8,704	.6:1	.8:1
Emery County, Utah	9,871	297	10,168	359	40	32		431	282	123	42	447				-1	48		494	.8:1	1.1:1
Seedskadee, Wyo.	24,760	1,230	25,990	916	183	220		1,319	694	721	354	1,769				-10			1,759	.5:1	1.3:1
Lyman, Wyo.	11,323	475	11,798	416	62			478	281	77	37	395				-4			391	.6:1	.8:1
La Barge, Wyo.	1,730	48	1,778	63	20	28		111	84	104	45	233							233	.8:1	2.1:1
Subtotal	305,506	14,733	320,239	11,291	1,447	806	502	14,046	4,589	3,171	1,605	9,365	2,423	1,437	93	-5	482	2	13,797	.6:1	1.0:1
Total	978,999	59,492	1,038,491	36,614	6,985	806	9,308	53,832	4,589	3,171	1,605	16,077	42,812	1,437	124	-5	698	2	61,955		1.1:1

1/ Estimated at $2 per acre-foot of increased stream depletion.
2/ No adjustment made for development period.
3/ Costs of Transmission division have been prorated among the units of the storage project.
4/ Benefits from the Navajo Indian irrigation project have been assigned to the Navajo unit in the proportion that the cost of the Navajo Reservoir bears to the total cost of the Navajo project including Navajo Reservoir.
5/ Storage benefits assignable to future participating projects.
6/ Excludes $5,750,000 for construction of certain Central Utah project features to ultimate phase capacity.

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The irrigation benefit from participating projects includes direct, indirect, and public benefits. About $4,309,000 of the total represents direct benefits, measured by the increase in net farm income that will be realized with project development. Approximately $2,951,000 represents indirect benefits, measured by the increased profits of businesses handling, processing, and marketing products from the developments and of enterprises supplying goods and services to project farms. The remaining $1,492,000 will be of a public nature realized from the increase or improvement in community facilities and services and stabilization of the local and regional economy.

Benefits from irrigation were evaluated on the basis of average long-term projected price levels.

Power benefits

Total power benefits for the storage project and participating projects are estimated at an average of $42,812,000 annually. These benefits are taken as the average annual value of the total estimated cost of obtaining equivalent power from the most economical alternative source likely to be developed in the absence of the storage project and participating projects. Steam-electric plans constructed and operated by private utilities are considered to be the most likely alternative source. The private plants and necessary transmission lines would be located throughout the market area so as to provide the most economical means of serving the load centers with the necessary power. The plants generally would be large, modern, three-unit installations having a high efficiency and being strategically located with respect to fuel supply. The average cost of alternative steam-electric power and energy delivered to representative load centers throughout the market area is estimated to be $24.50 a year per kilowatt of dependable capacity (including $8.50 per year for taxes) and 2.7 mills per kilowatt-hour for energy. The average annual benefits as shown above result from applying these unit costs to the average annual equivalent amounts of capacity and energy estimated at 1,095,000 kilowatts and 5,920 million kilowatt-hours for the storage project and central Utah project.

The total cost of the most economical alternative source of equivalent power or power benefits for the Colorado River storage project is estimated at $40,389,000 annually as shown under "Cost allocations." The total cost of the most economical alternative source of equivalent power or power benefits for the central Utah project is estimated at $2,423,000 annually.

Municipal and industrial water benefits

Benefits from municipal and industrial water in present evaluations are confined to those that will result from the central Utah project and are estimated to average $1,437,000 annually. This estimate is based on the average annual equivalent cost of obtaining a comparable water supply from the most economical alternative single-purpose means of development.

Flood-control benefits

Preliminary appraisals by the Corps of Engineers indicate that the reduction in flood damage that will result from operation of the authorized project developments will average $124,000 annually. The benefits are equal to the different between the flood damage that is expected to occur with and without the project. The corps will further evaluate flood-control benefits in connection with definite plan studies.

Fish and wildlife benefits

Effects of participating projects on fish and wildlife resources, both beneficial and adverse, have been partially evaluated by the Fish and Wildlife Service. The total adverse effects for the projects studied were found to exceed the total benefits by an average of $5,000 annually. No evaluation, however, has been made of the effects of the storage units on fish and wildlife. The example of Lake Mead suggests that the net benefits of the large storage reservoirs may be substantial. Further evaluation of fish and wildlife benefits will be made as a part of pre-construction surveys.

Recreational benefits

The National Park Service estimates the recreational benefits of the authorized projects and units studied to date at $698,000 annually. The estimate is generally based on the service's judgment that annual benefits of the specific (Federal and non-Federal) recreational facilities included in preliminary plans are at least equal to the annual equivalent cost of constructing, operating, and maintaining the facilities and that a like benefit value will accrue from the recreational use of dams and reservoirs. The evaluation of recreational benefits will be continued in preconstruction surveys.

Other benefits

A number of minor benefits in addition to those mentioned may be expected from project development. The only one so far evaluated is a sediment control benefit in connection with a potential reservoir of the central Utah project which, according to an estimate by the Bureau of Indian Affairs, will have a value of $2,000 annually in preventing sedimentation of Indian irrigation canals.

AVERAGE ANNUAL EQUIVALENT COSTS

Determination of costs

For comparison with the average annual benefits, an estimate was made of the average annual equivalent Federal cost of development. This cost includes the Federal investment amortized over the 100-year period of analysis at 2½ percent interest and annual operation, maintenance, and replacement costs. Construction costs used in the benefit-cost analysis do not include past investigation costs since these do not bear on the advisability of future expenditures. Also they do not include contributed funds for the Glen Canyon bridge and highway nor costs of constructing certain central Utah project features to ultimate phase capacity since no evaluations have been made of benefits from such expenditures. Interest on expenditures during the construction period is added to construction costs. An amount

equivalent to taxes on an alternative private power development is also included as an economic cost of developments involving power production. Also included for participating projects is each project's pro rata share of the cost of regulatory facilities of the Colorado River storage project for reasons explained below.

Storage project costs assigned to participating projects

Reservoirs of the Colorado River storage project, as explained under "Water Supply," will provide replacement water for the lower basin and Mexico in prolonged drought periods in order to permit continued expansion of water-consuming uses in the upper basin. A portion of the cost of the storage reservoirs may therefore appropriately be assigned to the water-consuming uses of participating projects in the benefit-cost analysis. Under the authorized repayment plan, however, all of the reimbursable storage costs will be rapaid from power revenues.

Since the amount of replacement storage required is a direct function of increases in stream depletion, it is equitable to assign the allocated costs of replacement storage to each participating project in proportion to the amount of stream depletion that it will cause. In a later section of this report, a total cost of $122,086,000 on a present worth basis for units of the storage project is allocated to irrigation. This allocation, prorated to an average increase in consumptive use of 1,800,000 acre-feet annually over the 100-year period of analysis, amounts to about $70 per acre-foot. On an annual equivalent basis it is about $2 per acre-foot of depletion.

BENEFIT-COST SUMMARY

Benefit-cost comparisons have been made for each unit of the Colorado River storage project, the combined storage units, each participating project, and for the storage project and participating projects combined. Comparisons have been made for a 100-year period of analysis in accordance with Bureau of Reclamation policy and for a 50-year period in response to requests from the Bureau of the Budget. For both periods of analysis comparisons have been made for total benefits (direct, indirect, and public) and where possible for direct benefits only. Results of the comparisons are shown in the tables facing page 21.

The benefit-cost analysis for the 100-year period, with consideration given to all the benefits, is believed to be the most equitable measure of economic justification. Use of the 100-year period of study is more realistic than a 50-year period since the major features have been designed and are being constructed to last well beyond 100 years. Recognition of all benefits is desirable because direct benefits do not fully measure the significance of the project. Operation of the storage units and participating projects will be interrelated in stream regulation, power production, and power transmission. Consequently, the benefits of storage are recognized in the analysis of the participating projects, and a corresponding assignment of costs for stream depletion is made as discussed above. Because of the interdependence of storage works and local facilities for use of water, a

benefit-cost ratio for an individual storage unit or participating project is necessarily arbitrary and is less significant than a ratio of total benefits to total costs for the authorized features.

In the analysis for the 100-year period and with consideration given to all the anticipated benefits, the Colorado River storage project and participating projects combined have benefits in excess of costs and each individual storage unit and participating project has benefits equal to or greater than the costs. The overall project benefit-cost ratio is 1.3 to 1.

Cost Allocations

Preliminary allocations have been made of the estimated costs of the Colorado River storage project and participating projects as a basis for determining reimbursable costs by purposes and for making repayment studies. Costs of the four units of the storage project have been allocated as a single project cost and have been apportioned to irrigation and other water-consuming uses, power, flood control, and recreation. Costs of each participating project have been separately allocated to the same purposes as the storage project costs and also on some instances to municipal and industrial water and to fish and wildlife. The allocations are of necessity preliminary in nature since they are based on estimated costs and project plans that may be modified in definite plan studies.

Procedures used in allocations of the storage project costs are discussed in the following sections and the resulting allocations are summarized in the table on page 29. Allocations of cost of participating projects also are summarized in the table on pages 30 and 31. Procedures used in making the participating project allocations are similar to those for the storage project.

DERIVATION OF STORAGE PROJECT COST ALLOCATIONS

Storage project costs used as a basis for the allocations include construction costs, interest during construction, and operation, maintenance, and replacement costs. Costs of past investigations financed from the reimbursable Reclamation and Upper Colorado River Basin funds were included in the construction costs, but those financed from the nonreimbursable Colorado River development fund and contributed funds were excluded. Also excluded were costs of construction financed from contributed funds.

Method of allocation

Only separable costs of recreational facilities were allocated to recreation. Remaining costs were then allocated to irrigation, power, and flood control by the separable cost-remaining benefits method. Under this method the separable costs of each purpose were allocated to that purpose and the sum of the separable costs for all purposes was subtracted from the total project costs to obtain remaining joint costs. The remaining joint costs were then allocated to the various project purposes in proportion to the remaining benefits of the purposes in excess of their separable costs. Thus the total allocation to each purpose is equal to or greater than the separable cost of including that purpose in the project and is not more than either the benefits or the cost of the most economical single-purpose alternative. Under this method

the costs of facilities serving more than one purpose are allocated to the various purposes in a manner that permits each purpose to share in the economy of the multiple-purpose development.

In the allocation procedure all benefits and costs including interest during construction were converted to present values at the beginning of the 100-year period of analysis at an interest rate of 2½ percent. The total allocations made on this basis were then converted to appropriate capital and annual amounts. The amount of interest during construction was then converted to reflect a 2⅞-percent rate to determine the amount of interest during construction to be reimbursed.

Separable and joint costs

The separable costs for each purpose of the multiple-purpose project are defined as the difference between the cost of the multiple-purpose project and the cost of the project with the purpose omitted. Thus the separable costs for each purpose include the costs of those project facilities used solely by that purpose plus the difference in costs of the joint use facilities that would change in size or design with the purpose omitted. Separable costs were determined by assuming each purpose in turn as the last purpose added to the multiple-purpose project. The remaining joint costs are the total project costs less the sum of the separable costs for the various purposes. The estimated separable costs of power, irrigation, flood control, and recreation for the four units of the storage project and the remaining joint costs for the project are shown in the following table.

Determination of separable and remaining joint costs—Colorado River storage project

[In thousands of dollars]

Unit and item	Construction costs [1]	Interest during construction at 2½ percent	Annual costs		
			Operation and maintenance costs	Replacement costs	Total
	Multiple-purpose project cost				
Glen Canyon	$322,794	$27,898	$1,648	$1,179	$2,827
Dam and reservoir	204,666	17,575	530	44	574
Powerplants and switchyards	118,128	10,323	1,118	1,135	2,253
Flaming Gorge	66,505	4,562	233	185	418
Dam and reservoir	49,618	3,421	66	10	76
Powerplants and switchyards	16,887	1,141	167	175	342
Navaho	42,540	2,403	16	9	25
Dam and reservoir	42,333	2,403	16	9	25
Recreational facilities	207				
Curecanti	84,866	4,051	385	391	776
Dam and reservoir	45,397	2,147	37	41	78
Powerplants and switchyards	39,017	1,904	348	350	698
Recreational facilities	452				
Transmission division	157,445	5,845	884	1,605	2,489
Total	674,150	44,759	3,166	3,369	6,535
	Multiple-purpose project with power omitted				
Glen Canyon Dam and Reservoir	$195,000	$16,471	$482	$41	$523
Flaming Gorge Dam and Reservoir	46,300	2,850	58	10	68
Navaho—					
Dam and Reservoir	42,333	2,403	16	9	25
Recreational facilities	207				
Curecanti—					
Dam and Reservoir	16,700	878	12	10	22
Recreational facilities	452				
Total	300,992	22,602	568	70	638
Separable power costs	373,158	22,157	2,598	3,299	5,897
	Multiple-purpose project with irrigation omitted				
Glen Canyon	$322,794	$27,898	$1,648	$1,179	$2,827
Flaming Gorge	66,505	4,562	233	185	418
Navaho—recreation	207				
Curecanti	84,866	4,051	385	391	776
Transmission division	157,445	5,845	884	1,605	2,489
Total	631,817	42,356	3,150	3,360	6,510
Separable irrigation costs [2]	42,333	2,403	16	9	25
	Multiple-purpose project with recreation omitted				
Glen Canyon	$322,794	$27,898	$1,648	$1,179	$2,827
Flaming Gorge	66,505	4,562	233	185	418
Navaho	42,333	2,403	16	9	25
Curecanti	84,414	4,051	385	391	776
Transmission division	157,445	5,845	884	1,605	2,489
Total	673,491	44,759	3,166	3,369	6,535
Separable recreational costs	659				
	Recapitulation				
All units:					
Total costs	$674,150	$44,759	$3,166	$3,369	$6,535
Less total separable costs	416,150	24,560	2,614	3,308	5,922
Remaining joint costs	258,000	20,199	552	61	613

[1] Excludes nonreimbursable costs of past investigation paid from Colorado River development fund and contributed funds. Also excludes money contributed for construction.

[2] Includes flood-control costs on San Juan River and therefore considered as a dual cost in cost-allocation table.

Justifiable irrigation expenditure

The justifiable irrigation expenditure for the Colorado River storage project is limited to the maximum benefits that could be attributed to the storage water replacement function or the costs of the most economical alternative single-purpose replacement storage, whichever is the lesser. The alternative single-purpose costs were found to be substantially less than the benefits and thus were taken as the justifiable expenditure. Both the benefits and the alternative costs are discussed in the following sections.

Benefits.—The maximum benefits that could be attributed to the water replacement function of the storage project are taken as the benefits in excess of local construction and operating costs of future water-consuming projects in the upper basin over the 100-year period of analysis. Consideration was given only to the benefits and costs associated with irrigation, municipal, and industrial use. The excess of the benefits over costs for the 100-year period was estimated by projection of the excess benefits anticipated for the 11 initial participating projects. The projections were made on the basis of the average value of excess benefits per acre-foot of stream depletion. In order to arrive at a conservative estimate, however, the excess benefit value determined for the initial participating projects was slightly lowered when related to other future projects. Also the computations were based on the weighted average increase in stream depletions of 1,800,000 acre-feet over the 100-year period rather than the projected total increase of 2,950,000 acre-feet by the end of the period. Derivation of the excess benefits is summarized in the following table.

Excess annual benefits of initial participating projects and projection for future water-consuming projects [1]

[In thousands]

Participating projects	Annual benefits	Annual costs	Annual benefits in excess of costs	Increased annual stream depletion (acre-feet)	Average excess benefits per acre-foot of stream depletion
Paonia	$640	$236	$404	10	$40
Pine River extension	509	178	331	28	12
Smith Fork	150	110	40	8	5
Florida	341	221	120	13	9
Silt	198	111	87	6	15
Hammond	202	84	118	9	13
Central Utah	5,562	5,317	245	189	1
Emery County	426	298	128	16	8
Seedskadee	1,567	893	674	110	6
Lyman	388	384	4	0	0
La Barge	206	69	137	14	10
Subtotal	10,189	7,901	2,288	403	6
Total projected average including future projects for 100-year period			9,000	1,800	5

[1] Includes only those benefits associated with irrigation, municipal, and industrial water.

As shown in the table, the estimate of total excess benefits for the 100-year period of analysis amounts to an average of $9 million annually. The present worth of this annual amount over a 100-year period at 2½ percent interest is about $330 million.

Alternative single-purpose costs.—The alternative single-purpose irrigation costs of the Colorado River Storage project were estimated

as the costs of providing replacement storage for irrigation and other upstream water-consuming uses equivalent to that at the Glen Canyon, Flaming Gorge, Curecanti, and Navajo units.

After allowances are made for sediment deposition to year 2062 and minimum operating levels for power production, the multiple-purpose reservoirs at Glen Canyon, Flaming Gorge, Curecanti, and Navajo units will have about 22,443,000 acre-feet of active storage capacity. The single-purpose alternative must have an equivalent amount of active storage capacity, without any specific reservation of dead storage to maintain a minimum power pool, after making allowances for evaporation losses and sediment deposition to year 2062. The lowest cost single-purpose alternative was found to consist of the Cross Mountain, Flaming Gorge, Dewey, and Navajo Reservoirs. To assure the initial filling of such alternative reservoirs during the present period of incomplete water use in the Colorado River Basin, they would need to be constructed under the same schedule as the authorized multiple-purpose reservoirs.

The lowest cost single-purpose replacement storage alternative was selected by reconnaissance analyses using available data on the various large reservoir sites in the upper basin. The estimated capacities and construction costs of the selected alternative system of reservoirs are shown in the table on the following page.

Justifiable power expenditure

The justifiable expenditure for power is taken as the cost of the most economical single-purpose alternative power development described on page 29. As previously explained, this same cost is taken as a measure of the project power benefit. The total annual costs of the alternative development were estimated on the basis of private financing including taxes and interest at the rate of 6¼ percent. The estimated costs are summarized below.

Item	Average annual equivalant of total cost	Present worth [1]
Cost excluding taxes	$31,583,000	$1,156,380,000
Taxes	8,806,000	322,423,000
Total	40,389,000	1,478,803,000

[1] Computed over a 100-year period with interest at rate of 2½ percent.

Estimated cost of single-purpose storage alternative—Colorado River storage project

	Cross Mountain Dam and Reservoir	Flaming Gorge Dam and Reservoir	Dewey Dam and Reservoir	Navajo Dam and Reservoir	Total
Initial active storage capacity	5,200,000	3,930,000	9,500,000	1,028,000	19,658,000
Active capacity remaining in year 2062	5,160,000	3,730,000	8,000,000	948,000	17,838,000
Construction cost	$20,265,000	$48,446,000	$92,350,000	$42,333,000	$203,394,000
Interest during construction [1]	1,139,000	3,246,000	7,389,000	2,403,000	14,177,000
Net investment by year completed	21,404,000	51,692,000	99,739,000	44,736,000	217,571,000
Annual operation, maintenance, and replacement costs	104,000	77,000	193,000	25,000	399,000
Present worth of operation, maintenance, and replacement costs	3,808,000	2,819,000	7,066,000	915,000	14,608,000
Present worth of total cost	25,212,000	54,511,000	106,805,000	45,651,000	232,179,000

[1] Computed at an interest rate of 2½ percent.

Justifiable flood-control expenditure

Flood control benefits, as estimated by the Corps of Engineers, were used as the justifiable flood-control expenditure. These have been evaluated only for the Navaho unit and are estimated at $1,135,000 as the present worth of $31,000 annually over 100 years at 2½ percent interest. No estimate was made of the cost of the cheapest alternative means of providing flood control for consideration as the justifiable flood-control expenditure as the cost of such an alternative would far exceed the anticipated flood-control benefits.

RESULTS OF ALLOCATIONS—STORAGE PROJECT AND PARTICIPATING PROJECTS

A summary of the derivation of the allocations made for the storage project is shown in the following table. Results of the allocations made for the storage project and for the participating projects are summarized on pages 30 and 31.

Derivation of cost allocations—Colorado River storage project [1] *(separable costs-remaining benefits method)*

[In thousands of dollars]

	Irrigation	Power	Flood control	Subtotal	Recreation	Total
1. Benefits [2]	330,000	1,478,803	1,135	1,809,938	-------	----------
2. Alternative single-purpose cost [3]	232,179	1,478,803	(4)	----------	-------	----------
3. Justifiable expenditure	232,179	1,478,803	1,135	1,712,117	-------	----------
4. Initially separable costs [3]	---------	933,651	--------	933,651	659	934,310
(a) Construction costs	---------	373,158	--------	373,158	659	373,817
(b) Interest during construction	---------	22,157	--------	22,157	-------	22,157
(c) Operation, maintenance, and replacement costs	---------	215,913	--------	215,913	-------	215,913
(d) Taxes foregone	---------	322,423	--------	322,423	-------	322,423
5. Remaining benefits before dual costs	232,179	545,152	1,135	778,466	-------	----------
6. Allocated dual costs [3]	45,422	----------	229	45,651	-------	45,651
(a) Construction costs	42,121	----------	212	42,333	-------	42,333
(b) Interest during construction	2,391	----------	12	2,403	-------	2,403
(c) Operation, maintenance, and replacement costs	910	----------	5	915	-------	915
7. Remaining benefits	186,757	545,152	906	732,815	-------	----------
8. Allocated joint costs [3]	76,604	223,979	--------	300,643	-------	300,643
(a) Construction costs	65,790	192,210	--------	258,000	-------	258,000
(b) Interest during construction	5,151	15,048	--------	20,199	-------	20,199
(c) Operation, maintenance, and replacement costs	5,723	16,721	--------	22,444	-------	22,444
9. Total allocation [3]	122,086	1,157,630	229	1,279,945	659	1,280,604
(a) Construction costs	107,911	565,368	212	673,491	659	674,150
(b) Interest during construction	7,542	37,205	12	44,759	-------	44,759
(c) Operation, maintenance, and replacement costs	6,633	232,634	5	239,272	-------	239,272
(d) Taxes foregone	---------	322,423	--------	322,423	-------	322,423
10. Construction costs:						
(a) Excluding interest during construction	107,911	565,368	212	673,491	659	674,150
(b) Including interest during construction at 2½ percent	115,453	602,573	224	718,250	659	718,909
(c) Including reimbursable interest during construction at 2⅞ percent	107,911	609,277	212	717,400	659	718,059
11. Annual operation, maintenance, and replacement costs:						
(a) Based on 2½ percent	181	6,354	0	6,535	-------	6,535
(b) Based on 2⅞ percent	174	6,108	0	6,282	-------	6,282

[1] No cost has been allocated to fish and wildlife because studies of this function have not been completed. Future studies may result in allocations to this and other functions not presently included.

[2] Present worth of annual benefits over 100 years at 2½ percent interest.

[3] Include construction costs with exception of expenditures from contributed funds and Colorado River Development Fund, interest during construction at 2½ percent, operation, maintenance, and replacement costs, and taxes foregone when appropriate. Figures for operation, maintenance, and replacement costs and taxes foregone are present values computed for a 100-year period at 2½ percent.

[4] Greater than benefits.

Summary of allocated costs [1]*—Colorado River storage project and participating projects*

[In thousands of dollars]

Storage project and participating projects	Irrigation	Power	Municipal and industrial water	Flood control	Subtotal	Recreation	Fish and wildlife [2]	Other	Total
Storage project:									
Construction costs	$107,911	$565,368		$212	$673,491	$659			$674,150
Reimbursable interest during construction		43,909			43,909				43,909
Operation, maintenance, and replacement costs	174	6,108			6,282				6,282
Participating projects:									
Paonia, Colo.:									
Construction costs	7,684			72	7,756	8			7,764
Operation, maintenance, and replacement costs	22				22	1			23
Pine River extension, Colorado and New Mexico:									
Construction costs	5,486				5,486				5,486
Operation, maintenance, and replacement costs	21				21				21
Smith Fork, Colo.:									
Construction costs	3,437				3,437	24			3,461
Operation, maintenance, and replacement costs	12				12				12
Florida, Colo.:									
Construction costs	7,234			125	7,359		$52		7,411
Operation, maintenance, and replacement costs	16				16				16
Silt, Colo.:									
Construction costs	3,531				3,531				3,531
Operation, maintenance, and replacement costs	12				12				12
Hammond, N. Mex.:									
Construction costs	2,433				2,433				2,433
Operation, maintenance, and replacement costs	18				18				18
Central Utah (initial phase), Utah:									
Construction costs	131,242	49,048	$44,419	2,232	226,941	1,552	477	[3] $5,750	234,720
Reimbursable interest during construction		3,062	2,456		5,518				5,518
Operation, maintenance, and replacement costs	240	490	53		783	187	70		1,040
Emery County, Utah:									
Construction costs	9,704				9,704	190			9,894
Operation, maintenance, and replacement costs	25				25	15			40
Seedskadee, Wyo.:									
Construction costs	25,060				25,060				25,060
Operation, maintenance, and replacement costs	183				183				183
Lyman, Wyo.:									
Construction costs	11,376				11,376				11,376
Operation, maintenance, and replacement costs	62				62				62
LaBarge, Wyo.:									
Construction costs	1,751				1,751				1,751
Operation, maintenance, and replacement costs	20				20				20

Subtotal, participating projects:									
Construction costs	208,938	49,048	44,419	2,429	304,834	1,774	529	5,750	312,887
Reimbursable interest during construction		3,062	2,456		5,518				5,518
Operation, maintenance, and replacement costs	631	490	53		1,174	203	70		1,447
Total, storage project and participating projects:									
Construction costs	316,849	614,416	44,419	2,641	978,325	2,433	529	5,750	987,037
Reimbursable interest during construction		46,971	2,456		49,427				49,427
Operation, maintenance, and replacement costs	805	6,598	53		7,456	203	70		7,729

[1] Allocated construction costs exclude expenditures from contributed funds and Colorado River Development Fund. Interest during construction and replacement costs are based on interest at rate of 2⅞ percent.

[2] The fish and wildlife allocation is incomplete because no appraisal of fish and wildlife benefits from the storage project has been made and benefits from the participating projects have been only partially evaluated.

[3] Estimated cost of constructing certain features to ultimate phase capacity.

Project Repayment

A repayment analysis of the Colorado River storage project and participating projects has been made to demonstrate how repayment of reimbursable construction costs of the project, including interest during construction, can be accomplished in accordance with the provisions of the authorizing legislation. Costs allocated to recreation and to fish and wildlife are made nonreimbursable by the authorizing act. Costs allocated to flood control are also nonreimbursable. Costs allocated to irrigation, power, and municipal and industrial water use, which represent more than 99 percent of the project cost after deductions are made for contributed funds and nonreimbursable investigation expenditures, are reimbursable.

Reimbursable costs except as noted below will be repaid in a period of not more than 50 years from the date of completion of the respective storage units, participating projects, or separable features thereof, following in the case of irrigation a suitable development period of not more than 10 years. Irrigation-water users will repay in accordance with their estimated ability for a period of 50 years except as otherwise provided by separate authorization acts for the Eden and Paonia projects. Project repayment contracts will be executed with conservancy-type districts which have the capacity to levy assessments upon all taxable real property located within their boundaries to assist in paying project costs. Municipal and industrial water users will repay with interest at 2⅞ percent the full cost allocated to municipal and industrial water. Power will be sold at rates at which all costs allocated to power will be repaid with interest at 2⅞ percent and revenues will be provided to assist in the repayment of irrigation costs.

Upper Colorado River Basin Fund

All revenues collected in the operation of the Colorado River storage project and participating projects will be credited to and disbursed from the Upper Colorado River Basin fund as provided by the project authorizing act. Accounting records for the basin fund will be maintained to show (1) source of revenue and (2) the application of total revenues received into the fund. Surplus revenues in the basin fund, as defined in section 5 (e) of the act of April 11, 1956, will be used to repay irrigation costs of participating projects that are beyond the repayment ability of the project irrigators. Surplus revenues remaining in the basin fund from participating projects will be apportioned to the State in which such participating project is located and surplus revenues from the storage units will be apportioned by States as shown below.

	Percent		*Percent*
Colorado	46.0	Wyoming	15.5
Utah	21.5	New Mexico	17.0

In accordance with the foregoing procedures, disbursements from the basin fund for the storage project or for participating projects will be made generally in the following order:

(1) Payment of operation, maintenance, replacement, and emergency costs for project facilities.

(2) Payment of interest on the unpaid balance of construction costs allocated to power and municipal and industrial water.
(3) Repayment of reimbursable construction costs.

SUMMARY OF COSTS AND REPAYMENT

Tentative construction cost allocations and estimated repayment under the procedures previously discussed are summarized in the table facing page 34. Following that summary six different repayment schedules are presented. The first (p. 35) is a repayment schedule for all power costs, including those of the storage project and central Utah project, and for irrigation costs of the storage project. It shows how power revenues will repay all reimbursable costs of the storage project and power costs of the central Utah project and establishes revenues available to assist in the repayment of irrigation costs of participating projects. The next four schedules (pp. 36 to 39) demonstrate repayment of irrigation costs of participating projects segregated by the States of Colorado, New Mexico, Utah, and Wyoming, respectively. The last schedule is a summary of power, municipal and industrial water, and irrigation repayment for all authorized units of the storage project and all participating projects, as well as the Eden project in Wyoming.

The repayment tables and schedules indicate that all costs allocated to power for both the storage project and participating projects, amounting to $661,387,000 including interest during construction, can be repaid with interest within a period of 50 years following completion of each of the separable power features. Power costs according to present schedules would be fully repaid in year 2008. Costs of the storage units allocated to irrigation, amounting to $107,911,000, would be repaid from power revenues in 5 years or in the 43d year (2012) following completion of the irrigation investment at the different units. Costs allocated to municipal and industrial water, amounting to $46,875,000 including interest during construction, would be repaid with interest in 50 years following completion of appurtenant facilities. The municipal and industrial water development is presently scheduled in three blocks with repayment being completed in years 2014, 2023, and 2031. Costs of the 11 participating projects and the Eden project allocated to irrigation, totaling $217,129,000 plus $5,750,000 allocated to the ultimate phase of the central Utah project, would be repaid within a 50-year period following the development periods, except that authorized periods of 68 years and 60 years would be used for the Paonia and Eden projects, respectively. The last payment would be made in year 2049, the 90th year of the combined operation of all storage units, the participating projects, and Eden project. The irrigation repayment would be made by the irrigators and from power revenues and conservancy district taxes as illustrated in the summary table. In repayment studies for participating projects, drafts on power revenues in the basin fund at no time exceeded scheduled revenues apportioned to the State in which the respective projects are located. Repayment of reimbursable project costs was accomplished prior to the dates on which final payments are due and interest-bearing and non-interest-bearing costs, to the extent practicable, were paid concurrently.

Summary of cost allocations and repayment—Colorado River storage project and participating projects

[In thousands of dollars]

Item	Allocated construction costs of storage units and participating projects	Reimbursable interest during construction for storage units and participating projects	Eden project construction costs	Total repayment for storage units, participating projects, and Eden project
Reimbursable costs:				
Irrigation	316,849		8,191	325,040
From water users				(31,612)
From power revenues				(284,985)
From conservancy districts				(8,443)
Power	614,416	46,971		661,387
Municipal and industrial use	44,419	2,456		46,875
Ultimate phase, central Utah project	5,750			5,750
Subtotal	981,434	49,427	8,191	1,039,052
Nonreimbursable costs:				
Flood control	2,641			
Recreation	2,433			
Fish and wildlife	529			
Subtotal	5,603			
Total allocated costs	987,037			
Plus expenditures from Colorado River development fund	2,779			
Contributed funds	2,358			
Total project costs	992,174			
Earned surplus through 2049	775,528			

REPAYMENT SCHEDULE OF AUTHORIZED STORAGE PROJECT UNITS AND POWER FEATURES OF THE CENTRAL UTAH PROJECT
AND ESTABLISHMENT OF REVENUES AVAILABLE TO ASSIST IN IRRIGATION REPAYMENT OF PARTICIPATING PROJECTS
(Unit--1,000,000 kilowatt-hours and $1,000)

Year of study	Fiscal year	Deliverable energy: Firm	Deliverable energy: Nonfirm	Gross revenues: From firm energy at 6 mills a kw.-hr.	Gross revenues: From nonfirm energy at 2.5 mills a kw.-hr.	Gross revenues: Total	Operation, maintenance, and replacement costs 1/	Net power revenues	Electric plant in service at end of year	Interest on unpaid power investment at 2/7/8%	Repayment of power investment	Unpaid balance of power investment	Allowable unpaid balance of power investment	Power revenues used to repay irrigation investment of storage project	Irrigation plant of storage project in service at end of year	Unpaid balance of irrigation investment of storage project	Allowable unpaid balance of irrigation investment of storage project	Remaining net power revenues of Central Utah project apportioned to Utah	Remaining net power revenues of Colorado River Storage units apportioned to: Colorado 46%	Utah 21.5%	New Mexico 17%	Wyoming 15.5%	Total	Total power revenues available for irrigation repayment assistance	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0	1959																								0
1	60																								1
2	61																								2
3	62																								3
4	63																								4
5	64								201,043			201,043	201,043		63,158	63,158	63,158								5
6	65	1,500	1,650	9,000	4,125	13,125	3,780	9,345	378,820	5,780	3,565	375,255	378,820		105,279	105,279	105,279								6
7	66	2,950	400	17,700	1,000	18,700	5,104	13,596	501,087	10,789	2,807	494,715	501,087		105,279	105,279	105,279								7
8	67	3,200	550	19,200	1,375	20,575	5,187	15,388	506,155	14,233	1,165	498,618	506,155		105,279	105,279	105,279								8
9	68	3,750	500	22,500	1,250	23,750	5,187	18,563	506,155	14,335	4,228	494,390	506,155		105,279	105,279	105,279								9
10	69	3,950	500	23,700	1,250	24,950	5,205	19,745	537,408	14,214	5,531	520,112	537,408		107,911	107,911	107,911								10
11	70	4,250	550	25,500	1,375	26,875	5,539	21,336	537,408	14,953	6,383	513,729	537,408												11
12	1971	4,250	650	25,500	1,625	27,125	5,539	21,586	537,408	14,770	6,816	506,913	537,408												12
13	72	5,700	1,150	34,200	2,875	37,075	5,539	31,536	537,408	14,574	16,962	489,951	537,408												13
14	73						6,050	31,025	622,604	14,086	16,939	558,208	622,604												14
15	74						6,450	30,625	625,654	16,048	14,577	546,681	625,654												15
16	75						6,470	30,605	647,987	15,717	14,888	554,126	647,987												16
17	76						6,742	30,333	650,187	15,931	14,402	541,924	650,187												17
18	77						6,772	30,303	651,787	15,580	14,723	528,801	651,787												18
19	78								653,387	15,203	15,100	515,301	653,387												19
20	79								654,987	14,815	15,488	501,413	654,987												20
21	80								656,587	14,416	15,887	487,126	656,587												21
22	1981	5,700	1,150	34,200	2,875	37,075		30,303	658,187	14,005	16,298	472,428	658,187												22
23	82	5,550	550	33,300	1,375	34,675		27,903	659,787	13,582	14,321	459,707	659,787												23
24	83								660,787	13,217	14,686	446,021	660,787												24
25	84								661,387	12,823	15,080	431,541	661,387												25
26	85									12,407	15,496	416,045													26
27	86									11,961	15,942	400,103													27
28	87									11,503	16,400	383,703													28
29	88									11,031	16,872	366,831													29
30	89									10,546	17,357	349,474													30
31	90									10,047	17,856	331,618													31
32	1991	5,550	550	33,300	1,375	34,675		27,903		9,534	18,369	313,249													32
33	92	4,850	0	29,100	0	29,100		22,328		-9,006	13,322	299,927													33
34	93									8,623	13,705	286,222													34
35	94									8,229	14,099	272,123													35
36	95									7,824	14,504	257,619													36
37	96									7,407	14,921	242,698													37
38	97									6,978	15,350	227,348													38
39	98									6,536	15,792	211,556													39
40	99									6,082	16,246	195,310													40
41	2000									5,615	16,713	178,597													41
42	2001	4,850	0	29,100	0	29,100		22,328		5,135	17,193	161,404													42
43	02	5,400	1,150	32,400	2,875	35,275		28,503		4,640	23,863	137,541													43
44	03									3,954	24,549	112,992													44
45	04									3,249	25,254	87,738													45
46	05									2,522	25,981	61,757													46
47	06									1,776	26,727	35,030													47
48	07									1,007	27,496	7,534		0	107,911										48
49	08									217	7,534	0		20,752	87,159										49
50	09													28,503	58,656										50
51	10													28,503	30,153										51
52	2011	5,400	1,150	32,400	2,875	35,275		28,503						28,503	1,650										52
53	12	5,200	800	31,200	2,000	33,200		26,428						1,650	0				11,398	5,327	4,212	3,841	24,778	24,778	53
54	13												661,387			107,911	1,675		11,386	5,322	4,208	3,837	24,753	26,428	54
55	14												460,344			44,753									55
56	15												282,567			2,632									56
57	16												160,300			2,632									57
58	17												155,232			2,632									58
59	18												155,232			2,632									59
60	19												123,979			0									60
61	20												123,979												61
62	2021	5,200	800	31,200	2,000	33,200		26,428					123,979						11,386	5,322	4,208	3,837	24,753	26,428	62
63	22	4,850	350	29,100	875	29,975		23,203					123,979						9,903	4,628	3,660	3,337	21,528	23,203	63
64	23												38,783												64
65	24												35,733												65
66	25												13,400												66
67	26												11,200												67
68	27												9,600												68
69	28												8,000												69
70	29												6,400												70
71	30												4,800												71
72	31												3,200												72
73	32												1,600												73
74	33												600												74
75	34												0												75
76	35																								76
77	36																								77
78	37																								78
79	38																								79
80	39																								80
81	40																								81
82	41																								82
83	42																								83
84	43																								84
85	44																								85
86	45																								86
87	46																								87
88	47																								88
89	48																								89
90	49	4,850	350	29,100	875	29,975	6,772	23,203	661,387																90
Total		426,650	51,100	2,559,900	127,750	2,687,650	561,148	2,126,502	661,387	444,890	661,387			107,911	107,911		1,675	61,975	391,156	182,809	144,564	131,810	850,339	912,314	

1/ Includes all operation, maintenance, and replacement costs of storage project and operation, maintenance, and replacement costs of Central Utah project allocated to power.

REPAYMENT SCHEDULE FOR IRRIGATION COSTS OF PARTICIPATING PROJECTS IN COLORADO

(Unit--$1,000)

Year of study	Fiscal year	Apportionment of power revenues to State	Florida project: Repayment of irrigation costs By irrigators	Florida project: Repayment of irrigation costs By apportioned power revenues	Florida project: Irrigation plant In service at end of year	Florida project: Irrigation plant Unpaid balance	Florida project: Irrigation plant Allowable unpaid balance	Paonia project: Repayment of irrigation costs By irrigators	Paonia project: Repayment of irrigation costs By apportioned power revenues	Paonia project: Irrigation plant In service at end of year	Paonia project: Irrigation plant Unpaid balance	Paonia project: Irrigation plant Allowable unpaid balance	Pine River project extension: Repayment of irrigation costs By irrigators	Pine River project extension: Repayment of irrigation costs By apportioned power revenues	Pine River project extension: Irrigation plant In service at end of year	Pine River project extension: Irrigation plant Unpaid balance	Pine River project extension: Irrigation plant Allowable unpaid balance	Silt project: Repayment of irrigation costs By irrigators	Silt project: Repayment of irrigation costs By apportioned power revenues	Silt project: Irrigation plant In service at end of year	Silt project: Irrigation plant Unpaid balance	Silt project: Irrigation plant Allowable unpaid balance	Smith Fork project: Repayment of irrigation costs By irrigators	Smith Fork project: Repayment of irrigation costs By apportioned power revenues	Smith Fork project: Irrigation plant In service at end of year	Smith Fork project: Irrigation plant Unpaid balance	Smith Fork project: Irrigation plant Allowable unpaid balance	Summary of application of apportioned power revenues: Irrigation repayment	Summary of application of apportioned power revenues: Cumulative surplus	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	1959																													0
1	60																													1
2	61																													2
3	62																													3
4	63																													4
5	64									7,684	7,684	7,684																		5
6	65							0			7,684																			6
7	66							0			7,684				5,212	5,212	5,212								3,437	3,437	3,437			7
8	67							0			7,684		0										0			3,437				8
9	68							24			7,660		0							3,531	3,531	3,531	0			3,437				9
10	69				7,234	7,234	7,234	24			7,636		0					0					0			3,437				10
11	70		0					24			7,612		0					0					19			3,418				11
12	1971		0					25			7,587		0					0								3,399				12
13	72		0					24			7,563		0					0								3,380				13
14	73		0					24			7,539		0					0			3,531					3,361				14
15	74		0			7,234		25			7,514		0					18			3,513					3,342				15
16	75		31			7,203		34			7,480		0								3,495					3,323				16
17	76					7,172		34			7,446		0			5,212					3,477					3,304				17
18	77					7,141		34			7,412		19			5,193					3,459					3,285				18
19	78					7,110		34			7,378		19			5,174					3,441					3,266				19
20	79					7,079		35			7,343		19			5,155					3,423					3,247				20
21	80					7,048		34			7,309		19			5,136					3,405					3,228				21
22	1981					7,017		34			7,275		19			5,117					3,387					3,209				22
23	82					6,986		34			7,241		19			5,098					3,369					3,190				23
24	83					6,955		34			7,207		19			5,079					3,351					3,171				24
25	84					6,924		35			7,172		37			5,042					3,333					3,152				25
26	85					6,893		34			7,138					5,005					3,315					3,133				26
27	86					6,862		34			7,104					4,968					3,297					3,114				27
28	87					6,831		34			7,070					4,931					3,279					3,095				28
29	88					6,800		34			7,036					4,894					3,261					3,076				29
30	89					6,769		35			7,001					4,857					3,243					3,057				30
31	90					6,738		34			6,967					4,820					3,225					3,038				31
32	1991					6,707		34			6,933					4,783					3,207					3,019				32
33	92					6,676		34			6,899					4,746					3,189					3,000				33
34	93					6,645		34			6,865					4,709					3,171					2,981				34
35	94					6,614		35			6,830					4,672					3,153					2,962				35
36	95					6,583		34			6,796					4,635					3,135					2,943				36
37	96					6,552		34			6,762					4,598					3,117					2,924				37
38	97					6,521		34			6,728					4,561					3,099					2,905				38
39	98					6,490		34			6,694					4,524					3,081					2,886				39
40	99					6,459		35			6,659					4,487					3,063					2,867				40
41	00					6,428		34			6,625					4,450					3,045					2,848				41
42	2001					6,397		34			6,591					4,413					3,027					2,829				42
43	02					6,366		34			6,557					4,376					3,009					2,810				43
44	03					6,335		34			6,523					4,339					2,991					2,791				44
45	04					6,304		35			6,488					4,302					2,973					2,772				45
46	05					6,273		34			6,454					4,265					2,955					2,753				46
47	06					6,242		34			6,420					4,228					2,937					2,734				47
48	07					6,211		34			6,386					4,191					2,919					2,715				48
49	08					6,180		34			6,352					4,154					2,901					2,696				49
50	09					6,149		35			6,317					4,117					2,883					2,677				50
51	10					6,118		34			6,283					4,080					2,865					2,658				51
52	2011		0			6,087		34	0		6,249		0			4,043					2,847					2,639				52
53	12	11,398		5,684		372		34	5,364		851		350			3,656		0			2,829					2,620		11,398		53
54	13	11,386		0		341		34	0		817		3,138			481		2,631			180		0			114		8,256	3,130	54
55	14					310		35			782		0			444		0			162		2,487			95			14,516	55
56	15					279		34			748					407					144		0			76			25,902	56
57	16					248		34			714					370					126					57			37,288	57
58	17					217		34			680					333					108					38			48,674	58
59	18					186		34			646					296					90					19	3,437		60,060	59
60	19					155		35			611					259					72		19			0	0		71,446	60
61	20					124		34			577					222					54		0						82,832	61
62	2021	11,386				98		34			543					185					36								94,218	62
63	22	9,903				62		34			509					148					18	3,531							104,121	63
64	23				7,234	31	7,234	34			475					111		18			0	0							114,024	64
65	24		31			0	0	35			440					74		0											123,927	65
66	25		0					34			406					37	5,212												133,830	66
67	26							34			372		37			0	0												143,733	67
68	27							34			338		0																153,636	68
69	28							34			304																		163,539	69
70	29							35			269																		173,442	70
71	30							34			235																		183,345	71
72	2031							34			201																		193,248	72
73	32							34			167																		203,151	73
74	33							34			133																		213,054	74
75	34							35			98	7,684																	222,957	75
76	35							28			70	1,670																	232,860	76
77	36							10			60																		242,763	77
78	37							10			50																		252,666	78
79	38							10			40																		262,569	79
80	39							10			30																		272,472	80
81	40							10			20																		282,375	81
82	2041							10			10	1,670																	292,278	82
83	42							10			0	0																	302,181	83
84	43							0																					312,084	84
85	44																												321,987	85
86	45																												331,890	86
87	46																												341,793	87
88	47																												351,696	88
89	48																												361,599	89
90	49	9,903			7,234					7,684					5,212					3,531					3,437				371,502	90
Total		391,156	1,590	5,684	7,234			2,320	5,364	7,684			1,724	3,488	5,212			900	2,631	3,531			950	2,487	3,437			19,654	371,502	

1/ Represents 95 percent of the project which is estimated to be in Colorado. The remaining 5 percent is in New Mexico.

2/ Repayments in some years arbitrarily increased by $1,000 to adjust for rounding off of amounts of less than $500 in other years.

INTERIOR--BUREAU OF RECLAMATION, SLC, UTAH

25927 O - 58 (Face p. 34) No. 2

REPAYMENT SCHEDULE FOR IRRIGATION COSTS OF PARTICIPATING PROJECTS IN NEW MEXICO

(Unit--$1,000)

Year of study	Fiscal year	Raymond project: Apportionment of power revenues to State	Raymond project: Repayment of irrigation costs By irrigators	Raymond project: Repayment of irrigation costs By apportioned power revenues	Raymond project: Irrigation plant In service at end of year	Raymond project: Irrigation plant Unpaid balance	Raymond project: Irrigation plant Allowable unpaid balance	Pine River project extension: Repayment of irrigation costs By irrigators	Pine River project extension: Repayment of irrigation costs By apportioned power revenues	Pine River project extension: Irrigation plant In service at end of year	Pine River project extension: Irrigation plant Unpaid balance	Pine River project extension: Irrigation plant Allowable unpaid balance	Summary of application of apportioned power revenues: Irrigation repayment	Summary of application of apportioned power revenues: Cumulative surplus	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1959														0
1	60														1
2	61														2
3	62														3
4	63				2,433	2,433	2,433								4
5	64		0												5
6	65		0												6
7	66		0							274	274	274			7
8	67		0					0							8
9	68		0					0							9
10	69		0					0							10
11	70		0					0							11
12	1971		0					0							12
13	72		0					0							13
14	73		0			2,433		0							14
15	74		6			2,427		0							15
16	75					2,421		1							16
17	76					2,415		1			274				17
18	77					2,409		1			273				18
19	78					2,403		1			272				19
20	79					2,397		1			271				20
21	80					2,391		1			270				21
22	1981					2,385		1			269				22
23	82					2,379		1			268				23
24	83					2,373		1			267				24
25	84					2,367		2			265				25
26	85					2,361					263				26
27	86					2,355					261				27
28	87					2,349					259				28
29	88					2,343					257				29
30	89					2,337					255				30
31	90					2,331					253				31
32	1991					2,325					251				32
33	92					2,319					249				33
34	93					2,313					247				34
35	94					2,307					245				35
36	95					2,301					243				36
37	96					2,295					241				37
38	97					2,289					239				38
39	98					2,283					237				39
40	99					2,277					235				40
41	2000					2,271					233				41
42	2001					2,265					231				42
43	02					2,259					229				43
44	03					2,253					227				44
45	04					2,247					225				45
46	05					2,241					223				46
47	06					2,235					221				47
48	07					2,229					219				48
49	08					2,223					217				49
50	09					2,217					215				50
51	10					2,211					213				51
52	2011	0		0		2,205			0		211		0	0	52
53	12	4,212		2,133		66			181		28		2,314	1,898	53
54	13	4,208		0		60			0		26		0	6,106	54
55	14					54					24			10,314	55
56	15					48					22			14,522	56
57	16					42					20			18,730	57
58	17					36					18			22,938	58
59	18					30					16			27,146	59
60	19					24					14			31,354	60
61	20					18					12			35,562	61
62	2021	4,208				12					10			39,770	62
63	22	3,660				6	2,433				8			43,430	63
64	23		6			0	0				6			47,090	64
65	24		0								4			50,750	65
66	25										2	274		54,410	66
67	26							2			0	0		58,070	67
68	27							0						61,730	68
69	28													65,390	69
70	29													69,050	70
71	30													72,710	71
72	2031													76,370	72
73	32													80,030	73
74	33													83,690	74
75	34													87,350	75
76	35													91,010	76
77	36													94,670	77
78	37													98,330	78
79	38													101,990	79
80	39													105,650	80
81	40													109,310	81
82	2041													112,970	82
83	42													116,630	83
84	43													120,290	84
85	44													123,950	85
86	45													127,610	86
87	46													131,270	87
88	47													134,930	88
89	48													138,590	89
90	2049	3,660			2,433					274				142,250	90
	Total	144,584	300	2,133	2,433			95	181	274			2,314	142,250	

1/ Represents 5 percent of the project which is estimated to be in New Mexico. The remaining 95 percent is estimated to be in Colorado.

25927 O - 58 (Face p. 34) No. 3

REPAYMENT SCHEDULE FOR IRRIGATION COSTS OF PARTICIPATING PROJECTS IN UTAH
(Unit--$1,000)

Year of study	Fiscal year	Apportionment of storage unit power revenues	Net power revenues from Central Utah project	Vernal unit of Central Utah project: Repayment of irrigation costs: By irrigators	Vernal unit of Central Utah project: Repayment of irrigation costs: By apportioned storage unit power revenues	Vernal unit of Central Utah project: Irrigation plant: In service at end of year	Vernal unit of Central Utah project: Irrigation plant: Unpaid balance	Vernal unit of Central Utah project: Irrigation plant: Allowable unpaid balance	Remainder of Central Utah project: Repayment of irrigation costs: Total	By irrigators 1/	By Conservancy District	By apportioned storage unit power revenues	By Central Utah project power revenues	Remainder of Central Utah project: Irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Emery County project: Repayment of irrigation costs: By irrigators	By apportioned power revenues	Emery County project: Irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Summary of application of storage unit power revenues: Irrigation repayment	Cumulative surplus	Cumulative surplus power revenues of Central Utah project	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0	1959																								0
1	60																								1
2	61																								2
3	62																								3
4	63																								4
5	64					6,192	6,192	6,192																	5
6	65			0			6,192																		6
7	66			0			6,192							3,680	3,680	3,680									7
8	67			0			6,192			0				3,680	3,680	3,680									8
9	68			30			6,162			0				3,680	3,680	3,680									9
10	69						6,132			0				5,403	5,403	5,403			9,704	9,704	9,704				10
11	70						6,102		26	26				37,078	37,052	37,078	0								11
12	1971						6,072		177	26	151			37,078	36,875	37,078	0								12
13	72						6,042		177	26				37,078	36,698	37,078	0								13
14	73						6,012		269	118				54,294	53,645	54,294	0								14
15	74						5,982		269	118					53,376		0				9,704				15
16	75						5,952		277	126					53,099		74				9,630				16
17	76						5,922		277	126					52,822						9,556				17
18	77						5,892		296	145				54,294	52,526	54,294					9,482				18
19	78						5,862		296	145				2/84,305	82,241	84,305					9,408				19
20	79						5,832		305	154	151			84,305	81,936	84,305					9,334				20
21	80						5,802		341	155	186			84,305	81,595	84,305					9,260				21
22	1981						5,772		341	155				109,087	106,036	109,087					9,186				22
23	82						5,742		340	154				117,826	114,435	117,826					9,112				23
24	83						5,712		341	155					114,094						9,038				24
25	84						5,682		340	154					113,754						8,964				25
26	85						5,652		341	155					113,413						8,890				26
27	86						5,622		349	163					113,064						8,816				27
28	87						5,592		381	195					112,683						8,742				28
29	88						5,562		381	195				117,826	112,302	117,826					8,668				29
30	89						5,532		399	213	186			130,800	124,877	130,800					8,594				30
31	90						5,502		440	213	227				124,437						8,520				31
32	1991						5,472		440	213					123,997						8,446				32
33	92						5,442		440	213					123,557						8,372				33
34	93						5,412		453	226					123,104						8,298				34
35	94						5,382		453						122,651						8,224				35
36	95						5,352		453						122,198						8,150				36
37	96						5,322		453						121,745						8,076				37
38	97						5,292		453						121,296						8,002				38
39	98						5,262		453						120,839						7,928				39
40	99						5,232		453	226	227				120,386						7,854				40
41	2000						5,202		523	258	265				119,863						7,780				41
42	2001						5,172		523	258					119,340						7,706				42
43	02						5,142		523	258					118,817						7,632				43
44	03						5,112		523	258					118,294						7,558				44
45	04						5,082		522	257					117,772						7,484				45
46	05						5,052		523	258					117,249						7,410				46
47	06						5,022		522	257					116,727						7,336				47
48	07						4,992		523	258					116,204						7,262				48
49	08						4,962		522	257					115,682						7,188				49
50	09						4,932		523	258	265				115,159						7,114				50
51	10						4,902		561	257	304				114,598						7,040				51
52	2011	0			0		4,872		258	258		0			114,340						6,966				52
53	12	5,327			4,692		150		892	257		635	0		113,448						6,892	5,327			53
54	13	5,322	1,675		0		120		7,255	258		5,322	1,675		106,193						6,818	5,322			54
55	14						90		7,254	257					98,939						6,744				55
56	15						60		7,255	258					91,684						6,670				56
57	16						30	6,192	7,254	257					84,430						6,596				57
58	17			30			0	0	7,255	258					77,175						6,522				58
59	18			0					7,254	257					69,921	130,800					6,448				59
60	19								7,255	258					62,666	127,120					6,374				60
61	20								7,228	231		5,322			55,438	127,120					6,300				61
62	2021	5,322							6,203	232		4,296			49,235	127,120	1,026		5,200			5,322			62
63	22	4,628							1,907	232					47,328	95,445	4,628		498			4,628			63
64	23								1,814	139					45,514	95,445	350		74	9,704		350	4,278		64
65	24								1,814	139					43,700	93,722	74		0	0			8,906		65
66	25								1,807	132					41,893	93,722	0						13,534		66
67	26								1,807	132					40,086	82,636							18,162		67
68	27								1,787	112					38,299	82,636							22,790		68
69	28								1,788	113					36,511	76,506							27,418		69
70	29								1,778	103					34,733								32,046		70
71	30								1,778	103					32,955								36,674		71
72	2031								1,778	103					31,177								41,306		72
73	32								1,777	102					29,400								45,930		73
74	33								1,778	103					27,622								50,558		74
75	34								1,778	103					25,844	76,506							55,186		75
76	35								1,778	103					24,066	68,158							59,814		76
77	36								1,769	94					22,297	43,376							64,442		77
78	37								1,738	63					20,559	43,376							69,070		78
79	38								1,737	62					18,822	21,713							73,698		79
80	39								1,720	45					17,102	21,713							78,326		80
81	40								1,720	45					15,382	21,713							82,954		81
82	2041								1,720	45					13,662	21,713							87,582		82
83	42								1,720	45					11,942	12,974							92,210		83
84	43								1,706	31					10,236								96,838		84
85	44								1,706	31					8,530								101,466		85
86	45								1,706	31					6,824								106,094		86
87	46								1,706	31					5,118								110,722		87
88	47								1,706	31					3,412								115,350		88
89	48								1,706	31				130,800	1,706	12,974							119,978		89
90	49	4,628	1,675			6,192			1,706	31			1,675	125,050	0	0			9,704				124,606		90
	Total	182,809	26,826	1,500	4,692	6,192	-	-	130,800	12,875	8,443	47,507	61,975	130,800	-	-	3,700	6,004	9,704	-	-	58,203	124,606	0	

1/ Adjustments of $1,000 made in certain years to compensate for rounding off of annual amounts of less than $500.
2/ Includes $5,750,000 allocated to ultimate phase.

REPAYMENT SCHEDULE FOR IRRIGATION COSTS OF PARTICIPATING PROJECTS IN WYOMING AND EDEN PROJECT
(Unit--$1,000)

Year of study	Fiscal year	Apportionment of power revenues to State	La Barge project: Repayment of irrigation costs: By irrigators	La Barge project: Repayment of irrigation costs: By apportioned power revenues	La Barge project: Irrigation plant: In service at end of year	La Barge project: Irrigation plant: Unpaid balance	La Barge project: Irrigation plant: Allowable unpaid balance	Lyman project: Repayment of irrigation costs: By irrigators	Lyman project: Repayment of irrigation costs: By apportioned power revenues	Lyman project: Irrigation plant: In service at end of year	Lyman project: Irrigation plant: Unpaid balance	Lyman project: Irrigation plant: Allowable unpaid balance	Seedskadee project: Repayment of irrigation costs: By irrigators	Seedskadee project: Repayment of irrigation costs: By apportioned power revenues	Seedskadee project: Irrrigation plant: In service at end of year	Seedskadee project: Irrrigation plant: Unpaid balance	Seedskadee project: Irrrigation plant: Allowable unpaid balance	Eden project: Repayment of irrigation costs: By irrigators 1/	Eden project: Repayment of irrigation costs: By apportioned power revenues	Eden project: Irrigation plant: In service at end of year	Eden project: Irrigation plant: Unpaid balance	Eden project: Irrigation plant: Allowable unpaid balance	Summary of application of apportioned power revenues: Irrigation repayment	Summary of application of apportioned power revenues: Cumulative surplus	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0	1959																			1,278	1,278	1,278			0
1	60																	0		1,278	1,278	1,278			1
2	61																	0		8,191	8,191	8,191			2
3	62																	0			8,191				3
4	63																	0			8,191				4
5	64																	0			8,191				5
6	65														2,887	2,887	2,887	0			8,191				6
7	66												0		2,887	2,887	2,887	9			8,182				7
8	67												0		12,637	12,637	12,637	14			8,168				8
9	68									11,376	11,376	11,376	0		18,061	18,061	18,061	14			8,154				9
10	69				1,751	1,751	1,751	0					0		25,060	25,060	25,060	25			8,129				10
11	70		0					0					0								8,104				11
12	1971		0					0					0								8,079				12
13	72		0					0					0								8,054				13
14	73		0					0			11,376		0								8,029				14
15	74		0					30			11,346		0								8,004				15
16	75		0								11,316		0			25,060					7,979				16
17	76		0								11,286		13			25,047					7,954				17
18	77		0								11,256		13			25,034					7,929				18
19	78		0								11,226		22			25,012					7,904				19
20	79		0			1,751					11,196		39			24,973					7,879				20
21	80		5			1,746					11,166		49			24,924					7,854				21
22	1981					1,741					11,136					24,875					7,829				22
23	82					1,736					11,106					24,826					7,804				23
24	83					1,731					11,076					24,777					7,779				24
25	84					1,726					11,046					24,728					7,754				25
26	85					1,721					11,016					24,679					7,729				26
27	86					1,716					10,986					24,630					7,704				27
28	87					1,711					10,956					24,581					7,679				28
29	88					1,706					10,926					24,532					7,654				29
30	89					1,701					10,896					24,483					7,629				30
31	90					1,696					10,866					24,434					7,604				31
32	1991					1,691					10,836					24,385					7,579				32
33	92					1,686					10,806					24,336					7,554				33
34	93					1,681					10,776					24,287					7,529				34
35	94					1,676					10,746					24,238					7,504				35
36	95					1,671					10,716					24,189					7,479				36
37	96					1,666					10,686					24,140					7,454				37
38	97					1,661					10,656					24,091					7,429				38
39	98					1,656					10,626					24,042					7,404				39
40	99					1,651					10,596					23,993					7,379				40
41	2000					1,646					10,566					23,944					7,354				41
42	2001					1,641					10,536					23,895					7,329				42
43	02					1,636					10,506					23,846					7,304				43
44	03					1,631					10,476					23,797					7,279				44
45	04					1,626					10,446					23,748					7,254				45
46	05					1,621					10,416					23,699					7,229				46
47	06					1,616					10,386					23,650					7,204				47
48	07					1,611					10,356					23,601					7,179				48
49	08					1,606					10,326					23,552					7,154				49
50	09					1,601					10,296					23,503					7,129				50
51	10					1,596					10,266					23,454					7,104				51
52	2011					1,591		0			10,236					23,405					7,079	0			52
53	12	3,841				1,586		3,841			6,365					23,356					7,054	3,841			53
54	13	3,837				1,581		3,837			2,498					23,307		0			7,029	3,837			54
55	14					1,576		2,198			270					23,258		1,639			5,365	3,837			55
56	15					1,571		0			240		0			23,209		3,837			1,503	3,837			56
57	16			1,501		65					210		1,121			22,039		1,215			263	3,837			57
58	17			0		60					180		3,837			18,153		0			238	3,837			58
59	18					55					150		3,837			14,267					213	3,837			59
60	19					50					120		3,837			10,381					188	3,837			60
61	20					45					90		3,837			6,495					163	3,837			61
62	2021	3,837				40					60		3,837			2,609					138	3,837	0		62
63	22	3,337				35					30	11,376	2,304			256					113	2,304	1,033		63
64	23					30		30			0	0	0			207					88	0	4,370		64
65	24					25		0								158	25,060				63	8,191	7,707		65
66	25					20							49			109	22,173	25			38	5,139	11,044		66
67	26					15							36			73	22,173	16			22	3,861	14,381		67
68	27					10							36			37	12,423	11			11	3,861	17,718		68
69	28					5	1,751						27			10	6,999	11			0	0	21,055		69
70	29	5				0	0						10			0	0	0					24,392		70
71	30	0											0										27,729		71
72	2031																						31,066		72
73	32																						34,403		73
74	33																						37,740		74
75	34																						41,077		75
76	35																						44,414		76
77	36																						47,751		77
78	37																						51,088		78
79	38																						54,425		79
80	39																						57,762		80
81	40																						61,099		81
82	2041																						64,436		82
83	42																						67,773		83
84	43																						71,110		84
85	44																						74,447		85
86	45																						77,784		86
87	46																						81,121		87
88	47																						84,458		88
89	48																						87,795		89
90	49	3,337				1,751				11,376					25,060					8,191			91,132		90
	Total	131,810	250	1,501	1,751		1,500	9,876	11,376			2,450	28,610	25,060			1,500	6,691	8,191			40,678	91,132		

1/ Not paid into basin fund because of separate authorization.

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SUMMARY REPAYMENT SCHEDULE—AUTHORIZED STORAGE PROJECT UNITS AND PARTICIPATING PROJECTS INCLUDING KEMH PROJECT
(Unit—$1,000)

Year of study	Fiscal year	Net power revenues from storage project units and Central Utah project	Application of net power revenues: To interest	To power investment	To irrigation investment of storage project units	Apportioned to States	Electric plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Storage project irrigation plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Net revenues from municipal and industrial water	Application of net revenues from municipal and industrial water: To interest	To municipal and industrial investment	Municipal and industrial plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Revenues applied to repayment of irrigation investment of participating projects: Total	From irrigators	From Conservancy District tax	From Central Utah project power	From storage project power	Irrigation plant of participating projects: In service at end of year	Unpaid balance	Allowable unpaid balance	Total revenues	Recapitulation: Project plant: In service at end of year	Unpaid balance	Allowable unpaid balance	Unused revenues: From storage project power	From Central Utah project: Municipal and industrial use	Year of study
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
0	1959																							1,278	1,278	1,278		1,278	1,278	1,278			0
1	60																							1,278	1,278	1,278		1,278	1,278	1,278			1
2	61																							8,191	8,191	8,191		8,191	8,191	8,191			2
3	62																							8,191	8,191	8,191		8,191	8,191	8,191			3
4	63																							10,624	10,624	10,624		10,624	10,624	10,624			4
5	64																							24,500	24,500	24,500		289,320	289,320	289,320			5
6	65	9,345	5,780	3,565			201,043	201,043	201,043	63,158	63,158	63,158				619	619	619						24,387	24,387	27,387	9,363	509,105	505,540	509,105			6
7	66	13,596	10,789	2,807			378,820	375,255	378,820	105,279	105,279	105,279	18	18	0				9	9				39,990	39,981	39,990	13,623	646,975	640,594	646,975			7
8	67	15,388	14,223	1,165			501,087	494,715	501,087										14	14				49,740	49,727	49,740	15,420	661,793	654,233	661,793			8
9	68	18,563	14,335	4,228			506,155	494,350	506,155	105,279	105,279	105,279							68	68				70,071	69,980	70,071	18,649	682,124	670,268	682,124			9
10	69	19,745	14,214	5,531			537,408	529,112	537,408	107,911	107,911	107,911							79	79				97,482	97,312	97,482	19,842	743,420	725,594	743,420			10
11	70	21,336	14,953	6,383			537,408	531,729	537,408										124	124				129,157	128,863	129,157	21,478	775,095	751,128	775,095			11
12	1971	21,586	14,770	6,816			537,408	506,913	537,408							619	619	619	276	276	151			129,157	128,987	129,157	21,880	775,095	744,030	775,095			12
13	72	31,536	14,574	16,962			537,408	485,951	537,408										275	124				129,157	128,312	129,157	21,829	775,055	726,793	775,055			13
14	73	31,025	14,086	16,939			622,604	558,208	622,604				18	18	0	45,177	45,177	45,177	367	216				146,373	145,161	146,373	21,810	922,065	866,457	922,065			14
15	74	30,625	16,048	14,577			625,652	546,681	625,652				1,709	1,298	411		44,766		422	271					144,739		32,756	925,115	844,097	925,115			15
16	75	30,605	15,717	14,888			647,987	552,126	647,987				1,713	1,291	422		44,344		544	393					144,195		32,862	947,448	850,576	947,448			16
17	76	30,333	15,931	14,402			650,187	541,524	650,187					1,275	438		43,906		557	406					143,638		32,603	949,648	837,379	949,648			17
18	77	30,303	15,580	14,723			651,787	528,801	651,787					1,262	451		43,455		556	445				146,373	143,042	146,373	32,612	951,248	823,209	951,248			18
19	78		15,803	15,100			663,387	515,301	663,387					1,248	465		42,990		605	454				176,384	172,448	176,384	32,621	982,859	838,650	982,859			19
20	79		14,815	15,488			694,587	501,413	694,587					1,236	477		42,513		632	481	151			176,384	171,816	176,384	32,648	984,459	823,653	984,459			20
21	80		14,416	15,887			666,587	487,126	666,587					1,222	491	45,177	42,022	45,177	682	496	186			176,384	171,436	176,384	32,698	986,059	808,193	986,059			21
22	1981	30,303	14,005	16,298			658,187	472,828	658,187				1,713	1,208	505	46,875	43,215	46,875	682	496				201,166	195,234	201,166	32,698	1,014,139	814,788	1,014,139			22
23	82	27,903	13,582	14,321			659,787	459,707	655,787				1,777	1,242	535		42,680		681	495				209,905	203,292	209,905	30,361	1,028,478	813,590	1,028,478			23
24	83		13,217	14,686			660,787	446,021	660,787				1,777	1,227	550		42,130		682	496					202,610		30,362	1,025,478	758,672	1,025,478			24
25	84		12,823	15,080			661,387	431,541	661,387				1,777	1,211	566		41,564		701	515					201,509		30,321	1,026,078	782,925	1,026,078			25
26	85		12,407	15,496				416,045					1,781	1,195	586		40,978		701	515					201,208		30,195	1,026,078	764,143	1,026,078			26
27	86		11,561	15,942				400,103						1,177	604		40,374		709	523					200,499		30,193	1,026,078	748,887	1,026,078			27
28	87		11,503	16,400				383,703						1,161	620		39,754		711	555					199,758		30,425	1,026,078	731,186	1,026,078			28
29	88		11,031	16,872				366,831						1,143	638		39,116		711	555				209,905	199,017	209,905	30,425	1,026,078	712,875	1,026,078			29
30	89		10,546	17,357				349,474						1,125	656		38,460		760	574	186			222,879	211,231	222,879	30,444	1,039,052	707,076	1,039,052			30
31	90		10,047	17,856				331,618						1,106	675		37,785		800	573	227				210,433		30,484		687,745				31
32	1991	27,903	9,534	18,369				313,249						1,086	695		37,090		800	573					209,631		30,484		667,881				32
33	92	22,328	9,006	13,322				299,927						1,066	715		36,375		800	573					208,831		24,909		653,044				33
34	93		8,623	13,705				286,222						1,045	736		35,639		813	586					208,018		24,922		637,790				34
35	94		8,229	14,099				272,123					1,781	1,025	756		34,883		814	587					207,204		24,923		622,121				35
36	95		7,821	14,504				257,619					1,785	1,003	782		34,101		813	586					206,391		24,926		606,022				36
37	96		7,407	14,921				242,698						981	804		33,297		813	586					205,578		24,926		589,484				37
38	97		6,978	15,350				227,348						957	828		32,469		813	586					204,765		24,926		572,493				38
39	98		6,536	15,792				211,556						934	851		31,618		813	586					203,952		24,926		555,037				39
40	99		6,082	16,246				195,310						909	876		30,742		814	587	227				203,138		24,927		537,101				40
41	2000		5,615	16,713				178,597						884	901		29,841		883	618	265				202,255		24,996		518,604				41
42	2001	22,328	5,135	17,193				161,404						857	928		28,913		883	618					201,372		24,996		499,600				42
43	02	28,503	4,640	23,863				137,541						832	953		27,960		883	618					200,489		31,171		473,901				43
44	03		3,954	24,549				112,992						804	981		26,979		883	618					199,606		31,171		447,488				44
45	04		3,249	25,254				87,738					1,785	776	1,009		25,970		883	618					198,723		31,171		420,342				45
46	05		2,522	25,981				61,757					1,789	747	1,042		24,928		882	617					197,840		31,175		392,436				46
47	06		1,776	26,727				35,030						715	1,074		23,854		883	618					196,958		31,176		363,753				47
48	07		1,007	27,496				7,534						695	1,094		22,750		882	617					196,075		31,175		334,270				48
49	08		217	7,534	20,756			0						654	1,135		21,615		883	617					195,193		31,176		303,967				49
50	09				28,503									621	1,168		20,447		884	619	265				194,309		31,176		273,412				50
51	10				28,503									587	1,202		19,245		921	617	304				193,388		31,213		242,786				51
52	2011	28,503			28,503									553	1,236		18,009		618	618					192,770		30,910		212,429				52
53	12	26,428			1,650	24,778								517	1,272		16,737		617	617					192,153		28,834		208,890				53
54	13					26,428								481	1,308		15,429	46,875	618	618		1,675	22,880		166,980		28,835		182,609	1,039,052	7,338	7,338		54
55	14													443	1,346		14,083	46,256	618	618			17,415		147,272		28,835		161,355	774,232	15,594	15,594		55
56	15													405	1,350		12,733		618	618			9,159		135,820		28,835		148,553	596,455	15,680		26	56
57	16													366	1,388		11,345		618	617					124,960	228,879	28,826		135,714	474,188	15,621		27	57
58	17													327	1,427		9,918		618	587					112,917	216,687	28,827		122,835	462,928	15,621		27	58
59	18													286	1,466		8,452		589	589					101,496	216,687	28,796		109,938	462,928	15,623		29	59
60	19													243	1,510		6,942		542	542					90,073	209,570	28,798		97,015	379,805	15,622		28	60
61	20													200	1,556		5,386		542	542					78,697	209,570	28,152		84,083	379,805	15,619		25	61
62	2021	26,428				26,428								155	1,598		3,788		543	543					67,320	209,570	28,752		71,108	379,805	15,682	15,594	28	62
63	22	23,203				23,203								108	1,645		2,143	46,256	543	543			9,159		55,946	177,895	25,527		58,046	348,130	14,524	14,596	28	63
64	23													62	1,690		453	1,658	450	397			6,932		47,339	160,595	25,434		47,339	201,036	21,207	21,178	29	64
65	24													13	51		402		397	284			350		44,446	141,098	25,381		44,866	179,385	23,245	21,526	1,717	65
66	25													12	53		349		284	262					42,505	135,955	25,268		42,854	151,053	23,244		1,716	66
67	26													10	54		295		262	198					40,568	118,105	25,246		40,863	131,003	23,245		1,717	67
68	27													9	56		239		198	190					38,695	108,355	25,182		38,934	119,653	23,244		1,716	68
69	28													7	57		182		190	153					36,830	92,240	25,174		37,012	102,638	23,245		1,717	69
70	29													5	59		123		153	137					35,038	84,190	25,137		35,195	92,288	23,245		1,717	70
71	30													4	61		62	1,668	137	137					33,190		25,121		33,252	90,488	23,245		1,717	71
72	2031													2	62		0	0	137	136					31,378		25,121		31,378	87,390	23,245		1,717	72
73	32													0	0				136	137					29,567		25,120		29,567	85,790	23,309		1,781	73
74	33																		137	138					27,755		25,121		27,755	84,190				74
75	34																		138	131					25,942	84,190	25,122		25,942	84,190				75
76	35																		131	104					24,136	69,828	25,115		24,136	69,828				76
77	36																		104	73					22,357	45,046	25,088		22,357	45,046				77
78	37																		73	72					20,609	45,046	25,057		20,609	45,046				78
79	38																		72	55					18,862	23,383	25,056		18,862	23,383				79
80	39																		55	55					17,132	23,383	25,039		17,132	23,383				80
81	40																		55	55					15,408	23,383	25,039		15,408	23,383				81
82	2041																		55	55					13,672	23,383	25,039		13,672	23,383				82
83	42																		55	55					11,942	12,974	25,039		11,942	12,974				83
84	43																		55	31					10,236		25,015		10,236					84
85	44																		31	31					8,530		25,015		8,530					85
86	45																		31	31					6,824		25,015		6,824					86
87	46																		31	31					5,118		25,015		5,118					87
88	47																		31	31					3,412		25,015		3,412					88
89	48																		31	31					1,706	12,974	25,015		1,706	12,974				89
90	2049	23,203				23,203	661,387		661,387	107,911		107,911	1,781		1,781	46,875		46,875	222,879	31,612	8,543	61,975	120,849	222,879	0	0	1,706,615	1,039,052	0	0	7,338,615	1,039,052	90
Total		2,136,592	388,690	661,387	157,911	912,304	661,387			107,911			135,078	42,165	46,875	46,875	0	0															

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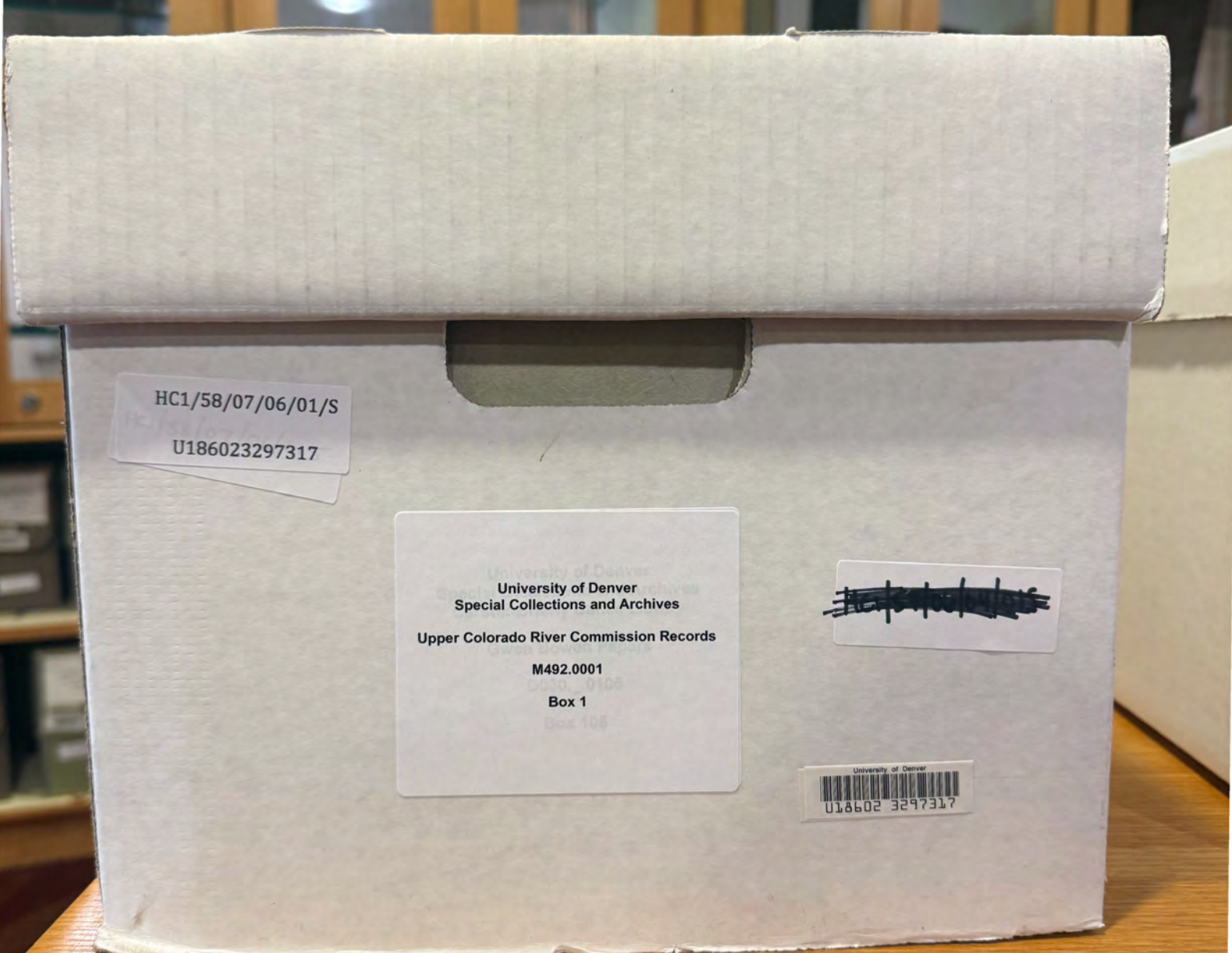
INTERIOR - BUREAU OF RECLAMATION, SALT LAKE CITY, UTAH

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	**28**	**AY-1_pgs i-103**
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI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OFFICIAL RECORD

VOLUME 16

UPPER COLORADO
RIVER COMMISSION

1964

OFFICIAL RECORD

VOLUME 16

UPPER COLORADO RIVER COMMISSION



1964

FOREWORD

The Upper Colorado River Commission is an interstate administrative agency created under the terms of the Upper Colorado River Basin Compact executed at Santa Fe, New Mexico, on October 11, 1948, and subsequently ratified by each of the legislatures of the states and by the Congress of the United States. The Commission represents the states of Colorado, New Mexico, Utah and Wyoming and the Federal Government.

The major purposes of the Upper Colorado River Basin Compact are: (1) to provide for the equitable division of the use of waters of the Colorado River System among the Upper Basin States, namely, Arizona, Colorado, New Mexico, Utah and Wyoming; (2) to establish obligations of each state with respect to the delivery of water to the Lower Basin; (3) to promote interstate harmony; (4) to remove causes of controversies; (5) to secure the expeditious agricultural and industrial development of the Upper Basin states, the storage of water, and the protection of life and property from floods.

The Commission, in order to fulfill the major purposes of the Compact, has been granted broad and comprehensive powers and charged with well-defined duties and responsibilities. Among its powers and duties are: adopting rules and regulations; locating and establishing water-gaging stations; making forecasts of water run-off; engaging in cooperative studies of water supplies; collecting, analyzing, correlating and preserving all types of water supply data; determining the quantity of water used each year in the Upper Colorado River Basin and in each state, and delivered to the Lower Basin; determining extent of curtailment of use, if necessary; determining reservoir losses and their apportionment; making findings of fact concerning obligations under the Mexican Treaty; acquiring and holding property; performing all functions required of it under the Upper Colorado River Basin Compact; reporting annually on its activities to the Governors of the signatory states and to the President of the United States.

This volume contains the transcripts of all meetings of the Commission during the 1964 calendar year.

EXPLANATORY NOTE

This document consists of a series of verbatim transcripts of meetings of the Upper Colorado River Commission. The records for each calendar year are in a separate volume.

The meetings of each Volume are separated by blue insert sheets.

A subject index is to be found at the beginning of each Volume with an explanation of its use.

At the beginning of the transcript of each meeting, there is a Table of Contents that refers to the major actions or decisions of the Commission.

Volume 16 includes transcripts of the following meetings of the UPPER COLORADO RIVER COMMISSION:

Meeting No.	City and State	Month, Day, Year
87	Boise, Idaho	March 16, 1964
88	Denver, Colorado	April 14-15, 1964
89	Denver, Colorado	May 20, 1964
90	Denver, Colorado	September 7, 1964
91	Boise, Idaho	September 21, 1964
92	Salt Lake City, Utah	November 5, 1964

Meeting No. 88

ADJOURNED REGULAR MEETING
Denver, Colorado

April 14 and 15, 1964

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Notice of Regular Meeting	16	88	7
Letter of Transmittal	16	88	8
Agreement to establish Time and Place Of Adjourned Regular Meeting	16	88	8
Notice of Adjourned Regular Meeting	16	88	9
Supplemental Agreement to re-establish Time and Place of Adjourned Regular Meeting	16	88	9
Supplemental Notice of Adjourned Regular Meeting	16	88	10
Minutes of Adjourned Annual Meeting September 27, 1963	16	88	11
Motion by Com. Bliss to approve (Passed)	16	88	11
Minutes of Regular Meeting March 16, 1964	16	88	11
Report of Chairman	16	88	12
Report of Executive Director	16	88	12
Motion by Com. Bliss to accept and file (passed)	16	88	47
Report by Mr. Rechard on Water Supply and Reservoir Operation	16	88	47

Meeting No. 88 Index (Continued)

	Volume	Meeting	Page
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Mr. Moody	16	88	60
Motion by Com. Clyde, report be transmitted to Secretary of the Interior, etc. (Passed)	16	88	67
Remarks by Mr. Pat Head of Nevada	16	88	68
Remarks by Commissioner Johnson	16	88	69
Report of Treasurer	16	88	79
Motion by Com. Clyde to accept (Passed)	16	88	80
Report of Legal Committee	16	88	80
Motion by Com. Clyde to accept (Passed)	16	88	88
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UPPER COLORADO RIVER COMMISSION

355 South Fourth East Street
Salt Lake City, Utah 84111

COMMISSIONERS

Robert J. Newell	Chairman United States of America
George D. Clyde	Vice Chairman State of Utah
Edwin C. Johnson	State of Colorado
John H. Bliss	State of New Mexico
E. J. Van Camp	State of Wyoming

SECRETARY

Ival V. Goslin

TREASURER

I. J. Coury

STAFF

Ival V. Goslin	Executive Director
Paul A. Rechard	Principal Hydraulic Engineer
Paul L. Billhymer	General Counsel
Mrs. Lois P. Crowder	Official Reporter

ADVISERS and OTHERS PRESENT

COLORADO:

John A. Love	Governor of the State of Colorado Denver, Colorado
R. T. Eckles	Natural Resources Coordinator Denver, Colorado
Felix L. Sparks	Director, Colorado Water Conservation Board Denver, Colorado
Leonard R. Kuiper	Engineer, Colorado Water Conservation Board Denver, Colorado
R. M. Gildersleeve	Engineer, Colorado Water Conservation Board Denver, Colorado
R. J. Moses	Attorney, Colorado Water Conservation Board Boulder, Colorado
William H. Nelson	Member, Colorado Water Conservation Board Grand Junction, Colorado
C. N. Feast	Denver Water Board Denver, Colorado
William S. Eakes	Southwestern Water Conservation Board Durango, Colorado
D. Lew Williams	Southwestern Water Conservancy District Norwood, Colorado
Sam Haslem	San Miguel Water Conservancy District Norwood, Colorado
Howard E. Scott	Colorado Rural Electric Association Denver, Colorado
Elizabeth W. Ingraham	Architect, Civic Design Study Colorado Springs, Colorado

L. N. McClellan	Consulting Engineer Denver, Colorado
F. B. Cook	Consulting Engineer Denver, Colorado

NEVADA:

Pat Head	Colorado River Commission of Nevada Las Vegas, Nevada
Dan J. Reed	Basic Management, Inc. Henderson, Nevada

NEW MEXICO:

I. J. Coury	New Mexico Interstate Stream Commission Farmington, New Mexico
F. Harlan Flint	Special Assistant Attorney General Santa Fe, New Mexico

UTAH:

A. Pratt Kesler	Attorney General Salt Lake City, Utah
Wayne D. Criddle	State Engineer Salt Lake City, Utah
Jay R. Bingham	Director, Utah Water and Power Board Salt Lake City, Utah
Dallin W. Jensen	Assistant Attorney General Salt Lake City, Utah
Harvey F. McPhail	Colorado River Basin Consumers Power, Inc. Salt Lake City, Utah

WYOMING:

Clifford P. Hansen	Governor of the State of Wyoming Cheyenne, Wyoming

Earl Lloyd	Adviser to Commissioner Cheyenne, Wyoming
Floyd A. Bishop	State Engineer Cheyenne, Wyoming
John F. Raper	Attorney General Cheyenne, Wyoming
H. T. Person	Assistant to Commissioner Laramie, Wyoming
Norman W. Barlow	Assistant to Commissioner Cora, Wyoming

BUREAU OF RECLAMATION:

Floyd E. Dominy	Commissioner of Reclamation Washington, D. C.
N. B. Bennett, Jr.	Assistant Commissioner of Reclamation Washington, D. C.
Edward Weinberg	Deputy Solicitor Department of the Interior Washington, D. C.
Arthur L. Mitchell	Planning Division Denver, Colorado
Wade Taylor	Power Division Denver, Colorado
G. E Burks	Technical Information Branch Denver, Colorado
A. B. West	Regional Director, Region 3 Boulder City, Nevada
Paul Oliver	River Control Engineer Boulder City, Nevada
Byron Miller	Power Division Boulder City, Nevada

Frank M. Clinton	Regional Director, Region 4 Salt Lake City, Utah
LeRoy E. Holmes	River Control Engineer, Region 4 Salt Lake City, Utah
Val G. Killin	Wyoming Reclamation Representative Cheyenne, Wyoming

U. S. GEOLOGICAL SURVEY:

Edward J. Tripp	Denver, Colorado

BUREAU OF INDIAN AFFAIRS:

G. B. Keesee	Project Engineer, Navajo Indian Irrigation Project Farmington, New Mexico

DEPARTMENT OF AGRICULTURE:

W. E. Anderson	River Basin Surveys Denver, Colorado

REPRESENTATIVES FROM UTILITIES:

R. T. Person	Public Service Company of Colorado Denver, Colorado
L. R. Patterson	Public Service Company of Colorado Denver, Colorado
R. F. Walker	Public Service Company of Colorado Denver, Colorado
Ralph Sargent	Public Service Company of Colorado Denver, Colorado
B. L. Baugh	Public Service Company of New Mexico Albuquerque, New Mexico
R. C. Connick	Public Service Company of New Mexico Albuquerque, New Mexico
R. W. Moody	Utah Power and Light Company Salt Lake City, Utah

C. R. Leever	Pacific Power and Light Company Casper, Wyoming
Hugh W. Evans	Utah Construction and Mining Company San Francisco, California

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PROCEEDINGS

The Adjourned Regular Meeting was called to order by Mr. Robert J. Newell, the Chairman, on Tuesday, April 14, 1964, at 10:00 o'clock a.m. in Room 330, State Office Building, Denver, Colorado.

THE CHAIRMAN: The Commission will be in order. The Secretary will call the roll of appearances.

MR. GOSLIN: Mr. Newell?

THE CHAIRMAN: Here.

MR. GOSLIN: Mr. Bliss?

COM. BLISS: Here.

MR. GOSLIN: Mr. Van Camp?

COM. VAN CAMP: Here.

MR. GOSLIN: Mr. Clyde?

COM. CLYDE: Here.

MR. GOSLIN: Mr. Johnson?

COM. JOHNSON: Present.

MR. GOSLIN: Mr. Chairman, all Commissioners are present and accounted for.

THE CHAIRMAN: The next item is to get this meeting legal. Because we change our mind about the place and the date rather informally, we have to get legal at the beginning of the following meeting. Mr. Secretary, will you proceed to read the necessary documents into the record.

MR. GOSLIN: Mr. Chairman, if it is permissible I will merely submit these documents in written form for the record.

The first thing that was necessary was an agreement to change the place of the Regular Meeting of the Upper Colorado River Commission. This was done by unanimous written agreement of the Commissioners under the By-Laws, the meeting being changed from its regular place in Salt Lake City to Boise, Idaho

(Documents submitted for the record read as follows:)

"AGREEMENT TO CHANGE PLACE OF REGULAR MEETING
OF UPPER COLORADO RIVER COMMISSION

Pursuant to Article IV, Paragraph 5, of the By-Laws of the Upper Colorado River Commission, I hereby agree that the Regular Meeting of the Upper Colorado River Commission scheduled for March 16, 1964 (third Monday in March) shall be held at 3 Hulbe Road, Boise, Idaho."

(Documents reading as above, dated March 6, 1964, signed by the following: Robert J. Newell, Commissioner for the United States; Edwin C. Johnson, Commissioner for the State of Colorado; John H. Bliss, Commissioner for the State of New Mexico; George D. Clyde, Commissioner for the State of Utah; and E. J. Van Camp, Commissioner for the State of Wyoming.)

MR. GOSLIN: Then the notice together with a letter of explanation. The notice of this Regular Meeting was prepared and sent to those interested with the explanation that the meeting would be adjourned for a lack of a quorum.

(Documents submitted for the record read as follows:)

"UPPER COLORADO RIVER COMMISSION
355 South Fourth East Street
Salt Lake City 11, Utah

March 6, 1964

NOTICE OF REGULAR MEETING

In accordance with Article IV, Paragraph 4, of the By-Laws, notice is hereby given that the Regular Meeting of the Upper Colorado River Commission will be held, beginning at 8:00 a.m., on Monday, March 16, 1964, at 3 Hulbe Road, Boise, Idaho.

(Signed) Ival V. Goslin
Secretary."

"March 6, 1964

Commissioners and Advisers
Upper Colorado River Commission

Gentlemen:

Attached is a Notice of the Regular Meeting of the Upper Colorado River Commission. According to the By-Laws this meeting is to be convened in Salt Lake City, on the third Monday in March, March 16, 1964.

Other business makes impossible the holding of this meeting on the regular date. Our Commissioners have agreed to schedule the Regular Meeting in Boise, Idaho on March 16, 1964 pursuant to the attached notice; and Chairman Newell shall adjourn it for lack of a quorum.

After consultation with the Commissioners, arrangements will be made for holding an Adjourned Regular Meeting.

Sincerely yours,

(Signed) Ival V. Goslin
Secretary."

MR. GOSLIN: Next, we established the time and place of the Adjourned Regular Meeting by unanimous written agreement of the Commissioners, the agreement being that the meeting should be held on April 6, 1964, here in Denver, Colorado.

(Documents submitted for the record read as follows:)

"AGREEMENT TO ESTABLISH TIME AND PLACE
OF ADJOURNED REGULAR MEETING

In accordance with Article IV (12) of the By-Laws, I, the undersigned, Commissioner for _____, concur that the Regular Meeting of the Upper Colorado River Commission, which I previously agreed should be held in Boise, Idaho on March 16, 1964, and which was adjourned for lack of a quorum, shall be held in Denver, Colorado in Room 330, State Office Building, commencing at 10:00 o'clock a.m. on Monday, April 6, 1964."

(Documents reading as above, dated March 24, 1964, signed by the following: Robert J. Newell, Commissioner for the United States; Edwin C. Johnson, Commissioner for the State of Colorado; John H. Bliss, Commissioner for the State of New Mexico; George D. Clyde, Commissioner for the State of Utah; and E. J. Van Camp, Commissioner for the State of Wyoming.)

MR. GOSLIN: Notice of this Adjourned Regular Meeting in accordance with the By-Laws was also sent to the Commissioners and interested parties.

(Document submitted for the record reads as follows:)

"UPPER COLORADO RIVER COMMISSION
355 South Fourth East Street
Salt Lake City 11, Utah

March 25, 1964

NOTICE OF ADJOURNED REGULAR MEETING

In accordance with Article IV (4) of the By-Laws, notice is hereby given that the Adjourned Regular Meeting of the Upper Colorado River Commission will be held beginning at 10:00 o'clock a.m. on Monday, April 6, 1964 in Room 330, State Office Building in Denver, Colorado.

The Regular Meeting of the Upper Colorado River Commission, which by unanimous written consent was scheduled to be convened in Boise, Idaho, on March 16, 1964, was adjourned for lack of a quorum.

(Signed) Ival V. Goslin
Secretary."

MR. GOSLIN: Next, because we ran into the situation in which we needed additional technical data and water supply forecast data, by unanimous agreement the Commissioners agreed to change the meeting to April 14, 1964, this agreement being a supplemental agreement to re-establish the time and place of the Adjourned Regular Meeting.

(Documents submitted for the record read as follows:)

"SUPPLEMENTAL AGREEMENT TO RE-ESTABLISH TIME
AND PLACE OF ADJOURNED REGULAR MEETING

In accordance with Article IV (12) of the By-Laws, I, the undersigned, Commissioner for _____, concur that the Regular Meeting

of the Upper Colorado River Commission, which I previously agreed should be held in Boise, Idaho on March 16, 1964, and which was adjourned for lack of a quorum, and which I subsequently agreed should be held in Denver, Colorado on April 6, 1964, shall be held in Room 330 of the State Office Building, commencing at 10:00 o'clock a.m. on April 14, 1964."

(Documents reading as above, dated April 2, 1964, signed by the following: Robert J. Newell, Commissioner for the United States; Edwin C. Johnson, Commissioner for the State of Colorado; John H. Bliss, Commissioner for the State of New Mexico; George D. Clyde, Commissioner for the State of Utah; and E. J. Van Camp, Commissioner for the State of Wyoming.)

MR. GOSLIN: Then again in accordance with the By-Laws, supplemental notice of the Adjourned Regular Meeting was sent to the Commissioners and other interested parties.

(Document submitted for the record reads as follows:)

"UPPER COLORADO RIVER COMMISSION
355 South Fourth East Street
Salt Lake City 11, Utah

April 2, 1964

SUPPLEMENTAL NOTICE OF ADJOURNED REGULAR MEETING

In accordance with Article IV (4) of the By-Laws, notice is hereby given that the Adjourned Regular Meeting of the Upper Colorado River Commission will be held beginning at 10:00 o'clock a.m. on Tuesday, April 14, 1964 in Room 330, State Office Building, in Denver, Colorado.

The Regular Meeting of the Upper Colorado River Commission, which by unanimous written consent was scheduled to be convened in Boise, Idaho, on March 16, 1964, was adjourned for lack of a quorum.

The Adjourned Regular Meeting previously scheduled for April 6, 1964 has been cancelled by unanimous agreement of our five Commissioners in order that the necessary April 1st stream forecast and other technical data may be available for a constructive discussion of the Glen Canyon reservoir filling problem at the Adjourned Regular Meeting scheduled above.

(Signed) Ival V. Goslin
Secretary."

MR. GOSLIN: Mr. Chairman, I believe that constitutes the necessary legal work to get this meeting to its proper status.

THE CHAIRMAN: Then if we are now legal, we will proceed with the agenda as has been distributed?

MR. GOSLIN: Yes, sir.

THE CHAIRMAN: The next item, "Reading and approval of minutes of Adjourned Annual Meeting of September 27, 1963."

MR. GOSLIN: Mr. Chairman, these minutes have been distributed to the Commissioners in accordance with the By-Laws. If the Commission wishes them read into the record, I will be happy to do so.

THE CHAIRMAN: Does the Commission want these minutes read now?

COM. BLISS: Mr. Chairman, I move they be approved as distributed.

COM. VAN CAMP: I second it.

THE CHAIRMAN: It has been moved and seconded that these minutes be approved as distributed. (Thereupon a vote was taken.) Motion is carried; these minutes are approved.

The next item, "Reading and approval of minutes of Regular Meeting of March 16, 1964."

MR. GOSLIN: Mr. Chairman, this was meeting No. 87 of the Commission. It was the meeting that was adjourned for lack of a quorum. In order that we have a complete record it will be necessary that I read these short minutes into the record:

"MINUTES OF REGULAR MEETING
UPPER COLORADO RIVER COMMISSION
March 16, 1964

Pursuant to notification, Article IV (4) of the By-Laws and to written consent executed by each Commissioner, Article IV (5) of the By-Laws, the Commission met at 3 Hulbe Road, Boise, Idaho.

The meeting was called to order at 8:00 o'clock a.m. by Chairman Robert J. Newell. Noting the absence of a quorum, and there being no objection, the Chairman announced that the meeting would be adjourned to a day and place to be announced later."

These minutes are signed by Mr. Robert J. Newell, Chairman.

THE CHAIRMAN: Are there any corrections for these minutes? (No response.) Without a correction, then these will stand approved.

The next item is a report of the Chairman and it has not been the practice in this Commission to take up valuable time unless there is something important for the party to say. The Chairman has no important report to make this morning and we will proceed with the report of the Executive Director, Ival Goslin.

MR. GOSLIN: Mr. Chairman, I think that was about the shortest report on record.

Before I read my report and while the gentlemen are passing out copies of it to the members of the audience, Mr. Dick Eckles has an announcement he would like to make to the Commission. Is Mr. Eckles in the room?

MR. ECKLES: I would like to invite the Commission, their Legal Committee and the Engineering Committee for lunch this noon. The reservation has not been confirmed yet, so when the meeting adjourns at noon I will make the announcement where we are going to have lunch.

MR. GOSLIN: Thank you very much, Dick.

(Documents distributed.)

MR. GOSLIN: Mr. Chairman, I am going to stand while I am doing this because I am hidden behind your shoulders here. This is the report of the Executive Director of the Commission dated as of today, April 14, 1964.

Due to the long interval since our last Commission meeting this report will touch only briefly on several items, especially those about which we have sent detailed memoranda or other correspondence to our Commission members and advisers. In order to keep this report to a reasonable length some items that ordinarily would be discussed may be omitted. These conditions, however, should not preclude a full discussion of any item at this meeting.

PACIFIC SOUTHWEST WATER PLAN

Pursuant to instructions of the Commission, our staff prepared a detailed analysis of the August 1963 Pacific Southwest Water Plan and presented it in a documented and illustrated manner to our four Governors,

Commissioners, and others, at a meeting in Salt Lake City on November 8, 1963. Following this meeting each of the Governors submitted official comments on the Pacific Southwest Water Plan to the Secretary of the Interior. Although I have not had an opportunity to make a detailed study of each of these comments, it appears that each Governor, in general, approved the principle of broad-scale, basin-wide, water resource development for the Lower Colorado River Basin with recommendations that the interests of the Upper Basin must be adequately protected in the authorizing legislation.

The Secretary of the Interior has prepared a revised report of the plan dated January 1964. This report was filed February 14 with the Federal Power Commission pursuant to orders issued in license proceedings in which the Arizona Power Authority seeks permission to construct a hydroelectric development at Marble Canyon. The Department of the Interior has opposed the granting of a license to the Arizona Power Authority. The major points of the revised Pacific Southwest Water Plan include:

1. Immediate authorization for Federal construction of Bridge and Marble Canyon dams and powerplants as "cash register" contributors to the Pacific Southwest Development Fund.

2. A guarantee of the equivalent of 7,500,000 acre-feet of water per year for consumptive use: 4,400,000 acre-feet in California; 2,800,000 acre-feet in Arizona; 300,000 acre-feet in Nevada.

3. The Development Fund would underwrite the guarantee of 7,500,000 acre-feet of water, regardless of any future deficiencies in Colorado River supplies, at no greater cost to the users than they would incur if there were sufficient natural flows in the river to meet this guarantee.

4. Immediate provision for enlargement of the California Aqueduct now under construction, and completion of investigations for construction at a later date of a new system of reservoirs and conveyance structures to transport excess water from Northern to Southern California.

5. Water salvage and recovery programs to assure maximum beneficial use of existing supplies.

6. Immediate authorization of:

   (a) Central Arizona Project--including Hooker Dam and reservoir in New Mexico

(b) Southern Nevada Water Supply Project

(c) Moapa Valley Pumping Project in Nevada

(d) Dixie Project in Utah

(e) Indian irrigation systems--both new irrigation and drainage projects and rehabilitation and betterment of old systems in the Lower Basin

(f) Outdoor recreation and fish and wildlife facilities.

In the section of Interior's revised report on the Pacific Southwest Water Plan dealing with a "Discussion of the Comments of the Upper Colorado River Basin States", it is made clear that the suggestions from the Upper Basin were either rejected, ignored, or brushed off as inconsequential. In view of this situation coupled with events related to the filling of Glen Canyon Reservoir and the Supreme Court's decision in Arizona versus California, it is apparent that when legislation to authorize the Central Arizona Project and/or the Pacific Southwest Water Plan reaches the House of Representatives the Upper Basin must be prepared to offer a number of protective amendments. If agreement concerning the amendments to protect the rights of the Upper Basin cannot be reached with the proponents of the legislation, we should be prepared to fight for this protection to the extent of letting the Congress know that we are opposed to authorization legislation for Lower Basin Colorado River projects that does not encompass Upper Basin protection. We surely should have learned by this time that a couple of statements in a project report saying that the Pacific Southwest Water Plan will not encroach upon the water supply of the Upper Basin as defined by the Colorado River Compact, or that the Compact provisions are not at issue and are not discussed or interpreted by implication, are not sufficient protection for the future development of the water resources of the Upper Basin.

WATER RESOURCES PLANNING ACT

The House Committee on Interior and Insular Affairs held hearings on S. 1111, the proposed Water Resources Planning Act, as amended by the Senate, and H. R. 3620 by Congressman O'Brien of New York during the week of March 23. There will be another day of hearings on these bills on April 20. It is doubtful that the House Committee will take any further action on S. 1111 very soon after April 20.

SAVERY-POT HOOK, BOSTWICK PARK, FRUITLAND MESA PROJECTS

On March 9 and 10 the House Subcommittee on Irrigation and Reclamation held hearings on H. R. 3672, a bill to authorize the Savery-Pot Hook Project in Wyoming and Colorado and the Bostwick Park and Fruitland Mesa Projects in Colorado. The two most important developments during these hearings were the arguments about the size of a farm unit necessary to provide an adequate family living, and the advisability of authorizing any future projects at a time when Glen Canyon Reservoir cannot be filled to the point of generating power and revenues for repayment of project costs beyond the ability of the water users to repay. Members of Congress are extremely sensitive to both of these problems. H. R. 3672 is now pending before the House Committee. The earliest date that the Subcommittee can give further consideration to this bill will be during or following the first week in May.

APPROPRIATIONS OF FUNDS FOR THE COLORADO RIVER STORAGE PROJECT

The total Colorado River Storage Project construction program for fiscal 1965 will require about $67,000,000 in new funds. In addition, $4,767,180 are being requested for the operation and maintenance of the three storage units, the transmission division, and three participating projects. A memorandum summarizing the items in the President's budget request was transmitted to our Commissioners and their advisers on January 23.

We have written to Chairman Cannon of the House Appropriations Committee requesting time for the presentation of testimony in support of appropriations. We have not been notified of the time for our witnesses to appear, but expect to receive a definite answer soon. The Commission should decide at this meeting how it wishes to have its testimony presented this year.

FILLING GLEN CANYON RESERVOIR

One of the major problems confronting us at this time is the filling of the minimum power pool--6,100,000 acre-feet at elevation 3490--in Glen Canyon Reservoir in order that hydroelectric generation and the accumulation of revenues in the Upper Basin fund can be commenced as soon as possible. Anything that affects the initiation of generation or the amount of generation at Glen Canyon also affects the amount of revenues going to the Basin Fund, and consequently, the rate of repayment of presently authorized projects and the starting of new water development projects in the Upper Basin.

On March 25, 1964, there were about 3,100,000 acre-feet of water in Lake Powell behind Glen Canyon Dam. On March 26 under orders from the Secretary of the Interior, water began flowing from the reservoir in quantities greatly in excess of the inflow.

In order to place this problem of reservoir filling in its proper perspective we should briefly review a little past history. On blue paper attached to this report are several appendices to which references are made in this history. Although I do not intend to read these documents they are an integral part of the official proceedings of this meeting and are attached for your information. (Blue paper appendices referred to--A-1 through A-22--attached hereto at end of the report of Executive Director.)

As far as this immediate problem is concerned, the one marked A-7, the letter from the Secretary of the Interior to Governor Clyde attached to the News Release of March 26, 1964, is of extreme importance.

The next one, A-9, is a letter of March 27, 1964, from the Upper Colorado River Commission to Mr. Robert T. Person, President of the Public Service Company of Colorado. Identical letters were also sent to the presidents of the other private utilities in the Upper Basin area.

1. During 1957 the Bureau of Reclamation made an economic and financial analysis of the Colorado River Storage Project. As an assumed basis for filling the Upper Basin reservoirs the Bureau used the "Hydrologic Bases" which it announced on October 24, 1957, at a meeting of Colorado River Basin Governors or their representatives in Washington, D. C.

During the next three years a series of meetings were held by the Bureau's engineers with the engineers of the Lower Division States and with the engineers of the Upper Division States. All three of these groups of engineers made literally hundreds of studies of various proposed methods of filling the Storage Project reservoirs without reaching agreement. Secretary Seaton tentatively approved a draft of criteria on February 9, 1960, after which negotiations again proceeded.

On April 2, 1962, Secretary Udall officially approved and released the filling criteria, known as the "General Principles to Govern, and Operating Criteria for, Glen Canyon Reservoir (Lake Powell) and Lake Mead During the Lake Powell Filling Period", under which he is now operating the reservoirs. The "general principles" were published in the Federal Register on July 19, 1962.

The filling criteria were not approved by the Upper Basin States or the Upper Colorado River Commission. I suppose it would be fair to say that these entities did not formally reject the criteria either.

Paragraph 5 of the criteria requires that diminutions in generation of firm energy--the so-called deficiencies--at Hoover Dam caused by the operation of Upper Basin reservoirs during the Lake Powell filling period shall be made up at the expense of the Upper Basin Fund, with partial restitution to that fund after 1987, if Congress so directs.

The portions of Paragraph 7 of the Secretary's filling criteria that are pertinent to the present problem provide that:

(a) the filling of the minimum power pool--6,100,000 acre-feet at elevation 3490--shall be accomplished at the earliest practicable time;

(b) until elevation 3490 is reached any water stored in Lake Powell can be released to maintain rated head--14,500,000 acre-feet at elevation 1123--on the Hoover powerplants;

(c) when the elevation of Lake Powell reaches 3490 the stored water cannot be released below that point;

(d) the filling of the minimum power pool in Lake Powell will be in such manner as not to cause Lake Mead to drop below elevation 1123; and

(e) in the process of filling the minimum power pool at Lake Powell, the release of water at Glen Canyon Dam shall not be less than 1,000,000 acre-feet per year and 1,000 second-feet.

During conferences with Bureau engineers preceding the promulgation of the criteria several engineer representatives of the Upper Basin objected strenuously to the provisions of both Paragraph 5 and Paragraph 7 of the criteria. In general, the objections to Paragraph 5 were that it gave a guarantee of firm energy to the Lower Basin Hoover power allottees that was not contemplated at the time they signed contracts for energy with the Secretary--this guarantee was at the expense of the development of the water resources of the Upper Basin which is not a party to the contracts--and the Upper Basin has as much right to unimpaired development of its water resources as the Lower Basin.

The objections to Paragraph 7 were that it made the operation of Lake Powell subservient to Lake Mead--that it guaranteed a fixed generating capacity at Lake Mead which was even more unreasonable than guaranteeing the firm energy--that it placed the burden of supplying water for evaporation from Lake Mead upon the Upper Basin--that during a poor water year

or series of poor water years during the filling period the requirement to hold Lake Mead at 14,500,000 acre-feet would make the filling of Lake Powell impossible for long periods. This is the situation in which we now find ourselves in 1964.

2. On March 13, 1963, the gates were partially closed at Glen Canyon Dam and storage of water began. Lake Mead held 22,300,000 acre-feet of water at elevation 1188.2 feet. The flow below Glen Canyon Dam was reduced to about 1,000 second-feet and water accumulated until there were about 3,100,000 acre-feet at elevation 3414.9 feet.

3. On January 30, 1964, the flows from Lake Powell were increased to about 2,440 second-feet; on January 31st to 3,770 second-feet; and from February until March 26 continued at about 4,000 second-feet. These increases in flow were made to meet the requirements of 1,000,000 acre-feet per year following March 13, 1963, in Paragraph 7 of the criteria. About 2,500,000 acre-feet were delivered to Lake Mead during the 1963 water year ending September 30, 1963, and about 1,400,000 acre-feet during the calendar year 1963.

4. At the end of January 1963 there were 22,700,000 acre-feet of water in Lake Mead. By the end of January 1964 Lake Mead had dropped to 15,400,000 acre-feet. There were 3,100,000 acre-feet in Lake Powell. The runoff at Lee Ferry for 1963, adjusted for the storage in Flaming Gorge, Navajo and Lake Powell, amounted to only 6,300,000 acre-feet. The runoff for 1963 was the third lowest in history.

5. After the February 1, 1964 streamflow forecasts became available our office became acutely aware that there was a strong possibility that 1964 was going to be another "bad" water year, and that under a strict adherence to the filling criteria it might be impossible to have the minimum power pool at Glen Canyon filled during 1964 or by the time the generators would be ready to operate which at that time was estimated to be July 1st. We now understand that all facilities necessary for initiating generation may not be available until August 1 or September 1, or later. Another way of stating the situation as it appeared on the basis of the runoff anticipated on February 1, is to say that it seemed extremely unlikely that the minimum power pool could be filled at Lake Powell in 1964 and at the same time hold Lake Mead at rated head with 14,500,000 acre-feet.

While in Washington, D. C., during the week of February 17, I called this problem to the attention of the Secretary of the Interior, the Assistant Secretary, the Commissioner and Assistant Commissioner of Reclamation. I requested that, in the interest of getting the generators at Glen Canyon on the line as soon as possible and preserving harmony among the

interested people in the Upper Basin, the Bureau should study the problem thoroughly and seek a means of filling the minimum power pool at Glen Canyon. It was further suggested, should conditions warrant, purchase of energy and generating capacity from outside sources should be considered and negotiated in order to compensate for the additional diminution in generation at Hoover Dam that would be caused by drawing Lake Mead below the rated head of the Hoover powerplants while accumulating water at Glen Canyon. I also offered the services of our Commission and other interested parties in the Upper Basin to aid in finding a solution to the problem, and requested that we be kept informed regarding progress towards a solution. I was given positive assurances of cooperation and information.

6. Although there was no evidence that the anticipated runoff had improved by the end of February, there was no indication that negotiations were being held by the Bureau with utilities in the area or the Hoover Power contractors that might lead to a solution of the problem if the streamflow should prove to be too low to fill Glen Canyon's minimum power pool and hold Lake Mead at rated head--yet high enough to justify purchasing energy and capacity for replacement to the Hoover power users. Knowing how erratic the Colorado River streamflows have been in the past, it is reasonable to believe that the Bureau was waiting for more reliable information from later forecasts before moving in the direction of negotiating an alternative solution.

7. Realizing the difficulties inherent in rapid negotiations, the limitations that exist with respect to delivery of energy from the Upper Basin to the Los Angeles area, and the need for a solution at a definite time in order to have storage water in Glen Canyon, we began making inquiries of our own during the first week of March about the availability of energy and capacity for Hoover replacement purposes. Among other things, Mr. Kuiper and I learned in Los Angeles that (a) some of the Hoover power contractors were interested in having Glen Canyon generators on the line as soon as possible; (b) that energy and capacity for replacement purposes were available in California but the cost would be higher than average because it would have to be derived from the less efficient generating plants not presently being used to full capacity; and (c) that the Hoover power contractors believe that it was not their responsibility to work out a solution to the problem and take it to the Secretary, but that the Secretary should devise alternatives for their consideration and negotiation. We also learned in Arizona that energy and capacity might be available in Arizona through an exchange process from the Arizona Power Authority generators at Hoover Dam, and that capacity in excess of normal reserve requirements is available from Arizona Public Service Company.

Due to the lack of connections at the Hoover switchyard between the powerplant on the Arizona side of the river and the plants on the California side a real problem exists relative to the transmission of large quantities of power from Arizona to Southern California.

8. On March 2 Governor Clyde wrote to the private utilities of the area asking them to consider the "problem of filling Glen Canyon Reservoir with the view that there may be a way in which your companies will be able to aid in its resolution, perhaps by furnishing generating capacity and energy together with transmission service to supply Hoover power contractors with power and energy during the period Lake Mead may be drawn below rated head as the result of accumulating storage at Glen Canyon."

9. On March 10 the utilities answered Governor Clyde's letter by saying that engineering and power supply studies were underway by five utilities, and that preliminary results of these studies indicated that these five utilities, together with neighboring utilities, were able and willing to be of substantial aid, beginning this summer, in solving the problem.

10. The streamflow forecasts for March 1, 1964, showed even lower anticipated runoff than the forecasts of February 1, thus making the resolution of the problem by the purchase of replacement power and energy for Hoover power contractors to appear to be less practicable than before--but not impossible, if the future forecasts were as good as, or better than, those of March 1.

Therefore, we appeared to be faced with two "dry" years in succession on the Colorado River--a condition that existed at least once before in 1954 and 1955 without Glen Canyon Dam on the river when a total of less than 13,500,000 acre-feet passed Lee Ferry in two years, to be followed by only 8,750,000 acre-feet at Lee Ferry in 1956.

11. On March 17 our four Governors addressed a letter to the Secretary of the Interior urging the Department to adopt a policy under which the minimum power pool at Glen Canyon can be filled in 1964 without detriment to other power and water uses in the Colorado River Basin and offering their cooperation in attaining this objective.

12. On March 26 the Secretary of the Interior announced his decision to release stored water from Lake Powell on an interim basis in amounts sufficient to maintain the level of Lake Mead at rated head--14,500,000 acre-feet at elevation 1123. The Secretary attached a copy of his reply to the letter from our four Governors to his announcement. In this reply he stated, ". . . that early spring storms could increase the

anticipated runoff to the point where Lake Mead storage could be permitted to drop somewhat below the 14,500,000 acre-foot mark temporarily. The resultant reduction in Hoover generation would then be made up by purchase of power from outside sources." The Secretary thus left the door open for a later, more final decision to purchase replacement power, if the actual runoff is near or exceeds the median March 1 forecast of 4,700,000 acre-feet for April-July runoff, and if the energy and capacity are available and can be delivered to the Hoover power users.

13. In his letter to the Governors the Secretary mentioned that any major interim purchase of power would require special fiscal arrangements because funds are not now programmed for that purpose; that is, an item for funds for this purchase is not in the President's budget request for fiscal 1965. He also stated:

> "I may add that up to the present time, although we have read newspaper stories concerning an offer by Upper Basin private utilities to supply replacement power, we have had no proposal with necessary data such as rates and the means the utilities would use to get the power to the Lower Basin, particularly California. While under present circumstances we could not avail ourselves of the utilities' offer because of the critical outlook, we hope these data will be forthcoming immediately. It will be necessary to have these data without delay if the proposal is to be considered when the water situation is reviewed and a final decision reached concerning a course of action on operation of the river in this critical water year."

14. On March 27 after a careful study of the Secretary's news release of March 26 and his reply to our four Governors' letter, we directed a letter to the president of each of the private utilities in the area in which we (1) outlined and proposed for exploration a manner by which the utilities might be able to provide replacement generation capacity and energy under an "exchange and banking" procedure that would not require large sums of Federal cash; (2) asked the utilities if they had studied the feasibility of transmitting power to the Hoover power contractors and if they knew of any physical limitations to accomplishing this delivery; and (3) asked the utilities to inform us as soon as possible of their willingness to negotiate with the Secretary of the Interior on the basis outlined, if the capacity and energy "exchange" conditions would be satisfactory and there were no physical limitations to the delivery of power to the Lower Basin users.

15. The next day we wrote to the Secretary of the Interior telling him that we had written to the utilities. We also informed the Secretary that if favorable replies were received from the utilities we would let him

know, and would urge that he hold a joint meeting with the Governors, the Bureau of Reclamation, the utilities, and representatives of the Upper and Lower Basin States for the purpose of further exploring a solution to the reservoir filling problem. Of course, the proposed courses of action must be subject to the availability of sufficient runoff and reasonable cost.

16. The utilities replied promptly to our letter of March 27. Their replies were not identical but they did express about the same views. Since today we are in the State of Colorado I will use the following quotation from the letter of Mr. Robert T. Person, President, Public Service Company of Colorado, to illustrate the type of answer received. He said in his letter:

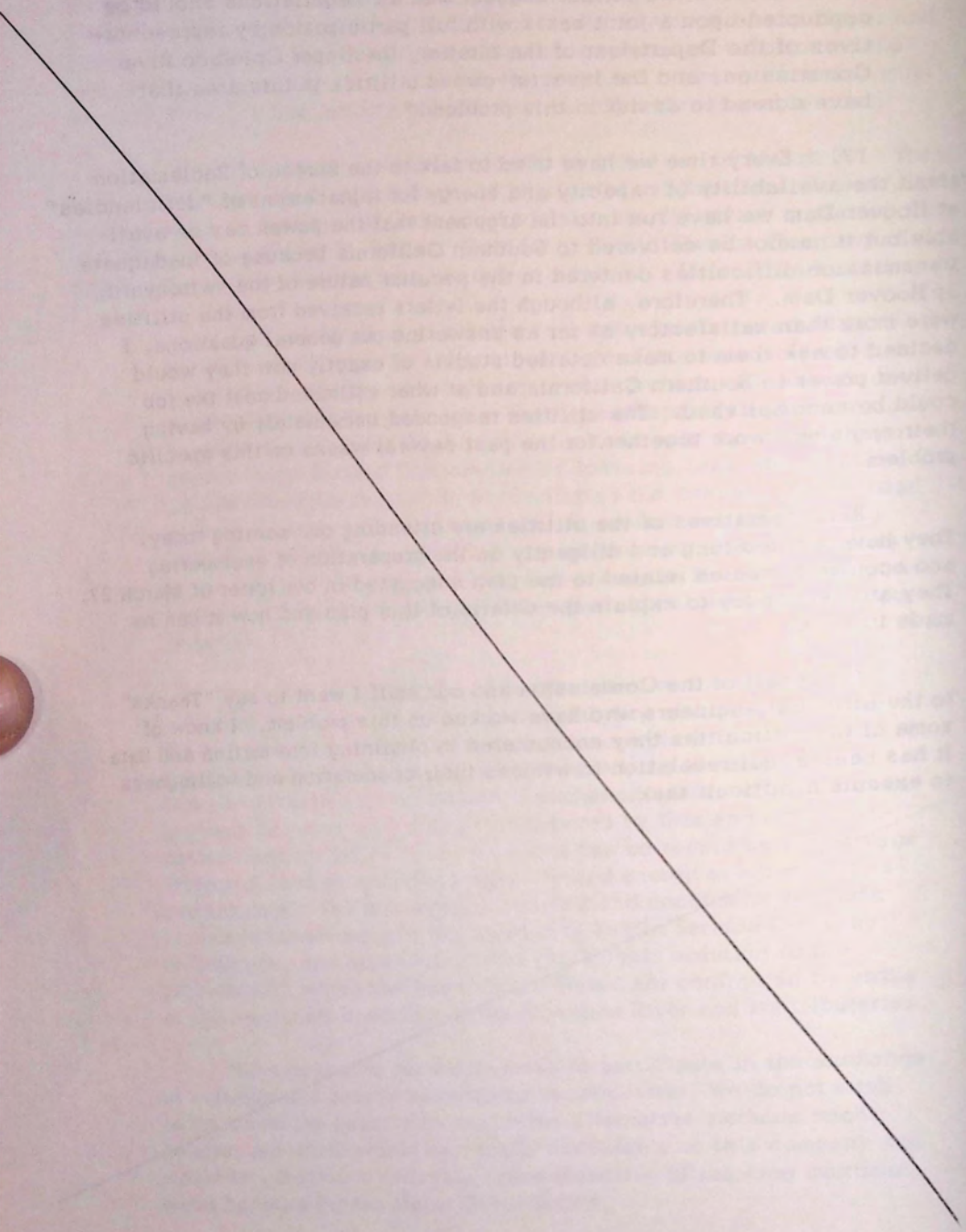
> "As indicated in your letter, we have participated with various other companies in engineering and power supply studies in an effort to arrive at a solution to this problem. These studies established that the necessary generating capacity and energy can be made available by these companies to supply the deficiency in generation at Hoover Dam created by lowering Lake Mead below 14,500,000 acre-feet while accumulating the minimum power head at Glen Canyon. We might add that at present our engineering investigation has not disclosed any serious physical limitations in the means of delivering power and energy to Hoover power contractors of a sufficient magnitude to prevent carrying forward your proposal.
>
> "In view of the fact that the Secretary of the Interior has indicated some concern over the availability of funds to pay for the necessary capacity and energy to accomplish this purpose, Public Service Company of Colorado is willing to participate in this undertaking on your proposed exchange basis. In this manner payment for power and energy contributed by this and other companies need not be made in cash but can be repaid by the Storage Project in kind by supplying capacity and energy at agreed times and amounts. The remaining principles and conditions set forth in your letter are equally acceptable to Public Service Company of Colorado, and appear to offer a practicable solution to the problem with which the Upper Basin States are confronted by virtue of the low runoff condition of the Colorado River and its tributaries.
>
> "By expressing our willingness to participate in the exchange of capacity and energy as outlined in your letter, we do not wish to foreclose the possibility that other alternative methods might be arranged which would be equally acceptable to this company and would be consistent with your prime objective of insuring maximum water benefits for the Upper Basin States.

". . . . We further suggest that all negotiations should be conducted upon a joint basis with full participation by representatives of the Department of the Interior, the Upper Colorado River Commission, and the investor-owned utilities in this area that have agreed to assist in this problem."

17. Every time we have tried to talk to the Bureau of Reclamation about the availability of capacity and energy for replacement of "deficiencies" at Hoover Dam we have run into the argument that the power may be available but it cannot be delivered to Southern California because of inadequate transmission difficulties centered in the peculiar nature of the switchyard at Hoover Dam. Therefore, although the letters received from the utilities were more than satisfactory as far as answering our general questions, I decided to ask them to make detailed studies of exactly how they would deliver power to Southern California and at what estimated cost the job could be accomplished. The utilities responded immediately by having their engineers work together for the past several weeks on this specific problem.

Representatives of the utilities are attending our meeting today. They have worked long and diligently on the preparation of engineering and economic studies related to the plan suggested in our letter of March 27. They are here today to explain the details of this plan and how it can be made to work.

On behalf of the Commission and our staff I want to say "Thanks" to the utilities' engineers who have worked on this problem. I know of some of the difficulties they encountered in obtaining information and data. It has been a real revelation to witness their cooperation and willingness to execute a difficult task.



STATE OF UTAH
OFFICE OF THE GOVERNOR
Salt Lake City

George D. Clyde
Governor

March 2, 1964

Mr. Ed Naughton, President
Utah Power and Light Company
Salt Lake City, Utah

Dear Mr. Naughton:

As you probably know from recent newspaper articles it appears that the runoff on the Colorado River for 1964 will be much below average. There appears to be little chance this year of filling the reservoir at Glen Canyon to minimum power head and starting generation under the reservoir filling criteria promulgated by the Secretary of the Interior. In the interests of paying for the reimbursable costs of the Colorado River Storage Project and aiding the development of the water resources of the State of Utah and her sister States, as contemplated in the Congressional authorizing Act, it is vitally important that generation of electric energy be initiated at Glen Canyon as soon as possible.

I am advised that the minimum power head at Glen Canyon can be reached in 1964, under adverse streamflow conditions, if the criteria for filling the reservoir were to be modified by the Secretary of the Interior to allow the withholding this spring of from one-half million to one and one-half million acre-feet of water from Lake Mead below the rated head figure of 14.5 million acre-feet. Under other requirements of the criteria the Upper Basin Fund is charged with the costs of curtailment in generation at Hoover Dam due to the filling of Glen Canyon. For this reason a question is raised concerning the availability of electrical energy, generating capacity and transmission facilities that would be necessary to replace the power that would be curtailed at Hoover Dam by withholding the water in Lake Powell.

I recall that during the trying days preceding the enactment of the Colorado River Storage Project Act the electric utility companies in the Colorado Basin testified on numerous occasions as to their willingness to aid in the resolution of problems associated with the financial feasibility and electrical stability of the Storage Project. Therefore, I am asking you in

conjunction with your associated investor-owned utilities in the Colorado River Basin to consider this important problem of filling Glen Canyon Reservoir with the view that there may be a way in which your companies will be able to aid in its resolution, perhaps by furnishing generating capacity and energy together with transmission service to supply Hoover power contractors with power and energy during the period Lake Mead may be drawn below rated head as the result of accumulating storage at Glen Canyon.

I fully realize that there are many complex engineering problems involved that I have not contemplated, but any suggestions you may have to offer will be much appreciated.

Yours sincerely,

/s/ George D. Clyde

Governor

GDC/mw

UTAH POWER & LIGHT COMPANY
P. O. Box 899
Salt Lake City 10, Utah

March 10, 1964

E. M. Naughton
President & General Manager

The Honorable George D. Clyde
Governor of the State of Utah
State Capitol Building
Salt Lake City 14, Utah

Dear Governor Clyde:

This is in response to your letter of March 2, 1964 concerning the finding of a solution to the problem of filling Lake Powell and at the same time satisfying U. S. Bureau of Reclamation contractual obligations to supply Hoover Dam power during the period Lake Mead may be drawn below rated head as a result of accumulating storage for power head at Glen Canyon.

Pursuant to your request, the executive officers of five inter-mountain investor-owned electric utilities met in Salt Lake City today, March 10, and I am authorized in their behalf to assure you that these companies stand ready and willing now, as we have in the past, to make every effort to help place this highly important Colorado River Storage Project in operation.

All of these companies are very much concerned not only with the current problem brought about by low runoff of the Colorado River, but with the long-range problem of making certain that a maximum of power revenues are produced to allow construction of the participating water use projects at the earliest possible date. I am sure we all agree the development of these participating projects and maximum utilization of the water of the Colorado are of prime importance and will benefit every citizen of the Basin area, and must be the foremost consideration.

Engineering and power supply studies were started the day I received your letter, by Public Service Company of New Mexico, Public Service Company of Colorado, Idaho Power Company, Utah Power & Light Company, and Pacific Power & Light Company.

I am pleased to assure you that preliminary results of these studies indicate that these five investor-owned companies, together with neighboring utilities, can be of substantial aid, beginning this summer, in solving this serious problem.

These studies indicate that the investor-owned utilities can provide displacement power which we believe will be equivalent to 2 or 2-1/2 million acre-feet of water per year, that would otherwise have to be generated at Hoover Dam to satisfy power commitments of the Bureau for power generated at Hoover Dam. The objective here, of course, is early water storage in Lake Powell. As you know, our utilities have reserve steam-electric generating capacity and their operations can be pooled and coordinated by utilizing their high-voltage interconnections which will permit us to provide substantial assistance to the project.

The fact that the Bureau of Reclamation will be unable to meet its commitments to supply Upper Basin preference customers with power from Glen Canyon generators beginning May 1 of this year, presents no problem. Rocky Mountain Investor-owned electric utilities have been supplying most of the power requirements of these customers for many years and we will continue to do so.

While you may rest assured that these utilities can and will help, the ultimate solution will involve many and varied engineering problems. All of us have one common interest--the earliest possible development of the participating water use projects and maximum utilization of our water.

I will report our findings to you at the earliest possible date.

Cordially,

/s/ E. M. Naughton

EMN/ws

COLORADO NEW MEXICO UTAH WYOMING

March 17, 1964

Honorable Stewart L. Udall
Secretary
Department of the Interior
Washington 25, D. C.

Dear Secretary Udall:

It has been called to our attention that under a strict adherence to the "General Principles to Govern, and Operating Criteria for, Glen Canyon Reservoir and Lake Mead During the Lake Powell Filling Period," as promulgated, there will be very little if any chance of storing sufficient water behind Glen Canyon Dam to generate electric energy in 1964. The purpose of the criteria was to provide guide lines as the basis of securing a practical approach to the problems of reservoir filling within a reasonable exercise of Secretarial discretion, while, at the same time, protecting the interests of water and power users.

Now, at a time when water should be accumulating at Glen Canyon, we find that an exceptional circumstance in the form of a "bad" water year has intervened--a circumstance that could preclude the filling of the minimum power pool at Glen Canyon unless wise and judicial use is made of the available water.

On the basis of water and power analyses that have been made we are convinced that it would be practicable to store sufficient water at Glen Canyon to cause the generators to produce energy by August 1, 1964, and that this objective can be attained without injury to downstream water or power users. We understand that a solution to this problem will entail considerable leadership and cooperation among the many diverse Colorado River Basin interests, including your Bureau of Reclamation.

From the information presently available it appears that a policy decision regarding the operation of the various facilities on the Colorado River under the jurisdiction of the Secretary of the Interior should be made prior to April 1st in order to insure power production at Glen Canyon in 1964.

Both private and public entities in the Upper and Lower Basins are willing to cooperate fully to make possible the generation of power at Glen Canyon in 1964. We are also confident that it is in the best interests of everyone concerned to arrive at a method of filling the minimum power pool at Glen Canyon at the earliest possible date.

We know that you are informed regarding the many ramifications of this complex problem. We, therefore, urge that the Department of the Interior adopt a policy under which the minimum power pool at Glen Canyon will be filled in 1964 without detriment to other water and power uses in the Colorado River Basin.

In order to reach these objectives we offer our full cooperation, and respectfully request that you consult with us in the development of your plans with reference to the problems herein outlined.

Sincerely yours,

/s/ John A. Love
Governor of Colorado

/s/ Jack M. Campbell
Governor of New Mexico

/s/ George D. Clyde
Governor of Utah

/s/ Clifford P. Hansen
Governor of Wyoming

Attached to March 26, 1964
News Release of Department of the Interior

UNITED STATES
DEPARTMENT OF THE INTERIOR
Office of the Secretary
Washington 25, D. C.

Dear Governor Clyde:

We appreciate very much the letter of March 17 from you and the other Governors of the Upper Colorado River Basin States concerning the operating criteria for Glen Canyon reservoir, which is now known as Lake Powell, and Lake Mead during the Lake Powell filling period. We join with you in your expressions of concern over release of water from Glen Canyon reservoir before the lake has reached the operating level.

Regrettably, and for the time being, we can see no satisfactory alternative to undertaking immediate discharge of sufficient water from Glen Canyon reservoir to maintain the level of Lake Mead at the minimum operating level of 1,123 feet above mean sea level, or 14.5 million acre-feet of storage. A press release announcing this interim decision is attached.

As the press release explains, there is still a possibility, albeit an unlikely one, that early spring storms could increase the anticipated runoff to the point where Lake Mead storage could be permitted to drop somewhat below the 14.5 million acre-foot mark temporarily. The resultant reduction in Hoover generation would then be made up by purchase of power from outside sources. Any major interim purchase of power, of course, would require special fiscal arrangements inasmuch as funds are not now programmed for that purpose.

However, the existing situation is such that at least until we have a better knowledge of the 1964 water supply, we have no alternative but to live with the filling criteria which were first promulgated in 1960 by my predecessor Secretary of the Interior, Fred Seaton. After careful review of the criteria in light of the administration's fiscal policy, I approved the criteria in 1962 as the best procedure to protect the Federal investment already made in Hoover, Davis, and Parker Dams, as well as the investment in the Upper Basin and the objectives of the total development program.

I may add that up to the present time, although we have read newspaper stories concerning an offer by Upper Basin private utilities to supply replacement power, we have had no proposal with necessary data such as rates and the means the utilities would use to get the power to the lower basin, particularly California. While under present circumstances, we could not avail ourselves of the utilities' offer because of the critical outlook, we hope these data will be forthcoming immediately. It will be necessary to have these data without delay if the proposal

is to be considered when the water situation is reviewed and a final decision reached concerning a course of action on operation of the river in this critical water year. I have directed the Commissioner of Reclamation, through his Regional offices, to maintain close and continuing contact with the utilities and to keep me advised on a day to day basis of any changes in the water situation, in order that necessary decisions can be made on a timely basis.

I should also explain that if the presently forecast mean runoff occurs in 1964, Lake Powell is expected to remain at approximately its present level or even to increase somewhat during the runoff period which coincides with the principal recreation demands on the lake. After the runoff, of course, if there is no material improvement in the water outlook, the lake may be drawn down considerably to meet necessary downstream commitments.

Sincerely yours,

/s/ Stewart L. Udall

Secretary of the Interior

Hon. George D. Clyde
Governor of Utah
Salt Lake City, Utah

Identical letters to:

Governor John A. Love, Colorado
Jack M. Campbell, New Mexico
Clifford P. Hansen, Wyoming

UPPER COLORADO RIVER COMMISSION
355 South Fourth East Street
Salt Lake City, Utah 84111

March 27, 1964

Mr. Robert T. Person
President
Public Service Company of Colorado
P. O. Box 840
Denver, Colorado

Dear Mr. Person:

The recent action of the Secretary of the Interior ordering the release of water stored in Lake Powell at a rate that will maintain storage in Lake Mead at a minimum of 14.5 million acre-feet pending a final decision dependent upon stream runoff during the next two months makes it imperative that the Upper Basin States find a way to save this water.

Governor Clyde in his letter of March 2, 1964 to the electric utilities in the area stated that the problem appears to be one "concerning the availability of electrical energy, generation capacity and transmission facilities that would be necessary to replace the power that would be curtailed at Hoover Dam by withholding the water in Lake Powell." In answer to Governor Clyde's letter, your Company and others indicated that they were willing and able to be of substantial aid in solving this problem.

The Secretary of the Interior in his answer to a letter of March 17th from the Governors of the four Upper Basin States said that although there had been newspaper stories concerning an offer by Upper Basin utilities to supply replacement power, his Department had received no proposals with the necessary data, such as, rates and the means the utilities would use to deliver the power to the Lower Basin, particularly California. He also said that it will be necessary to have these data immediately, if a proposal is to be considered when the water situation is reviewed and a final decision reached concerning a course of action on operation of the river in this critical water year.

We believe that because water is now being released at a rapid rate from Lake Powell, the situation has become even more urgent, and there must be an immediate solution, if the minimum power pool in Lake Powell is to be filled in 1964. The utilities' letter of March 10th to Governor Clyde indicated that the various companies started immediately to make engineering and power supply studies pertaining to this problem.

We have also noted in the Secretary's reply to our four Governors that he seems to be concerned about the availability of federal funds for any major interim purchase of power because funds are not now included in the President's budget for that purpose.

After reviewing the overall problem we would like to know if your Company, in cooperation with other electrical utilities in the area, can and will make available the necessary capacity and energy to supply the deficiency in generation at Hoover Dam created by lowering Lake Mead below 14.5 million acre-feet while accumulating the minimum power head at Glen Canyon Dam under an arrangement similar to the following:

(a) The Companies' obligation to extend to the supplying of generation deficiency at Hoover created by filling Lake Powell to its minimum power head and to terminate when Lake Mead reaches 14.5 million acre-feet, or at such time as power generation at Glen Canyon Dam is equal to the deficiency so created at Hoover; and

(b) any energy generated at Glen Canyon Dam following creation of minimum power head to be used first to supply the deficiency at Hoover, described above, with the utilities providing the balance; and

(c) the capacity and energy supplied by the companies to be returned in kind by the Colorado River Storage Project at a time agreeable to the companies upon appropriate notice and under conditions to be agreed upon with the Secretary of the Interior; and

(d) the amount of energy to be returned under (c) to be increased over the amount delivered by a fixed percent per year as compensation to the companies for the cost of money associated with the "banked" energy.

In addition to meeting the concern of the Secretary with regard to the availability of federal cash, we have suggested the above method of repayment because we feel that it results in both a practicable and acceptable means of repaying the companies for their services while at the same time maintaining an optimum financial position for the CRSP. This suggestion, however, certainly does not preclude other methods of repayment, if such methods can be satisfactorily negotiated by the parties concerned.

Mr. Robert T. Person
March 27, 1964
Page Three

We have heard considerable argument to the effect that although the utilities may have the necessary capacity and energy available, the means may be lacking for the transmission of energy to the power users in the Lower Colorado River Basin. Have your engineers or those of your associated utilities studied the feasibility of delivery of power to the Hoover power contractors? Do you know of any physical limitations to accomplishing this phase of the job?

If the capacity and energy "exchange" conditions generally outlined in (a) to (d) above would be satisfactory to your Company, and if you know of no physical limitations to the delivery of power to the Lower Basin users, will you please inform us at the earliest possible date of your willingness to negotiate with the Secretary of the Interior on the basis outlined herein.

Sincerely yours,

/s/ Ival V. Goslin

Ival V. Goslin
Executive Director

IVG:hiw

Identical letters sent to the following:

Arizona Public Service Company
Idaho Power Company
Public Service Company of New Mexico
Utah Power & Light Company
Pacific Power & Light Company

UPPER COLORADO RIVER COMMISSION
355 South Fourth East Street
Salt Lake City, Utah 84111

March 28, 1964

Hon. Stewart L. Udall
Secretary
U. S. Department of the Interior
Washington 25, D. C.

Dear Mr. Secretary:

Your reply to the letter of March 17, 1964 from the four Upper Colorado River Governors and the March 26th news release to which both letters were attached indicates that if actual stream run-off conditions warrant there is a possibility of filling the minimum power pool at Glen Canyon in 1964. To resume storage in Lake Powell might require dropping the level of Lake Mead below elevation 1123 temporarily and making up for the resultant reduction in generation at Hoover Dam by purchases of power from outside sources.

You commented that although there have been newspaper stories concerning an offer by Upper Basin electric utilities to supply replacement power, you have had no proposal with necessary data such as rates and the means to be used to get the power to the Lower Basin, particularly California. You expressed an urgent need for these data, if the proposal is to be considered when the water situation is reviewed and a final decision reached concerning a course of action on operation of the river in this critical water year.

I have been informed that since the seriousness of this problem of reservoir filling first became apparent back in February when I talked to you and Commissioner Dominy about it, there has been very little, if any, liaison between the Bureau of Reclamation and the electric utilities who offered to aid; nor have there been any serious proposals to negotiate an alternative solution with the Lower Basin's interested parties.

Your letter to the Governors also mentioned that any major interim purchase of power for replacement purposes would require special fiscal arrangements inasmuch as funds are not now programmed for that purpose.

Hon. Stewart L. Udall
March 28, 1964
Page Two

In view of the above situation, yesterday I directed a letter to the president of each of the six electric utilities in this area. I outlined and proposed for exploration a manner of having the utilities provide replacement generation capacity and energy on an "exchange and banking" basis that should not require large outlays of Federal cash. Second, I asked the utilities if they had studied the feasibility of delivery of power to the Hoover power contractors, and if they knew of any physical limitations to accomplishing this part of the job. Third, I asked the utilities that if they believed the capacity and energy "exchange" idea might work, and if they knew of no reasons why power could not be delivered to the Lower Basin users, to inform us immediately of their willingness to negotiate with the Secretary of the Interior on the basis outlined.

If favorable replies are received from the utilities, we will immediately let you know and urge you to hold a joint meeting with the Governors, the Department's engineers and those of the utilities, and the Upper and Lower Colorado River Basin States for the purpose of further exploring a solution to this complex problem.

In the meantime we will all be hoping for heavy snow storms on the Colorado watershed.

Sincerely yours,

/s/ Ival V. Goslin

Ival V. Goslin
Executive Director

IVG/mbg

PUBLIC SERVICE COMPANY OF NEW MEXICO
P. O. Box 1360
Albuquerque, New Mexico

March 31, 1964

Mr. Ival V. Goslin
Executive Director
Upper Colorado River Commission
355 South Fourth East Street
Salt Lake City 11, Utah

Dear Mr. Goslin:

This will acknowledge your letter of March 27 and serves as confirmation of our telegram of this date regarding your request that the Public Service Company of New Mexico assist in furnishing the power and energy to make up the deficiency at Hoover Dam that would be created by holding Colorado River water in Lake Powell.

Please be assured that our Company is willing to enter into negotiations immediately with the Secretary of Interior on the basis suggested in your letter.

As the result of a recent Board study, it is our understanding that there are no physical limitations to the transmission of power and energy to the power users of the Lower Colorado River Basin.

Let me assure you that the Public Service Company of New Mexico will cooperate to the fullest with the Colorado River Commission in this effort.

Very truly yours,

/s/ D. W. Reeves

D. W. Reeves
President

DWR:oj

ARIZONA PUBLIC SERVICE COMPANY
P. O. Box 2591
Phoenix, Arizona

Walter T. Lucking
President

April 1, 1964

Mr. Ival V. Goslin
Executive Director
Upper Colorado River Commission
355 South Fourth East Street
Salt Lake City 11, Utah

Dear Mr. Goslin:

We have given consideration to your letter of March 27, 1964 concerning the availability of electric energy to replace the power that would be curtailed at Hoover Dam by withholding water in Lake Powell.

Only for the purpose of accuracy, I would like to point out that our company did not receive a letter from Governor Clyde, so therefore, we have not been in communication with your good Governor. However, in response to a request by Utah Power and Light Company, we did express our willingness to assist the Upper Basin companies in supplying power and energy to meet Colorado River deficiencies.

I am enclosing copy of a letter which Mr. Forman of our company addressed to Mr. N. B. Bennett on March 12, which expresses our ability, in connection with some of our neighboring systems, to supply approximately 400,000 kilowatts to the Bureau, and our willingness to discuss making it available by sale or on an equitable exchange basis.

We wish to assure you, as we have advised the Bureau and the Upper Basin companies, of our willingness to cooperate with all agencies and Upper Basin companies to assist in solving this very great problem. We believe that our willingness to arrange an equitable exchange of electricity with the USBR meets the conditions outlined in your letter.

Yours very truly,

/s/ Walter T. Lucking

WTL:mft
Enclosure

ARIZONA PUBLIC SERVICE COMPANY
P. O. Box 2591
Phoenix 2, Arizona

A. H. Forman, Jr.
Executive Vice President

March 12, 1964

Mr. N. B. Bennett
Assistant Commissioner
U. S. Bureau of Reclamation
Department of the Interior
Washington, D. C.

Dear Mr. Bennett:

In our meeting in Washington on February 11 you asked about our margin of generation in excess of load and about our ability to sell you energy from our Four Corners Plant. I told you that we expect to use the output of that plant but do have substantial margins in other plants.

In the years 1964, 1965 and 1966 we expect to have capacity in excess of normal reserve requirements which, in connection with some neighboring systems, would permit the supply of approximately 400 mw. As you know, we now have contracts to furnish excess energy to the Bureau. However, if the current water conditions in the Colorado River made it desirable for you to purchase firm capacity, we would be pleased to discuss making it available by sale or on an equitable exchange basis.

We have been asked by Utah Power & Light Company whether we would agree to assist Upper Basin companies in supplying capacity to meet Colorado River deficiencies and have expressed our willingness to do so if needed.

We would appreciate hearing from you.

Very truly yours,

/s/ A. H. Forman, Jr.

AHFORMAN:ddd

IDAHO POWER COMPANY
Box 770
Boise, Idaho

April 1, 1964

T. E. Roach
President

Mr. Ival V. Goslin, Executive Director
Upper Colorado River Commission
355 South Fourth East Street
Salt Lake City 11, Utah

Dear Mr. Goslin:

This will acknowledge your letter of March 27, 1964 regarding the offer of the intermountain utilities to join in making available energy which would avoid the necessity of drawing Lake Powell storage in order to satisfy power delivery obligations below Hoover Dam.

Our offer to participate in this joint effort was made in conjunction with Utah Power & Light Company, inasmuch as the systems of our two companies have been closely coordinated over a great many years in order to make the most effective and economical use of our respective facilities. In keeping with those joint efforts, we are prepared to supply such energy and transmission capacity as we may have available to assist your Commission in resolving this problem and to accept reimbursement under the conditions and in the manner agreed upon by Utah Power & Light Company and the other participating utilities.

Cordially,

/s/ T. E. Roach

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PUBLIC SERVICE COMPANY OF COLORADO
P. O. Box 840
Denver, Colorado 80201

R. T. Person
President

April 1, 1964

Mr. Ival V. Goslin
Executive Director
Upper Colorado River Commission
355 South 4th East Street
Salt Lake City 11, Utah

Dear Mr. Goslin:

We are pleased to reply to your letter of March 27, 1964 in which you set forth the proposal that Public Service Company of Colorado, in conjunction with other utilities in the Rocky Mountain Area, provide the necessary electrical generating capacity and energy to allow the continued filling of Glen Canyon Reservoir as originally contemplated. Our company is happy to cooperate in this important endeavor.

As indicated in your letter, we have participated with various other companies in engineering and power supply studies in an effort to arrive at a solution to this problem. These studies established that the necessary generating capacity and energy can be made available by these companies to supply the deficiency in generation at Hoover Dam created by lowering Lake Mead below 14.5 million acre feet while accumulating the minimum power head at Glen Canyon. We might add that at present our engineering investigation has not disclosed any serious physical limitations in the means of delivering power and energy to Hoover power contractors of a sufficient magnitude to prevent carrying forward your proposal.

In view of the fact that the Secretary of the Interior has indicated some concern over the availability of funds to pay for the necessary capacity and energy to accomplish this purpose, Public Service Company of Colorado is willing to participate in this undertaking on your proposed exchange basis. In this manner payment for power and energy contributed by this and other companies need not be made in cash, but can be repaid by the Storage Project in kind by supplying capacity and energy at agreed times and amounts. The remaining principles and conditions set forth in your letter are equally acceptable to Public Service Company of Colorado, and appear to offer a practicable solution to the problem with which the Upper Basin states are confronted by virtue of the low runoff condition of the Colorado River and its tributaries.

By expressing our willingness to participate in the exchange of capacity and energy as outlined in your letter, we do not wish to foreclose the possibility that other alternative methods might be arranged which would be equally acceptable to this company and would be consistent with your prime objective of insuring maximum water benefits for the Upper Basin states.

We wholeheartedly agree with your statement that the recent action of the Secretary of the Interior, in ordering the release of water stored in Lake Powell for the benefit of power production at Lake Mead makes it imperative that the Upper Basin states find a way to save this water. In order that your proposal may be implemented and placed in actual operation at the earliest possible date, we not only agree to negotiate with the Secretary of the Interior on the basis outlined in your letter, but suggest that you immediately call a meeting for that purpose. We further suggest that all negotiations should be conducted upon a joint basis with full participation by representatives of the Department of the Interior, the Upper Colorado River Commission, and the investor-owned utilities in this area that have agreed to assist in this problem.

We again wish to commend you and the Commission for your dedication to the water interests of the states comprising the Upper Basin of Colorado River and for your collective efforts to bring about an equitable water conservation and storage program. You may rest assured that Public Service Company of Colorado will continue to cooperate with the Upper Colorado River Commission in every way possible.

With best personal regards.

Very truly yours,

/s/ R. T. Person

President

R. T. Person/m

UTAH POWER & LIGHT COMPANY
P. O. Box 899
Salt Lake City 10, Utah

E. M. Naughton
President & General Manager

April 1, 1964

Mr. Ival V. Goslin
Executive Director
Upper Colorado River Commission

Dear Mr. Goslin:

This is in reply to your letter of March 27 regarding the problem of not only retaining the water now in Lake Powell but also increasing its level to minimum power head requirements.

As I indicated in my letter of March 10 to Governor Clyde, our company is willing and anxious, as it always has been, to aid Utah and surrounding states in promoting development of water resources. Since being asked to pursue this matter, our company, in conjunction with other area electric utilities, has made studies and arrived at the conclusion that we are in a position to be of material assistance.

It has been determined that collectively the area's investor-owned utilities can meet the electric power deficiencies caused by lowering the level of Lake Mead while accumulating the minimum level for power head at Lake Powell. This company, in cooperation with such utilities, welcomes the opportunity to negotiate toward this end generally in accordance with the method outlined in your letter. We see no serious problems in following a plan of repayment through a capacity and energy exchange as you have suggested but we are willing to explore other methods of payment the Commission or others may suggest.

In answer to your other question concerning the ability of the transmission system to handle the delivery of replacement power to Hoover power customers, studies have been made of the utility systems and that portion of the Federal system which would be affected by the exchange of power. These studies show that the required amounts of power from the utility systems can be delivered to Hoover and that electrical bus modifications at Hoover would require minimal time and expense. In other words, we know of no serious physical limitations that would either unduly delay or prevent rapid solution of this problem. We also know of no reason why releases of water could not be curtailed so that all possible water could be retained in Lake Powell.

We look forward to an early meeting with your Commission and representatives of the Department of the Interior to resolve this serious problem as quickly as possible.

Very truly yours,

/s/ E. M. Naughton

EMN/ws

PACIFIC POWER & LIGHT COMPANY
Public Service Building
Portland 4, Oregon

D. R. McClung
President

April 2, 1964

Mr. Ival V. Goslin, Executive Director
Upper Colorado River Commission
355 South Fourth East Street
Salt Lake City 11, Utah

Dear Mr. Goslin:

In response to your letter dated March 27, 1964, Pacific will be very happy to join other utilities in the region in assisting in the filling of Lake Powell by furnishing electric power. We are advised that by August 1964 there should be sufficient transmission capacity available to deliver this power to the Lower Colorado Basin from whence we further understand arrangements can be made to deliver the power into California.

The general proposed arrangements indicated in your letter for the delivery and later return of the power would be satisfactory to Pacific.

We are glad to be able to assist in the matter and appreciate this opportunity to be of service.

Sincerely yours,

/s/ D. R. McClung

DRM:rbk

THE CHAIRMAN: Thank you, Mr. Goslin. What does the Commission want to do, if anything, at this point with this report?

COM. BLISS: Mr. Chairman, I assume that the items mentioned in the report will come up for further discussion during the meeting and I now move that the report be accepted and filed.

THE CHAIRMAN: Is there a second?

COM. VAN CAMP: I second it.

THE CHAIRMAN: Any questions? (No response. Thereupon a vote was taken.) Motion is carried; the report is received for filing.

MR. GOSLIN: Mr. Chairman, is it then the desire of the Commission to go on with the presentation of more background data? If so, Mr. Paul Rechard, our Principal Hydraulic Engineer on the staff in Salt Lake City, has a report ready on water supply and reservoir operation which I think you should hear.

COM. CLYDE: Mr. Chairman, it is my understanding that there will be an opportunity later in this meeting to consider further this report?

THE CHAIRMAN: Yes, sir. Mr. Rechard.

MR. RECHARD: Mr. Chairman, I don't have a written report. The water supply situation we are facing as far as filling Glen Canyon Reservoir should start, I believe, with the situation as it now exists or as it existed as of April 1.

At that time Navajo Reservoir had 330,000 acre-feet in storage, Flaming Gorge had 872,000, Lake Powell had 3,000,000, and Lake Mead had 14,600,000 acre-feet. The Bureau estimates that the units of the Storage Project have approximately an additional 10 percent in bank storage.

The various agencies made forecasts of inflow to the reservoirs as of April 1. They are shown on your table, and probably the most important one or at least the one that will have the most effect with the Secretary of the Interior is the Bureau's forecast which is 4,700,000 acre-feet during the April-July runoff period into Lake Powell. The S.C.S. for that same period had a little greater, 5,100,000. The Weather Bureau had a little less, 4,400,000. For the purposes of my studies I used the Bureau's forecast.

The water that is in storage now can be moved around somewhat. However, there are minimum storages that we must recognize. These are not final

figures; however, they were used by me in my studies. I used Navajo could be drawn down to its dead storage level of 175,000 acre-feet; Flaming Gorge to its minimum power head of 275,000 acre-feet; Lake Mead down to 10,700,000 acre-feet, which is the level at which the generators at Hoover Dam run into difficulties we are informed.

Lake Powell, of course, we are attempting to get to 6,124,000 acre-feet. Therefore, the point at which I was aiming was to get Glen Canyon up to elevation 3490 by August 1, which was the date I was informed the first generator would be capable of being operated.

The water that I had to work with then was 171,000 acre-feet that could be drawn from Navajo, 658,000 acre-feet from Flaming Gorge, 3,900,000 acre-feet from Lake Mead, or a total draw from storage of 4,737,000 acre-feet, when added to the forecast for the April-July period of 4,700,000, gave me 9,437,000 acre-feet that I had to work with.

The downstream requirements were about 3,500,000 acre-feet during April-July, giving me a total then possible to use of about 6,000,000 acre-feet, of which I needed at Lake Powell 3,434,000 acre-feet. Therefore, on this basis there is enough water in the system if the forecasts are accurate to fill Lake Powell and not go below the minimum storage in the other reservoirs that I stated earlier, and have a little bit to spare.

COM. BLISS: What is the figure at Hoover?

MR. RECHARD: 10,700,000 acre-feet. That is elevation 1083 approximately.

This is up to August 1; however, the point of danger is after the snow melt runoff has occurred and the stream does not continue to flow enough water to meet downstream requirements. Therefore, the low point of storage occurs in March of 1965.

Looking at the total water supply picture again, we can move from storage 4,700,000 acre-feet, we needed in Glen Canyon 3,400,000, leaving us an excess in storage of 1,300,000 acre-feet. With an estimated inflow between April 1964 and March 1965 of about 8,000,000 acre-feet, subtracting the estimated downstream requirements of about 8,500,000 acre-feet, there was still a little bit of a cushion for consideration.

Using this then, I decided it should be worked through on an operation study. These operation studies are in front of the Commission. I chose to make my operation study only as an example of what could be done, not as a final decision that this is the way that the water should be passed from reservoir to reservoir, but just to see if it were possible.

To give you the criteria I used: Navajo Reservoir, I passed the inflow until the high water was gone, which was through June. Then I drew the reservoir to dead storage by continuing to release from Navajo about the same quantity that I had been during the high water. This resulted in reaching dead storage by the end of August. From then on I held Navajo at dead storage and passed all the inflow.

For Flaming Gorge, the turbines at Flaming Gorge will carry about 5,000 second-feet. This is not exactly correct; that is the elevation in the reservoir now, but it is close so I chose to pass 5,000 second-feet until the reservoir was drawn almost to minimum power pool and a little cushion--I used 50,000 acre-feet as a cushion--then I passed the inflow.

For Glen Canyon, since the generators won't be ready to operate until August 1st there was no need to cover a minimum power pool until then. So on the basis of forecasts and the operation of Navajo and Flaming Gorge which I just stated, I operated to fill Glen Canyon as of August 1. This resulted in being able to release approximately 400,000 acre-feet per month, and then after Glen Canyon reached the minimum power pool I passed the inflow.

Lake Mead, of course, the operation was more or less straightforward. I had the inflow from Glen Canyon, and I used the releases for downstream requirements, and then there was some gain between Glen Canyon and Hoover Dam.

To give you the data that I used in a little more detail, the inflow to the reservoirs was obtained from the forecasts. Rather than just using the figures in the forecast, I went through the records and chose the year which came closest to the forecast. For Navajo that happened to be the year 1956; for Flaming Gorge the year was 1959; and for Lake Powell I had to average the years 1959, '60 and '61. These similar periods were assumed to continue not only for the forecast period but beyond to the end of the calendar year. A thorough check was not made as to the hydrologic characteristics of each of the years after the April-July runoff; however, the records did not indicate there were any unusual occurrences during those years which would invalidate their use.

Starting in January of 1965 I assumed a longtime average, 1906 to 1962, of the present modified inflow to the reservoirs. To obtain the gain from Glen Canyon to Hoover Dam, I estimated it to be the same as the year 1961, which was a year of low runoff. During that year the gain was 836,000 acre-feet, but there was a drawdown in Lake Mead of about 2,000,000 acre-feet during that year. And I estimated that of that 836,000 acre-feet of gain, there was 120,000 acre-feet of bank storage, and therefore the gain should be 716,000 acre-feet for the year. This is within 100,000 acre-feet of the evaporation that I assumed at Lake Mead, incidentally.

For power generation, the schedule of the generator installation that I was informed was in the planning at Glen Canyon, the first unit would be available by August 1, the second unit by September 1, the third unit by October 1, and additional units on four-month intervals. This would make it the fourth unit on February 1 of 1965, and the fifth unit by June 1 of 1965.

The capability of these units at minimum power head has been estimated to be 71,300 kilowatts. Operating this on the basis of kilowatt-hours it grew to about 50,000,000 kilowatt-hours per month, which was the figure I used. And also to figure my energy output factor, I used 78 percent efficiency and a tailwater elevation of 3143.

Hoover generation was computed on the basis that the capability of the powerplant would reduce to about 86 percent of the name plate capacity when Lake Mead was drawn down to elevation 1083. The energy output factors were based on reducing the efficiency starting with 83 percent when Lake Mead was about 14,000,000 acre-feet of storage; 78 percent when it was between 13 and 14; 74 percent when it was between 12 and 13; and 70 percent when it was below 13,000,000 acre-feet. I used a constant tailwater elevation of 646 feet.

In the operation that I chose there would be a reduction of 708,000,000 kilowatt-hours of generation at Hoover Dam through June of 1965. And on the basis of the curve that I used, which I said resulted in 86 percent reduction in the name plate capacity at elevation 1083, the maximum decrease in capability of Hoover powerplant was 142 megawatts. During this time Glen Canyon would generate 1.5 billion kilowatt-hours. Also by June of 1965 the capability at Glen Canyon would be better than 300 megawatts.

Now there are methods of juggling the water among the reservoirs. The one that I used was only an example of how it could be done. I am sure that the Bureau didn't exactly duplicate my figures, probably the utilitities didn't. Anyone else who has made an operation study undoubtedly did not duplicate them. However, they should be within the ball park.

Hydrologically I feel that I can state that there is an advantage to the Colorado River system as a whole in bringing Lake Powell to elevation 3490 by August 1.

To bring us up a little bit more to date, these studies were based on April 1 forecasts. The Weather Bureau, that is Gene Peck in the Weather Bureau in Salt Lake, has at our request made a special mid-April forecast of runoff. They went to a great deal of work to get the information for us, calling most of their stations to find out what has happened in the Basin to the middle of April. Also just this morning they informed me of their 30-day outlook, that is up until May 15th.

The results of their mid-April forecast if you have got it in front of you--I won't read it completely--however, over a large part of the Basin the precipitation was very good, up from 150 to 200 percent of normal for the southwest drainage in Utah, the Grand Mesa area in Colorado and the lower valley areas of the Gunnison River and over the San Juan River Basin. However, the upper headwaters of the Green River and the Upper Colorado River were not very good.

The result of their forecast then is that they reduced the inflow to Lake Powell in forecast by about one percent, which in visiting with Gene, I don't believe that he would say that they can be exactly this accurate. So in effect it is about the same as the April 1 forecast. I have a few copies of Gene's statement which I can pass out later.

Also this morning he informed me of their 30-day outlook, which is for the temperature over the Colorado River Basin to be slightly below normal --this is just slightly below normal--with a tendency for the west side of the Basin, that is Utah, to be near normal. Precipitation is to be more or less moderate, that is about normal, with a very slight tendency to be a little bit below normal in the San Juan Basin. The five-day outlook is for fair skies, as we see now, with some weather to move in after that short period. So in essence, as far as he was concerned, the April 1 forecast will probably be pretty good for the next 30 days.

Are there any questions?

THE CHAIRMAN: Thank you, Mr. Rechard. Does the Commission want to ask him any questions at this point?

COM. BLISS: Mr. Chairman, I don't know whether it is a fair question: He said, as I understand it, that hydrologically there was an advantage to filling Glen Canyon. I wonder if he has translated this into economics.

MR. RECHARD: Pardon me?

COM. BLISS: You said hydrologically there was an advantage. Economically is there an advantage to filling Lake Powell?

MR. RECHARD: This depends, of course, on the rates that are used. I made a study of it. I used a rate for the sale of Glen Canyon energy and I assumed a rate for the purchase of energy to make up the Hoover deficiency, and my study showed that it was economically feasible also.

COM. BLISS: Perhaps this is a question that should come later.

MR. RECHARD: Yes.

THE CHAIRMAN: It has been stated at some length, the utilities have rallied around and made studies of their own to try to discover a solution for this problem. May I present Mr. Leever of the Pacific Power and Light--I got that right, did I not?

MR. LEEVER: You did.

THE CHAIRMAN: I am asking Mr. Leever to present the people from the other utilities that have been working on this program and to direct the presentation.

MR. LEEVER: Mr. Chairman, the utilities in the area were asked to make engineering studies and prepare a report, and so we have done that. We have a report prepared and which is here today to present to the Commission. It is entitled, "Attainment of Minimum Power Head at Glen Canyon Powerplant in 1964". (This report appears on pages 99 through 124.)

The engineers that worked on this report are here: Mr. R. L. Baugh of Public Service Company of New Mexico; Mr. R. F. Walker, Public Service Company of Colorado; Mr. R. W. Moody, Utah Power and Light Company, Salt Lake City. I am C. R. Leever of the Pacific Power and Light Company from Casper. Mr. Walker and Mr. Moody will present this report.

MR. GOSLIN: Mr. Chairman, I noticed Mr. Person, President of the Colorado Public Service Company, in the audience. I quoted rather extensively from his letter to us. I wonder if it wouldn't be appropriate to ask Mr. Person if he has a few words to say.

THE CHAIRMAN: I think he should have a chance to speak back.

MR. R. T. PERSON: Mr. Chairman, members of the Commission, Ival Goslin: I gather from this, such speaking as I do should be of minimum duration. But I do appreciate your making it possible for me to say one or two things that I think are perhaps self-evident.

It goes without saying that we as a company, and our group of companies who are associated in studying this problem, share with you the concern for filling Lake Powell and in turn meeting the deficiency at Lake Mead. Mr. Goslin has very well and capably and concisely presented the background to the problem. He has pointed out the letter which we received from Governor Clyde, the reply by Mr. Naughton on March the 10th, and in turn his letter to the companies, to the individual companies, on March the 27th.

I think it is apparent from the dates on these replies which are contained in your information, that we do share this problem and are concerned with it to the end that maximum benefits might be provided for the Upper Basin Fund, which in turn would provide those participating projects which are important to all of us in this general area.

We recognize also, in making these studies, we proceeded promptly to analyze these questions in the light of the best information that was available to us; and we recognize also that there are many other questions which this Commission and others involved must resolve in order to arrive at the best possible solution.

We recognize that there are questions of a legal nature; we recognize that there are questions concerning the actual hydrological problems of the project, and we have tried to work broadly on a very conservative basis within the realm of this broad concept to come up with a plan that we felt would assist the Commission in its deliberations and the Bureau of Reclamation and the Department of Interior in solving this very critical problem. We feel that we have arrived at a satisfactory solution, and as was indicated in Mr. Goslin's remarks and in his letter, a third problem which enters into this general consideration is the budgetary problem. So we have also tried to work within the broad scope of that particular problem as well as the water and power facets.

I will not belabor this subject any more but before I present Mr. Walker, who I think is going to act as the spokesman for the committee, I want to do this, and I know that my friends and fellow executives of the other participating companies, would like to commend this Commission for the diligence, the sincerity, and the aggressive manner in which they have and are, and we hope will continue, to work with this problem. I assure you that it will always be our desire and our hope to work constructively with you in the broad framework of the questions you are confronted with.

With that I would like to present Mr. Dick Walker of the Public Service Company of Colorado, who participated in these studies and who will make the presentation to the Commission and other interested parties here today.

THE CHAIRMAN: Thank you.

MR. WALKER: I have one chart that I would like to show, that I think would be advantageous to put up here (places chart on blackboard).

Thank you, Mr. Newell, and your fellow Commissioners, and Mr. Goslin. It is certainly a pleasure to be here to present our report.

Mr. Goslin has very appropriately read much of the background to this study, and I would like to take off where he ended, and I will do it in this manner: After talking with Mr. Goslin and looking at the time, I will give you a brief introduction and summary of the results which we have come up with, and then will give you my guesses on the water supply situation; and at that time, if it is close to noon, then we will break and have the discussion of the electrical features and the transmission after lunch. We want to go into this in quite a little detail, and we don't want to have to rush it.

Basically our report covers two phases: The first one is the determination of the amount of Hoover impairment and how long would this impairment last; the second phase of our study covers the transmission and physical arrangements necessary to deliver this power to the Hoover power contractors.

I think you are all aware of the time element involved here and the number of factors involved. Any time you work with water data, every water man comes up with slightly different water figures, and I am no exception. My figures are slightly different than the previous speaker, but we feel they are reasonable and in line with the most reasonable forecast.

Our report shows that if Lake Mead is temporarily reduced below 14,500,000 acre-feet, which is the storage set in the criteria, that Glen Canyon can commence generation in August of 1964, assuming that the units will be available at that time, and this is our understanding, that one of them will be.

Also our studies showed by March of 1965 there would be more than ample Glen Canyon generation to make up for the Hoover deficiencies; in other words, the additional generation at Glen Canyon would be greater than the impairment at Hoover at that time.

For purposes of illustration, our studies showed that for the period April 1 through March of 1965, Glen Canyon would generate a little over 500 million kilowatt-hours and that the Hoover impairment during this time would be approximately 250 million kilowatt-hours. So you can see the difference of 250 million kilowatt-hours would be excess over the impairment.

It is our feeling that if the present filling criteria is followed, this difference in generation would not be available and part of it would be lost entirely; and possibly Glen Canyon could not start generation until June of 1966.

We have been a little more conservative on our study figures than some other people. Our studies show that the Hoover capacity impairment would start immediately with 10 megawatts or 10,000 kilowatts in April of this year, and would build up to 192,000 kilowatts in March of 1965. These figures are of the same magnitude as the previous speaker talked about. Ours are slightly higher.

The Glen Canyon generation would start in August with the availability of the units. For the purpose of our study we used 70,000 kilowatts as the generation of the Glen Canyon units at their minimum power head. For the purposes of our study we used 6,200,000 acre-feet of storage as the minimum power head, and this would increase of course as additional units would be added. We had three units installed by March of next year, which is slightly different than the figure that the previous speaker used, but here again our estimate is somewhat more conservative.

In order to put this in proper sequence, the first thing you have to have if you are going to supply generating capacity or banking or exchange arrangement is the generating capacity. We have analyzed our generating resources, and the six companies--which in addition to the four companies that prepared the report are the Idaho Power Company and the Arizona Public Service Company--by this summer will have a total generating capability of 5,170,000 kilowatts. This is over 20 times larger than the maximum Hoover impairment that could occur, and they would have adequate capacity from a generating standpoint to cover this problem.

We have also made I.B M. digital computer flow studies of the transmission system to determine whether sufficient transmission line capability existed to do this job and have concluded that we can also handle any amount of this power transmissionwise from Arizona over to the Hoover system.

However, as you all well know, it is not possible to supply the Southern California Edison Company and the City of Los Angeles impairment at Hoover without making certain electrical changes. From the standpoint of technical feasibility, we feel the best method of supplying this deficiency and getting it to California would be to switch a Metropolitan Water District unit over to the City of Los Angeles generating bus and then to move a Colorado River Commission unit over to the Metropolitan Water District bus. You would also have to change one transformer connection to take an allotment that goes to the Nevada system off of the City of Los Angeles bus. We will have diagrams and we will go into this discussion of these arrangements in great detail a little later on.

The thing that makes this the best solution as we look at it is that this could be done by just switching--no undue delay involved in ordering

equipment--and in this of course, time is of the essence. The one thing that this plan would require is that the Southern California Edison Company supply their own impairment by an arrangement with them. We have talked to them on a technical level, but, obviously, I cannot speak for the management of the Southern California Edison Company.

As I said, we think this method is probably the best because it can be done with just switching, without entailing any large investment.

If it is determined, however, that we have to supply the total impairment from the Arizona system, this can also be done. This would require paralleling the Southern California Edison 230 kv bus with the Arizona-Nevada --commonly called the States--bus. Paralleling these 230 kv busses would increase the transmission into California, and then by displacement would allow all the impairment to come from Arizona over to that area and into California.

It is our understanding that certain metering and load control facilities would be required which would require a minimal amount of investment at some time for the installation of these facilities. Here again we will explain this in more detail a little bit later on.

The one thing I want to point out is, our report is from an engineering technical feasibility standpoint. We certainly realize there are certain operating contractual arrangements that would have to be modified and worked on, and it would require the cooperation of everybody involved--the Hoover power contractors, the Bureau, the utilities, anyone involved in this. And it is like any type of an arrangement, when you are working with somebody else's system and someone else's system is involved, everyone will have to cooperate and just sit down around the table as has been suggested by Mr. Goslin, and work out all these details. We feel though that our solution is technically feasible. This in a nutshell is our proposal, which we will explain to you now in detail.

I would like to cover now some of the water information that I used, which will be somewhat of a repetition of the previous speaker.

For our runoff we used 8,000,000 acre-feet for the 12-month period beginning April 1 of this year to March 31 of 1965. For our spring runoff we used 4,880,000 acre-feet, which is slightly higher than the Bureau forecast. In order to make our operation study, we prorated these on a monthly basis, based on historical monthly percentages of inflow. And for the following two 12-month periods we used 10,500,000 acre-feet as the probable runoff into Lake Powell.

I might also comment on how we handled the stretch of river between Glen Canyon and Lake Mead. We assumed that the inflow in that portion of the river would be equal to the evaporation loss at Lake Mead. A look at the historical data shows some variation in these two factors, but we believe this to be a reasonable and a conservative assumption. Some people use 100,000 or 200,000 acre-feet increase in that stretch of the river.

For releases from Lake Mead we used an annual figure of 8,500,000 acre-feet, which is fairly close to the average for the water year 1961-62 and the water year 1962-63; and it is also the same figure, as I recall, that the Bureau used in their Colorado River Storage Project payout analysis.

I do wish to point out that the use of this figure for study purposes doesn't necessarily mean that we accept this as the amount of water that should go into the Lower Basin. We are operating engineers and are not attempting to interpret the legal aspects of the Compact, and we based it on those two historical years. And obviously if the releases from Lake Mead are reduced, your problem is reduced, the impairment would be reduced.

Now I would like to show you--rather than read you a lot of figures--I will show you the basis of our operation study.

This is Lake Powell on this side (indicating on chart) and Lake Mead over on the other side. We have shown the years here with the small dashes being the months. On this scale we have shown the elevation of the reservoir, this for Lake Powell, and this is the elevation for Lake Mead.

Under the blue tape, which we have labelled, "Present filling criteria," based on holding Lake Mead at 14,500,000 acre-feet throughout this period, that would be this blue line here.

Using the water assumptions we made--8,000,000 acre-feet this year with 10,500,000 acre-feet in the two following years--this is what the Lake Powell elevation would be following the blue line (indicating). Incidentally this point here is the minimum power head of 6,200,000. It would get down there for one month and then come back down and then June of 1966 would be back up to minimum power head.

Under the proposal we are discussing here today, so modifying the criteria, this is the red line. In this case we brought Lake Powell up to 6,200,000, which is the red line, and held it there until mid 1966, and then let it build up gradually. Of course, when you do this, you have to let Lake Mead drop down, which is shown by the red line here; that goes down and down following the inflow.

At this point here (indicating), we came out 1084 feet, which corresponds to a reservoir storage of 10,800,000 acre-feet, which occurred in March of 1965. This is the point of Hoover impairment of 192,000 kilowatts. The area in here, of course (indicating), this area is about equal to this area; and this area is about equal to this area, which it should be working with the same amount of water. You are just transferring it from here to here, and from here down to here (indicating).

Under the assumptions we have made, however, in addition, with the inflow between the two reservoirs being equal to the evaporation, why any decrease in releases from Lake Mead is just as good as an increase in inflow into Lake Powell. A rough rule of thumb that you can use is 1,000,000 acre-feet difference would make about 50,000 kilowatts difference in impairment. In other words, if we had 1,000,000 acre-feet less release from Lake Mead, the impairment could be reduced some 50,000 kilowatts. Or if you got 1,000,000 more acre-feet inflow into Lake Powell, then we assume you could reduce the impairment also by 50,000 kilowatts.

I think I need to say that also the data involved here in working with a system that is not your own, we gathered together the information that was available to us and made the best estimates we could on this information. We don't hold ourselves as experts in this field. We used as much published data and performance curves as we could find; and our answers will probably vary slightly from other people who have worked out the same answers. I think the picture is the same; the figures might be slightly different but they are all in the same ball park.

I think the important factor is that the impairments are of such magnitude that they can easily be handled by our generation, by the transmission of all the systems and some physical arrangement at the Hoover switchyard.

The next item we would have would be a detailed discussion of the electrical arrangements involved at the Hoover switchyard. I will ask Mr. Goslin, how would you like to proceed? This would probably take what, Bob, 30 minutes?

MR. MOODY: I think it would take about that, or less.

MR. WALKER: It would take close to 25 or 30 minutes to cover these electrical arrangements. We will abide by your decision.

MR. GOSLIN: Do you think you would have plenty of time?

(Commissioners confer.)

MR. GOSLIN: Mr. Chairman, our Recorder I think needs a recess; she has been real busy here. And perhaps if it is all right with you fellows, we will postpone this until after lunch; that might be a good idea.

MR. WALKER: Okay.

MR. GOSLIN: Mr. Chairman, you have had a lot of background information and so on here this morning. I have a little article here that I think you might like to hear. This is a poem that appeared over in one of the papers in Salt Lake City. It was unsigned so I can't give credit to the author.

I also wish to state that it is being read purely for your entertainment. I have no reason whatsoever to read it for any other purpose. In fact, while it uses our good Secretary's name here, I want you to understand that Secretary Udall is a personal friend of mine. I don't mean it as any sign of disrespect to him. But it is an interesting poem and represents another facet of this problem.

It says:

"QUIT TAKING OUR WATER!

It now appears to Utahns
That we pulled one big boner . . .
We robbed our Utah lakes of fish
For Udall's Arizona.

We raised the fish and planted Powell,
They grew to luscious size;
Then Udall opens all the gates
And stole them 'fore our eyes.

When fish go through that dam, my friends,
They're then in Udall's state.
Let's get some legal action goin'
Before the time's too late.

Let's all petition L. B. J.
To crack down on Udall.
Before our "neighbor" wrecks the West
We'd best get on the ball!"

(Laughter.)

MR. ECKLES: The luncheon is going to be here in the Argonaut Hotel, and our reservation is between 12:00 and 12:30 at your pleasure.

MR. GOSLIN: Thank you, Dick.

MR. SPARKS: Members of the Legal Committee, could we meet over in the Water office library at 1:00 o'clock, briefly.

THE CHAIRMAN: We will stand in recess than until 1:30 p.m.

(11:45 a.m., Noon Recess.)

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(1:30 p.m., Meeting resumed. All Commissioners present.)

THE CHAIRMAN: Mr. Kuiper?

MR. KUIPER: Yes.

THE CHAIRMAN: You have an announcement to make? We will be happy to hear it.

MR. KUIPER: There are some new developments that have come up in this Mexican salinity problem, and there are several representatives of the Committee of Fourteen, including Nevada, and we would all like to meet at 8:30 in the Water Board library tomorrow morning. If all of us meet, with one from each State, we could get the information out. That is across the street in the State Services Building in Room 215.

THE CHAIRMAN: The utilities have the floor.

MR. WALKER: Mr. Bob Moody of the Utah Power and Light Company will now discuss the electrical arrangements and transmission aspect of our report. Bob.

MR. MOODY: Mr. Chairman, my part of the report will be pertaining to the electrical transmission system and the physical arrangement of Hoover plant.

This map I have here shows the principal transmission lines in the Western United States. Obviously all the lines are not there in New Mexico and California and Nevada. I have shown enough to illustrate how we would interconnect and satisfy by transmission any impairment that may be developed at Hoover.

At the present time the Northwest power pool and the Rocky Mountain power pool, encompassing this region up here (indicating on map), has approximately 16 million kilowatts installed capacity. Electrically separated from there at this time along the Colorado, Utah and Arizona, New Mexico lines are the Pacific Southwest power pool. That system has approximately 18 million kilowatts installed capacity.

This year there will be an electrical tie between these three power pools, and it will run in the vicinity of the Utah-Colorado-New Mexico-Arizona lines. These ties are coming as a result of the Colorado River Storage Project, the lines that are associated with it. The initial tie that could be made would be August, about the same time as the first unit would be available at Glen Canyon. That tie could be made from the 230-kv system coming out of Salt Lake to Glen Canyon and then over Federal lines from Glen Canyon over to Shiprock, whereby it could be tied with the systems of the Public Service of New Mexico and Arizona Public Service. That would then make a connection in this manner through here (indicating on map).

Later this year, I believe it is scheduled about September, the Bureau 345 kv line from Glen Canyon to Phoenix will be available for operation. Then we will have a fairly substantial electrical intertie between the Northwest and Pacific Southwest.

Our problem is supplying over this network the impairment as it develops with Hoover. The impairment, if this plan is adopted, would commence in April, progressively increase through the months; but up until August there is no tie in the Upper Basin area, and, therefore, impairment as it developed would initially have to be satisfied from the systems of Public Service of New Mexico and the Arizona Public Service Company. They have sufficient capacity to meet any impairment as it develops at that time. After the tie is made, then by system operations and transfers it is possible together with the generation at Glen Canyon to schedule impairment power to Hoover contractors; and that would be accomplished with the various networks that would be connected at that time.

We have made studies to determine capability of the system in its various stages, and we find that the transmission network as it will be connected is easily capable of supplying the maximum amount of Hoover impairment. That is a figure somewhere around 360 megawatts. We did not have to go that far in our studies, but the system itself is capable of putting 350 megawatts over to the river.

This comes about largely because during summer operation the transmission lines going southeasterly into Arizona from Hoover have power flow in that direction. The effect of the power generated in New Mexico and Arizona, Utah, Colorado and so forth, would be to transmit that power into

the Arizona system, and Arizona, in turn, would further transmit that to the river; the river plants being Parker, Davis and Hoover. But the effect would be to turn that power around first and then transmit it further in towards California.

So that our studies have shown that we can get easily the transmission to the river, Hoover and the adjacent plants. But with the arrangement at Hoover it is not possible to utilize all of that power unless certain modifications are made. That leads us into Hoover switchyard.

This is a very simplified diagram of Hoover (indicating chart). The open positions here merely indicate that there is no electrical connection across there, and this is just showing the normal method of operation. There is no attempt to show the number of circuit breakers and disconnect switches which are there.

Basically, Hoover as it operates, it has, I believe, five power contractors. They of course have the electrical facilities; they own and operate those facilities as their own. Here is California Electric (indicating), now Southern California Edison, beginning up at this point (indicating).

Then they have Unit A9, which is a Colorado River Commission unit, or commonly referred to as Nevada. Its power goes into the 69 kv system.

Then the City of Los Angeles has six units. Capacity out of two of these units is available for Colorado River Commission.

Metropolitan Water District has three units and its 230 kv bus at this point (indicating). And N8 is again a Colorado River Commission unit, or called Nevada. Arizona Power Authority has the two units frequently referred to as Arizona; and Southern California Edison, the three units.

In our studies we have found that we could easily supply without any changes at all at Hoover, any impairment that developed for Nevada, Arizona and Metropolitan Water District. That maximum amount would be 84 megawatts, at the time the total impairment would be 192 as we previously mentioned. By transmission that could be supplied with no further changes.

Now if it is desired, and the plan we have recommended as being technically the best would be to make an arrangement whereby we could supply the City of Los Angeles, and Southern California Edison Company carrying its own. The only means of getting capacity in the City of Los Angeles is to transfer units or allocations of power to the City, in effect creating a larger impairment over on the Arizona side, and that impairment in turn would be supplied by transmission out of Arizona.

We have a switching proposal here that would show basically how we would change from this arrangement to the one where we are supplying the City of Los Angeles.

(Transparency placed over chart.)

Can you gentlemen see this?

We have the transparency showing the switching changes that would be made. Green indicates the opening changes and red indicates closing.

Under this condition of 192 megawatts impairment at Hoover, we would supply the City of Los Angeles by transferring a Metropolitan Water District unit, N5 to the City of Los Angeles bus--opening here and closing this (indicating), this sequence to get it on the network in this manner. We would transfer the allocation of Bank Y to the City of Los Angeles. That is a 40 megawatt rated transformer. So for our purpose, we have considered 40 megawatts being available from these two units for the City. And, therefore, we would require closing here (indicating) to take care of the load that is normally supplied off these lines from the transmission system, and opening up the network here, leaving the transmission normally through this Bank Y to the City. Their change would be to take Unit N8, which is a Nevada unit, and transfer that to the Metropolitan Water District. That, in effect, replaces the unit losses from Metropolitan Water District. Then the impairment would be supplied, this transmission system supplying the total (indicating).

I have a few figures here which might illustrate briefly what that impairment is in regard to the City. Under this condition the City of Los Angeles would have an impairment of 66 megawatts. To satisfy that 66 megawatts, there would be 40 megawatts from Bank Y and from Unit N5 26 megawatts, providing the 66 megawatts.

In developing the impairment at Hoover totally, N5 has a capacity of 71 megawatts at this particular head. We are using 26 for the City. That leaves 45 megawatts unused from the unit, which does create an additional impairment.

So to illustrate what the total impairment would be, we have 192 megawatts all unused, unused from Unit N5 is 45 megawatts, creating a total of 237 megawatts impairment.

Southern California Edison, if they supplied their own, would supply 42 megawatts, that is including California Electric; and from the transmission system in Arizona there would be supplied 45 megawatts.

This method is the one that we believe is the simplest; the one that can be handled by merely switching and no investment.

We looked further into another method if it is desired that the total impairment be supplied from the transmission system. We have a proposal to that effect which we will show you on this next transparency.

(Transparency placed over chart.)

Of course, it is obvious if transmission of power is going right into Los Angeles for those that are involved, mainly Southern California Edison, there will have to be some additional transmission capacity from Arizona into the Southern California system. The studies have shown that if we take an initial step towards increasing this transmission capacity between Arizona and California, we would propose an electrical tie between what we call the Southern California Edison 230 kv bus and the States 230 kv bus--the states meaning Arizona and Nevada. This, of course, puts in more lines.

This map is not very clear, but it in effect ties more lines together running to Los Angeles, for which more power can be transmitted across.

To accomplish that we do basically the same thing for the City of Los Angeles as discussed previously by transferring Unit N5 to the City, an allocation out of Bank Y to the City. To make this connection at Hoover between the States and Southern California Edison, it is just a matter of closing some switches, to do that.

However, in the process it does involve certain facilities, and, as we understand it, it would be principally metering facilities which are required for energy accounting and system operation, for load control and dispatching purposes; very probably some other minor changes, relay changes and switching, but we do not believe this to be of a large magnitude.

With the network so connected as described here, together with the changes in the City of Los Angeles, we could then supply the total impairment developed at Hoover; and the figure that we have is 237 megawatts, that includes Southern California Edison.

I believe that covers my phase of it, Dick, unless there is anything more you think I should say.

MR. WALKER: Okay, Bob, thank you very much. This essentially completes our report. I might just summarize very briefly.

Our water studies do show that Glen Canyon could start operating this August or September and that this Hoover impairment would be created on around 200 megawatts which could be supplied. We as utilities have generating capacity to do so. There is transmission line capacity available to get the power there. And with the switchyard changes proposed and discussed by Mr. Moddy there are two methods of making arrangements at the Hoover switchyard to carry this out.

I would like to point out that this would require the cooperation of all the parties involved--the operators there, the Bureau of Reclamation, the people that are going to supply the energy with us in this case--but I think if everybody wanted to solve this problem, this could be done.

I would like also to express our willingness again on this banking of energy and capacity. We have capacity that can be banked; and to us this looks like a real good solution of this and gets you out of the appropriations thing. And we are willing to bank and take it back at a time when they would have generation to do so.

The arrangements that would be made between the companies, obviously our five or six companies would have to work out our own arrangements for taking care of this. We have explored this and can do this. As Mr. Moody mentioned, in the early months Arizona and New Mexico are the only ones that can physically supply it when there is no connection. After that, it can be taken from various parties and paid back to various parties.

As stated in Mr. Goslin's letter on the energy, there would be a cost of money thing. Some of you would have to expend money for fuel to produce this energy and would have some working capital tied up.

We have done the best job we could with the data involved here, and we are certainly willing to sit down and work with the parties involved tomorrow, the next day, or any day that you want to. We are willing to cooperate to the fullest extent, and I think I can speak for all the management in that respect. We want to help, we want to get Glen Canyon operating, and this looks like it might be the way to do it. We have a lot of problems to solve however.

THE CHAIRMAN: We greatly thank the utilities.

COM. BLISS: I would like to ask Mr. Walker if the companies have any choice in these two selections. Is there any one or the other you feel is better as far as arrangements or complications?

MR. WALKER: From the time standpoint, the first method that requires none of this metering equipment for load control and accounting purposes, would be the better because it is just a matter of closing switches. The other could require some time to install metering equipment and this type of thing, which would be a matter of months. So just from the time standpoint--and time seems to be critical--we would say this would be preferable. Of course, that means Southern California Edison would have to cooperate.

MR. BLISS: Moneywise there would be little choice in the two?

MR. WALKER: I don't know exactly what this metering and load control equipment would cost, but it would be very minimal as investments go.

MR. GOSLIN: One of the great questions that will come up with regards to this, of course, is going to be the rate, in other words, the cost of this energy. Of course we have noticed in here that you have not used any rate figures or cost of money figures specifically; and you stated, I think, just a moment ago that was due to the fact that the various companies have different rates of money costs, and they would have to have facilities tied up in the process if this is done.

Are you as a group of companies in a position to sit down and talk with the representatives of the Secretary of the Interior and other interested parties about what that cost might be? I am referring specifically to Paragraph (d) of the proposal that was sent in my letter to you, that:

> "the amount of energy to be returned under (c) to be increased over the amount delivered by a fixed percent per year as compensation to the companies for the cost of money associated with the 'banked' energy."

Could you elaborate any further on that question?

MR. WALKER: I think Mr. Person would like to take that one.

MR. R. T. PERSON: Maybe I can answer that very quickly.

No. 1, we are prepared to sit down and discuss it in the light of your letter. We think it is worthy of emphasis that we do not contemplate the payment of cash for the exchange of energy.

There are some variations insofar as cost of money and the obligations of the various companies involved. The plan would contemplate that an increment of energy would be returned to the companies in order to compensate

them for that. This hasn't been precisely determined. I am sure that it is fair to say that I would not visualize there would be any problems in that general connection.

On the extremely low side, I think those who view this from an objective viewpoint visualize that something in terms of six percent energy per year might very well be in line; and recognizing also I think that if that ran to as much as, let us say, ten percent, this would still make the plan a very feasible one.

So within the broad range of that general concept, I feel confident that I can say on behalf of the companies there would be no reason why we could not arrive at a successful arrangement or satisfactory arrangement in order to accomplish these exchanges of capacity and energy.

Does that satisfy you?

MR. GOSLIN: Yes, I think that answers my question. I asked the question, Mr. Person, of course, because that is one question that anybody else is going to ask us or you when you sit down around the conference table.

COM. CLYDE: Mr. Chairman, I would like first to commend the utilities for this very excellent definitive report. It appears to offer a solution to this problem which we face; namely, to provide energy and capacity to make up the impairment in power output at Hoover, to provide transmission facilities and to provide a means of paying for the cost of this operation. It in effect answers the questions which we are facing as to how we can operate the river, bring Lake Powell up to the minimum head and keep the impairment in Hoover at a minimum.

Therefore, Mr. Chairman, I move that a copy of this proposal entitled, "Survey Report, Attainment of Minimum Power Head at Glen Canyon Powerplant in 1964", be transmitted this day to the Secretary of the Interior; and that the Executive Director of the Commission urge the Secretary of the Interior to institute negotiations immediately directed toward accepting the plans outlined in this report.

THE CHAIRMAN: You have heard that motion. Is there a second?

COM. BLISS: I will second the motion.

THE CHAIRMAN: Any discussion? Are you ready to vote?

COM. BLISS: Question.

(Thereupon a vote was taken.)

THE CHAIRMAN: Motion carried. It is so ordered.

MR. GOSLIN: Mr. Chairman, the other day I had a phone call from a friend of mine who represents one of the Hoover power contractors, who wanted to know if he could come to this meeting. I told him certainly that he could. I think it is very well that he is here today because as was so ably expressed by Mr. Walker, any plan of this kind is going to require the cooperation of all parties concerned.

Mr. Pat Head of the Colorado River Commission of Nevada is sitting in the back of the room. I do not wish to put him on the spot but I would like to have, if he feels that he could do so, a statement from him with regards to whether he and his organization would be willing to sit down and talk about this plan in the interest of seeing if it could be made practicable.

MR. HEAD: Yes, Ival, thank you. I can't speak for the Lower Basin of course, but I can speak for Nevada. We certainly not only would be willing to sit down, but I think the solution to this problem is for the Southern Division Hoover contractors to sit down with the Upper Basin people, with the power companies and with the Secretary's representatives to work this out. I am sure we can all work it out and come to a satisfactory conclusion.

But I have noticed a viewpoint in this procedure that has taken place on the filling criteria recently. I have one question to ask Mr. Moody, if he was aware of the installation of Bank Z along with Bank Y.

MR. MOODY: I believe Bank Z is one that is to be paralleled with Bank Y?

MR. HEAD: Right.

MR. MOODY: For the supply to U.S.B R., Boulder City?

MR. HEAD: Yes.

MR. MOODY: As I understand the allocation, there is 60 megawatts from the City of Los Angeles Units A1 and A2.

MR. HEAD: I have nothing else except I appreciate being here. I am enjoying getting the information this way rather than getting it over the telephone or someone telling what went on at the meeting.

MR. GOSLIN: We are glad to have you here and we appreciate your statement very much; and you can tell your other friends in the Lower Basin we want to sit down and talk with them about this matter.

MR. HEAD: Thank you.

MR. WALKER: We do have a five-page summary of this report. It may be some people here would like to have it. We don't have enough with the attachments, but we do have the summary that I will leave on the table.

THE CHAIRMAN: Anything further?

MR. KUIPER: This is apart from the problem at hand but we would like to get some information right away. Mr. Friedkin from the International Boundary Commission is in town and he can meet with us this afternoon. How many of your people, the Committee of Fourteen people, would like to meet this afternoon with Friedkin?

(Informal discussion.)

THE CHAIRMAN: I have always forgotten how to address you, Governor Johnson, whether it is Senator or Commissioner or whatnot, but you have the floor.

COM. JOHNSON: Thank you, Mr. Chairman. I want to discuss the theme that the Secretary discussed this morning. I have some copies of what I am going to say and anybody that wants a copy may have it.

(Document distributed.)

Mr. Chairman, I want to discuss the matter our Secretary discussed this morning from this point of view: That here in this great problem we have two basins--not just one basin, two basins. And so far as the legal procedures are concerned, these two basins are very different, one from the other. I think there must be a great deal of confusion over the fact that we have two basins and that they are so different. I think it makes our problem much more difficult because we get these two basins confused in their operation. I have tried to approach this matter on the basis that we have two basins, and that I want to talk about the Upper Basin.

As I say, about the only thing they have in common is that they are on the same river, the Colorado River; and beyond that, besides a few obligations and burdens that have been placed upon the Upper Basin to serve the Lower Basin, they are not at all similar.

On August 25-27, 1920, the League of the Southwest--and that was the Daddy of the present organization--assembled in Denver, just across the street from where we now sit, to develop a practical plan for negotiating a Seven-State Compact. Governor Campbell of Arizona presided. Delph

Carpenter, Colorado Water Commissioner, proposed that the League utilize the treaty making procedures provided in the Federal Constitution, and which is open to the states. The League agreed, and this course of action was adopted and to a considerable extent it has been followed.

In five of its original articles, treaty making by the states is authorized and circumscribed by the Federal Constitution. I quote them here:

> "Article I, Sec. 10, Par. 3: No state shall, without the consent of Congress . . enter into any agreement or compact with another state. . . .
>
> "Article II, Sec. 2, Par. 2: He (the president) shall have power by and with the advice and consent of the Senate, to make treaties, provided two-thirds of the Senators present concur;
>
> "Article III, Sec. 2, Par. 1: The judicial power shall extend to all cases in Law and equity, arising under. . ., treaties made, or which shall be made . . . .
>
> "Article III, Sec. 2, Par. 2: In all cases affecting Ambassadors, other public ministers and consuls, and those in which a state shall be a party, the Supreme Court shall have original jurisdictions.
>
> "Article VI, Par. 2: All Treaties made, or which shall be made, under the authority of the United States, shall be the Supreme Law of the Land, and the Judges in every State shall be bound thereby, anything in the constitution or laws of any State to the contrary notwithstanding."

The Founding Fathers could not have made it clearer that treaties and state compacts cannot be interpreted, altered, amended or modified by Congress. No court other than the Supreme Court has jurisdiction in a compact case in which a state is a party--no court has jurisdiction except the Supreme Court. However, the Seven-State Compact itself provided that it could be terminated at any time by the unanimous agreement of the signatory states, and, of course, it could be amended by those states also, but only on a unanimous basis. No one state can amend this Compact.

So it is not true--and I have heard it stated, and that is the reason I have stated here--it is not true that Congress amended or interpreted the Seven-State Compact or the temporary Six-State Compact by the enactment of the Boulder Canyon Project Act. Congress had no such authority, and it did not attempt to do so. The Boulder Canyon Project Act did not dot an "i" or cross a "t" in any article, paragraph or provision of either of these compacts.

President Hoover was very careful to not make the Project Act effective by Presidential Proclamation until after six states, including California, had ratified the Colorado River Compact, and the California Legislature had accepted the limitation of 4,400,000 acre-feet of water as being California's maximum share as required by this act; and this act I am talking about is the Boulder Canyon Project Act. By this clever and effective maneuver, President Hoover made certain that the Boulder Canyon Project Act was subservient to the Colorado River Compact. You hear it stated otherwise, but I think this distinctly clarifies that situation and makes the Project Act secondary, which, of course, it is.

As a matter of fact this act of Congress, and I mean the Project Act, has the identical relationship to the Seven-State Compact in the Lower Basin as has Public Law No. 485 authorizing the Colorado River Storage Project in the Upper Basin. Both can be amended, modified, changed or repealed by Congress; that is, the Boulder Canyon Project Act and Public Law No. 485 are subject to the will of Congress. Congress can change them any time that they want to, but Congress cannot change the Compact, and neither can the Secretary of the Interior, but he hasn't found that out yet. That is but one of their differences to the Seven-State Compact. Congress can amend, repeal, restrict or do anything it wishes with and to the Boulder Canyon Project Act.

On July 19, 1940, Congress did amend this act by the enactment of the Boulder Canyon Project Adjustment Act. I was a member of the Senate when that act was passed and supported it at the urgency of Secretary Ickes. But neither Congress nor the Secretary of the Interior can touch a solitary provision of the Seven-State Colorado River Compact. And only the Supreme Court in the Judicial Branch of Government can interpret it. If the Secretary understood that, he would not be violating its provisions, and if the Upper Basin realized this extraordinary status, as they should, it would not permit the Secretary to make the Compact his personal puppet. Sometimes we must conclude that the Upper Basin doesn't really know what a solid foundation legally they stand on.

The Glen Canyon Dam 13 miles downstream from the Utah-Arizona boundary cost more than $425,000,000 to construct. It is a very important unit of the Upper Basin.

It will store more than 26,000,000 acre-feet, backing water 196 miles up the Colorado River and 71 miles up the San Juan River. It will have an average annual generation of 4.1 billion kilowatt-hours. Now this 4.1 is an earlier estimate; we have some more recent estimates here today and they would be much more accurate. Its reservoir, Lake Powell, will be useful for river regulation, power production and sediment control. It will

catch 80,000 acre-feet of sediment annually and extend the life of Lake Mead 200 years. It will be the big revenue producer for the entire Upper Basin. It will insure Upper Basin delivery at Lee Ferry of 7,500,000 acre-feet every year. And that is an important thing, to have that flow going down there constantly year after year, not high water one year and low water the next; and that is the reason that we built these reservoirs, so we will have an even flow, and that is especially important and necessary in the production of power and in the regulation of the river.

The Colorado River Compact imposes a terrifying burden on the Upper Basin. Before the people of Denver or Colorado Springs or the Air Force Academy can take a drink of Colorado River water, before Northern Colorado or the Arkansas Valley can turn a drop of Colorado River water on their parched crops, to say nothing of the Western Slope of Colorado, the State of Utah, Wyoming and New Mexico, 7,500,000 acre-feet of water must be delivered to the Lower States at Lee Ferry. Of course, we know that is on a ten-year basis, 75,000,000 acre-feet in those ten years, but that is a terrible burden.

I was in the Colorado Legislature when this Compact was ratified by the State of Colorado, and I objected strenuously to that provision. Instead of dividing it so each of them would get their water, we gave the Lower Basin the preference.

But Delph Carpenter, a brilliant lawyer and a great patriot, and Ward Bannister, another great water lawyer, called on me and said, "We don't want you to oppose it, we want you to go along because we are getting some advantages too. We are in a bad position with the Lower States because they are in shape to go ahead with the development, and under our doctrine of first-in-time, first-in-right, with this kind of a doctrine we are in grave danger." And then they pointed out a recent decision that shook all of Colorado and that was the Wyoming-Colorado case in which the first-in-time was the first-in-right was extended interstate and made available to the lower states on a river.

It is not a share and share alike proposition; it is a preference arrangement--a preference arrangement, mind you. Can we be blamed if we try to protect ourselves and the Lower Basin? Protecting them too, trying to give them good water service, that is what Glen Canyon will do for them, and give them 200 years' longer life by collecting sediment. Can we be blamed if we utilize Glen Canyon for the wholesome and prudent purpose for which it was built? Are we ready to accept Glen Canyon as a monument to the perfidy of the Secretary of the Interior? Slaves would do so, but not proud states, and we are proud states.

In 1923 when they preached a good neighbor policy--and they preached it to me--did Delph Carpenter, Ward Bannister, S. B. Davis of New Mexico, R. E. Caldwell of Utah and Frank C. Emerson of Wyoming believe for one split second that we were dealing with water thieves? And yet today when

we attempt to fill our own Lake Powell with our own water--not with somebody else's water, with our own water, mind you--to protect ourselves and the Lower Basin, the Secretary of the Interior illegally and arbitrarily and against our wishes opens the gates of Glen Canyon! I want to ask in all seriousness: Is he inviting mob rule by that illegal and arbitrary action?

The Compact requires the Upper Basin States to deliver at Lee Ferry 75,000,000 acre-feet in each ten-year period--I am explaining why that is our water and this is the reason it is our water. The Compact requires the Upper Basin States to deliver at Lee Ferry 75,000,000 acre-feet in each ten-year period; and in this present ten-year cycle, instead of delivering 75,000,000 we have delivered 93,740,000 acre-feet. 18,740,000 acre-feet of it was Upper Basin water. We must have 3,000,000 acre-feet to put the Glen Canyon powerplant into production, and the Secretary unlawfully denies us that lawful right by opening our gates and taking our water!

We have met our commitment. The Compact gives us the consumptive use of 7,500,000 acre-feet of water, and the only string on it is that commitment. Now we have met that commitment, and we are entitled to that much water because we haven't used 7,500,000 acre-feet consumptively in the Upper Basin, and so it is our water. And it is our reservoir, Lake Powell is our reservoir. We built it; and the water that we are putting in it is our water, and we have a clear title to it, and the Secretary has no right to take a drop of that water.

Maybe I am using some strong language, but I grew up in an irrigation country, and when they take water that belongs to somebody else, sometimes a shotgun comes into good play. Many men have been murdered for stealing water. It is a high crime. And people will take a greater offense at a crime of that kind than they will an ordinary crime.

Once the Upper Basin has enough water in Lake Powell to put its powerplant into production, the Upper Basin out of the goodness of its heart, and not because it is required by the Compact to do so, is willing to permit all the additional water at Glen Canyon go on down the river to Lake Mead and carry these folks over their present predicament of water shortage, but we are doing that out of the goodness of our heart and not because somebody has a lash to use upon our naked backs.

The Secretary vetoes that good-will settlement of an emergency caused by his own incompetence. Stupidly he failed to harbor water to carry him over the temporary shortage at Lee Ferry which he knew would occur when Glen Canyon was being put into energy production. The minute that Glen Canyon was authorized by the Congress of the United States they knew, the Secretaries of the Interior, whoever they may have been, knew, and they should have been storing that water because it was precious, mighty precious. The evidence supports a record of reckless water extravagance below Lee Ferry especially in 1962, 1963, and in previous years.

The United States is required by treaty to deliver to Mexico 1,500,000 acre-feet of water annually but during the period when we should have been storing water in Lake Mead, 10,000,000 acre-feet was being poured into the Gulf of California, wasted, lost.

Here is the unbelievable record of incompetence by the Secretaries of the Interior. I could have included other years but I have included the year 1958 and so on:

Year	Excess delivery of Water to Mexico over and above required deliveries of 1,500,000 acre-feet
1958	4,909,000 acre-feet
1959	2,196,000 acre-feet
1960	1,243,000 acre-feet
1961	509,000 acre-feet
1962	267,000 acre-feet
1963	616,000 acre-feet
Total	9,740,000 acre-feet

It is a good guess that there were other excesses of water wastage or unnecessary uses which would bring this total to more than 15,000,000 acre-feet. This excess should have been stored in the reservoirs below Lee Ferry to carry us over the period of drastic reductions at Lee Ferry which everyone knew was coming--the inevitable period when we would put Glen Canyon into energy production.

Mr. Sparks has asked the Interior Department to give us the figures on the amount of water that was in excess to the water rights of the people that used the water in the Lower Basin, but we haven't had a reply yet, or, at least, so far as I know, there has been no reply. I hope that when Mr. Dominy gets here tomorrow he will have accurate figures on that and an explanation of how come.

On July 1, 1962, Lake Mead contained 24,600,000 acre-feet of water. Since that date the Upper Basin delivered at Lee Ferry water that had not yet reached Lake Mead, 10,400,000 acre-feet. And yet on January 1, 1964, Lake Mead was down to 16,000,000 acre-feet; and April 1st Lake Mead was down to 14,500,000 acre-feet. What became of all of this water? What became of it?

It would do no harm if Lake Mead were reduced to 12,500,000 acre-feet instead of 14,500,000, so I am told. Production of energy would be slightly reduced but the private power lines have offered to supply this shortage of falling water production of power. From where I sit it appears to me the Secretary of the Interior is determined to keep Glen Canyon out of production for some reason or other. There will never be a better time to get it going than this spring and summer. The law is on our side and common sense is on our side. Remember, it is Upper Basin water the Secretary is confiscating.

And I want to read you a statement here of some pretty good lawyers. Lawyers often caution me not to be making so much talk about the legality of matters, and I apologize because I do it so often. But in this case I brought in eight mighty good lawyers--not just ordinary run-of-mine lawyers, not just country laywers--I brought in eight Justices of the United States Supreme Court to talk a little about the two Basins. I am going to quote from the Supreme Court decision in Arizona versus California; I am on Page 16 of that now. I am just going to read very little, not very much; don't get nervous.

> "Nothing in that Compact"--they are talking about the Colorado River Compact--"purports to divide water among the Lower Basin States"--that is among the three states--"nor in any way to affect or control any future apportionment among those States or any distribution of water within a state." They kept clear out of that. "That the Commissioners were able to accomplish"--that is the Commissioners who wrote the Compact--"That the Commissioners were able to accomplish even a division of water between the Basins is due to what is generally known as the 'Hoover Compromise'."
>
> And this is the Hoover Compromise: "Participants (in the Compact negotiations) have stated that the negotiations would have broken up but for Mr. Hoover's proposal: that the Commission limit its efforts to a division of water between the Upper Basin and the Lower Basin, leaving to each Basin the future internal allocation of its share."

That is the end of that quote. Here the Supreme Court begins talking:

> "And in fact this is all the Compact did"--that is, divided the water between the two Basins.

They didn't try to divide the water between the States. In the Upper Basin we have the Upper Colorado River Basin Compact of our own. In the

Lower Basin they couldn't get that job done. But we got the job done, and that is why I say that the Upper Basin is dissimilar to the Lower Basin in many regards, and that is one of the most important.

> "To begin with, the Act explicitly approves the Compact"--that's the Boulder Canyon Project Act--"To begin with, the Act explicitly approves the Compact and thereby fixes a division of waters between the Basins which must be respected."

That is what my eight lawyers said that that division must be respected. The Secretary does not respect it.

> "Further, in several places the Act refers to terms contained in the Compact. For example, Section 12 of the Act"--and that is still the Boulder Canyon Project Act--"adopts the Compact definition of 'domestic', and Section 6 requires satisfaction of 'present perfected rights' as used in the Compact. Obviously, therefore, those particular terms, though originally formulated only for the Compact's allocation of water between Basins, are incorporated into the Act and are made applicable to the Project Act's allocation among Lower Basin States. The Act also declares that the Secretary of the Interior and the United States in the construction, operation, and maintenance of the dam and other works and in the making of contracts shall be subject to and controlled by the Colorado River Compact. These later references to the Compact are quite different from the Act's adoption of Compact terms. Such references, unlike the explicit adoption of terms, were used only to show that the Act and its provisions were in no way to upset, alter, or affect the Compact's Congressionally approved division of water between the Basins."

Let me read that again. We are talking about the problem of water between the two Basins. That is what we are talking about. That is what we are in trouble about. That is what we are arguing about. And my eight lawyers say:

> "Such references, unlike the explicit adoption of terms, were used only to show that the Act and its provisions were in no way to upset, alter, or affect the Compact's Congressionally approved division of water between the Basins."

How much plainer can you get a statement than that? But that's what these eight lawyers call attention

> "They were not intended to make the Compact and its provisions control or affect the Act's allocation among and

> distribution of water within the States of the Lower Basin. Therefore, we look to the Compact for terms specifically incorporated in the Act, and we would also look to it to resolve disputes between the Upper and Lower Basins, were any involved in this case."

The Supreme Court don't know about this argument we are having out here all by ourselves--"were any involved in this case".

Now I want to go over here to Page 34 of the Supreme Court's decision in the case between Arizona and California. They are talking over here about something that is very important to us and a very important point in this whole dispute; and that is the power of the Secretary.

Now the Secretary was given tremendous power in the Boulder Canyon Project Act; but the Project Act itself applied only to the Lower Basin. There is no question whatever about the Secretary having tremendous power and tremendous authority in the Lower Basin, but he does not have any power at all of this nature in the Upper Basin. He has no right to be taking our water; he has no authority to do anything of that kind.

> "It specifically set out in order the purposes"--the Boulder Canyon Project Act--"for which the Secretary must use the dam and reservoir:"

Here are the uses for which he must use it.

> "'First, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses and satisfaction of present perfected rights in pursuance of Article VIII of said Colorado River Compact; and third, for power.'
>
> "The Act further requires the Secretary to make revenue provisions in his contracts adequate to insure the recovery of the expenses of construction, operation, and maintenance of the dam and other works within 50 years after their construction."

And that is what we were concerning ourselves with in the United States Senate, I think it was in 1944, when we passed the Boulder Canyon Project Adjustment Act.

> "The Secretary is directed to make water contracts for irrigation and domestic uses only for 'permanent service.'"--but he was to make them all in the Lower Basin, not in the Upper.

> "He and his permittees, licensees, and contractees are subject to the Colorado River Compact, and therefore can do nothing to upset"--listen to this--"and therefore can do nothing to upset or encroach upon the Compact's allocation of Colorado River water between the Upper and Lower Basins."

These eight lawyers of mine say he can't do one thing about that he evidently heretofore hasn't read the decision in this lawsuit.

> "In the construction, operation, and management of the works, the Secretary is subject to the provisions of the Reclamation Law, except as the Act otherwise provides."

This particular part of the Supreme Court decision was made to explain what powers the Secretary has or doesn't have. That has been quite a dispute in the Lower Basin. In the Upper Basin there is no dispute because he has none. But in the Lower Basin there has been considerable dispute about it, and that is what the Supreme Court is talking about.

> "One of the most significant limitations in the Act is that the Secretary is required to satisfy present perfected rights, a matter of intense importance to those who had reduced their water rights to actual beneficial use at the time the Act became effective. And, of course, all of the powers granted by the Act are exercised by the Secretary and his well-established Executive Department, responsible to Congress and the President and subject to judicial review."

That is in the Lower Basin.

> "Notwithstanding the Government's construction, ownership, operation, and maintenance of the vast Colorado River works that conserve and store the river's waters and the broad power given by Congress to the Secretary of the Interior to make contracts for the distribution of the water"--that is all down in the Lower Basin--"it is argued that Congress in Sections 14 and 18 of the (Boulder Canyon Project) Act took away practically all the Secretary's power by permitting the States to determine with whom and on what terms the Secretary would make water contracts. Section 18 states:
>
> > "'Nothing herein shall be construed as interfering with such rights as the States now have either to the waters within their borders or to adopt such policies and enact such laws as they may deem necessary with respect to the appropriation, control, and use of waters within their borders. . . .'"

I could go through this decision and point out to you maybe as many as twenty places where the Supreme Court talks about the 7,500,000 acre-feet of water that the Upper Basin shall let flow down to Lee Ferry--at least that many cases. And I don't see how there could be any reserve in anyone's mind in reading this document and noting all the times that they talk about that 7,500,000. And that is all they talk about, that is all the water they talk about, is that 7,500,000 that we have assumed very reluctantly, but we have assumed it, and we have to let it go down there. And the Supreme Court has taken notice of that and discounts that as one of the parts of this whole problem; the 7,500,000 acre-feet is going down there and the Lower Basin States are going to use that water. It is taken for granted that it will be there, the Supreme Court has said.

We are stuck; we have to let it flow down there. But we don't have to let more than 7,500,000 acre-feet flow down there. We don't have to let the Secretary come up to Glen Canyon and open the gates and take our water that we have such a great use for.

I thank you very much for letting me get this off my chest. (Applause.)

THE CHAIRMAN: The next item is the Report of the Treasurer, I. J. Coury.

(Documents distributed.)

MR. COURY: Mr. Chairman, members of the Commission, the Report of the Treasurer is for the period July 1, 1963, to March 31, 1964, which represents three-quarters of the fiscal year.

	1st Nat. Bank Grand Junction Operating Account	U.S. Bank GrandJunction Motion Picture Account	Total Account
Balance on deposit per bank statements, July 1, 1963	$ 55,953.26	$ 742.31	$ 56,695.57
Less outstanding checks, 7/1/63	3,771.04		3,771.04
	$ 52,182.22	$ 742.31	$ 52,924.53
Cash received during period	79,915.00		79,915.00
	$132,097.22	$ 742.31	$132,839.53
Less Cash disbursements during period:			
For expense of prior year	$ 1,262.40		$ 1,262.40
For operating expenses	51,990.71		51,990.71
	$ 53,253.11		$ 53,253.11
	$ 78,844.11	$ 742.31	$ 79,586.42
Add outstanding Checks March 31, 1964	4,368.97		4,368.97
Balance per bank statements March 31, 1964	$ 83,213.08	$ 742.31	$ 83,955.39

The Cash Statements prepared in the office of the Executive Director of the Upper Colorado River Commission for the period ending March 31, 1964, have been distributed to the Commissioners, Treasurer, Assistant Treasurer and the Finance Committee Chairman.

COM. CLYDE: Mr. Chairman, I move the report be accepted.

THE CHAIRMAN: Is there a second?

COM. BLISS: Second the motion.

THE CHAIRMAN: It has been moved and seconded that this report be accepted. (Thereupon a vote was taken.) Motion carried. The report is accepted.

The next item is the Report of the Legal Committee.

COM. BLISS: Mr. Chairman, before you start with the Legal Committee, I would like to say that since the unfortunate and untimely death of Dudley Cornell, one of our legal advisers to the Commissioner, I would like at this time to appoint Harlan Flint as a legal adviser to the Commissioner from New Mexico in place of Dudley Cornell.

THE CHAIRMAN: Thank you. It is certainly accepted.

COM. BLISS: I think you were introduced before, but I wish you would stand up and take a bow, if you will.

MR. FLINT: Thank you (standing).

THE CHAIRMAN: The Legal Committee, Mr. Sparks.

MR. SPARKS: Mr. Chairman and gentlemen of the Commission: Governor Johnson has upstaged the Legal Committee, and we are in thorough agreement, I will say, with what he had to say. And since he has already thrown the wildcat in the hen house, I suppose we can continue in the same vein.

We have some specific recommendations to make to the Commission. First I would like to preface them with a few remarks telling why we feel the way we do.

It has already been mentioned by Governor Johnson that the Upper Basin was sold a bad bill of goods, or to quote a poor pun, was sold down the river in 1922, and what we all thought was an equal division of the water, turned out to be not that way at all.

When these filling criteria first came up some years ago, I think it was realized by every member of the Commission, and certainly as well by the Legal and Engineering staff, that there were very obvious dangers posed in those filling criteria to the Upper Basin. We pointed out those dangers as forcefully as we knew how and objected strenuously to many provisions of the filling criteria.

I was somewhat appalled to read in the press a few weeks ago a release purported to come from the Bureau of Reclamation that these filling criteria were adopted as a result of agreement among the States. No such thing occurred. This was a one-party agreement--the agreement was arrived at by the Bureau of Reclamation.

At that time the State of Colorado started the preparation of a document on a crash basis using consultant help, the best we could find. We sent our staff and consultants into the Lower Basin and interviewed power users, water users, and went into the operation of Hoover Dam, met with the International Boundary Commission, and surveyed the river from Hoover on down to Mexico. We prepared a publication entitled, "Future Operation of Glen Canyon Reservoir as related to the Colorado River Compact."

The fears that we had and the fears that the other states had have now come to pass. Our only fault was that we fell in with that possibility that perhaps the weather would be kind enough to eliminate any future controversy, but we knew better. The weather has not created any problem; the weather has only exposed this situation. When you build upon a rotten foundation you come back eventually to a rotten condition. But we have been equally guilty with the Bureau of Reclamation in believing that weather would solve our problems.

It goes back to the old saying, in connection with the Colorado River Compact and now with the filling criteria that we let slide by--it is a saying with a moral: "Rape me once, shame on you; rape me twice, shame on me." And this is exactly what we have done. We have allowed this situation to go on merely by protesting in the form of letters without any specific recommendations. The Legal Committee is about to propose some specific recommendations.

The filling criteria, as we all knew and pointed out at its original inception, placed the entire burden of stream deficiencies on the Upper Basin and placed the Upper Basin at the complete mercy of the Hoover Dam operation and particularly the Hoover Dam power contractors.

It has been said that the Government is anxious to protect its investment at Hoover, and, therefore, the reason for Glen Canyon not being allowed

to fill. This is an astonishing philosophy. The Congress has authorized for appropriation to date over one billion dollars for the Upper Basin Projects. The remaining Federal investment in Hoover Dam is less than 100 million dollars. So this is a case where ten dollars are sent to chase one. So we cannot understand a philosophy of protecting the Federal investment in Hoover.

Secondly, we have been told that the Federal Government is under an obligation to deliver power to the contractors at Hoover Dam. Nothing could be further from the truth--nothing could be further from the truth. When the Hoover Dam power contracts were entered into they plainly stated in each contract that the Government did not guarantee the delivery of any water or the delivery of any power. This was a fully recognized fact, was accepted by the power contractors at Hoover Dam when the contracts were first entered into.

Neither has Congress nor the contracts ever indicated that there was any obligation on the part of either the Upper Basin or the Federal Government to deliver power to the Hoover Dam contractors. Yet suddenly we find a philosophy which is to the effect that the Hoover Dam contractors are a sacred cow and take precedence over everything else in the river. They are given favored and preferential treatment by virtue of what authority we have not yet been able to determine.

We have been told constantly that unless this filling criteria were agreed to, the Lower Basin would bring a suit against us to stop the construction of Glen Canyon. Now we have never found the Hoover contractors nor the Lower Basin interests to be unreasonable at any time throughout this long period of the authorization of the Colorado River Storage Project Act or subsequent negotiations with them. We have found them to be most reasonable at all times. I am not stating that they are to blame at all in the situation we find ourselves today.

The gentleman from Nevada hit the nail on the head, the vacuum has existed in the negotiations between the two Basins. And I am fully convinced that if this problem had been left up to the two Basins some years ago, there would be no problem today. Our problem emanates from that City known as Washington, D. C.

You have all heard of scrambling devices, which is a device put on telephone or radio communication to deceive the listener. We have a scrambling device in Washington when it comes to communication between the Upper and Lower Basin. We think there are no real issues in controversy between the two Basins except those artificial impediments which have been created in Washington.

We have had the utmost cooperation from the Bureau of Reclamation in the Colorado River Storage Project. The people who have worked on those projects have been devoted to their jobs, and on the regional level. We can do nothing more than to acknowledge the tremendous contribution of the Bureau of Reclamation. But for some reason or other, there is somebody in Washington determined that at all costs the Federal Government must honor those power contracts at Hoover.

Now we are willing to assist in their being honored within reasonable limitations, and we will point out shortly here a method. But what Governor Johnson has stated is correct, there has been a prodigious waste of water from Hoover Dam. And today the filling criteria is nothing more than a relationship with the releases at Hoover, which again is nothing more than a discretion of the people who are operating and ordering the operation of Hoover Dam. They are simply unable to recognize the facts of life, that another reservoir is on the river.

There is a saying that you can't teach old dogs new tricks. We submit to them, to get some new dogs on the job.

We have said that this foundation was rotten from the beginning, and it is now being blamed on the weather. You will recall that in recent months there was a great scandal in New York in connection with certain brokage firms. A certain gentleman pledged thousands of gallons of nonexistent soy bean oil and accumulated debts running into many millions of dollars. When the price of soy bean oil suddenly dropped, he had to make up his margin and was unable to do so. There was no foundation for the market that he was building up.

And there has been no foundation for the filling criteria which was foisted upon the Upper Basin. We are completely at the mercy of what is considered to be the necessary releases from Hoover Dam. As Governor Johnson has pointed out, there has been little or no attempt to improve that situation.

The Legal Committee for over a year now has been preparing exhaustive information in connection, first, with the treatment of the Lower Basin tributaries. We have compiled, primarily through the Commission's office and their counsel, Mr. Billhymer, voluminous briefs and information on the treatment of tributary problems. We are continuing those briefs on all aspects of the Colorado River problem.

The Legal Committee would be the last one to recommend precipitate legal action. There is an old saying that most lawyers know and remember that goes something like this:

"Here lies the body of Jonathan Gray,
He died defending his right-of-way.
He was legally right as he sped along
But he is just as dead as if he were wrong."

California found this out in the Arizona-California suit. So the chances are that the protracted litigation would do nothing more than further muddy the water in the Arizona-California way, adding to our problems rather than solving them. But there comes a point where you have no other recourse, so the Legal Committee is preparing for that today. We believe however that most of the salient issues can be solved by reasonable agreement among the States, and only on one of these points we have here we believe there is any disagreement and that is on the part of one State only.

We recommend that positive action be taken along the following lines and the resolutions and the necessary legislation be prepared within the next 15 to 20 days, and that a special meeting of the Commission be held immediately thereafter to consider these resolutions that will be prepared along with the legislation.

This very day hearings are being held in Washington on the Central Arizona Project. Yet the States have nothing to offer in a way of constructive amendments to that legislation, nor has the Commission. We think this is a lamentable situation and must be remedied immediately.

First, we recommend that legislation be introduced immediately to accomplish the return in full of all funds and the value of power, whether primary or secondary, diverted from the Upper Basin Fund to make up so-called deficiencies at Hoover Dam.

In the filling criteria it was promised that something would be done along this line after 1987. Now we cannot postpone today's problems we feel until 1987. I for one doubt I will be around here in 1987 unless I am as hardy as Governor Johnson, and I am not.

In this connection we think we can work out a reasonable agreement with the Lower Basin States so that they can receive power that will permit them to get along, and at the same time our Basin Fund could be fully reimbursed. The criteria provides for the return of some funds after 1987, but only a small part. In other words, we were thrown a small bone and said, "Well give us ten dollars today, and we will give you a dollar back in 1987." That is the effect of the filling criteria. If we lose a dollar today, we want a dollar back in 1987 or before because we are not talking about peanuts, as one of the high ranking members of the Bureau of Reclamation staff told

us in Washington one time; we are talking about millions and millions of dollars. Perhaps to him a million dollars is a peanut, but it is a million dollars to me and to all of us in the Upper Basin, and we believe that this can be accomplished, as has already been pointed out.

We suggest that legislation be immediately prepared to amend the Boulder Canyon Project Act to provide that the Colorado River Development Fund of $500,000 a year be immediately applied to the power deficiencies at Hoover, and applied thereafter as long as necessary and until the Upper Basin Fund is reimbursed 100 percent for the diversion of either money or power from that fund.

This to us is an equitable arrangement, and it should attract the economy-minded members of Congress because that $500,000 a year is presently non-reimbursable to the Federal Government. In other words, it is a gift by the Federal Government to the seven states of the Colorado River. We in the Upper Basin feel that this is part our money, and it is part the Lower Basin's money. So we think it is a neighborly division or return of the money to the Federal Government of the $500,000 a year from all of our pockets.

This can be accomplished by a simple amendment to the Boulder Canyon Project Act. It will not increase the cost of the power to the Lower Basin users; it will permit them to receive their full contract amounts and will provide a return of $500,000 a year to the Federal Government that it would not otherwise get.

Secondly, in any legislation which is introduced, or which will be introduced, to authorize either the Central Arizona or the Pacific Southwest Water Plan, that an amendment must be put onto that legislation to the effect that the State of Arizona shall agree or must agree that the Lower Basin tributaries must be accounted for as part of the water allocated to the Lower Basin under Articles III (a) and (b) of the Colorado River Compact; that unless such amendments are agreed upon that the Upper Basin will oppose with all the vigor at its command any authorization of any of the Pacific Southwest Water Plan or any of its component parts.

Now is the time to strike. This opportunity, as Governor Johnson said, will never pass this way again. This is a way to eliminate we think a lawsuit on this critical problem. If the State of Arizona is going to maintain that it is not bound by the Colorado River Compact, it is time the Upper Basin found it out.

Three, that action be taken immediately to reduce or eliminate the regulatory waste below Hoover Dam. Now those figures have run as high as a million acre-feet annually, what is conveniently charged off in the Bureau

reports as regulatory waste. And most of them are not regulatory wastes at all; they are the result of water which could be properly accounted for.

One significant use is the illegal use of water by illegal occupants of Federal lands along the lower Colorado River. This is an incredible situation and exists only because the people who started that practice were former members of the Bureau of Reclamation. It may be that there is something sacred about not kicking those people off of Federal land. But if this practice is continued, we should urge the President to open up lands in the Upper Basin so we can privately hold them without buying them, without paying taxes, and have the Government give us free water, and have them paid retirement funds from the Federal Government!

It is an incredible set of circumstances. It takes one order to get these people off, and they are consuming in excess of 100,000 acre-feet of water annually. In the entire authorization of the Colorado River Storage Project, Colorado had five projects authorized which we fought for for 50 years, and they utilize less water than do these illegal occupants of Federal lands on the lower Colorado River.

We submit that a resolution should be framed by the Commission directed to the President, to the Secretary of the Interior and to the Attorney General of the United States that immediate legal action be instituted to return this land into Federal ownership; or in the alternative that the people be allowed to purchase the land and that it be included as part of the project so that proper accounting for the water can be made. At the present time it is the Upper Basin that is furnishing that 100,000 acre-feet of water to those illegal occupants of Federal lands.

Fourth, that the dilution of the water of the Colorado River be immediately stopped. As Governor Johnson has pointed out, many hundreds of thousands of acre-feet, as a matter of fact, millions of acre-feet in just the past few years over and above the requirements of the Treaty with the Republic of Mexico have been allowed to flow down the Colorado River. In recent years part of that excess delivery has been to dilute the saline waters in the lower reaches, the water originating from the Wellton-Mohawk Project in the State of Arizona.

Again it is Glen Canyon which is bearing the burden of that dilution and the Upper Basin. Everything that is done apparently down there, it should be the Upper Basin that has to take care of it; this is the prevailing philosophy. If legal action is necessary on this point, then we should institute it.

We are willing to work with the State of Arizona, this Committee of Fourteen, to solve that problem, and admittedly it is a problem, and we would like to see it solved. But we do not consider it a solution, in order that we

should receive credit for 40,000 acre-feet of water, bad water, that we should chase it with a hundred thousand acre-feet of good water. That makes no good sense but it is being done today.

We hope the Committee of Fourteen can come up with a reasonable solution, and certainly we will work with Arizona to the end that they are not charged with this water for a reasonable period of years; but the present solution is no solution at all.

Fifth, that interconnection be immediately provided at the switchyard at Hoover Dam. Again this is an impossible situation where, as shown by this diagram, there is a series of disconnected generators. This has resulted in a prodigious waste of water and energy at Hoover, a situation which continues to this date. And the cost of this interconnection is relatively minor; it is less than our Fund is being bled for each year to make up these power deficiencies.

The Colorado River Storage Project Act directs the Secretary to interconnect these systems to make the maximum use of the power produced by the two systems. How can that be done without an interconnection at Hoover Dam? Right today we are faced with a problem of how to replace river power to the Lower Basin because of this lack of interconnection. I don't think you will find another powerplant in the United States, and possibly the world, that is so operated.

We think that a resolution should be adopted by the Commission urging immediate action and we should assist the Lower Basin in securing appropriation for this point.

And one other point: The Lower Basin was charged by the Boulder Canyon Project Act with the repayment of the flood control capacity of Hoover Dam. I forget what the charge was but I think it was in the magnitude of $25,000,000.

We think this is an improper charge against the Lower Basin and insofar as we know, no other project, no other Federal project in the United States is so constituted so that flood control is charged to the project.

We think some remedial legislation should be sought along this line, and again we are willing to assist the Lower Basin to take a tremendous burden off them in the payment of that project and give them equal treatment with all projects in the United States.

Mr. Chairman, that is our report.

THE CHAIRMAN: There is a request for a break. Is there any objection to a recess for 10 minutes? (No response.)

(3:10 p.m., Recess.)

(3:30 p.m., Meeting reconvened.)

THE CHAIRMAN: You have heard the Report of the Legal Committee. What do you want to do with it?

COM. CLYDE: Mr. Chairman, I move we accept the Report of the Committee, and I think there will be a resolution introduced covering it.

THE CHAIRMAN: Is there a second?

COM. VAN CAMP: Second.

(Thereupon a vote was taken.)

THE CHAIRMAN: The Report of the Legal Committee is accepted.

COM. JOHNSON: Mr. Chairman, I offer the following resolution and move that it be adopted, and let the Secretary read it.

MR. GOSLIN: All right, sir.

"I move that the Legal and Engineering Committees be instructed to prepare the necessary resolutions and legislation to accomplish the five recommendations contained in the Report of the Legal Committee.

"I further move that this Commission meet in special session within the next 30 days to discuss the resolutions and legislation so prepared."

COM. JOHNSON: I so move.

COM. CLYDE: Second the motion.

THE CHAIRMAN: You have heard this motion and its second. Is there any discussion?

COM. BLISS: Question.

(Thereupon a vote was taken.)

THE CHAIRMAN: Motion carried; the resolution is adopted. Those Committees are so ordered.

MR. GOSLIN: Mr. Chairman, speaking for Mr. Sparks and myself, we will have the necessary meetings to draw up the necessary documents.

THE CHAIRMAN: The next item on the agenda is Unfinished Business and the Report of the Commissioner of Reclamation. It is understood that the Commissioner of Reclamation will be here tomorrow morning. What is the wish of the Commission?

COM. CLYDE: Mr. Chairman, if it is appropriate I would like to submit a resolution.

THE CHAIRMAN: It is in order.

COM. CLYDE: Since the President's budget was prepared, certain developments and progress has been made with respect to the Central Utah Project in my State. The definite plan report is now complete, the Conservancy District has been organized, the repayment contract can be prepared we hope in about six months, which means that actual construction of that project could start in 1965 were appropriations available.

I would therefore like to submit for the consideration of the Commission the following resolution:

"WHEREAS, the States of the Upper Colorado River Commission have traditionally worked for development of the water resources of the Basin and have given unified support to the early construction of participating projects; and,

WHEREAS, the Central Utah Project is an authorized participating project; and,

WHEREAS, the Definite Plan Report for the Bonneville Unit of the Initial Phase has been completed by the Regional Office of the U. S. Bureau of Reclamation; and,

WHEREAS, the Central Utah Water Conservancy District was officially created by the District Court on March 2, 1964; and,

WHEREAS, the Project is needed; and,

WHEREAS, appropriations are needed to initiate construction, it should be supported by the Upper Colorado River Commission:

NOW, THEREFORE, BE IT RESOLVED that the Upper Colorado River Commission and the individual states it represents, do hereby give support to the inclusion in the Reclamation Appropriation Act an item of $1,500,000 to commence construction during fiscal year 1965."

I move the resolution be adopted.

COM. JOHNSON: Second the motion.

THE CHAIRMAN: You have heard that resolution read, the motion that it be adopted and the second. Is there any discussion or question?

COM. BLISS: Question.

(Thereupon a vote was taken.)

THE CHAIRMAN: The resolution is adopted.

COM. CLYDE: Mr. Chairman, I have another suggestion I would like to make for the consideration of the Commission. It has developed over recent years that the problem of water pollution has become of major importance and that there are many actions being taken at the present time with respect to the matter of water pollution. I am not sure of the organization in the respective states, but in my State we have what we call a Water Pollution and Control Board, the director of which, I think, could make a contribution to the Engineering Committee.

I am wondering if it wouldn't be desirable, if it is in the interest of the respective states to authorize a member or representative of the water pollution agency in the respective states to be made a part of the Engineering Committee of this Commission.

The purpose of that proposal is simply to bring into focus the matters of pollution as they might affect the projects which we have under consideration.

MR. GOSLIN: Mr. Chairman, the reason I hastily grabbed this Tenth Annual Report was to look up the By-Laws of the Commission to see what might be necessary in order to comply with them. May I have just a moment?

(Mr. Goslin examines book.)

COM. CLYDE: I might say, Mr. Chairman, my purpose of bringing this up is not necessarily to get action right now, but I thought the idea was worth considering.

THE CHAIRMAN: We would like to have comment or discussion in any case.

MR. GOSLIN: Mr. Chairman, may I speak to the motion? I realize I don't have a vote, but for a good many years our staff has been watching this problem of pollution more or less strictly on its own because we realized that it was a very important problem as Commissioner Clyde has pointed out.

I feel quite strongly that we should definitely have some close liaison with members of the pollution control boards in the various states. Therefore, I would certainly look with favor upon any manner of getting this problem of pollution before us and in giving our staff or its committees official authority of the Commission to pursue it.

The problem of pollution in the Colorado River Basin is becoming recognized more and more every day. The Department of Health, Education and Welfare of the Federal Government has been asked by the various Health Departments of the states to set up committees. They have regular meetings. I have been asking Mr. Billhymer to attend these meetings to make reports to us with respect to what transpires there. And certainly I believe that this action that is being asked by Governor Clyde is in the best interests of the Upper Basin and of the Commission.

I am not exactly sure of the desirability of having a member appointed from each state as a member of the Engineering Committee because of so many other duties that the Committee has. Although if that is the way that the Commission directs that it be done, certainly we would recommend that suggestion from the Commission.

COM. JOHNSON: Mr. Chairman, I would like to move to have the matter lay over and have a report from the Secretary with respect to it for consideration at the next meeting.

COM. CLYDE: Second the motion.

MR. GOSLIN: Is that satisfactory to you, Governor Clyde?

COM. CLYDE: Yes.

MR. GOSLIN: I am certainly not opposing it. I am for the idea very strongly, but just want to be sure we do it in a proper manner is all.

COM. CLYDE: I think we should study it.

COM. BLISS: Mr. Chairman, I think I would like to take a little time to think this matter over.

Let me say this: It appeals to me that the action of the Health, Education and Welfare and the State Health Departments in many instances seem to be at cross purposes to what we as a Commission are attempting to accomplish. Now perhaps Governor Clyde's suggestion is a way to bring them into camp--I don't know. But I do think there should be closer liaison between this Commission and the Health, Education and Welfare and the State agencies and see if we can't perhaps direct some of their activities more in line with what we are attempting to do.

COM. CLYDE: It might be one way to find out what they are doing.

MR. GOSLIN: Mr. Chairman, I certainly concur with what Mr. Bliss has said. As I indicated a moment ago, I have been asking Mr. Billhymer to follow this matter closely. He has done so and has been attending all the meetings to which he could get. I would like to have him say a few words about the subject, its importance and so on, if he would.

MR. BILLHYMER: Mr. Chairman and Commissioners: Right now there is pending in Congress a bill in the House to amend Public Law 660 for the third time to increase the authority of Health, Education and Welfare in the field of water pollution. It seems as if it is stymied.

Now I talked to Lynn Thatcher from Utah, who is the pollution man representing Utah on this Colorado River pollution; and he tells me that the States may have derailed the thing.

There was a provision in that bill that is kind of interesting--I think we sent a memorandum around to everybody on this--which provided for quality standards in river basins of the United States, determined by the Secretary of Health, Education and Welfare.

Colorado River pollution problems will be considered May the 26th and 27th, I know, in Las Vegas, New Mexico. This will be the fifth conference on this.

A VOICE: Nevada.

MR. BILLHYMER: I am sorry. They wouldn't go to New Mexico; you can't gamble there. I. J. used to have some tables there but they took them out.

As I understand it there is a new program. The program is going to be continued, what they had before. They are going to make an economic study, and I believe it is Dr. Wollman from New Mexico that is in charge of the economic study, evaluation of water uses.

I think this is something that this Commission better take a good look at because they are going to evaluate or attempt to evaluate the value of an acre-foot of water in various water uses, and there are some people in our Basin that are very enthusiastic about it. In other words, an acre-foot of water may be a lot more valuable for trout than it is for the project you are trying to advocate.

They are also going to take another look at pollution by pesticides and residual fertilizers in farming. This has some real interesting aspects and may well mean that some of our farmers are going to find themselves enjoined from the type of farming they have been used to by the Health, Education and Welfare because they are polluting the Colorado River.

And you have read in the papers what happened along the Mississippi, about the fish killed down there. Thatcher again told me that they are appalled at what they found in those fish. The fact of the matter is they found two poisons they don't even know a name for which still killed the fish.

So this H. E. W. stuff on pollution is really a potent thing, and let me warn you, they have the authority to act. Now I am just clueing you, Public Law 660 gives the Secretary of Health, Education and Welfare real authority and there are real teeth in it. Blatnik and some of the other people--what is the name of the man from Maine?

A VOICE: Muskie

MR. BILLHYMER: --Muskie, are real eager to give him more authority. The strange thing is that the Health, Education and Welfare people are reluctant to grab the authority Congress is willing to give them; this is the thing that is kind of amazing. But it looks as if it may get crammed down their throats. This group has money. Frankly, I think they are also looking for people to help them out and are willing to cooperate with people. The ones that I have talked to are very receptive to discussion.

It seems to me it is time we get on the ball and work with them rather than to find them looking down our throats and telling us what to do. And I think they are willing to work with us at this time.

THE CHAIRMAN: Thank you.

COM. VAN CAMP: Mr. Chairman, just a brief remark. Governor Clyde, we certainly concur in your concern on this matter of pollution, particularly in regard to the legislation that Mr. Billhymer has just referred to that was passed by the Senate last November.

I believe the matter has been called to the attention of several groups, and I am happy to report that as far as the State of Wyoming is concerned, we did take action even though it was passed in the Senate.

We understand it is in the House, and we are opposed to these amendments permitting Health, Education and Welfare to have this additional authority. I would concur in the thought that you had expressed here, that we explore this as has been explained here to see if better coordination can be had within the activities of the Upper Colorado River Commission.

That is all I have to say.

COM. CLYDE: Thank you. I believe Mr. Kuiper had his hand up down there.

THE CHAIRMAN: Mr. Kuiper.

MR. KUIPER: Along with what Paul Billhymer said, I might report that the Council of State Governments is actively and almost unanimously opposing the amendments which are proposed for 660, and certainly we are supporting that opposition.

One further thing let me say, any of you who have seen this proposed study of the Colorado River, there is one thing that is extremely frightening to me and that is the evaluation of damages to the quality of water in the river by uses upstream whether they be irrigation or what have you. And as I read this, it is possible to incorporate as a cost of future projects in the Upper Basin the damage that they may cause to the water which is downstream. This is very frightening to us, and we have come up with nothing on what to do about it.

But I would like to commend to any of you that have an opportunity to take a look at this report. It sure scares us.

MR. BILLHYMER: You are talking about the report that came out of this Denver conference just the other day?

MR. KUIPER: One I sent you a copy of.

MR. BILLHYMER: We got a copy.

THE CHAIRMAN: Is there further discussion?

COM. CLYDE: Mr. Chairman, I would like to raise another red flag. All I know is what I read in the newspaper. But this action which was recently taken to bring power from the Pacific Northwest into this area at 2.2 mills would appear at first glance to pose a very definite threat to all future reclamation projects which depend on power revenues for payout. Our rate for the Colorado River Project is 6 mills. If they can bring it in here for 2.2 mills, what is it going to do the power we generate in our plants? Of course you know that 2.2 mills can be brought in only because of Government subsidy.

I merely drop that as a suggestion to you. I think you ought to be thinking about it.

MR. GOSLIN: Mr. Chairman, the only other item I had on the agenda --I referred to it briefly in my report this morning--that is the matter of the appropriations for the Colorado River Storage Project for the fiscal year 1965. If I recall correctly, I suggested that the Commission should decide at this meeting how it wished those hearings handled this year.

Last year we asked our four Governors to appear before the House Committee on Appropriations. We have done that on several occasions. On several occasions we have done it in other ways by having Commissioners appear, or I have appeared on numerous occasions.

I think it is only fair that the Commission express its will with regard to this question.

COM. BLISS: Mr. Chairman, it seems to me that the presentation by the Governors makes a very effective presentation for the Committee. If it is at all possible I would hope that the four Governors could go back again for the presentation in regard to the appropriations for the 1965 fiscal year.

If it is in order, I will move that the Secretary approach the problem in this manner and see if we cannot arrange for the Governors to be back there for the hearings.

THE CHAIRMAN: You have heard the suggestion, which is a motion?

COM. BLISS: It is a motion, that is right.

COM. VAN CAMP: I second it.

THE CHAIRMAN: And the second.

COM. JOHNSON: Did you get the word "invite" in there--inviting the Governors to do it?

COM. BLISS: I will so amend my motion if it isn't there.

COM. JOHNSON: Put it in there.

COM. BLISS: We will invite them to go back.

COM. JOHNSON: I would like to have it in there because you can't be telling these Governors what to do. (Laughter.)

THE CHAIRMAN: Is there any comment or discussion on this matter? The motion is that the Secretary invite the Governors to follow out that program.

COM. JOHNSON: Right.

(Thereupon a vote was taken.)

THE CHAIRMAN: Motion is carried. The Secretary is instructed.

COM. VAN CAMP: Mr. Chairman, I have just a few words to say here in I hope the closing of the meeting here, and I am not going to elaborate on any details at this time, but I think I want to reaffirm our concern as far as Wyoming is involved in the seriousness of this situation in regard to Glen Canyon.

I think it is apparent that the action that has been taken has been taken on rather short notice in order to get the job moving, and I hope we can get it done. In other words, time I think was and is of the essence.

I want to express appreciation as far as Wyoming is concerned to the utilities that have appeared here today in a very outstanding presentation of this problem. And last but not least, I want to express our thanks to the Commission staff, which has required an extraordinary amount of time and work on their part in preparing the meeting that we have had here today--I think this is a good example to show in handling situations of this nature, of what can be done--as well as thanks to the other Commissioners of this Commission, and particularly Governor Clyde. Thank you very much.

MR. GOSLIN: Mr. Chairman, I believe it would be appropriate to announce that this meeting of the Commission will continue tomorrow morning at 10:00 o'clock in this room.

MR. BARLOW: Mr. Chairman, may I ask in the motions that were made by Governor Johnson and Governor Clyde, is it the feeling of the Commission that we have taken appropriate action, if it is the sense of this Commission's thinking at this point that we are in agreement that the gates be closed at Glen Canyon at an appropriate time, maybe day after tomorrow or some similar suggested date; or is it necessary to discuss it any further? A matter of information.

MR. GOSLIN: Mr. Chairman, tomorrow representatives of the Bureau of Reclamation and the Department of the Interior will be here for a presentation. I have no doubt that after they appear the Commission will probably wish to take some additional action. The matter that Mr. Barlow has mentioned could more properly be discussed at the meeting tomorrow than it could today.

THE CHAIRMAN: We asked them to come, didn't we?

MR. GOSLIN: Yes, sir. They told us they were coming.

THE CHAIRMAN: Any comment?

COM. CLYDE: Mr. Chairman, just for the purpose of amplification, you will recall the motion, Norm, that I made has to do with the report submitted by the utilities specifically and the further action by the Commission I am sure will come after we have the meeting tomorrow.

This motion you will recall specified that the report be transmitted this day to the Secretary of the Interior and the Executive Director urge the Secretary of the Interior to institute negotiations immediately towards implementing this plan. So that was specific, as far as that goes.

MR. BARLOW: That was my inquiry, Mr. Chairman, as to what Governor Clyde has just said.

I do think, I am sure that this Commission and those that are in this room feel that now we have data that has been presented today, that we do have an urgency relative to some regulation at Glen Canyon. Official action of this Commission I am sure will be had at the appropriate time.

I would hope the discussions here--it is an open meeting--I would hope that it would get onto all the wires and the Commissioner and the Secretary of the Interior would know we have had a meeting here today in Denver and a good one.

I do think we have an urgency in that particular matter of business. I am sure it is something that we want to settle before we leave Denver.

COM. BLISS: Mr. Chairman, I move we recess until 10:00 o'clock tomorrow morning.

THE CHAIRMAN: Is there objection? (No response.)

Without objection we will recess until 10:00 o'clock tomorrow here.

(4:00 p.m., Tuesday, April 14, 1964, Meeting recessed.)

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SURVEY REPORT

ATTAINMENT OF MINIMUM POWER HEAD AT GLEN CANYON POWER PLANT in 1964

Prepared by

Pacific Power & Light Company
Public Service Company of Colorado
Public Service Company of New Mexico
Utah Power & Light Company

At the Request of

The Upper Colorado River Commission

April 14, 1964

ATTAINMENT OF MINIMUM POWER HEAD AT GLEN CANYON POWER PLANT in 1964

By letter to Utah Power & Light Company dated March 2, 1964, Governor George D. Clyde of the State of Utah advised that run-off on the Colorado River for 1964, was expected to be much below average and that under the present Glen Canyon filling criteria there appeared to be little chance this year of filling the reservoir to minimum power head and commencing the generation of electric power and energy. Temporary modification of the filling criteria to permit lowering of Lake Mead below the rated head value corresponding to 14.5 million acre-feet of storage may be necessary to allow sufficient storage at Lake Powell. It also appears that the Upper Basin Fund would be charged with the costs of any power impairment at Hoover due to the filling of Lake Powell and, therefore, would be required to furnish sufficient power and energy to supply the impairment created by reducing Lake Mead below 14.5 million acre-feet or provide suitable compensation to the Hoover Power Contractors.

For the above reasons Governor Clyde requested that the investor-owned utilities in the Colorado River Basin consider the problem of filling Lake Powell to minimum power head to determine if the companies could aid in its resolution, perhaps by furnishing generating capacity and energy together with transmission service to supply the Hoover power impairment during the period that Lake Mead would be drawn below rated head as a result of filling Lake Powell.

In response to Governor Clyde's request, engineering studies were started, and on the basis of preliminary results, Governor Clyde was

advised on March 10, 1964, that the companies, together with neighboring utilities, could supply the Hoover impairment. Following the companies' reply, Mr. Ival V. Goslin, Executive Director of the Upper Colorado River Commission, on March 27, 1964, wrote to Arizona Public Service Company, Idaho Power Company, Pacific Power & Light Company, Public Service Company of Colorado, Public Service Company of New Mexico and Utah Power & Light Company and inquired if the companies would be willing to negotiate with the Secretary of Interior to supply the Hoover impairment under a power and energy exchange arrangement outlined generally by Mr. Goslin. A copy of this letter is included as an attachment to this report.

Each of the aforementioned companies expressed a willingness and desire to cooperate fully with the Upper Colorado River Commission and the Department of Interior in resolving this problem.

PURPOSE

This Survey Report was prepared at the request of the Upper Colorado River Commission by an engineering committee of the investor-owned utilities in the Upper Basin area to investigate technical feasibility of the utility companies and/or Glen Canyon supplying the Hoover impairment until such time as storage at Lake Mead is returned to 14.5 million acre-feet. Basically the study covers two areas of investigation consisting of: (1) Determination of the amount and period of Hoover impairment; and (2) the transmission system and physical method of supplying Hoover impairment. The results of these studies are set forth in detail in the following sections of this report.

In all cases the information contained in this report was prepared from the best and most recent data available to the companies

within the limited time available for preparation of this report. The results are not intended to represent a comprehensive engineering study, but are more than adequate to demonstrate that minimum power head can be attained at Glen Canyon during 1964.

SUMMARY

This report shows that if storage at Lake Mead is temporarily reduced below 14.5 million acre-feet, Glen Canyon can attain minimum operating head and commence power generation by August of 1964. The study further shows that Glen Canyon generation would exceed the associated Hoover impairment by March of 1965, and subsequent operations would show a substantial surplus to assist in CRSP payout. For purposes of illustration Glen Canyon would generate approximately 541,000 mwh during the operating year of April 1, 1964, through March, 1965 as compared to only 254,000 mwh impairment at Hoover. If the present filling criteria is followed this difference in generation would be lost entirely and Glen Canyon could not commence generation before June of 1966.

The Hoover capacity impairment would vary from 10 mw in April, 1964 to a maximum of 192 mw in March of 1965, and would disappear entirely in June of 1966, when Lake Mead regains a storage of 14.5 million acre-feet. Glen Canyon capability would become 70 mw in August of 1964, and would increase to 210 mw by March of 1965, as additional units are added.

On the basis of the assumptions made in this analysis, the minimum elevation at Lake Mead would be 1084 feet representing 10.8 million acre-feet of storage which would occur in March, 1965.

The six investor-owned utilities have made realistic surveys of their loads and generating resources and have concluded that they have

more than ample generating capacity to supply any conceivable impairment in generation at Hoover that results from lowering Lake Mead storage below 14.5 million acre-feet. The six utilities will have 5,170 mw of generating capacity by the summer of 1964, which is over 20 times the maximum Hoover impairment.

Studies made of the transmission system show that there is adequate line capacity to supply any amount of Hoover impairment. However, because of the present electrical arrangement at Hoover, it is not possible to supply the Southern California Edison Company (Edison Company) and the Los Angeles Department of Water and Power (City of L.A.) impairment without making certain changes at Hoover.

From the standpoint of technical feasibility the best method of supplying the total Hoover impairment would involve switching a Metropolitan Water District unit, switching a Colorado River Commission unit and transferring the Colorado River Commission allotment from "Bank Y" at Hoover to provide for the City of L.A. impairment. Under this method, the Edison Company would supply its own impairment and the balance of the total expected impairment could be supplied from the Arizona transmission system. It appears that this method could be accomplished without any investment or undue delay.

If it is determined that the transmission system from Arizona should supply the total impairment at Hoover, it is physically possible to do so by providing an electrical interconnection at Hoover between the Arizona-Nevada (States) and Edison Company 230 kv busses together with the transfer of generating capacity similar to that described above for the City of L. A. Such a connection would materially increase the transmission capacity between the Arizona and California systems and

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	**29**	**AY-2_pgs 104-221**
14	V, W	30	AZ, BA
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

could be effected primarily by the installation of metering and load control equipment.

While the plans proposed in this report are technically feasible, it is recognized that temporary modification of operating and contractual arrangements may be necessary. However, with the full cooperation of all parties this should present no problem.

CALCULATION OF HOOVER IMPAIRMENT

In order to analyze the problem of attaining minimum power head at Glen Canyon it was necessary to make certain assumptions as to the inflow to Lake Powell and the releases from Lake Mead.

On the basis of the latest information on the water conditions in the Colorado River Basin, a value of 4.88 million acre-feet for the April-July, 1964 spring runoff and a total annual inflow to Lake Powell for the period April 1, 1964 to March 31, 1965 of 8.0 million acre-feet was selected. Monthly inflows were obtained by prorating the annual flows on the basis of historical data. For purposes of this study, annual flows of 10.5 million acre-feet were assumed for the following two twelve-month periods.

Since the inflow between Glen Canyon and Lake Mead is about equal to the evaporation from Lake Mead, the releases from Glen Canyon are assumed to be the inflows to Lake Mead. Historical data shows some variation in these two factors; but for purposes of analysis, the error so created would be insignificant.

The monthly releases from Hoover were based on the historical releases for the water years 1961-62, and 1962-63, which averaged about 8.5 million acre-feet. This figure is in agreement with the releases

used in the CRSP payout studies. The use of this figure for study purposes does not mean that the committee necessarily accepts this as the amount of water to which the Lower Basin is entitled. If releases are reduced below the 8.5 million acre-feet per year, the Hoover impairment created by attaining minimum power head at Glen Canyon would be reduced.

The results of the water studies based on the above assumptions are shown in tabular form on the following two pages.

Basically these tables show that the minimum level of Lake Mead of 1084 feet would occur in March, 1965. The tables also show that the maximum impairment would be 192 mw. The impairment would end in June of 1966. The total energy impairment would amount to 421,000 mwh.

Glen Canyon generation could commence in August, 1964, if the published information on the installation of units at Glen Canyon is followed. Since the studies are based on holding Lake Powell to 6.2 million acre-feet (approximately minimum power head) until Lake Mead reaches 14.5 million acre feet, the generation at Glen Canyon would be limited to 70 mw per machine during this period. During the period of the Hoover impairment resulting from operation below 14.5 million acre-feet, the Glen Canyon power plant would generate 2,396,000 mwh.

After Lake Powell reaches minimum power head and if storage is maintained at this level, the Hoover impairment is a direct function of the annual inflow to Lake Powell minus the releases from Lake Mead. In other words, a reduction in Lake Mead releases is approximately equivalent to an increase in inflow at Lake Powell of the same magnitude. A one million acre-foot change is equivalent to an impairment of approximately 50 mw.

The data used to develop capacity and energy values were based on the best information available to the committee at this time. This information is believed to be accurate enough for the purposes of this study and that any minor modification would not affect the overall answer.

RUNOFF DATA AND RESERVOIR OPERATION

	LAKE POWELL			LAKE MEAD		
	Inflow Million Acre-Feet	End of Month Storage Million Acre-Feet	Powell Release (Mead Inflow) Million Acre-Feet	End of Month Storage Million Acre-Feet	Release Million Acre-Feet	Elevation Feet
Mar.'64		3.00		14.50		1123
Apr.	.64	3.00	.64	14.26	.88	1121
May	1.49	3.65	.84	14.21	.89	1120
Jun.	2.05	5.60	.10	13.53	.78	1113
Jul.	.70	6.20	.10	12.77	.86	1106
Aug.	.47	6.20	.47	12.39	.85	1102
Sep.	.36	6.20	.36	12.03	.72	1098
Oct.	.37	6.20	.37	11.82	.58	1096
Nov.	.38	6.20	.38	11.64	.56	1094
Dec.	.36	6.20	.36	11.46	.54	1092
Jan.'65	.35	6.20	.35	11.33	.48	1090
Feb.	.34	6.20	.34	11.14	.53	1088
Mar.	.49	6.20	.49	10.80	.83	1084
Total	8.00		4.80		8.50	
Apr.'65	1.06	6.20	1.06	10.98	.88	1086
May	2.17	6.20	2.17	12.26	.89	1100
Jun.	2.79	6.20	2.79	14.27	.78	1121
Jul.	1.15	6.26	1.09	14.50	.86	1123
Aug.	.55	6.20	.61	14.26	.85	1121
Sep.	.38	6.20	.38	13.92	.72	1117
Oct.	.42	6.20	.42	13.76	.58	1116
Nov.	.42	6.20	.42	13.62	.56	1114
Dec.	.35	6.20	.35	13.43	.54	1112
Jan.'66	.33	6.20	.33	13.28	.48	1111
Feb.	.38	6.20	.38	13.13	.53	1109
Mar.	.50	6.20	.50	12.80	.83	1106
Total	10.50		10.50		8.50	
Apr.'66	1.06	6.20	1.06	12.98	.88	1108
May	2.17	6.20	2.17	14.26	.89	1121
Jun.	2.79	7.97	1.02	14.50	.78	1123
Jul.	1.15	8.26	.86	14.50	.86	1123
Aug.	.55	7.96	.85	14.50	.85	1123
Sep.	.38	7.62	.72	14.50	.72	1123
Oct.	.42	7.46	.58	14.50	.58	1123
Nov.	.42	7.32	.56	14.50	.56	1123
Dec.	.35	7.13	.54	14.50	.54	1123
Jan.'67	.33	6.98	.48	14.50	.48	1123
Feb.	.38	6.83	.53	14.50	.53	1123
Mar.	.50	6.50	.83	14.50	.83	1123
Total	10.50		10.20		8.50	

HOOVER AND GLEN CANYON PLANT OPERATION

	HOOVER IMPAIRMENT			GLEN CANYON GENERATION	
	Elevation Feet	Capacity Impairment mw (1)	Energy Impairment Million kwh	Glen Canyon Capacity mw	Glen Canyon Energy Million kwh (2)
Mar.'64	1123				
Apr.	1121	10	3		
May	1120	15	4		
Jun.	1113	49	11		
Jul.	1106	83	21		
Aug.	1102	103	25	70	39
Sep.	1098	123	26	70	39
Oct.	1096	133	22	70	39
Nov.	1094	142	23	140	77
Dec.	1092	152	24	140	77
Jan.'65	1090	162	23	140	77
Feb.	1088	172	26	140	77
Mar.	1084	192	46	210	116
Total			254		541
Apr.'65	1086	182	46	210	116
May	1100	113	29	210	116
Jun.	1121	10	2	210	116
Jul.	1123	0	0	280	154
Aug.	1121	10	2	280	154
Sep.	1117	29	6	280	101
Oct.	1116	34	6	280	111
Nov.	1114	44	7	350	111
Dec.	1112	54	8	350	93
Jan.'66	1111	59	8	350	87
Feb.	1109	69	11	350	101
Mar.	1106	83	20	420	133
Total			145		1393
Apr.'66	1108	74	19	420	231
May	1121	10	3	420	231
Total			22		462

(1) Calculated from performance data of output versus elevation.

(2) Calculated from 265 kwh/acre-foot of release or 550 hours use of capacity per month whichever produced the least energy.

PHYSICAL METHOD OF SUPPLYING HOOVER IMPAIRMENT

Power generated at Hoover Plant is transmitted to loads in Southern California, Southern Nevada and Arizona. The recipients of this power are Arizona Power Authority (APA), The Colorado River Commission (Nevada), Metropolitan Water District (MWD), Los Angeles Department of Water and Power (City of L.A.), and Southern California Edison Company including former California Electric Power Company (Edison Company).

If Lake Mead is lowered below 14.5 million acre-feet storage as a result of storing water in Lake Powell, the generators at Hoover operate at a reduced capacity. This reduced capacity or generation impairment affects all Hoover Power Contractors and it must be made up from other sources.

Transmission interconnections will be made this year between the Upper and Lower Basin systems, which will integrate the Pacific Northwest, Rocky Mountain and Pacific Southwest Power Pools. The map on page 12 of this report shows the principal transmission lines of the utilities and the Federal Government that could be used to assist in supplying the impairment capacity and energy to Hoover contractors.

Studies made show that by displacement any anticipated amount of Hoover impairment can be transmitted to the River Plants (Parker, Davis, Hoover) from Arizona (see power flow diagrams on pages 13-16). However, with the existing electrical arrangement of separate busses at Hoover, it is not possible to receive and utilize more than the generation impairment of APA, Nevada and MWD. For this reason and from the standpoint of technical feasibility, the best method of supplying total impairment would be an arrangement whereby the Edison Company would supply its own impairment, with the remainder of the impairment supplied by the transmission system from Arizona. To accomplish this it would be

necessary to shift generation capacity normally connected to Arizona-Nevada (States) system to the City of L.A. system. Such a connection provides for the capacity impairment at Hoover for the City of L.A. and in effect transfers that impairment to the States' system where it can be supplied by existing transmission lines.

Specifically the suggested changes at Hoover to supply the maximum expected impairment of 192 mw are as follows:

1. Units A1 and A2 of the City of L.A. would normally supply as much as 40 mw to the States' 69 kv system. Opening the connection to the States' 69 kv system (Bank Y) would provide 40 mw of impairment capacity for the City of L.A. (See diagrams on pages 17-18).

2. Electrically connect Unit N5 (MWD unit) to the City of L.A. bus and operate this unit in parallel with Units N3 and N4. The City of L.A. impairment under these conditions is 66 mw. Of this amount 40 mw is obtained from Bank Y as described in 1 above. Therefore, only 26 mw will be required from the Unit N5 which has a capacity of 71 mw at this level of impairment. This creates an additional impairment of 45 mw which must be supplied by transmission from Arizona. This arrangement keeps the total generation of the three units within the rating of the step-up transformer.

3. Electrically connect Unit N8 (Nevada unit on States Bus) to the MWD 230 kv bus. This transfer replaces Unit N5 for MWD.

4. Edison Company would supply its own capacity impairment.

The maximum capacity impairment at Hoover would be met as follows:

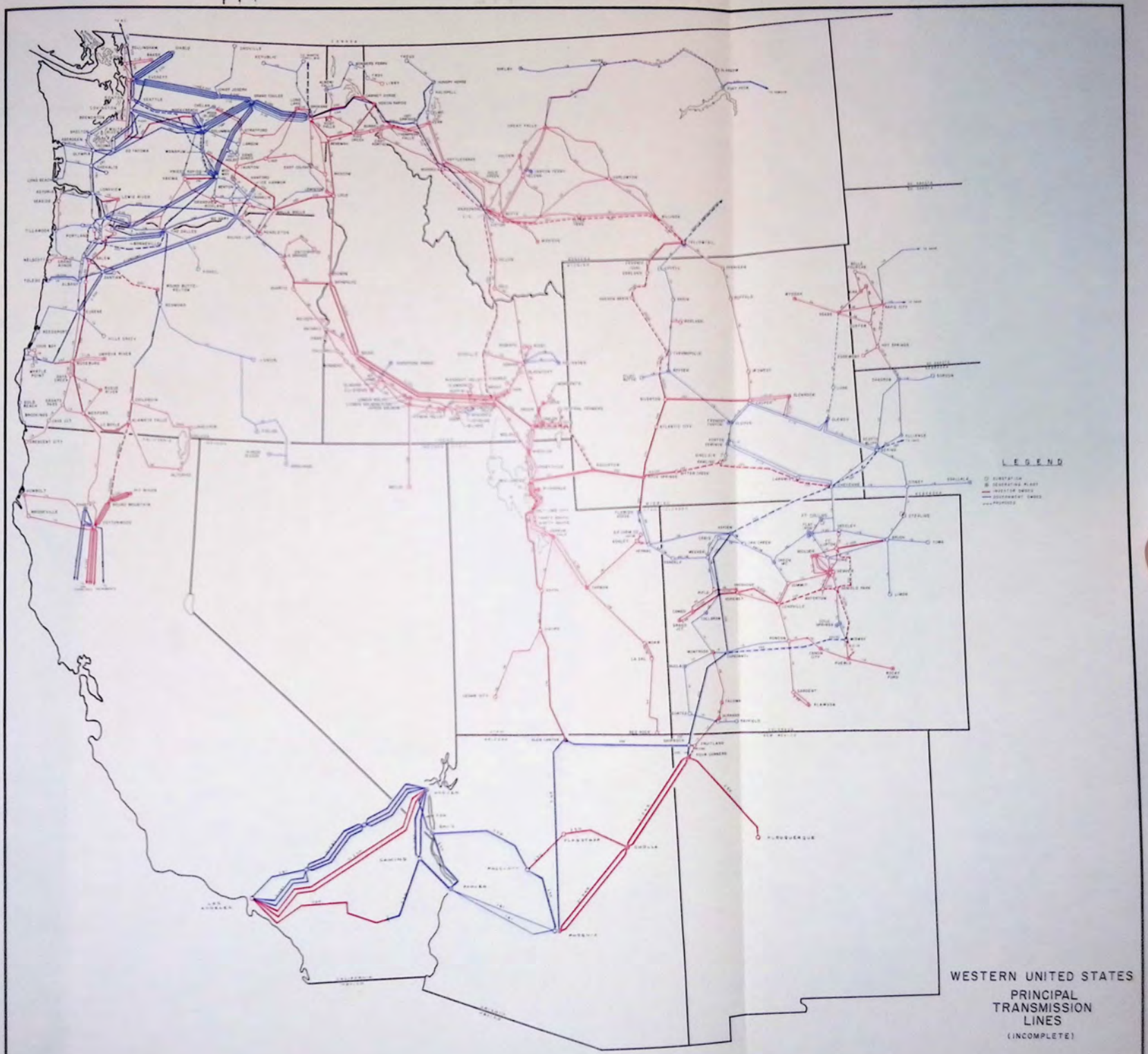
	Impairment mw	Source of Impairment Supply mw				
		Transfers				Transmission
		N5	N8	Bank Y	Edison	from Arizona
City of L.A.	66	26		40	0	0
Edison	42				42	0
MWD	36	-71	71		0	36
Arizona	24				0	24
Nevada	24		-71	-40	0	135
Total	192	-45*	0	0	42	195

* Unused capacity due to transferring Unit N5 to City of L.A.

The table on page 19 shows by months how the Hoover capacity impairment is supplied, and that Glen Canyon generation could supply the total Hoover impairment by March, 1965. A sequence for the above changes would have to be developed to fit the monthly variations in Hoover impairment. The above-described method outlines a plan to supply Hoover impairment with minimal changes at Hoover.

If it is desired, the total impairment, including Edison Company, can be supplied by transmission from Arizona. This can be accomplished by supplying the City of L.A.'s impairment at Hoover as described above and making an electrical interconnection at Hoover between the Edison Company and States' 230 kv bus. This connection increases the transmission capacity between Arizona and Southern California making it possible to supply the impairment of Edison Company and MWD from the Arizona system. Under these conditions the entire impairment of MWD plus the loss of Unit N5 capacity could be supplied from the transmission system. (See page 20).

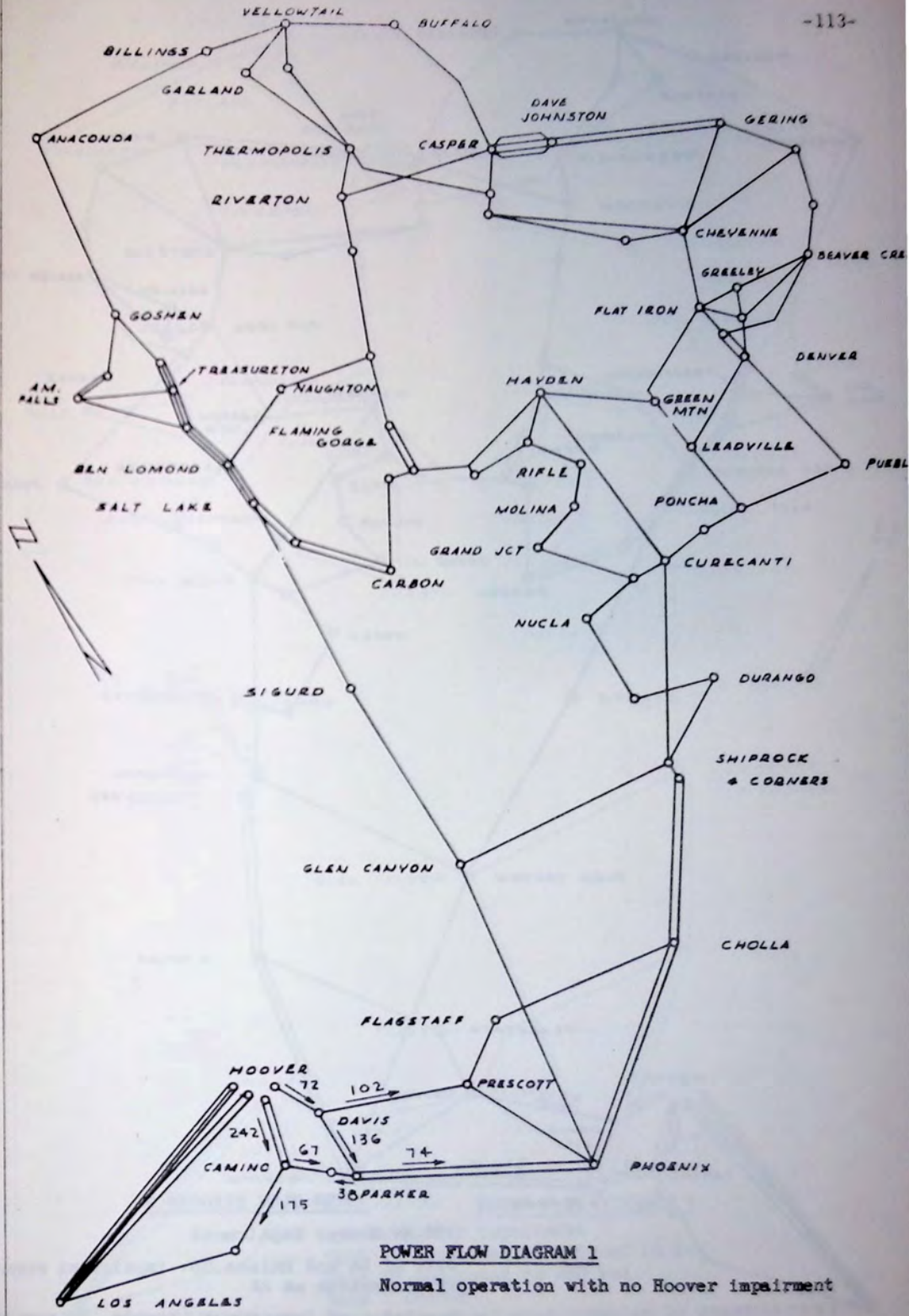
These changes make it necessary to install metering equipment for energy accounting and load control and possibly other minor modifications such as protective relay changes.



WESTERN UNITED STATES

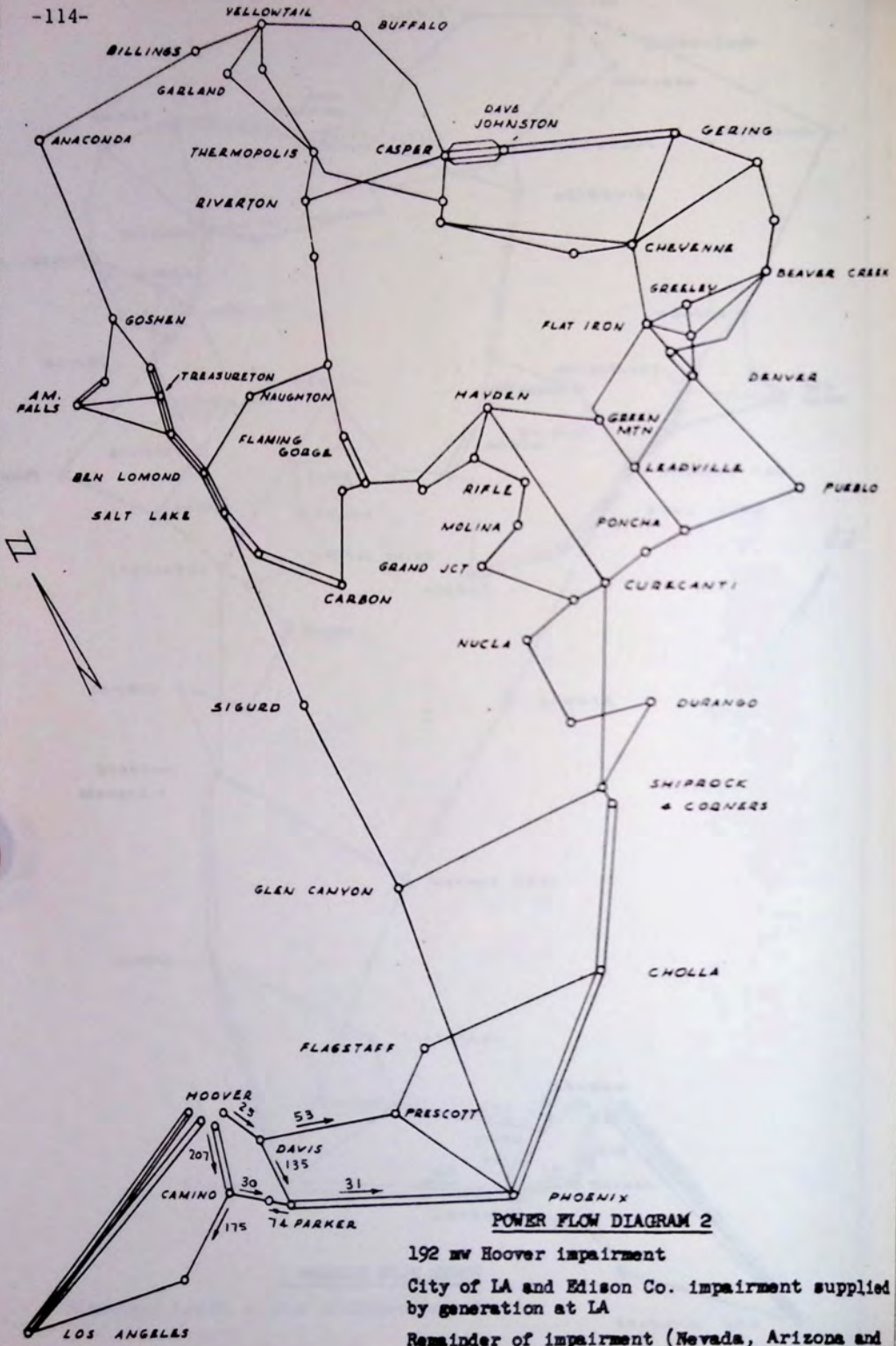
PRINCIPAL TRANSMISSION LINES

(INCOMPLETE)



POWER FLOW DIAGRAM 1

Normal operation with no Hoover impairment

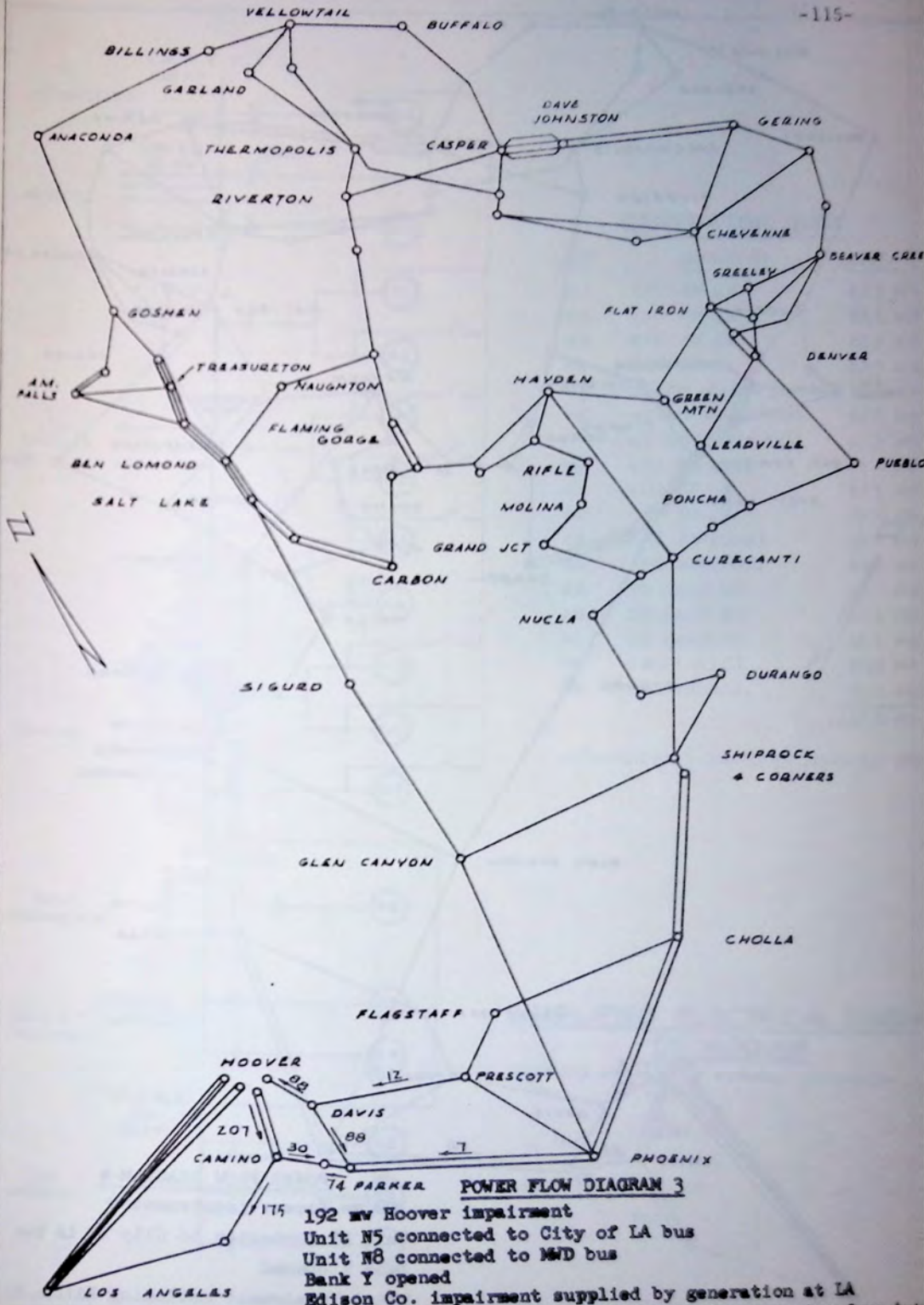


POWER FLOW DIAGRAM 2

192 mw Hoover impairment

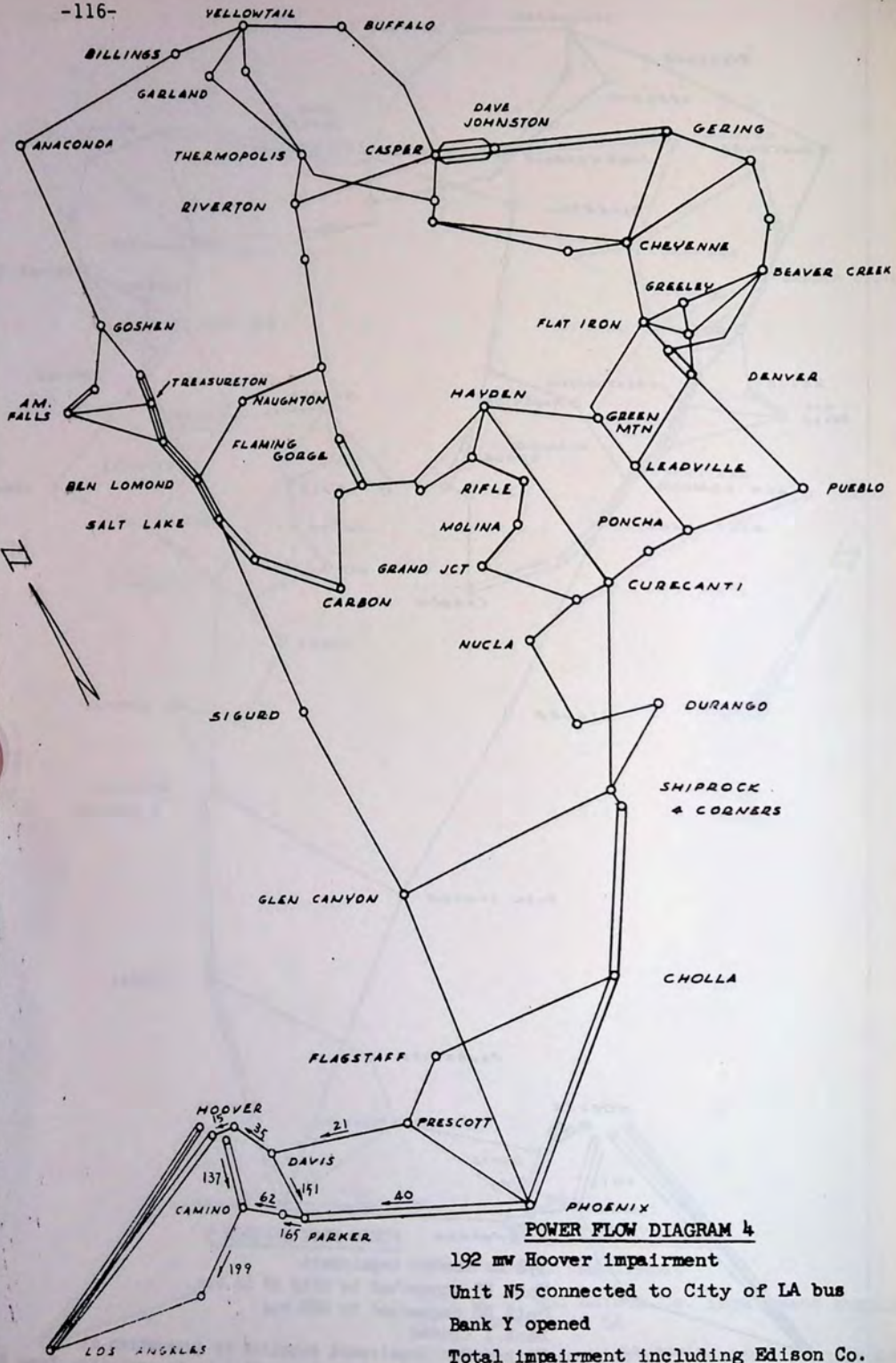
City of LA and Edison Co. impairment supplied by generation at LA

Remainder of impairment (Nevada, Arizona and MWD) supplied by transmission from Arizona



POWER FLOW DIAGRAM 3

192 mw Hoover impairment
Unit N5 connected to City of LA bus
Unit N8 connected to M&D bus
Bank Y opened
Edison Co. impairment supplied by generation at LA
Remainder of impairment supplied by transmission from Ari



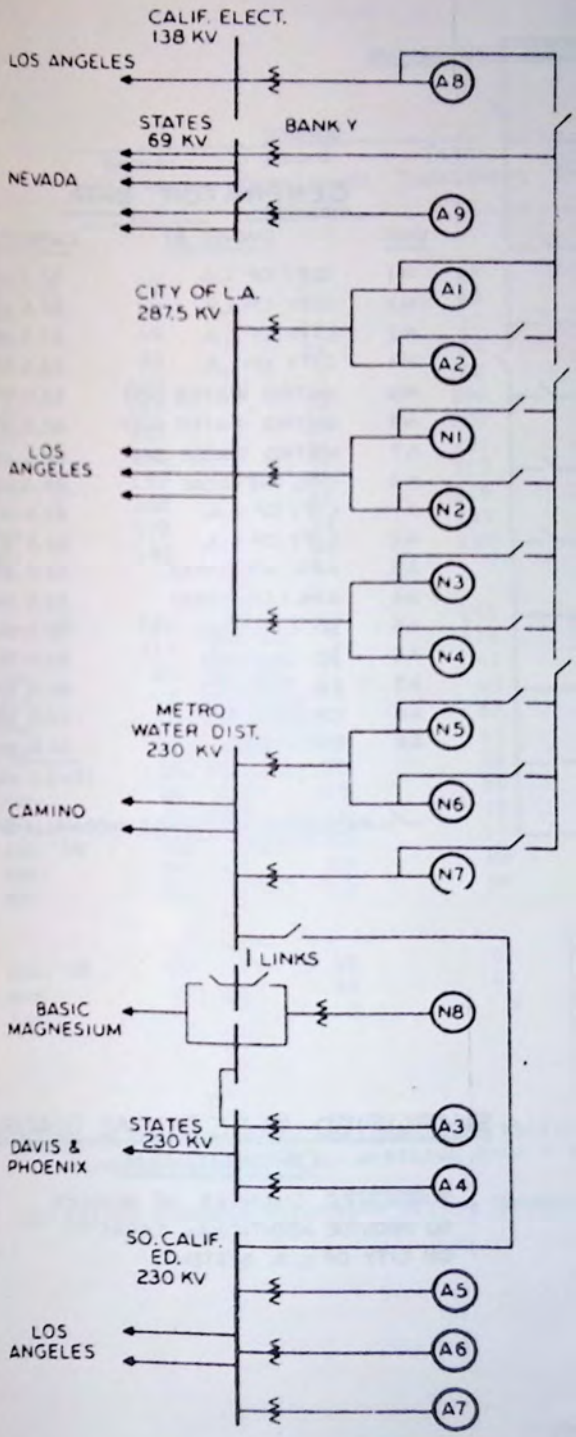
POWER FLOW DIAGRAM 4

192 mw Hoover impairment

Unit N5 connected to City of LA bus

Bank Y opened

Total impairment including Edison Co. supplied by transmission from Arizona



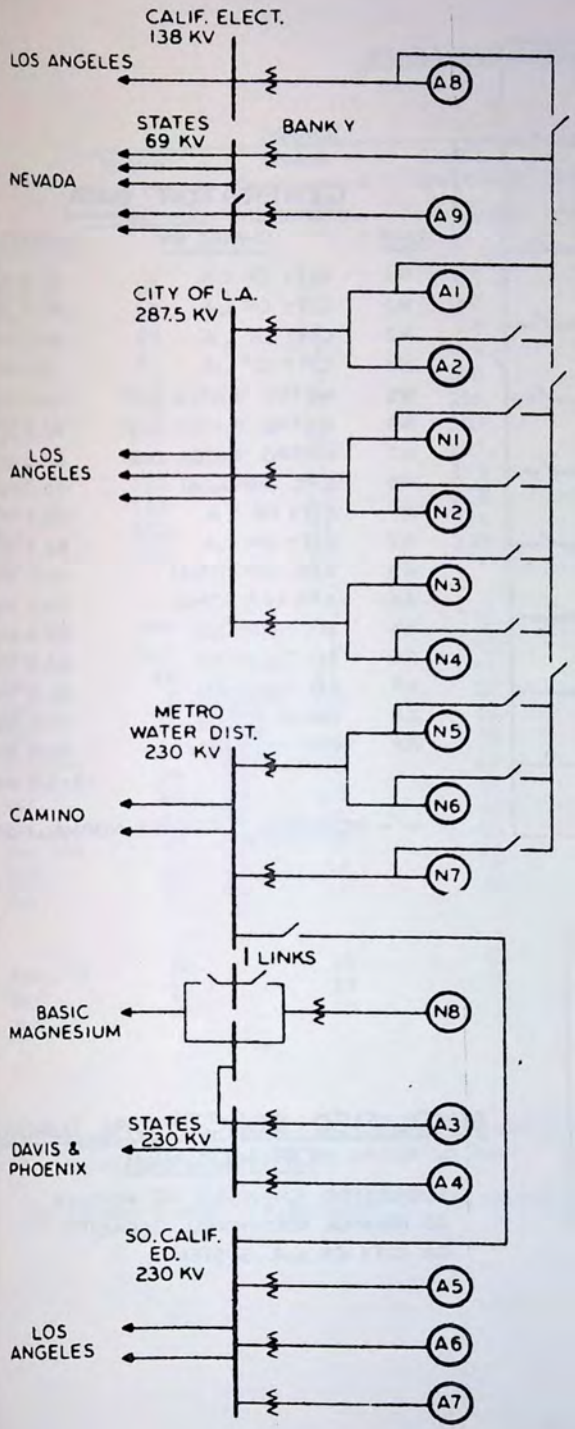
GENERATOR DATA

UNIT	OWNED BY	CAPACITY
N1	CITY OF LA	82.5 MW
N2	CITY OF LA	82.5 MW
N3	CITY OF LA	82.5 MW
N4	CITY OF LA	82.5 MW
N5	METRO WATER DIST	82.5 MW
N6	METRO WATER DIST	82.5 MW
N7	METRO WATER DIST	82.5 MW
N8	CRC (NEVADA)	95.0 MW
A1	CITY OF L.A.	82.5 MW
A2	CITY OF L.A.	82.5 MW
A3	APA (ARIZONA)	82.5 MW
A4	APA (ARIZONA)	82.5 MW
A5	SO. CALIF. ED.	82.5 MW
A6	SO. CALIF. ED.	82.5 MW
A7	SO. CALIF. ED.	82.5 MW
A8	CALIF. ELECT.	40.0 MW
A9	CRC (NEVADA)	50.0 MW
		1340.0 MW

—/— INDICATES SWITCHES NORMALLY OPE

SIMPLIFIED ELECTRICAL DIAGR OF HOOVER

SHOWING METHOD OF NORMAL OPERATION



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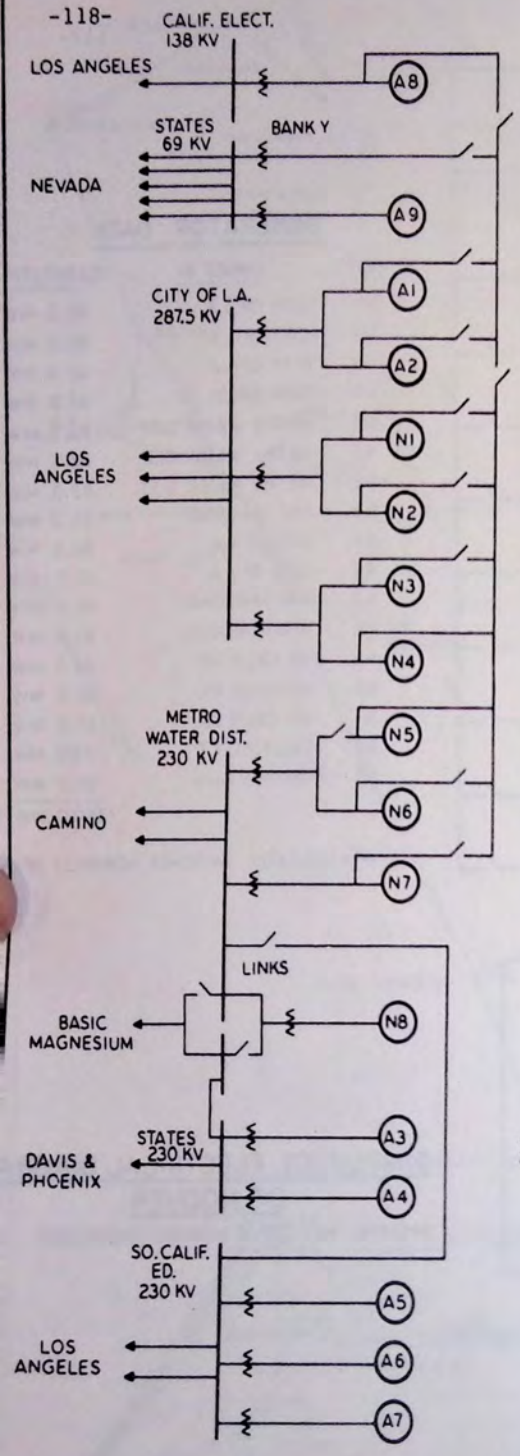
—/— INDICATES SWITCHES NORMALLY OP

SIMPLIFIED ELECTRICAL DIAGR
OF HOOVER

SHOWING METHOD OF NORMAL OPERATION



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		1340.0 MW

—/— INDICATES SWITCHES NORMALLY OPEN

SIMPLIFIED ELECTRICAL DIAGRAM OF HOOVER

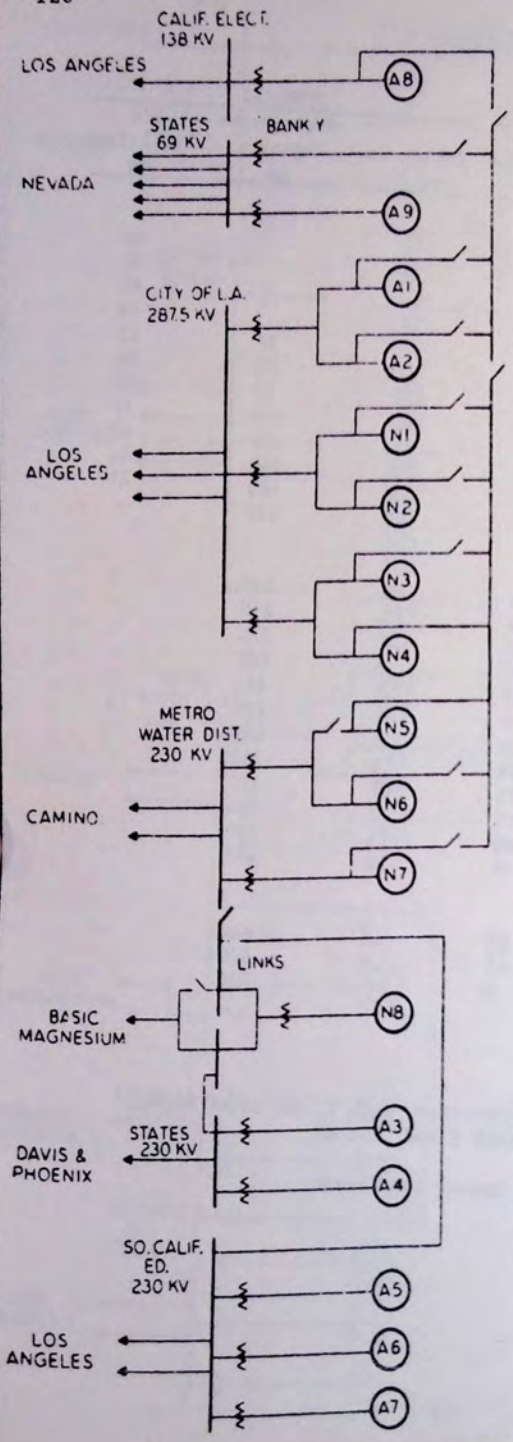
SUGGESTED CHANGES AT HOOVER
TO PROVIDE ADDITIONAL CAPACITY
ON CITY OF L.A. SYSTEM

HOOVER IMPAIRMENT

	SOURCE			SUPPLIER		
	Hoover Impairment mw	Added Impairment mw (1)	Total Impairment mw	Edison Co. mw (2)	Glen Canyon Capacity mw	Six Utilities mw
Apr.'64	10	37	47	2		45
May	15	35	40	3		47
Jun.	49	23	72	11		61
Jul.	83	11	94	18		76
Aug.	103	5	108	23	70	15
Sep.	123	73	196	27	70	99
Oct.	133	69	202	29	70	103
Nov.	142	65	207	31	140	36
Dec.	152	61	213	33	140	40
Jan.'65	162	57	219	35	140	44
Feb.	172	53	225	38	140	47
Mar.	192	45	237	42	210	-
Apr.'65	182	49	231	40	210	-
May	113	1	114	25	210	-
Jun.	10	37	47	2	210	-
Jul.	0	40	40	0	280	-
Aug.	10	37	47	2	280	-
Sep.	29	30	59	6	280	-
Oct.	34	28	62	7	280	-
Nov.	44	25	69	10	350	-
Dec.	54	21	75	12	350	-
Jan.'66	59	20	79	13	350	-
Feb.	69	17	86	15	350	-
Mar.	83	11	94	18	420	-
Apr.'66	74	15	89	16	420	-
May	10	37	47	2	420	-
Jun.	-	0	0	-	420	-

(1) Values below 41 mw are caused by shifting Bank Y, all other added impairments caused by shifting Bank Y and Unit N5.

(2) Edison Company's portion of the Hoover impairment.



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—/— INDICATES SWITCHES NORMALLY OPEN

SIMPLIFIED ELECTRICAL DIAGRAM OF HOOVER

CHANGES AT HOOVER TO SUPPLY TOTAL IMPAIRMENT

ATTACHMENTS

Copy of a letter from the
UPPER COLORADO RIVER COMMISSION

March 27, 1964

Mr. Robert T. Person
President
Public Service Company of Colorado
P. O. Box 840
Denver, Colorado

Dear Mr. Person:

The recent action of the Secretary of the Interior ordering the release of water stored in Lake Powell at a rate that will maintain storage in Lake Mead at a minimum of 14.5 million acre-feet pending a final decision dependent upon stream runoff during the next two months makes it imperative that the Upper Basin States find a way to save this water.

Governor Clyde in his letter of March 2, 1964 to the electric utilities in the area stated that the problem appears to be one "concerning the availability of electrical energy, generation capacity and transmission facilities that would be necessary to replace the power that would be curtailed at Hoover Dam by withholding the water in Lake Powell." In answer to Governor Clyde's letter, your Company and others indicated that they were willing and able to be of substantial aid in solving this problem.

The Secretary of the Interior in his answer to a letter of March 17th from the Governors of the four Upper Basin States said that although there had been newspaper stories concerning an offer by Upper Basin utilities to supply replacement power, his Department had received no proposals with the necessary data, such as, rates and the means the utilities would use to deliver the power to the Lower Basin, particularly California. He also said that it will be necessary to have these data immediately, if a proposal is to be considered when the water situation is reviewed and a final decision reached concerning a course of action on operation of the river in this critical water year.

We believe that because water is now being released at a rapid rate from Lake Powell, the situation has become even more urgent, and there must be an immediate solution, if the minimum

power pool in Lake Powell is to be filled in 1964. The utilities' letter of March 10th to Governor Clyde indicated that the various companies started immediately to make engineering and power supply studies pertaining to this problem.

We have also noted in the Secretary's reply to our four Governors that he seems to be concerned about the availability of federal funds for any major interim purchase of power because funds are not now included in the President's budget for that purpose.

After reviewing the overall problem we would like to know if your Company, in cooperation with other electrical utilities in the area, can and will make available the necessary capacity and energy to supply the deficiency in generation at Hoover Dam created by lowering Lake Mead below 14.5 million acre-feet while accumulating the minimum power head at Glen Canyon Dam under an arrangement similar to the following:

(a) The Companies' obligation to extend to the supplying of the generation deficiency at Hoover created by filling Lake Powell to its minimum power head and to terminate when Lake Mead reaches 14.5 million acre-feet, or at such time as power generation at Glen Canyon Dam is equal to the deficiency so created at Hoover; and

(b) any energy generated at Glen Canyon Dam following creation of minimum power head to be used first to supply the deficiency at Hoover, described above, with the utilities providing the balance; and

(c) the capacity and energy supplied by the companies to be returned in kind by the Colorado River Storage Project at a time agreeable to the companies upon appropriate notice and under conditions to be agreed upon with the Secretary of the Interior; and

(d) the amount of energy to be returned under (c) to be increased over the amount delivered by a fixed

percent per year as compensation to the companies for the cost of money associated with the "banked" energy.

In addition to meeting the concern of the Secretary with regard to the availability of federal cash, we have suggested the above method of repayment because we feel that it results in both a practicable and acceptable means of repaying the companies for their services while at the same time maintaining an optimum financial position for the CRSP. This suggestion, however, certainly does not preclude other methods of repayment, if such methods can be satisfactorily negotiated by the parties concerned.

We have heard considerable argument to the effect that although the utilities may have the necessary capacity and energy available, the means may be lacking for the transmission of energy to the power users in the Lower Colorado River Basin. Have your engineers or those of your associated utilities studies the feasibility of delivery of power to the Hoover power contractors? Do you know of any physical limitations to accomplishing this phase of the job?

If the capacity and energy "exchange" conditions generally outlined in (a) and (d) above would be satisfactory to your Company, and if you know of no physical limitations to the delivery of power to the Lower Basin users, will you please inform us at the earliest possible date of your willingness to negotiate with the Secretary of the Interior on the basis outlined herein.

Sincerely yours,

/s/ IVAL V. GOSLIN
Ival V. Goslin
Executive Director

IVG:hiw

Identical letters to presidents of Arizona Public Service Company, Utah Power & Light Company, Pacific Power and Light Company, Public Service Company of New Mexico and Idaho Power Company.

(10:00 o'clock a.m., Wednesday, April 15, 1964, Room 132 State Services Building, Denver, Colorado. All Commissioners present.)

THE CHAIRMAN: This session will resume. It is my pleasure to introduce to you now the Governor of Wyoming. (Applause.)

If you have anything to say, you have a chance to say it.

GOVERNOR HANSEN: I don't have at this time, thank you, sir.

THE CHAIRMAN: There has been some very clumsy introducing from this Chair, and I want you all to know the group that is representing the Bureau of Reclamation and the Interior Department this morning. And so there will be no mistakes made, I am asking my friend, Frank Clinton, to introduce them.

MR. CLINTON: Thank you, Mr. Chairman. I will start with our Assistant Commissioner, Buz Bennett. I think you all know him.

(Applause following each introduction.)

We have with us the Deputy Solicitor from the Department of the Interior from Washington, Eddie Weinberg.

Our Regional Director from Region 3 at Boulder City, Arleigh West. He has with him Paul Oliver, head of his River Control Division. And also By Miller, Power Division.

We have from the Denver office Wade Taylor of the Power Division. Art Mitchell from Randy Riter's Planning Division.

We have a Wyomingite here somewhere, Val Killin.

I think that is all we have here. I am passing up one, Mr. Chairman.

THE CHAIRMAN: I reserve the privilege of introducing the Commissioner, whose position I know positively. Commissioner Dominy. (Applause.)

MR. SPARKS: Mr. Chairman, I have here a letter submitted to the Secretary of the Interior by the Honorable Wayne N. Aspinall, our Congressman and Chairman of the Interior and Insular Affairs Committee of the House of Representatives, dated March 30, 1964.

I would like to read this letter and then commend it to the Commission for possible inclusion in the record of this proceeding. If you would permit me, I would like to read the letter.

"March 30, 1964

Dear Mr. Secretary:

In view of the situation we now find ourselves in with respect to the filling of Lake Powell, I believe it is imperative that we have a complete and detailed accounting with respect to all water releases from Lake Mead and water deliveries below Hoover Dam over the last 24 months. I would like to have this information at the earliest possible date.

The information furnished should show the release schedules from Hoover for the entire 24-month period in as great a detail as is available and the precise purpose or purposes for which the water was released. A recapitulation should show the total amounts released for each purpose including the 280,000 acre-feet released to Mexico (outside the Treaty) in the final months of 1962, the amounts released for meeting the various water contracts on a contract-by-contract basis and the amount and timing of releases for power production only.

With respect to deliveries, the information should include a complete listing of water contracts, the contract requirements with respect to deliveries, and the amounts and timing of deliveries under each of the contracts during the 24-month period, with a brief statement on the method and responsibility for measurement.

I would also like to have an estimate of the amounts of water diverted illegally from the River and a discussion of actions that are being taken to prevent these illegal operations.

In connection with water deliveries under the contracts, I would like to know the extent of the oversight responsibilities of the Bureau of Reclamation with respect to such matters as ultimate use of the water and a determination as to whether water is used excessively or is otherwise wasted. Over the last 24 months, what is the estimated amount of water included in the categories of excess use, waste, and illegal diversions from the River?

I would like to have the Department's position with respect to withholding water, under the Colorado River Compact and the water contracts, which it determines to be unnecessary or which may be wasted, if such water could be effectively used in other parts of the Basin. In view of the present water situation, does the Department have any plans at this time for saving water by reducing overuse and waste and preventing illegal diversions?

Again, I stress the importance of compiling this information and the need for furnishing it at an early date.

With best personal regards.

Sincerely,

Wayne N. Aspinall
Chairman

Honorable Stewart L. Udall
Secretary of the Interior
Department of the Interior
Washington, D. C."

MR. SPARKS: Mr. Chairman, it is my understanding that under date of April 13th, 1964, a reply to this letter was forwarded to Congressman Aspinall signed by Mr. Kenneth Holum, Assistant Secretary of the Interior. This reply was rather voluminous and contains numerous appendices in explanation of the basic reply letter.

This letter has been forwarded, I understand, to the Executive Director of the Commission, Mr. Ival Goslin, and he has it in his possession. I would also commend to the Commission that the reply to Congressman Aspinall be made a part of the record of this proceeding.

I have had only a brief opportunity this morning to examine the contents of the letter submitted in reply to the Congressman's inquiries. From what I saw, it was a forthright discussion of the problems and did present a picture of various attempts to solve the many problems of which we were so highly critical. The letter is full of good intentions; and if those good intentions are carried out, it is very possible that many of the questions would be resolved that were discussed yesterday.

I might add that we in Colorado have been concerned for some years now with the operation of the Committee of Fourteen. One of the points

specifically raised in the recommendations of the Legal Committee yesterday was that we felt that the so-called regulatory waste below Hoover Dam must be decreased. It is, of course, impossible to eliminate all of such waste, and we are hopeful that the Committee of Fourteen would come up with some solution to the salinity problem.

In the first instance there were three obvious solutions it seemed to us here in Colorado. One was to stop the pumping from the Wellton-Mohawk Project in Arizona. Two was to bypass the saline water which is being extracted from the aquifer there, bypassing Morelos Dam.

The other solution which was imposed upon us and was not of our will, was to dilute that water by deliveries from Hoover, and, thusly, from Glen Canyon. The third solution was imposed upon the Upper Basin without its consent.

I think there is a short report forthcoming from the Committee of Fourteen.

At least from Colorado's, and I think from the Commission's viewpoint, two years have been almost wasted in dawdling with this problem, and we are getting a little impatient of solutions which are obviously apparent. We in Colorado, and I am sure the Commission, wish to make every attempt to preserve the integrity of the Wellton-Mohawk Project in Arizona, but not at the expense of the Upper Basin States.

Mr. Chairman, I submit this letter.

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
Washington 25, D. C.

April 13, 1964

Dear Mr. Chairman:

This will respond to your letter of March 30, 1964. We share your concern over the continuing water shortage in the Colorado River Basin and the increasing demands on the river water. Accordingly, we are continuing to tighten up administration of water service contracts, to develop practices which will conserve water, and to propose measures which will prevent water losses. The steps we have taken in this regard are summarized later in this letter.

You have asked for a complete and detailed accounting with respect to all releases from Lake Mead and water deliveries below Hoover Dam over the last 24 months. This basic information is contained in the following enclosures:

(1) Water Logs of the Colorado River (Provisional Records), for calendar years 1962 and 1963.

(2) Table 1 - "Colorado River Flows and Diversions, 1962 and 1963."

(3) Table 2 - "Principal Lower Colorado River System Hydrographic Stations."

(4) Table 3 - "Diversion of Colorado River Water at Imperial Dam, Arizona Side, 1962 and 1963."

(5) Table 4 - "Diversion of Colorado River Water at Imperial Dam, California Side, 1962 and 1963."

(6) Table 5 - "Listing of Contractors Receiving Colorado River Water below Hoover Dam, 1963," including Form 7-322 - "Monthly Water Distribution Record on Reclamation Projects," for 1962 and 1963.

(7) Statement - "Illegal Diversion of Water from Colorado River to Federal, Private, and State Lands," including tables I, II, and III

The Water Logs of the Colorado River show diversions to other water users exclusive of permittees and illegal users. They also show cumulative return flows

Table 1 shows the water released from Hoover Dam in 1962 and 1963 and follows it down the river showing losses, diversions, returns, and ultimate delivery to Mexico.

No water has been released from Lower Colorado River powerplants then or now, for power production only. Power is generated only when water is released to meet downstream requirements.

As you are aware, our basic regulatory structure for the Lower Colorado River is Hoover Dam. That Dam is located 300 miles upstream from points of diversion for the Yuma Projects, Imperial and Coachella Districts, and treaty delivery to Mexico. It is extremely difficult, if not impossible, to control releases from Hoover so as to meet precisely requirements so far downstream. Even from Parker Dam, the lowest regulatory structure, it takes 72 hours for water to reach Imperial Dam. The vagaries of weather, bank storage, and winds are largely unpredictable and necessarily affect water deliveries through the river channel.

Illegal diversions present a further complication. Contract water users, ordering water days ahead from a distant point, simply do not order water with the same efficiency that they could achieve if the storage was immediately adjacent to their projects. These difficulties lead to the wasting of water and increase our problem of providing water to meet the delivery schedule to Mexico. Senator Wash Regulating Reservoir, now under construction approximately two miles above Imperial Dam on the California side of the river, will allow much closer regulation of river deliveries, and relieve this problem in part. It could be further relieved by the installation of ground water recovery facilities in the Yuma area. However, the State Department has advised that under the Mexican Water Treaty of 1944, consultation with Mexico is necessary prior to proceeding with such a program and the Mexican Government has expressed its concern regarding it.

Total amounts of water released from Lake Mead for the various purposes may be recapitulated as follows:

Purpose	Amount (acre-feet) 1962	1963
Irrigation and Domestic Purposes (United States)	6,136,878	6,203,915
Mexican Treaty Requirements	1,500,000	1,500,000
River Regulation and Sluicing	181,590	86,050
Reservoir and River Losses	481,642	473,782
Uncontrollable Flows (reject orders, vagaries of weather, etc.)	299,890	422,253
Reservoir Storage Change	+15,000	-153,000
TOTAL	8,615,000	8,533,000

You refer to "280,000 acre-feet released to Mexico (outside the Treaty) in the final months of 1962." The figures in the above tabulation of 181,590 acre-feet in 1962 and 86,050 acre-feet in 1963 represent releases for sluicing purposes during the October 1962 - February 1963 period. As set forth in the hearing before the Subcommittee on Irrigation and Reclamation of the Senate Interior and Insular Affairs Committee on June 7, 1962, releases in the amount of 280,000 acre-feet were planned to reduce a critical sediment aggradation problem on the Lower Colorado River below Imperial and Morelos Dam. The quantity of water actually released was 267,640 acre-feet which had been captured as a result of impingement upon the flood control regulations at Hoover in April 1962 and represented water that otherwise would have been released for flood control. These flows naturally served as an ancillary benefit to Mexico.

You have asked for a listing of water contracts, delivery requirements thereunder, and amounts and timing of deliveries under each contract, with a statement on the method and responsibility of measurement. These are provided as described below:

Table 2 lists the principal hydrographic stations, and describes their location, type of device used, and name of responsible agent.

Table 3 shows the delivery to the several contract water users of water diverted at Imperial Dam to the Gila Gravity Main Canal.

Table 4 provides similar information for water diverted at Imperial Dam into the All-American Canal.

Table 5 lists the principal contract water users. Their contracts do not specify delivery entitlements in acre-foot quantities. Rather they provide for delivery of water in such amounts as may be reasonably required by the water user (see Art. 17 of contract dated 12/1/32 between the United States and Imperial Irrigation District, p. 75 in "Hoover Dam Power and Water Contracts," Boulder Canyon Project Final Reports).

The Monthly Water Distribution Records (Form #7-322) included as a part of Table 5 show water diverted at Imperial Dam for each of the principal water-user organizations on Bureau of Reclamation projects. They show the disposition of water from the main delivery point of each organization through its canals and laterals, to final farm delivery. Return flows from each project or district are not shown.

You have asked for an estimate of the amounts of water diverted illegally from the river and a discussion of actions taken to prevent these illegal operations. The narrative statement entitled "Illegal Diversion of Water from Colorado River to Federal, Private, and State Lands" describes in detail illegal diversions, diversions under the Lower Colorado River Land Use Permit Program, and illegal occupancy of Federal Lands. In several cases, the threat of legal action has halted illegal diversions or trespass. Generally, illegal diversions by those owning private lands can only be stopped by a court-obtained injunction. Illegal diversions by trespassers can also be halted by evicting them from the land. The Langendorf case (a trespass case) is now in the Courts. The Milpitas Cattle Company case (an illegal diversion case) has also been referred to the Department of Justice, but its filing in court was delayed pending the handing down by the Supreme Court of its final decree in Arizona v. California. We are advised that the filing will be made shortly.

Within the last few months we have met in Los Angeles with representatives of the United States Attorneys' offices of both Arizona and Southern California in preparation for the processing of a number of these cases of both types. Eight cases are now in the office of our Regional Solicitor in Los Angeles receiving final preparation for referral to Justice. Thirty more cases are now in various stages of preparation in the Land Use Office in Yuma. Before this referral we propose to meet again with the appropriate Department of Justice personnel. That meeting is scheduled to take place in Washington, D. C. soon. You will appreciate that, apart from problems of land ownership which may be very troublesome, there are difficult evidentiary problems (particularly where the diversion is from wells). Thus it may not be easy to show that a particular well is pumping water from the river.

Permits issued to trespassers upon Federal lands under the Land Use Permit Program allow certain uses of water on the permitted lands. The program closed on October 15, 1963, and no permits have been issued since that date. The permits contain a 30-day water-use cancellation provision. We believe this program to be a valuable solution to a difficult problem on the river (it is the first effective solution reached in 50 years of trespass along the river) and, therefore, believe it should continue along present lines. However, we have the problem under continued study.

Where permittees have substantially violated the terms of their permits, as by failure to make their required payments, they will be treated as trespassers and eviction sought. Such cases are also being prepared for referral to Justice for appropriate litigation action.

You have asked regarding the extent of the responsibility of the Bureau of Reclamation for the ultimate use of the water so as to control excess use and waste.

Under the Supreme Court decision in Arizona v. California the Secretary is ultimately responsible for the management of the Lower Colorado River. We are convinced that there is excess use and waste of Colorado River water. The Bureau of Reclamation is now investigating the extent of such excess use and waste, in order to find ways to reduce the losses. Promising possibilities for water conservation include improvement in on-farm irrigation practices, lining or piping distribution systems, lining or treating major canals, recovering farm runoff water and ground water for use and re-use, etc. Some of these primarily require changes in irrigation practices. Some require the expenditure of sizable sums of money. Many of these approaches are included in the proposed Southwest Water Plan.

We have already formally warned all contract users of the current water shortage and asked that they conserve water. We propose to continue an active program of soliciting voluntary cooperation action in water conservation, together with the other measures described herein.

The water-use contracts limit the users to water which they reasonably require for potable and irrigation purposes (see previous reference - Art. 17 of Imperial Irrigation District contract).

The contracts also allow the Secretary to prescribe regulations for the diversion and delivery of water. We are now engaged in the preparation of such regulations. Preliminary drafts to serve as a basis for consultation with the water users involved should be ready within the next month or so. We hope that they will help us to bring wasteful practices under control.

These regulations will be preliminary to still wider and more all-embracing regulations which we propose to promulgate under the authority of the Boulder Canyon Act as interpreted by the Supreme Court in Arizona v. California. The importance of such regulations requires both their careful preparation and an opportunity for public review. We anticipate that this process will require at least six months.

In summary, this Department will exercise to its utmost all the authority and responsibility it possesses to prevent the waste of water which can be effectively used elsewhere.

Sincerely yours,

(sgd) Kenneth Holum

Assistant Secretary of the Interior

Hon. Wayne N. Aspinall, Chairman
Committee on Interior and Insular Affairs
House of Representatives
Washington, D.C.
Enclosures

TABLE I
COLORADO RIVER FLOWS AND DIVERSIONS
(Acre-Feet)

Calendar Year	1962	1963
Hoover Release	8,615,000	8,533,000
Lake Mohave		
Storage Change	+18,000	-148,000
Loss 3/	147,000	156,000
Davis Release	8,450,000	8,525,000
Lake Havasu		
Storage Change	-3,000	-5,000
Loss 3/	221,000	219,000
MWD Diversion	1,073,000	1,057,000
Parker Release	7,159,000	7,254,000
Colo. Riv. Ind. Reserv.		
Diversion	467,000	485,000
Return	289,000	298,000
P.V. Irrig. Dist.		
Diversion	962,000	933,000
Return 1/	581,000	566,000
Loss 3/	168,000	183,000
Colorado River at Imperial Dam 2/	6,432,000	6,517,000
A.A.C. Sta. 60	5,041,000	5,024,000
G.G.M. Sta. 30	883,000	917,000
Colorado River below Imperial Dam	508,000	576,000
North Gila returns		
to Colorado River	29,000	32,000
to Gila River	19,000	18,000
South Gila returns		
to Colorado River	0	0
to Gila River	54,000	54,000
Wellton-Mohawk returns		
to Gila River	215,000	201,000
Loss 3/ (-) = gain	-36,000	-45,000

COLORADO RIVER FLOWS AND DIVERSIONS
(Acre-Feet)

Calendar Year	1962	1963
Colorado River at Yuma	861,000	926,000
Reserv. Div. Drains	51,000	51,000
Calif. Waste Way	69,000	115,000
Pilot Knob P.P. and W.W.	812,000	702,000
Loss 3/ (-) = gain	- 13,000	- 36,000
Colorado River at North Boundary	1,811,000	1,834,000
Valley Dir. returns to River	24,000	25,000
to S. Boundary	147,000	149,000
Total Colorado River to Mexico	1,977,000	2,004,000

Source of Data:

Water Log (provisional)
1/ Palo Verde Irrigation District data
2/ Imperial Dam Reports (annual)
3/ "Loss" is a balancing figure which includes transit losses, unmeasured inflows and diversions, changes in channel surface and bank storage, etc.

Table 2
Principal Lower Colorado River System Hydrographic Stations 1/
Location - Type - Responsible Agency

Location	Type	Responsible Agency
Hoover Dam	Turbine flowmeter	Checked by U.S.G.S.
Davis Dam	Rated river section below dam	U.S.G.S.
Metropolitan Water District	Venturi meters	MWD
Parker Dam	Rated river section below dam	U.S.G.S.
Colorado River Indian Reservation	Rated headgates	U.S.G.S.
Palo Verde Irrigation District	Rated headgates	U.S.G.S.
All-American Canal		
Station 60	Rated section	Imperial Irrigation District & USGS
Reservation Division, Yuma Project	Calibrated gate, Cipolletti weir and Parshall flumes	U.S.B.R.
Valley Division, Yuma Project	Rated Siphon	U.S.G.S.
California Wasteway	Rated gates	U.S.G.S.
Pilot Knob Powerplant	Rated turbine	IID
Pilot Knob Wasteway	Calibrated gate	IID
Drop 1 to Imperial	Calibrated gate	IID and U.S.B.R.
Drop 1 to Coachella	Calibrated gate	IID and U.S.B.R.
Gila Gravity Main Canal		
Station 30	Rated section	U.S.G.S.
North Gila Turnout	Parshall flume	U.S.B.R.
Wellton-Mohawk Turnout	Rated gate and rated section	U.S.B.R.
Yuma Mesa Unit	Pump discharge curves	Yuma Mesa Irrigation & Drainage District and U.S.B.R.
Warren Act Contractors	Flowmeters	U.S.B.R.
Yuma Auxiliary Project	Flowmeters	U.S.B.R.
Return flows to Colorado River at numerous locations	Various types	Various

1/ Does not include all measuring points

Table 3

Diversion of Colorado River water at Imperial Dam
Arizona Side, 1962 and 1963, in Acre-feet

	Total diversions to Gila Gravity Main Canal (Station 30)	Deliveries to North Gila Valley Irrigation District	Deliveries to Wellton-Mohawk Irrigation and Drainage District	Deliveries to 14 Warren Act Contractors	Deliveries to Yuma Mesa Irrigation and Drainage District	Deliveries to Unit B Irrigation and Drainage District
Calendar Year 1962						
January	34,580	5,600	10,080	973	13,709	2,557
February	42,840	6,330	19,009	706	12,935	2,024
March	61,810	7,480	33,078	1,413	14,958	2,374
April	85,510	7,750	42,500	1,884	25,441	4,148
May	100,300	8,320	50,091	1,740	31,217	5,815
June	103,300	8,180	51,654	2,465	31,750	4,755
July	105,700	8,870	48,830	2,433	35,631	5,137
August	107,200	8,900	50,926	1,940	36,108	6,095
September	88,910	8,410	40,372	1,580	31,163	4,446
October	56,210	5,510	25,133	543	19,480	2,998
November	57,740	7,390	23,175	1,672	16,688	3,222
December	39,300	6,230	15,374	694	11,387	1,929
TOTAL	883,400 1/	88,970	410,222	18,043	280,467	45,500
Calendar Year 1963						
January	38,660	4,920	14,545	817	13,410	2,463
February	48,950	6,710	23,702	1,280	11,343	2,134
March	72,800	7,390	40,098	1,400	17,604	2,278
April	86,260	7,210	44,410	2,133	24,418	3,647
May	107,700	7,350	55,141	2,093	33,151	4,745
June	112,000	7,360	59,041	2,680	33,718	4,648
July	113,400	8,510	55,002	2,606	36,244	5,442
August	106,900	8,580	51,024	1,830	35,912	5,311
September	81,880	7,440	41,445	834	24,434	3,634
October	66,640	7,240	31,571	1,168	18,637	4,599
November	43,760	5,850	18,867	1,079	13,896	554
December	38,180	4,930	15,422	941	11,069	2,304
TOTAL	917,100 1/	83,490	450,268	18,861	273,836	41,759

Diversion of Colorado River water at Imperial Dam
Arizona Side, 1962 and 1963, in Acre-feet

	Total diversions to Gila Gravity Main Canal (Station 30)	Deliveries to North Gila Valley Irrigation District	Deliveries to Wellton-Mohawk Irrigation and Drainage District	Deliveries to 14 Warren Act Contractors	Deliveries to Yuma Mesa Irrigation and Drainage District	Deliveries to Unit B Irrigation and Drainage District
Calendar Year 1962						
January	34,580	5,600	10,080	973	13,709	2,557
February	42,840	6,330	19,009	706	12,935	2,024
March	61,810	7,480	33,078	1,413	14,958	2,374
April	85,510	7,750	42,500	1,884	25,441	4,148
May	100,300	8,320	50,091	1,740	31,217	5,815
June	103,300	8,180	51,654	2,465	31,750	4,755
July	105,700	8,870	48,830	2,433	35,631	5,137
August	107,200	8,900	50,926	1,940	36,108	6,095
September	88,910	8,410	40,372	1,580	31,163	4,446
October	56,210	5,510	25,133	543	19,480	2,998
November	57,740	7,390	23,175	1,672	16,688	3,222
December	39,300	6,230	15,374	694	11,387	1,929
TOTAL	883,400 1/	88,970	410,222	18,043	280,467	45,500
Calendar Year 1963						
January	38,660	4,920	14,545	817	13,410	2,463
February	48,950	6,710	23,702	1,280	11,343	2,134
March	72,800	7,390	40,098	1,400	17,604	2,278
April	86,260	7,210	44,410	2,133	24,418	3,647
May	107,700	7,350	55,141	2,093	33,151	4,745
June	112,000	7,360	59,041	2,680	33,718	4,648
July	113,400	8,510	55,002	2,606	36,244	5,442
August	106,900	8,580	51,024	1,830	35,912	5,311
September	81,880	7,440	41,445	834	24,434	3,634
October	66,640	7,240	31,571	1,168	18,637	4,599
November	43,760	5,850	18,867	1,079	13,896	554
December	38,180	4,930	15,422	941	11,069	2,304
TOTAL	917,100 1/	83,490	450,268	18,861	273,836	41,759

TABLE 4

Diversions of Colorado River Water at Imperial Dam, California Side, 1962 and 1963, in Acre-feet

	Total Diversions to All-American Canal (Station 60)	Deliveries to Reservation Divi. Yuma Project	Deliveries to Valley Division Yuma Project thru Colo. River Siphon to Arizona	Deliveries to Mexico		Deliveries Imperial Irrigation District at Drop 1, AAC	Deliveries to Coachella Valley County Water District at Drop 1 AAC
				California Wasteway	Pilot Knob		
Calendar Year 1962							
January	278,400	3,710	15,010	3,300	99,420	119,060	28,960
February	245,000	6,640	24,090	4,910	11,210	151,800	31,850
March	498,700	9,300	29,940	1,940	133,400	262,280	46,950
April	555,800	8,850	32,900	1,490	124,300	308,840	63,580
May	479,500	11,580	37,680	5,830	45,110	298,082	60,032
June	515,000	12,160	34,100	3,550	88,760	296,249	57,322
July	583,400	12,490	38,920	3,300	115,400	332,680	63,140
August	569,700	12,070	38,530	5,920	101,400	329,730	66,900
September	469,200	7,550	40,040	20,240	13,030	314,684	53,020
October	348,000	5,790	31,150	6,950	0	254,898	32,531
November	316,200	3,980	21,420	10,320	72,030	171,864	26,458
December	181,900	3,320	11,710	7,060	7,860	111,142	23,673
TOTAL	5,041,000 1/	97,440	355,500 2/	74,810	811,900	2,951,309	554,416
Calendar Year 1963							
January	238,300	3,720	18,650	5,390	15,240	150,833	34,602
February	281,300	6,620	27,980	19,720	3,750	185,163	26,109
March	514,800	9,890	29,560	3,150	110,800	290,475	41,925
April	529,700	7,960	27,890	13,370	112,100	296,579	45,986
May	462,200	11,690	37,810	30,540	2,180	292,388	60,208
June	533,800	11,570	32,420	3,180	101,500	303,520	57,057
July	617,300	13,460	40,660	3,230	126,100	343,073	65,883
August	603,700	11,770	34,840	3,600	147,800	311,314	62,626
September	456,400	5,530	31,900	16,920	66,320	269,903	47,532
October	348,600	5,040	28,000	9,640	16,260	150,920	22,856
November	226,400	4,620	19,700	3,950	0	157,053	25,864
December	211,300	4,220	14,700	2,140	0	240,208	34,659
TOTAL	5,024,000 1/	96,100	344,100 3/	114,800	702,000	2,991,429	525,307

1/ Difference between total diversions at Station 60 and deliveries to contractors and to Mexico represent main canal losses.
2/ Includes 7,929 acre-feet delivered to City of Yuma.
3/ Includes 8,055 acre-feet delivered to City of Yuma.

Table 5

Listing of Contractors Receiving Colorado River Water Below Hoover Dam, 1963

California Contractors

Metropolitan Water District of Southern California

San Diego County Water Authority

Palo Verde Irrigation District

Imperial Irrigation District, All-American Canal

Coachella Valley County Water District, All-American Canal

Reservation Division, Yuma Project (Individual water-right applicants and Bureau of Indian Affairs)

In general, water deliveries to these California users are made within the framework of the amounts and with priorities in accordance with the recommendation of the Chief of the Division of Water Resources of the State of California (subject to availability thereof for use in California under the Colorado River Compact and the Boulder Canyon Project Act). Said water is delivered as ordered by the contractor, insofar as reasonable diligence will permit.

Arizona Contractors

Colorado River Indian Reservation (Contract not required)

Yuma County Water Users' Association, Valley Division, Yuma Project

Unit B Irrigation and Drainage District, Yuma Auxiliary Project

Wellton-Mohawk Irrigation and Drainage District, Gila Project

North Gila Valley Irrigation District, Gila Project

Yuma Mesa Irrigation and Drainage District, Gila Project 1/

Yuma Irrigation District, Gila Project 2/

Warren Act Contractors, Gila Project (14 contractors)

These contracts generally provide for water facilities on a capacity basis, with water deliveries to be in such amounts as may be reasonably required and beneficially used.

1/ A number of miscellaneous water contractors obtain small quantities of water for special purposes through the Yuma Mesa Irrigation and Drainage District's system.

2/ No surface water deliveries to this District until 1-1-65. Distribution system now under construction.

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Yuma Project - Reservation Division Area Irrigated 10,193 Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	3,710			3,710			3,710	6	1,684		2,020	
February,	6,640			6,640			6,640	24	2,266		4,350	
March,	9,300			9,300			9,300	71	3,069		6,160	
April,	8,850			8,850			8,850	102	2,888		5,860	
May,	11,580			11,580			11,580	28	4,432		7,120	
June,	12,170			12,170			12,170	39	4,361		7,770	
July,	12,480			12,480			12,480	56	4,354		8,070	
August,	12,060			12,060			12,060	64	4,076		7,920	
September,	7,560			7,560			7,560	16	3,064		4,480	
October,	5,790			5,790			5,790	72	2,378		3,340	
November,	3,980			3,980			3,980	260	1,450		2,270	
December,	3,320			3,320			3,320	137	1,413		1,770	
Total,	97,440			97,440			97,440	875	35,435		61,130	
Acre ft. per acre,												6.0
Per cent Net Supply,							100	1	36		63	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

a Measured at _____

b Measured at _____

GPO 840824

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Yuma Project - Valley Division Area Irrigated 43,979 Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 1/	Inflow from Reservoirs and other * sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	15,010	1,373		16,383	2,950		13,433	460	3,523	343	9,107	
February,	24,090	1,336		25,426	3,520		21,906	670	4,534	373	16,329	
March,	29,940	1,464		31,404	3,380		28,024	860	5,782	477	20,905	
April,	32,900	1,362		34,262	2,890		31,372	690	7,186	764	22,732	
May,	37,680	1,418		39,098	3,100		35,998	720	7,331	765	27,182	
June,	34,100	1,262		35,362	2,510		32,852	590	8,241	951	23,070	
July,	38,920	1,385		40,305	2,680		37,625	550	9,085	1,241	26,749	
August,	38,530	1,302		39,832	3,090		36,742	530	9,464	1,184	25,564	
September,	40,040	1,423		41,463	3,470		37,993	710	9,165	992	27,126	
October,	31,150	1,412		32,562	3,560		29,002	870	6,855	705	20,572	
November,	21,420	1,184		22,604	4,150		18,454	860	3,695	550	13,349	
December,	11,710	1,207		12,917	3,080		9,837	460	2,229	440	6,708	
Total,	355,490	16,128		371,618	38,380		333,238	7,970	77,090	8,785	239,393	
Acre ft. per acre,												5.4
Per cent Net Supply,				100	10		90	2	21	2	65	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

1/ a Measured at Colo. River Siphon

b Measured at

* Sump Pump

GPO 840884

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila Project
North Gila Irrigation District Area Irrigated 5,940 Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 5/	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste 6	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	5,600			5,600	3,294		2,306		560		1,746	
February,	6,330			6,330	2,700		3,630		633		2,997	
March,	7,480			7,480	3,376		4,104		748		3,356	
April,	7,750			7,750	2,823		4,927		775		4,152	
May,	8,320			8,320	2,905		5,415		832		4,583	
June,	8,180			8,180	2,690		5,490		818		4,672	
July,	8,870			8,870	3,095		5,775		887		4,888	
August,	8,900			8,900	3,602		5,298		890		4,408	
September,	8,410			8,410	3,907		4,503		841		3,662	
October,	5,510			5,510	2,159		3,351		551		2,800	
November,	7,390			7,390	4,163		3,227		739		2,488	
December,	6,230			6,230	4,946		1,284		623		661	
Total,	88,970			88,970	39,660		49,310		8,897		40,413	
Acre ft. per acre,												6.8
Per cent Net Supply,				100	45		55		10		45	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

5/ At Station 409+25 on Gila Gravity Main Canal

a Measured at _____

b Measured at _____

6 Returned to river
Measured over Cipolletti Weir by Recorder

GPO 840834

-142-

Form 7-522 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

GILA PROJECT - (SOUTH GILA UNIT)

Project WARREN ACT CONTRACTORS Area Irrigated 1990 Year 1962

QUANTITIES IN ACRE-FEET

MONTH	(a) Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	973			973			973				973	
February,	706			706			706				706	
March,	1,413			1,413			1,413				1,413	
April,	1,884			1,884			1,884				1,884	
May,	1,740			1,740			1,740				1,740	
June,	2,465			2,465			2,465				2,465	
July,	2,433			2,433			2,433				2,433	
August,	1,940			1,940			1,940				1,940	
September,	1,580			1,580			1,580				1,580	
October,	543			543			543				543	
November,	1,672			1,672			1,672				1,672	
December,	694			694			694				694	
Total,	18,043			18,043			18,043				18,043	
Acre ft. per acre,												9.07
Per cent Net Supply,	100			100							100	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

a Measured at _____

b Measured at _____

GPO 840884

(a) Farm T.O. on Gila Gravity Main Canal - Sparling Meter Readings

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila - Yuma Mesa Unit Area Irrigated 16,295 Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 1/	Inflow from Reservoirs and other sources 5	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	13,709	14		13,723		1,755			13	73	11,882	
February,	12,935	9		12,944		1,536			15	63	11,330	
March,	14,958	14		14,972		1,461			21	78	13,412	
April,	25,441	43		25,484		2,848			19	121	22,496	
May,	31,217	102		31,319		4,107			21	160	27,031	
June,	31,750	163		31,913		3,902			24	196	27,791	
July,	35,631	188		35,819		3,984			27	194	31,614	
August,	36,108	236		36,344		4,802			27	196	31,319	
September,	31,163	232		31,395		4,487			25	166	26,717	
October,	19,480	259		19,739		1,149			19	131	18,440	
November,	16,688	148		16,836		1,618			15	104	15,099	
December,	11,387	79		11,466		1,940			17	77	9,432	
Total,	280,467	1,487		281,954		33,589			243	1,559	246,563	
Acre ft. per acre,												15.13
Per cent Net Supply,				100		12				1	87	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

5 Inflow from tile drains

1/ a Measured at Gila Pumping Plant

b Measured at

GPO 840934

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila Project - Wellton-Mohawk Div. Area Irrigated 51,735 Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 1/	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	10,080			10,080	680						9,400	
February,	19,009			19,009	2,375						16,634	
March,	33,078			33,078	3,149						29,929	
April,	42,500			42,500	5,655						36,845	
May,	50,091			50,091	8,582						41,509	
June,	51,654			51,654	8,817						42,837	
July,	48,830			48,830	7,662						41,168	
August,	50,926			50,926	8,587						42,339	
September,	40,372			40,372	5,510						34,862	
October,	25,133			25,133	4,654						20,479	
November,	23,175			23,175	4,558						18,617	
December,	15,374			15,374	1,579						13,795	
Total,	410,222			410,222	61,808						348,414	
Acre ft. per acre,												6.73
Per cent Net Supply,	100			100	15						85	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

1/ a Measured at Wellton-Mohawk check and turnout

b Measured at

GPO 840834

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Coachella Division
All-American Canal System
Boulder Canyon Project

Area Irrigated 52,753

Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 5/	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	20,308			20,308	4	2,710		212			17,382	
February,	21,603			21,603	6	965		258			20,374	
March,	32,773			32,773		6,053		429			26,291	
April,	45,198			45,198	50	9,864		445			34,839	
May,	44,568			44,568		5,400		380			38,788	
June,	40,711			40,711		3,812		342			36,557	
July,	46,380			46,380		4,458		547			41,375	
August,	48,494			48,494	10	1,707		663			46,114	
September,	39,178			39,178		1,616		515			37,047	
October,	22,089			22,089	4	1,282		297			20,506	
November,	16,388			16,388		1,624		246			14,518	
December,	15,793			15,793	5	2,917		302			12,569	
Total,	393,483			393,483	79	42,408		4,636			346,360	6.6
Acre ft. per acre,												
Per cent Net Supply,												

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

5 Delivered at Station 2603 of Coachella Main Canal

a Measured at _____

b Measured at _____

GPO 840834

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Imperial Irrigation District
All-American Canal System
Boulder Canyon Project

Area Irrigated 430,989

Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1/	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	119,060											
February,	151,800											
March,	262,280											
April,	308,840											
May,	298,082											
June,	296,249											
July,	332,680											
August,	329,730											
September,	314,684											
October,	254,898											
November,	171,864											
December,	111,142											
Total, 2	951,309	-	-	2,951,309	12,822	162,568	2,775,919	31,140	251,408	16,969	2,493,371	5.79
Acre ft. per acre,												
Per cent Net Supply,												

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

a Measured at _____

b Measured at _____

GPO 840824

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Yuma Auxiliary (Entire) Area Irrigated 3,129 Year 1962

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,				2,557		218	2,339		73		2,266	
February,				2,024		215	1,809		72		1,737	
March,				2,374		213	2,161		71		2,090	
April,				4,148		412	3,736		137		3,599	
May,				*5,815		511	5,304		186		5,118	
June,				*4,755		427	4,328		145		4,183	
July,				5,137		498	4,639		166		4,473	
August,				*6,095		383	5,712		84		5,628	
September,				*4,446		352	4,094		63		4,031	
October,				2,998		284	2,714		95		2,619	
November,				3,222		358	2,864		119		2,745	
December,				1,929		222	1,707		74		1,633	
Total,				*45,500		4,093	41,407		1,285		40,122	
Acre ft. per acre,												12.8
Per cent Net Supply,				100		9	91		3		88	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

* Estimated. Meter out of service.

a Measured at _____

b Measured at _____

GPO 840584

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project YUMA PROJECT - RESERVATION DIV. Area Irrigated 11,313 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	3,720			3,720				87	1,319		2,314	
February,	6,610			6,610				223	1,967		4,420	
March,	9,890			9,890				158	2,842	5	6,885	
April,	8,113			8,113				149	2,740	60	5,164	
May,	11,690			11,690				158	3,883		7,649	
June,	11,573			11,573				44	4,023		7,506	
July,	13,464			13,464				54	4,665		8,745	
August,	11,764			11,764				50	4,162		7,552	
September,	5,528			5,528				491	1,754		3,283	
October,	5,035			5,035				149	1,857		3,026	
November,	4,620			4,620				206	1,556		2,858	
December,	4,217			4,217				465	1,320		2,432	
Total,	96,224			96,224				2,234	32,088		61,834	
Acre ft. per acre,												5.47
Per cent Net Supply,				100				3	33		64	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

a Measured at _____

b Measured at _____

GPO 840884

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Yuma Project - Valley Division Area Irrigated 46,321 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 **	Inflow from Reservoirs and other * sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	1/ Delivered to Laterals a	Lateral Waste	System Lateral Losses 3/	2/ Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	18,650	1,261		19,911	3,665		15,897	630	2,449	349	12,818	
February,	27,980	1,147		29,127	2,933		25,744	570	4,465	450	20,709	
March,	29,560	1,392		30,952	3,396		27,026	578	5,783	530	20,665	
April,	27,890	1,234		29,124	3,479		25,053	678	5,967	592	18,408	
May,	37,810	1,295		39,105	3,399		34,853	609	8,312	853	25,932	
June,	32,420	1,255		33,675	3,153		29,529	693	8,776	993	20,060	
July,	40,660	1,277		41,937	2,861		37,903	620	8,519	1,173	28,764	
August,	34,840	1,221		36,061	3,856		31,039	671	6,683	1,166	23,685	
September,	31,900	1,270		33,170	3,124		29,220	760	6,368	826	22,092	
October,	28,000	1,381		29,381	3,429		25,303	837	4,329	649	20,137	
November,	19,700	1,513		21,213	2,689		18,084	622	3,791	440	13,671	
December,	14,700	1,572		16,272	3,091		12,765	395	2,971	416	9,399	
Total,	344,110	15,818		359,928	39,075		312,416	7,663	68,413	8,437	236,340	
Acre ft. per acre,												5.1
Per cent Net Supply,				100	11		87	2	19	2		

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.
2 Reservoirs connected with distributing system only.
3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.
4 Do not include power.
* Sump Pump

** a Measured at Colo. River Siphon
b Measured at

1/ Net supply less nonirrigation deliveries and main canal waste
2/ Delivered from main canal
3/ Includes main canal loss

GPO 840884

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Gila Project - South Gila Unit

Project Warren Act Contractors Area Irrigated 2,020 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	(a) Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	817			817			817				817	
February,	1,280			1,280			1,280				1,280	
March,	1,400			1,400			1,400				1,400	
April,	2,133			2,133			2,133				2,133	
May,	2,093			2,093			2,093				2,093	
June,	2,680			2,680			2,680				2,680	
July,	2,606			2,606			2,606				2,606	
August,	1,830			1,830			1,830				1,830	
September,	834			834			834				834	
October,	1,168			1,168			1,168				1,168	
November,	1,079			1,079			1,079				1,079	
December,	941			941			941				941	
Total,	18,861			18,861			18,861				18,861	
Acre ft. per acre,												9.3
Per cent Net Supply,							100				100	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

a Measured at _____

b Measured at _____

GPO 840534

(a) Farm turnout on Gila Gravity Main Canal - Sparling Meter readings

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila Project - North Gila Unit Area Irrigated 5,625 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	5 Net Supply 3	6 Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	4,920			4,920	3,220		1,700		492		1,208	
February,	6,710			6,710	3,240		3,470		671		2,799	
March,	7,390			7,390	3,740		3,650		739		2,911	
April,	7,210			7,210	3,840		3,370		721		2,649	
May,	7,350			7,350	2,630		4,720		735		3,985	
June,	7,360			7,360	2,680		4,680		736		3,944	
July,	8,510			8,510	3,560		4,950		851		4,099	
August,	8,580			* 5,580	5,220		3,360		858		2,502	
September,	7,440			7,440	4,000		3,440		744		2,696	
October,	7,240			7,240	3,220		4,020		724		3,296	
November,	5,850			5,850	3,170		2,680		585		2,095	
December,	4,930			4,930	3,130		1,800		493		1,307	
Total,	83,490			83,490	41,650		41,840		8,349		33,491	
Acre ft. per acre,												5.95
Per cent Net Supply,				100	50		50		10		40	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

a Measured at _____

b Measured at _____

* Obviously should be 8,580

5 Measured at Station 409+25 Gila Gravity Main Canal. 6 Measured over Cipolleti Weir by recorders

GPO 840534

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila Project - Yuma Mesa Unit Area Irrigated 16,556 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 1/	Inflow from Reservoirs and other sources 5	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses 6	Delivered to Laterals 4	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	13,410	83		13,493			1,435			90	11,968	
February,	11,343	42		11,385			1,460			110	9,815	
March,	17,604	65		17,669			1,726			122	15,821	
April,	24,418	119		24,537			3,060			136	21,341	
May,	33,151	209		33,360			4,319			193	28,848	
June,	33,718	243		33,961			4,411			226	29,324	
July,	36,244	245		36,489			3,703			239	32,547	
August,	35,912	238		36,150			4,645			246	31,259	
September,	24,434	165		24,599			3,370			207	21,022	
October,	18,637	140		18,777			2,172			139	16,466	
November,	13,896	57		13,953			1,051			85	12,817	
December,	11,069	25		11,094			1,438			90	9,566	
Total,	273,836	1,631		275,467			32,790			1,883	240,794	
Acre ft. per acre,												
Per cent Net Supply,												

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power. Includes 252 District use.

1/ a Measured at Gila Pumping Plant

b Measured at

5 Inflow from Tile Drains

6. Includes lateral losses

GPO 840884

Form 7-322 (July 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila Project - North Gila Unit Area Irrigated 5,625 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	5 Net Supply 3	6 Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	4,920			4,920	3,220		1,700		492		1,208	
February,	6,710			6,710	3,240		3,470		671		2,799	
March,	7,390			7,390	3,740		3,650		739		2,911	
April,	7,210			7,210	3,840		3,370		721		2,649	
May,	7,350			7,350	2,630		4,720		735		3,985	
June,	7,360			7,360	2,680		4,680		736		3,944	
July,	8,510			8,510	3,560		4,950		851		4,099	
August,	8,580			* 5,580	5,220		3,360		858		2,502	
September,	7,440			7,440	4,000		3,440		744		2,696	
October,	7,240			7,240	3,220		4,020		724		3,296	
November,	5,850			5,850	3,170		2,680		585		2,095	
December,	4,930			4,930	3,130		1,800		493		1,307	
Total,	83,490			83,490	41,650		41,840		8,349		33,491	
Acre ft. per acre,												5.95
Per cent Net Supply,				100	50		50		10		40	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

a Measured at _____

b Measured at _____

* Obviously should be 8,580

5 Measured at Station 409+25 Gila Gravity Main Canal.

6 Measured over Cipolletti Weir by recorders

GPO 840884

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila Project - Yuma Mesa Unit Area Irrigated 16,556 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 1/	Inflow from Reservoirs and other sources 5	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses 6	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	13,410	83		13,493			1,435			90	11,968	
February,	11,343	42		11,385			1,460			110	9,815	
March,	17,604	65		17,669			1,726			122	15,821	
April,	24,418	119		24,537			3,060			136	21,341	
May,	33,151	209		33,360			4,319			193	28,848	
June,	33,718	243		33,961			4,411			226	29,324	
July,	36,244	245		36,489			3,703			239	32,547	
August,	35,912	238		36,150			4,645			246	31,259	
September,	24,434	165		24,599			3,370			207	21,022	
October,	18,637	140		18,777			2,172			139	16,466	
November,	13,896	57		13,953			1,051			85	12,817	
December,	11,069	25		11,094			1,438			90	9,566	
Total,	273,836	1,631		275,467			32,790			1,883	240,794	
Acre ft. per acre,												
Per cent Net Supply,												

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power. Includes 252 District use.

5 Inflow from Tile Drains

6. Includes lateral losses

1/ a Measured at Gila Pumping Plant

b Measured at

GPO 840824

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Gila Project - Wellton-Mohawk Div. Area Irrigated 56,289 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 1/	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Lateral Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	14,545	155		14,700		1,930					12,770	
February,	23,702	140		23,842	33	3,429					20,380	
March,	40,098	155		40,253	11	5,437					34,805	
April,	44,410	150		44,560	4	7,010					37,546	
May,	55,141	155		55,296	50	9,099					46,147	
June,	59,041	150		59,191	38	11,594					47,559	
July,	55,002	155		55,157	32	10,207					44,918	
August,	51,024	155		51,179	63	11,175					39,941	
September,	41,445	150		41,595	20	8,508					33,067	
October,	31,571	155		31,726	7	6,571					25,148	
November,	18,867	150		19,017	2	3,026					15,989	
December,	15,422	155		15,577		1,762					13,815	
Total,	450,268	1,825		452,093	260	79,748					372,085	
Acre ft. per acre,												6.6
Per cent Net Supply,				100		18					82	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

1/ a Measured at Wellton-Mohawk Turnout from GGMC

b Measured at

GPO 840624

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Coachella Division
All-American Canal System
Boulder Canyon Project

Area Irrigated 57,773 acres

Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources 5	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,		24,185		24,185	3,307	6,588		309			13,981	
February,		18,577		18,577	131	2,183		317			15,946	
March,		32,959		32,959		4,393		290			28,276	
April,		35,008		35,008		5,745		355			28,908	
May,		45,325		45,325		4,713		451			40,161	
June,		44,068		44,068	65	6,405		404			37,194	
July,		49,091		49,091		3,469		497			45,125	
August,		48,296		48,296		3,554		548			44,194	
September,		36,793		36,793	2,441	3,997		585			30,370	
October,		25,569		25,569	561	3,403		414			21,191	
November,		15,995		15,995	95	2,419		266			13,215	
December,		15,739		15,739	644	1,984		414			12,697	
Total,		391,605		391,605	7,244	48,253		4,850			331,258	
Acre ft. per acre,				6.77	0.125	0.835		0.084			5.73	
Per cent Net Supply,				100.0	1.8	12.3		1.2			84.6	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

5 Delivered at Station 2603 of Coachella Main Canal

a Measured at _____

b Measured at _____

GPO 840884

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Imperial Irrigation District Area Irrigated 430,481 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1 1/	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Lateral Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,	150,833											
February,	185,163											
March,	290,475											
April,	296,579											
May,	292,388											
June,	303,520											
July,	343,073											
August,	311,314											
September,	269,903											
October,	240,208											
November,	157,053											
December,	150,920											
Total,	2991,429			2,991,429	19,539	264,534	2,707,356	47,719	374,971	18,239	2,266427	5.26
Acre ft. per acre,											5.26	
Per cent Net Supply,				100			90.5				75.8	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.
2 Reservoirs connected with distributing system only.
3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.
4 Do not include power.

1/ a Measured at Drop 1 All-American Canal
b Measured at

GPO 840834

Form 7-322 (July 1960)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MONTHLY WATER DISTRIBUTION

Project Yuma Auxiliary Project - Entire Area Irrigated 3,129 Year 1963

QUANTITIES IN ACRE-FEET

MONTH	Diverted from Stream 1	Inflow from Reservoirs and other sources	Delivered to Reservoirs 2	Net Supply 3	Main Canal Waste	Main Canal Losses	Delivered to Laterals a	Lateral Waste	Main Canal Lateral & Losses	Non-Irrigation Deliveries 4	DELIVERED TO FARMS b	
											Total	Per Acre
January,				2,463					265		2,198	
February,				2,134					295		1,839	
March,				2,278					247		2,031	
April,				3,647					499		3,148	
May,				4,745					347		4,398	
June,				4,648					445		4,203	
July,				5,442					396		5,046	
August,				5,311					548		4,763	
September,				3,634					404		3,230	
October,				4,599					351		4,248	
November,				554					80		474	
December,				2,304					320		1,984	
Total,				41,759					4,197		37,562	
Acre ft. per acre,												12.0
Per cent Net Supply,				100					10		90	

1 Diversion amount exclusive of waste at head gates for sand sluicing, etc.

2 Reservoirs connected with distributing system only.

3 Diversions plus inflow from reservoirs and other sources less delivery to reservoirs.

4 Do not include power.

a Measured at _____

b Measured at _____

GPO 840934

ILLEGAL DIVERSION OF WATER FROM COLORADO RIVER TO FEDERAL, PRIVATE, AND STATE LANDS

April 8, 1964

Summary

There are 15,785 acres of Federal lands being farmed in the flood plain along the Colorado River, of which 5,544 acres, or about 35 percent, is covered by land use permits. Of the total acreage, 5,102 acres receive water from irrigation districts, 7,153 acres are served from pumps taking water directly from the Colorado River, and 3,530 acres are served from wells. In addition, there are 10,900 acres of private and State lands being irrigated without benefit of contracts therefor with the Secretary of the Interior, i.e., 6,740 acres served by pumps in the river, and 4,160 acres irrigated from wells. A conservative average of water diversion is six acre-feet of water pumped from the river or drawn from the underground to irrigate each acre of land. The consumptive use of water by the crops being raised would be less, probably slightly more than four acre-feet per irrigated acre. Based on six acre-feet measured at the pumps or wells, there would be more than 100,000 acre-feet of water used on Federal lands of which only slightly over 21,000 acre-feet is pumped from wells. To irrigate private and State lands over 38,000 acre-feet of water is pumped from the river and nearly 25,000 acre-feet is taken from wells.

Combining these figures, it is apparent that over 160,000 acre-feet of water is diverted to Federal, private, and State lands, of which amount 117,000 acre-feet is pumped directly from the river or served to the land through facilities of an irrigation district. In addition, about 1,000 acre-feet is pumped or lifted from wells for use by over 500 commercial, residential or recreational developments on Federal, private, and State lands along the Colorado River. The small amount of water used by these entities is not considered significant.

General Comments

Illegal occupancy of Federal lands along the Colorado River from Davis Dam to the international boundary and use of water on these and private lands has been a continually growing problem since immediately preceding World War II. The acreage of bottomlands along the river farmed since 1955 is shown in the enclosed Table I.

Irrigation water to serve the farmlands, for most part lands lying outside of organized irrigation districts, has been developed by the trespasser or owner of the private lands either by digging a well or placing a pump directly in the Colorado River or in a slough or backwater area fed from the river. There is little doubt that the ground water is Colorado River water or in any case the

recharge of the underground is directly from the river. The source of water used to irrigate the Federal, private and State lands, and quantity of water diverted to each ownership category is as shown on the enclosed Table II.

In May 1959, a concerted effort was undertaken by the Department of the Interior to evict illegal occupants on Federal lands who were using water without a contract as required by the Boulder Canyon Project Act. Five initial instances of clearly illegal occupancy of Federal lands and use of Colorado River water were filed with the courts.

In April 1961, the Lower Colorado River Land Use Office was established for the purpose of regularizing use of the Federal lands by the 800 or more trespassers. The permit covering agricultural lands states the following with regard to water:

> "12 (a) In the event that the applicant diverts or pumps Colorado River water in connection with the enjoyment of the permit area such diversion or pumping by applicant during the term of this permit or any extension thereof shall be for essential beneficial use only and shall cease upon and as provided by 30 days' written notice to applicant from the Secretary of the Interior or the officer issuing the permit that Colorado River water is no longer available for use within the permit area. In the event that such notice is given, applicant may terminate this permit.
>
> (b) If the applicant diverts or pumps Colorado river water for agricultural use, applicant shall give advance notice of the daily water requirements for each period of seven (7) consecutive days beginning Monday of each week. Such notice shall be given not later than the Wednesday preceding such Monday to the official of the Bureau of Reclamation designated for that purpose by the officer issuing the permit. Quantities specified in such notice may be modified with the approval of the Bureau of Reclamation. Such notice shall be in the form prescribed by the Bureau of Reclamation, and applicant shall keep such records of water use as may be required by the Bureau of Reclamation."

The permit is silent concerning water taken from wells to serve Federal lands.

On December 31, 1963, the Land Use Office had entered into permits covering most of the residential and commercial areas and 73 permits covering 5,544 acres of irrigated Federal land on about 35 percent of the total Federal land being farmed. The breakdown of Federal land being farmed by States and acreage under permit is shown in the enclosed Table III.

A concerted effort was made by this Department during the Fall of 1963 to initiate legal action to stop the installation of a large-sized pump in the Colorado River to serve private lands then being leveled and developed. The recommendation of the Department of Justice was that institution of action on this case be withheld pending issuance of the decree in Arizona v. California, et al., which was then being prepared. The decree was issued March 9, 1964, and shortly thereafter, the Department of the Interior again requested the Department of Justice to file action to prevent further diversion of Colorado River water by the party under consideration in 1963.

It follows that additional actions should be initiated to curb direct pumping of water from the river to private lands and to Federal lands not under Land Use Office permits. Curbing the use of water taken from underground to irrigate private lands poses complex legal and enforcement problems. Stopping the use of water from wells on Federal lands not under permit can be accomplished by eviction of the trespassers.

TABLE I

FEDERAL AND PRIVATE LAND USE - 1955 - 1963

DAVIS DAM TO INTERNATIONAL BOUNDARY

	1955	1957	1958	1963
Total Acres Irrigated	24,151	41,565	36,755	26,685
Federal	9,294	12,275	12,310	15,785
Private, State	7,585	12,845	10,420	10,900
Land in Uncertain Ownership	7,272	16,445	14,025	0 1/

1/ Cadastral survey of Colorado River, 1960-1962, identified lands as either Federal or nonFederal.

TABLE II

SOURCE OF WATER TO FARMLANDS ALONG THE COLORADO RIVER OUTSIDE OF IRRIGATION DISTRICTS AND ACREAGE OF FEDERAL LAND WITHIN IRRIGATION DISTRICTS

Ownership	Water source	Acres Irrigated	Estimated Acre-Feet Diverted Annually
Federal	Pumps	7,153	42,918
	Wells	3,530	21,180
	Irrigation Dist.	5,102	30,612
	Subtotal	15,785	94,710
Private	Pumps	6,440	38,640
	Wells	3,260	19,560
	Subtotal	9,700	58,200
State	Pumps and Wells	1,200	7,200
	Total	26,685	160,110 1/

1/ Not including about 1,000 acre-feet annually used on private and Federal lands by estimated 525 small wells serving commercial, residential and recreational developments.

TABLE III

SUMMARY OF FEDERAL LAND USE PERMITS
COLORADO RIVER BOTTOMLANDS
December 31, 1963

State	Total Acres	Total No. Individuals	Acres Under Permit	No. Individuals Signed Permits
California	9,328	64	3,486*	40
Arizona	6,457	60	2,058**	33
Total	15,785	124	5,544	73

* 12 individuals pumping from river to serve . . . . . 1,265 acres

26 individuals using wells to serve . . . . . 2,059 acres

2 individuals receiving water from irrigation district to serve . . . . . 162 acres

40 individuals 3,486 acres

** 17 individuals pumping from river to serve . . . . . 829 acres

13 individuals using wells to serve . . . . . 1,179 acres

3 individuals receiving water from irrigation district to serve . . . . . 50 acres

33 individuals 2,058 acres

MR. KUIPER: In regard to the Committee of Fourteen, there are five states here represented at a meeting which was held yesterday evening and this morning. The conclusion we reached was that we should have an early meeting, which we hope to have the latter part of next week or the second full week of May to be brought up to date on developments in the area.

There has been some tile drainage, there have been some additional pumps installed down there. We don't know what the results of the pumps have been. We hope to have this information available to us so that the full Committee of Fourteen, representing all seven of the Colorado River Basin States, can come to arrive at some definitive action which will solve this. And we would hope to be able to report this to the Commission at the special meeting which was directed to be called yesterday. We will bend all our efforts to have a full report for the Commission at that time.

THE CHAIRMAN: Thank you. Through yesterday and early this morning a number of questions have been directed toward the Bureau and the Department. It is time for answers. The Commissioner, Mr. Dominy, is given the floor to present everything that he wants to present.

MR. DOMINY: If it pleases the Commission, I will move up here to the end of the table. (Document distributed).

Mr. Chairman, members of the Upper Colorado River Commission, ladies and gentlemen: It is of course a privilege and a pleasure for the Commissioner of Reclamation to be here and I appreciate your making yourselves available in an extra day at this session to permit me to come with appropriate members of my staff and with the Deputy Solicitor of the Department to be accountable to you for the stewardship of the Colorado River, which is recognized by all to be a legitimate and continuing all-important concern to you and the states that you represent.

So much information, misinformation and gratuitous comment have been circulating in the Upper Colorado River Basin States in recent weeks concerning filling operations at Lake Powell that I certainly welcome this opportunity to meet with the Upper Colorado River Commission.

Between us, we may be able to set the record straight and achieve a greater public understanding of the necessity for our actions. We have sought to explain this in our letter to the Governors of the Upper Basin States announcing the stepup in releases from Lake Powell and in public statements, but for some reason, many important details were ignored or pushed aside as critics of our operation rushed into print.

Let me say that Secretary of the Interior Stewart Udall and the Commissioner of Reclamation have a united objective to provide the fairest and most objective treatment possible to both the Upper and Lower Basin States during the filling of Lake Powell. This filling has been made most critical by the coincidence of two years of extreme drouth conditions.

I may say parenthetically that the Upper Colorado River Storage Project was designed to remedy just such a situation as we are now confronted with. If Lake Powell had been filled to normal operating level prior to these two years of consecutive drouth condition, the problem of river operation would have been simplified in these years of drouth, even beyond that which had existed if Glen Canyon Dam had not been built and were not on the river. Without Lake Powell storage, it is entirely possible that in periods such as this the Upper Basin would not have been able to deplete the river for the uses contemplated by the construction of the Colorado River Storage Project participating projects.

It must be recognized that neither Secretary Udall nor the Commissioner of Reclamation are free agents in the operation of the Colorado River. We are governed by the "law of the river" which includes among other things, a specific direction that the Upper Colorado River Storage Project is subject to the Colorado River Compact and to the Boulder Canyon Project Act.

Finally, by way of preface, let me reiterate my statement which has repeatedly been ignored that there has not yet been a final decision on filling operations for this year. If one could judge from comments, it was foregone conclusion that we are immediately going to drain Lake Powell dry. Now when Secretary Udall made the tentative decision--and I repeat--the tentative decision on March 26 to follow the filling criteria, the filling criteria that had been discussed for years and was announced by the Department long ago, on an interim basis so as to maintain rated head at Hoover powerplant, he simultaneously directed the Bureau of Reclamation to keep the runoff situation above Lake Powell under continuing re-examination. You can be certain that Secretary Udall will begin storing water in Lake Powell and undertake a power purchase program at Hoover Dam whenever runoff forecasts make such a decision economically possible. In regard to this latter possibility, the Bureau started in mid-February to explore with power suppliers in the Lower Basin the availability of replacement power for Hoover.

The normal precipitation registered during March is a big step toward that hoped for runoff. But it will require at least normal precipitation during April and May as well as during June and July, together with normal runoff conditions, to achieve this total. The normal precipitation during March did postpone into May the "point of no return" when we must make an irrevocable decision on this year's operations. Thus a final decision may be expected

when the May forecast of moisture in the Colorado drainage basin is available. In the meantime we will continue to investigate possible avenues for power purchase including the much publicized but until yesterday undocumented offer of the Upper Basin States' utilities.

With this preface, I would like to make the following comments concerning particular points of controversy:

DELIVERIES OF WATER TO MEXICO

During 1961, we limited Mexico's scheduling of Colorado River water deliveries to the guaranteed annual quantity of 1,500,000 acre-feet provided for in Article 10 (c) of the 1944 Treaty. We insisted upon this same limit in 1962, 1963, and again in 1964. However, there is always some variance between scheduled and actual water deliveries because of many factors, most of which are out of our control.

In 1963, an overdelivery of 503,890 acre-feet occurred to Mexico. Of this, 86,050 acre-feet were river regulation water released in January and February of 1963, and 68,000 acre-feet resulted from storm runoff below Imperial Dam between September 17-25, 1962, leaving a net overdelivery of 349,840 acre-feet caused by physical inability to completely control the river flow. This compares to overdeliveries of 258,700 acre-feet in 1961 and 295,440 acre-feet in 1962. Keep in mind, gentlemen, that we have a 72-hour uncontrolled period in releases of water out of Lake Mead and Parker Dam to meet downstream commitments, and that frequently the vagaries of Nature provides excess water at the boundary that we have no control over. We have never been able to hold our deliveries to Mexico precisely in accord with scheduled deliveries for that reason. We expect to bring these deliveries closer to schedule when the Senator Wash Dam and Reservoir, now under construction upstream from Imperial Dam, is completed, as we will explain further in this statement.

ADJUSTMENT OF FLOOD CONTROL CRITERIA TO CONSERVE WATER

To conserve the maximum amount of water in 1962, a year of good runoff, we reached an agreement with the Corps of Engineers to infringe on flood control space in Lake Mead to hold back an additional million acre-feet of water. An additional 370,000 acre-feet of water were subsequently stored and 267,640 acre-feet of that released between October 1962 and March 1963, as river regulation flow below Imperial Dam to scour a channel in that aggraded reach where phreatophytes were beginning to consume large quantities of water and Mexico was able to gain ancillary benefits from this release during that period by the resulting lowered salinity of water delivered under the Treaty. Details of the operation were fully discussed in hearings June 7, 1962, before the Senate Interior and Insular Affairs Committee and were public.

CUTBACK OF POWER GENERATION

Despite the opinions expressed by representatives of the power allottees at Hoover Dam that sufficient water should be available for generation of firm energy during the 1962-1963 year of operation, Regional Director A. B. West of the Bureau, and with my backing, held that only sufficient "water be made available at least sufficient to meet downstream requirements." It is a matter of record that water for downstream irrigation and domestic requirements only were released from Lake Mead in that year in anticipation of the needs to start filling operations at Lake Powell the following year and the same condition has since applied. No water has been released at Hoover Dam solely for power production since 1960. Starting with the runoff year 1961 there have been no releases of water at Lake Mead through the Hoover generators except water that was scheduled for downstream diversion.

WATER SALVAGE ON LOWER COLORADO RIVER

Channelization of the Colorado River from Topock Gorge to Big Bend has resulted in an annual water salvage of over 65,000 acre-feet. The printed copies distributed to you say 130,000 acre-feet; that is in error. It has been 65,000 acre-feet but an additional salvage of 190,000 acre-feet will result from the total channelization program which is being carried on; and when that is completed, we will not have just 65,000 acre-feet a year, we will have 65,000 plus 190,000 of salvage saved as a result of this non-reimbursable channelization program that is being carried on.

Since early 1960 the Bureau has had an approved plan for the rectification of 16 miles of badly braided river channel in the Cibola Valley that would result in an estimated additional annual salvage of 36,000 acre-feet of water. Work has been delayed until early this year by Congressional Committees pending agreement between the States of Arizona and California on their common boundary.

As mentioned above, up to 285,000 acre-feet annually of additional water salvage will be possible by operation of Senator Wash Dam and Reservoir, an offstream facility which we now have under construction at a site only two miles upstream from Imperial Dam. The reservoir, in a strategic offstream site, will be used for the storage of excess water reaching Imperial Reservoir, including minor floods, for later release as required to satisfy irrigation requirements. As pointed out previously, in our best years of operation at Imperial Dam, we have seldom been able to regulate flows reaching Imperial so that less than 300,000 acre-feet of water in excess of Mexico's scheduled annual requirement reached the International Boundary. We anticipate much closer and much more accurate downstream deliveries when Senator Wash Dam is completed. It will take two years to construct it so we have the runoff year of 1964 and the runoff year of 1965 before that facility will be available to us.

All of you people who are interested and have some knowledge of irrigation operations on a river system know that if you have a 72-hour delay from the time you release water under scheduled deliveries before it reaches the final diversion point, that you don't have a very good control, and we haven't had a good control of the Colorado River. We have needed this Senator Wash Dam for years. But until the Arizona-California suit was of record and the law of the river decided, and until we had all of these things working for us, it was impossible to get Congress to appropriate the kind of money needed, some $26,000,000, to build the Senator Wash regulating reservoir, but now it is under construction.

NEED OF CONSERVING WATER IN LOWER BASIN

Since issuance of the decree in Arizona versus California by the Supreme Court less than six weeks ago, we have given high priority to a determination of overall operating criteria to be followed in river operations under the decree.

On August 14, 1962, Regional Director West wrote all contractors of Colorado River water calling attention to the potential critical situation and urging a reduction in water requirements where possible. This has not been too successful, but since issuance of the decree the extent and requirements for uses of water all along the river have been and are presently under scrutiny to develop plans for reduced delivery schedules to irrigation and domestic users conforming with reasonable use provisions of the Lower Basin water contracts.

ILLEGAL DIVERSIONS

Reclamation has not been unaware of the problem of illegal use of water along the Colorado River. The decree in Arizona versus California has also strengthened the Secretary of the Interior's authority to enjoin use of river water without a contract.

There is some popular belief that illegal diversions can be halted simply by moving illegal occupants from the land or by shutting off their water supply through the medium of warrants served by a United States Marshal. Unfortunately it is not that simple, as I have learned to my sorrow.

In some cases the threat of legal action has halted illegal diversion or trespass but generally illegal diversion by those owning private lands can only be stopped by a court obtained injunction. Illegal diversions by trespassers can also be halted by evicting them from the land.

A trespass case is now in the courts and has been there for about five years. A recently instituted illegal diversion case has also been referred to

the Department of Justice, but its filing in court was delayed pending the final decree in Arizona versus California. Within the last few months we have met in Los Angeles with representatives of the United States Attorney's offices of both Arizona and Southern California in anticipation of processing a number of these cases of both types. Approximately eight trespass cases are now in the office of our Regional Solicitor in Los Angeles in final preparation for referral to Justice. Thirty more cases are in various stages of preparation in the Land Use office at Yuma, Arizona.

I might say parenthetically that as near as we can compute the total net depletion from these illegal diversions, it runs in the neighborhood of 100 to 125 thousand acre-feet annually.

FISHERY AND RECREATION RESOURCES AT LAKE POWELL

As with most Reclamation projects Lake Powell has created an outstanding fishery and outstanding recreation resource which outdoor sportsmen, in which I include myself, have taken great pride. I must nevertheless point out that these ancillary benefits are secondary to the primary purposes of the water for consumptive uses.

But I will also hasten to point out that the expressions of alarm over total draining of Lake Powell have been completely unfounded. Only under the most critical drouth conditions could this occur, and I mean another year beyond 1964 of drouth, and the normal precipitation during March has virtually eliminated this possibility for the current year at least. Even under the poor forecast conditions as they exist today, if we are not able to resume storage in Lake Powell, there will be a pool of more than 2,000,000 acre-feet of water during the summer. Within this same forecast we do not foresee any condition requiring a drawdown of Lake Powell below 400,000 acre-feet as a minimum, and even this should provide a lake 100 feet deep at the dam and extending 50 miles upstream. This would occur, if at all, in the late fall and winter when temperatures would be low enough to maintain the trout fishery.

Of course, if we have another minimum water year in 1965, the lake could well be drained. That is one of the exigencies we must face. On the other hand, as I have stated, if our early May runoff forecast shows normal precipitation in April and an April-July runoff of 4,700,000 acre-feet or better, we can carefully consider and, I for one fervently hope, undertake a power purchase program which will solve our immediate filling problems at Lake Powell.

The water meanwhile that we are releasing over and above the inflow into Lake Powell will not interfere if we are able to make a decision by the middle of May that there are reasonable prospects of an April-July runoff of as great as 4,700,000 acre-feet, because those quantities of water would need to be released to Hoover in any event to keep it from going below a level of 1083.

I told Congressman Aspinall the other day that I never wanted to be guilty of misrepresentation to Congress, and I told him that after two wonderful days on Lake Powell that I felt I had misled Congress when I had reported to them that this was a man-made lake, the greatest scenic and recreational potential in America. And I said after visiting there, I thought I had misled Congress because I underestimated, I think it is the most scenic and recreational lake in the world. And I certainly don't want to drain it. I want to help fill it as rapidly as possible, consistent with good business management and the total Federal investment on the entire Colorado River.

And the decision we have made on an interim basis is predicated solely on the fact that Nature has dealt us a low blow by depriving us of a normal snow pack on the Colorado drainage basin, coupled with a bad year the year previous.

Now if these conditions can change, certainly our decision can change and will change in my judgment. We do know that in 1962 we got the kind of months that we need now. We can hope that Nature will repeat the 1962 runoff precipitation pattern of April, May, June and July. If it does, our problem will be solved. If it doesn't, I am afraid we will continue to wrestle with it to the dissatisfaction of many people.

I and the members of my staff are here for such time as the Commission wants to devote to questions to us. We will not duck any; we will answer them as fully and factually as our knowledge and understanding of the problem permits.

THE CHAIRMAN: Thank you, Mr. Commissioner. Do you wish to have any of the staff of the Bureau or Department people offer anything further until questions are asked?

MR. DOMINY: I think not. I think that the best way to handle our time would be to go into any direct questions which the Commission members have, and I will call upon the appropriate member of my staff which I think is best informed on the particular question involved.

THE CHAIRMAN: Yes.

COM. CLYDE: Mr. Chairman.

THE CHAIRMAN: Governor Clyde.

COM. CLYDE: I appreciate very much, Commissioner Dominy, your frank statement of the situation as you see it. I think that we are all striving to reach the same objective, but we feel that the time to act is now, not next

May which is only 30 days hence or 45 days hence. And I would like to pose this question: Why these actions, these positive actions, cannot be taken now rather than to wait for another 45 days to do it.

Now I understand fully the relationship between the forecasted runoff and the operation procedures necessary to maintain the controls at Lake Mead and Lake Powell. I realize fully that we have had a fair but not unusually large precipitation during the fourteen days of April that have just passed, but we haven't lost ground. All of the prognostications that have been made to date appear to be on the conservative side, which is a good side to be on. But the fact remains that water has a habit of running downhill; we can always put it downhill but we can't bring it back uphill if our estimates and our conclusions are proven to be wrong.

Therefore, it would seem to me that now is the time to act, to set in motion a procedure which will involve the closing as required of the gates at Glen Canyon, and with a firm provision for providing a power source to meet the impairment which will result as a result of that action. Now those are things that can be done, and we have nothing to lose by doing them.

I would like to urge your group and the Secretary to take seriously into consideration the proposition that we immediately take the necessary steps to put this program into action now, that we start to close those gates, we do it in harmony with the presently known information and the information which will become known as the days pass; that we set up the procedures and the machinery whereby we can provide this replacement power in order to keep that water as high on the watershed as possible, and that means to put it in Lake Powell.

MR. DOMINY: Governor Clyde, there is no difference between the Department of the Interior, the Bureau of Reclamation and you as to the desirable situation, which would be of course to get the upstream reservoirs in full operation at the earliest practical moment.

Faced with the runoff situation, we see the distinct possibility that were we to attempt to hold the water now and bring Hoover down below rated head at this time, that we still wouldn't get enough water to accomplish minimum operation at Glen, we would then have to release the water later in any event, and meanwhile the Upper Basin would be charged with the making up of power losses at Hoover that would have been unnecessary had we put the water down to maintain it at 1123 from the start.

I point out also that the water we are putting down there now and would put down under this minimum operation decision up until about the middle of May, does not impair the prospects of bringing Lake Powell up to 6,100,000 acre-feet if by the middle of May we can be reasonably assured that we may have an April-July runoff of 4,700,000 acre-feet.

So a decision now is only adverse as we see it to the economic payout of the Upper Basin States because we know full well that last year in March we had a mean forecast of 5.9, we had a May forecast of 4.7, but we got an April-July runoff of only 3.2. We have no assurance on the basis of the studies we have to date on the moisture in the Basin that we can look for anything like 4.7 at this time.

COM. CLYDE: Mr. Chairman, I disagree with the last point there, but that is a matter of opinion. You say we cannot reach this 4.7. It seems to me all the evidence at hand to date indicates that we can. But my point is this, that there is no reason why we shouldn't provide the machinery and put it into motion to meet these contingencies when they arise.

I think it is entirely possible that we could get a depreciated streamflow. It is also entirely possible that we could get an appreciated streamflow. All we are doing by using this procedure is to set up the machinery to do this job. It takes a few days to do it. We don't have many days left.

And I think that the important thing, as I am sure you will all realize, is to get these reservoirs in the Upper Basin filled as quickly as possible because the whole Colorado River program is based on the basic assumption that this storage must be provided in order for this program to work. If we don't fill these reservoirs, the Colorado River Compact cannot be implemented. Therefore, we should hoard water if necessary. And I say that deliberately, we should hoard water until these reservoirs are filled and we can get this machine in operation as it was intended to operate in 1922 when this Compact was signed.

Here is an opportunity for us to begin. No one knows exactly the answer, I appreciate that, but all I am asking is that we put in motion now, that the Secretary acquiesce in a plan which will so operate those gates at Glen Canyon that in connection with Lake Powell and Lake Mead we can preserve the maximum water in Glen Canyon and have the minimum impairment at Lake Mead to meet. I think that is not asking too much. I hope we don't delay for 45 days before we decide whether or not to do this.

COM. JOHNSON: Mr. Chairman, I have some questions I would like to ask.

THE CHAIRMAN: Senator Johnson--is that proper?

COM. JOHNSON: It is improper but I will accept it, sir.

THE CHAIRMAN: All right.

COM. JOHNSON: Mr. Dominy, I have several questions that I would like to discuss with you briefly, sir. The problem that we have before us is the problem of the division of water between the Upper Basin and the Lower Basin. It is easy enough to confuse that simple problem with a lot of other problems on the river where there are so many problems. But I would like to confine my thinking and my approach and my conclusions upon the one problem of the division of the water between the two Basins.

Mr. Dominy, I think it was Confucius who said that "A fool can ask questions that the wisest man cannot answer." I think you can answer these questions of mine, and they are meant to make clear that one single problem of the division of water between the two Basins.

That is the one point that I am greatly concerned with today, not only for the year 1964 but for all of the years ahead. If there is confusion in the relationship and the water supplies between the two Basins, then we are going to be in for a long period of confusion. We just as well settle it now at this time and have it back of us; because if we don't settle it, it is going to plague the people on the Colorado River, the Upper and the Lower Basin, as long as that river is utilized for water supplies.

Now with my questions, Mr. Dominy, are you familiar with a legal document identified as the Seven-State Colorado River Compact?

MR. DOMINY: I am generally familiar with it, and my attorneys and some of my top staff are explicitly familiar with it.

COM. JOHNSON: But you are familiar with it?

MR. DOMINY: Yes, sir, in a general sense.

COM. JOHNSON: Does it have 11 articles, each dealing with some phase of the development of the Colorado River?

MR. DOMINY: I am assuming from the question that it does have.

COM. JOHNSON: Do you respect each of its provision, or do you consider it a scrap of paper? That is not meant to be an insult, sir.

MR. DOMINY: I consider it a very momentous scrap of paper. I also recognize--

COM. JOHNSON: You consider it what?

MR. DOMINY: A very momentous scrap of paper, an important scrap of paper. I think it is--

COM. JOHNSON: But you still think it is a scrap of paper?

MR. DOMINY: Oh, indeed not. I used that strictly in the humorous vein. I think it is a very significant document of great import on the Colorado River.

COM. JOHNSON: Does it divide the Colorado River drainage area into two Basins known as the Upper Colorado River Basin and the Lower Colorado River Basin?

MR. DOMINY: It does indeed and selects Lee Ferry as the arbitrary point of division.

COM. JOHNSON: Does the Colorado River Compact divide the consumptive use of the water of these two Basins?

MR. DOMINY: It presumes to do that, yes, sir.

COM JOHNSON: What do you mean by "presumes"?

MR. DOMINY: Well this is the purpose of it. There still has to be--

COM. JOHNSON: Does it or does it not?

MR. DOMINY: I think it does. There may be differences of opinion as to how it does it, but certainly it presumes to do it. I use that word advisedly.

COM. JOHNSON: I don't like your word "presume". I like to have, it either does or it doesn't. Now I can get a copy of the Compact and point out to you Article III and maybe you want to refresh your memory.

MR. DOMINY: I think I can amend my answer so it will satisfy you better, Mr. Johnson.

COM. JOHNSON: I wish you would.

MR. DOMINY: By saying that it certainly is the purpose and intent of the document to do that.

COM. JOHNSON: Well but does it do it?

MR. DOMINY: I think it does.

COM. JOHNSON: Thank you.

MR. DOMINY: There may be others who have some disagreement as to how it does.

COM. JOHNSON: You mean by "others" your attorneys?

MR. DOMINY: I mean all people involved in looking to the Colorado River for their economic life blood, including you, including Ival Goslin, including all of the Governors of the States affected, and so on.

COM. JOHNSON: How much water is apportioned to each Basin by the Compact?

MR. DOMINY: Well this is one of the questions that I want my legal eagle to give the answer to. Mr. Weinberg.

MR. WEINBERG: Article III (a) apportions 7,500,000 acre-feet to the Upper Basin and to the Lower Basin; and Article III (b) provides that the Lower Basin can increase its use by a million acre-feet a year.

COM. JOHNSON: May I read Article III and see if that is the way you understand it?

MR. WEINBERG: I will have to read it too then.

COM. JOHNSON: I will not read all of Article III; I will read Article III (a):

> "There is hereby apportioned from the Colorado River system in perpetuity to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist.
>
> "(b) In addition to the apportionment in Paragraph (a), the Lower Basin is hereby given the right to increase its beneficial consumptive use of such waters by 1,000,000 acre-feet per annum."

Is that the way you understand it?

MR. WEINBERG: I think that is in line with the answer I gave, Senator, speaking from memory.

COM. JOHNSON: Thank you. It is a very important question and I wanted there to be no question about it. One of the great troubles that we are facing today is because of so many different opinions instead of the actual facts. Now where is this water divided between the two Basins?

MR. DOMINY: The measurement is at Lee Ferry, which is a few miles below Glen Canyon Dam.

COM. JOHNSON: Outside of the Gila River drainage, does the Upper Basin produce practically all the water of the Colorado River?

MR. DOMINY: Substantially.

COM. JOHNSON: Substantially?

MR. DOMINY: I would say substantially all of the water outside of the Gila, and, of course, the Little Colorado puts some water in the river as well as other minor tributaries.

COM. JOHNSON: The Little Colorado?

MR. DOMINY: But this is a reasonable statement, that the great volume of water that reaches the lower basin is in the river at Lee Ferry and relatively small portions come in below that point.

COM. JOHNSON: The Little Colorado River is in the drainage basin of the Colorado River?

MR. DOMINY: That is right.

COM. JOHNSON: How many feet of water does the Compact require the Upper Basin to deliver to the Lower Basin at Lee Ferry in each 10-year period?

MR. DOMINY: I again ask Mr. Weinberg to answer for me.

MR. WEINBERG: Article III (d) of the Compact provides that:

> "The States of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series. . ."

COM. JOHNSON: ". . . beginning with the 1st day of October next succeeding the ratification of this Compact." So now we know the definite commitment that the Upper Basin is pledged to sustain and fulfill, is that correct?

MR. WEINBERG: Not by that reference to 75,000,000 acre-feet, Senator.

COM. JOHNSON: I didn't hear you.

MR. WEINBERG: I say the reference to 75,000,000 acre-feet is not the sole statement of the Upper Division's responsibilities under the Compact.

COM. JOHNSON: Would you name the other responsibilities that you have in mind?

MR. WEINBERG: Article III (e) is one.

COM. JOHNSON: III (e).

MR. WEINBERG: And the other one--

COM. JOHNSON: Yes, I think that is a very important one, and I think that it is very pertinent today.

MR. WEINBERG: The other one has reference to--

COM. JOHNSON: May I comment on (e):

> "The States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water, which can not reasonably be applied to domestic and agricultural uses."

My understanding is that in this particular case, the demand on the part of the Lower Division is for water to make power and not for irrigation, domestic or agricultural uses.

MR. WEINBERG: The other provision has to do with the bearing of any Mexican Treaty burden which may develop in the event of a deficiency.

COM. JOHNSON: What is the paragraph?

MR. WEINBERG: That is Article III (c).

COM. JOHNSON: Article III (c):

> "If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River system, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in Paragraphs (a) and (b); and if such surplus shall prove insufficient for this

purpose, then the burden of such deficiency shall be equally borne by the Upper Basin and the Lower Basin, and whenever necessary the States of the Upper Division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in Paragraph (d)."

It is your opinion that that is an additional burden?

MR. WEINBERG: Well this is an additional requirement that the Compact provides.

COM. JOHNSON: But you don't like to think of it as a burden?

MR. WEINBERG: Senator--

COM. JOHNSON: There are questions, legal questions with respect to Paragraph (c), whether that is a burden or whether it is not, whether that amount of water for Mexico is not included in the 75,000,000 overall. But that is a legal question and we won't try to argue that here today, unless you desire to be arguing.

MR. DOMINY: As a matter of fact, Mr. Johnson, the very purpose we had in spending several years of very intensive negotiations with the Lower Basin people and with the Upper Basin people in attempting to arrive at a filling criteria was an attempt to work out a practical, reasonable, economically sound method of filling Glen Canyon Dam and the other Upper Basin Reservoirs without getting into litigation and the long delays that could certainly result if we attempted to define in detail each word and punctuation and paragraph in this Compact.

Now we didn't ever ask either the Lower Basin or the Upper Basin to pass a resolution endorsing specifically the criteria that was finally announced. It was, however, agreed to as the best we could come up with to meet all of the possible exigencies with which we could be confronted, with all of us recognizing that were we unfortunate enough to get into a series of dry years, that we had a real problem on our hands. And unfortunately we have that problem on our hands.

COM. JOHNSON: You say it was agreed to; by whom was it agreed to in the Upper Basin?

MR. DOMINY: I said we did not ask for formal agreement on the part of this body which represents the Upper Basin. We did, however, give ample opportunity for everyone concerned to debate the issues with us and give us their judgment as to what kind of a filling criteria in their judgment meant the Upper Basin reservoirs--

COM. JOHNSON: The Governors of the Upper Basin did not agree. The Upper Basin Commission did not agree. I don't recall ever seeing you present at one of our meetings telling us you would like to have us agree to something or other.

MR. DOMINY: Well, sir, I made the statement that we asked for no formal agreement. I did have the very top members of our technical staff available to debate the issues with competent technical staff members of the Upper Basin States and the Lower Basin States.

COM. JOHNSON: I think the Upper Basin--I don't know whether I am representing their views exactly or not by this statement--but I think the Upper Basin relied upon something more substantial than manufactured criteria. I think they were depending upon the Compact, the Colorado River Compact, which was very specific on the point of division of water between the Upper Basin and the Lower Basin. I think they wanted to stay with the Compact.

That is the only assurance that we have, the Upper Basin States have, of being able to consumptively use 7,500,000 acre-feet of water and deliver to the Lower Basin 75,000,000 acre-feet of water in the 10-year period.

MR. DOMINY: And the entire Colorado River Storage Project, which has moved forward with the greatest rapidity of any project of this magnitude in the history of Reclamation, is predicated exactly on that premise.

COM. JOHNSON: And now at the critical time you are abandoning that Storage Project. You have got it built, you have got a lot of it built, you have spent $425,000,000 plus, and now you want to leave it inactive. That is one of our complaints.

MR. DOMINY: This of course comes down to matters of opinion and matters of judgment. I have repeatedly stated that the decision, the tentative decision, that is being followed is one strictly based on economics; and it is our judgment, based on all the facts, that we are protecting the interests of the Upper Basin Account as well as preserving the Secretary of the Interior's and Commissioner of Reclamation's responsibility for the total Federal investment on the river, by the tentative operation that we are following pending a more conclusive knowledge of what the flow will be during April-July of 1964.

COM. JOHNSON: Yes, but you are ignoring the Compact and the provisions of the Compact. Now under the Compact we are required to deliver a certain amount of water at a certain time; and we are also under the Compact awarded a consumptive use of 7,500,000 acre-feet of water annually and we want to live up to that Compact. We take that seriously, not as a scrap of paper, not as just a happy thought; we take it seriously and we want everyone to observe it and we want to observe it ourselves.

Under the Colorado River Compact does delivery--that is delivery of 75,000,000 acre-feet in ten years--take precedence over the 7,500,000 acre-feet of water the Upper Basin is authorized to consume each year?

MR. DOMINY: I defer to my lawyer again.

MR. WEINBERG: Well I think before you call upon me to answer a question like that, you should have the advice of your own counsel.

COM. JOHNSON: I didn't quite catch that answer.

MR. WEINBERG: I said I think you should have the advice of your own counsel before we are called upon to interpret the Compact in relation to these questions in terms of the most severe problem that faces all of us today with respect to the filling of Glen Canyon.

COM. JOHNSON: Mr. Chairman, am I a member of this Commission?

THE CHAIRMAN: You are, sir.

COM. JOHNSON: As a member of this Commission I am asking these questions and I repeat my question: Under the Colorado River Compact, does such delivery--and we are talking about the delivery of 75,000,000 acre-feet--take precedence over the 7,500,000 acre-feet of water the Upper Basin is authorized to consume each year? That is, can we consume the 7,500,000 acre-feet of water until we fulfill that commitment and make that delivery to the Lower Basin?

MR. WEINBERG: Senator, if it comes down to a question of whether there is enough water for 7,500,000 acre-feet of beneficial consumptive use in the Upper Basin and the meeting of the 75,000,000 acre-foot guarantee, I have never heard anyone express any other opinion than that the 75,000,000 acre-foot guarantee is the first responsibility.

COM. JOHNSON: It has a preference right and a preference status?

MR. WEINBERG: That is the only opinion I have ever heard expressed on this subject.

COM. JOHNSON: I am not expressing one today. Might such a commitment constitute, Mr. Dominy, a severe burden on the Upper Basin in a series of dry years?

MR. DOMINY: Yes, I think it is fully recognized that the Upper Basin has that commitment, and it does possibly cause real problems for you if a long dry cycle were to prevail.

COM. JOHNSON: Yes, we consider it a tremendous burden upon us and one to which we must give great concern and great attention. We can't just laugh it off.

MR. DOMINY: This is completely understandable.

COM. JOHNSON: One dry year--several dry years in a row and the Upper Basin would not have one drop of water.

MR. DOMINY: Of course Glen Canyon is the structure that is built to give you the control necessary so that you can meet that commitment without impairment of your rights. And we are satisfied that once we get the kind of years that will let us fill these main stream reservoirs that we will be able to ride through dry cycles without undue burden to anybody.

COM. JOHNSON: I am especially pleased and very glad to have you subscribe to that opinion. Your words are beautiful, your words are reassuring, but your actions to make Glen Canyon impotent are not reassuring, they are devastating and they bother us. That is what we are worried about and that is why we are meeting here.

MR. DOMINY: I would be pleased of course, Commissioner Johnson, if I were so potent in my control and operations that I could decide how much moisture we had in the Colorado River drainage basin; and if I were, I can guarantee we wouldn't have this problem. We have a problem strictly because Nature has deemed to give us the headache to wrestle with.

COM. JOHNSON: I heard you say a few moments ago that is the very reason that we built these projects, to take care of these problems. If there were no problem on the river, if there was an abundance of water for everybody, Upper and Lower Basin, and everybody that wanted to use the water, of course, there would be no problem, but that is completely not the situation. The situation is the reverse of that; and that is why we have built these projects. That is why we have gotten into this controversy. That is why we are meeting here today, trying to find our way out of a most difficult situation.

And speaking for myself, and I think I am speaking for a great many other people in the Upper Basin, we think the only procedure to follow is the Compact itself that was devised 40 years ago to take care of the situation that we are in today. We don't like to abandon what the patriots who worked on this problem thought was necessary to do 40 years ago.

MR. DOMINY: I must again state with emphasis, Mr. Johnson, that the actions of the Secretary of the Interior, made on my recommendation based on the facts as we obtained them and analyzed them on the basis of historical hydrology, is not capricious; it is not arbitrary; and it is not in our judgment adverse to the best interests of the Colorado River Storage Project.

We have made the decision because of our responsibility to protect the total Federal investment on that river. And were we to operate in such a way that neither Glen or Hoover is up to operating level and neither of the powerplants were functioning, we would be derelict in our responsibility. And based on the runoff forecast that we have, this is entirely possible were we to pull Hoover down now by storing in Lake Powell.

And I repeat that in our judgment our decision was a wise one. It was the only reasonable one that responsible people could make, given the facts that we have to face. And we are still hopeful that the storm clouds will hover over that area and dump a lot of moisture so that a more favorable forecast of runoff might later obtained.

COM. JOHNSON: It is not adverse to certain objectives which are noble objectives, to be sure. But I do continue to point out to you, Mr. Dominy, that it is adverse to the terms, the provisions, of the Colorado River Compact, and the Upper Basin States do not dare to not have that Compact followed to the letter by everybody. That is the only safety we have got. You have admitted that we have a tremendously difficult problem in the Upper Basin. But giving a preference right on the water that is produced there, 75,000,000 we must deliver to the Lower Basin, and we must deliver that and then take what is left for ourselves to fulfill the amount of water that we are authorized to consume. That is a terrible burden.

I was in the Colorado General Assembly in 1923 when the Colorado River Compact was ratified by our General Assembly. And I opposed with all the might that I could bring to bear against giving the Lower Basin a preference to the water that was produced in the Upper Basin. I was willing for them to have a share of that water, an equal share of it, but I objected strenuously to the preference right that they were given.

And that preference right is the very thing that brings us here today and causes us to plead with every word and every idea that we can bring forth to have everybody on the river follow the Colorado River Compact implicitly.

MR. WEINBERG: Commissioner Johnson, with the same earnestness and sincerity with which you state your position, let me say to you, sir, and

to the members of this Commission that the Secretary of the Interior and the Commissioner of Reclamation do not for one minute concede that any action that they have taken violates the responsibilities and duties imposed upon them by the law of the river, including the Colorado River Compact.

They will plead guilty to one act and one act alone, or one motive and one motive alone, and that is to frame criteria and to take actions after the fullest consultation designed to provide a reasonable solution to most difficult and vexing problems, and designed above all, Commissioner Johnson, to avoid in the Colorado River Basin another tragedy such as that that befell the Lower Basin by 14 years of continuous litigation in the Supreme Court which has not added a drop of water to the Colorado River; which has delayed planning for 14 years.

The greatest tragedy that could befall the Upper Basin or the whole Basin--and I speak only for myself in this--would be to plunge this river into litigation to examine issues which are not now present, which may never arise and which in today's context can only be considered on the basis of varying hypotheses. As I say, I think no greater tragedy, no greater error could be made than to plunge this river into litigation to litigate some of these concepts that have bothered all of us. If we are successful, and if the Upper and Lower Basins are successful, reasonable men will achieve reasonable solutions. The mark of our lack of success will come if we have to go back to the courtroom.

COM. JOHNSON: I know the Upper Basin, and I know that I am speaking for more than myself when I say it, would regard litigation and a lawsuit as a tragedy. We are not seeking a lawsuit. We would like to have a reasonable settlement of this problem, but we do not think it a reasonable settlement for the Secretary of the Interior to come up into the Upper Basin and open our storage reservoirs and take our water instead of working out or attempting to work out in a reasonable sort of a way an agreement between the two Basins.

Mr. Dominy said just a few minutes ago that they did not ask this Commission anything about the criteria, anything about a decision as to how to settle these questions. He said they didn't ask us, which they didn't.

MR. DOMINY: Let us keep the record exactly correct. I said we did not ask for formal approval by either Basin on the filling criteria as finally announced.

COM. JOHNSON: I thank you for the correction.

MR. DOMINY: I went on to say it had been discussed over a period of many, many months, actually several years, with the top technical experts of the Bureau of Reclamation and the top technical experts representing the States of the Upper Basin. And that the members of this Commission were not fully informed is something that I cannot accept.

I am satisfied that you were well aware of the nature of those discussions. We just didn't ask either the Lower Basin or the Upper Basin to give us a formal resolution of agreement because we recognized that there are elements of controversy in the operation of this river that we hope can be worked out by reasonable people meeting the problems as they arise and avoiding a final lengthy court test of every item in the Compact.

COM. JOHNSON: We realize you are afraid of a court test, and we don't want to impose one upon you.

MR. DOMINY: I don't fear a court test, Commissioner Johnson.

COM. JOHNSON: Your attorney said he did.

MR. DOMINY: If you are implying we fear a court test because we are operating outside the Compact, I want to make it abundantly clear that such is not the case.

We say we fear a court test because of the adverse effects of delays and the internal expense and the expense to all of us in the economic development that would not be made while the test was being made--which was 14 years in the Lower Basin where they had the fastest growing population in the Nation--with no plans to solve our water problems other than a court test.

We don't want to see any further controversy of that sort to delay the progress in the Colorado River Basin as a whole if it can be avoided.

COM. JOHNSON: I would agree with you completely if you would agree to follow the letter of the Compact. That is all we have to depend on. Everything else is sand under our feet. That Compact is the only solid rock we have got and we have got to adhere to it; we have got to stay with it.

MR. DOMINY: There apparently is a difference of opinion between yourself and the Commissioner of Reclamation. You imply that the means, our interim operation under the filling criteria, is in violation of the Compact. We do not so consider it.

COM. JOHNSON: I contend that when we delivered our commitment of water as required by the Compact, 75,000,000 acre-feet in the present

10-year period, and we have not consumed our 7,500,000 acre-feet which the Compact awards us, that we can store water up to the amount that we haven't used and utilized of that 7,500,000 in Lake Powell, and that it is our water.

MR. DOMINY: Part of our differences, Commissioner Johnson, may arise from the fact that you are using some figures that differ from ours in the statements you presented to the Commission late yesterday afternoon.

You stated on July 1, 1962, Lake Mead contained 24,600,000 acre-feet of water. Our records indicate that on July 1, 1962, Lake Mead contained 23,722,000 acre-feet of water.

You then go on to say that since that date the Upper Basin delivered at Lee Ferry water in the amount of 10,400,000 acre-feet. Our records indicate that during that period the delivery was 6,297,000 acre-feet.

The total of the two figures according to your mathematics was 35,000,000 acre-feet when actually it was 30,019,000 acre-feet.

COM. JOHNSON: I got my figures from the Commission's headquarters in Salt Lake City, and I think that they are accurate.

MR. DOMINY: I am sorry, sir, but they aren't.

COM. JOHNSON: I want to ask you some questions about these figures because I noticed from what you said this morning in your opening statement that there was a conflict between my figures and your figures. I got my figures from our Salt Lake office, and I think that they are accurate. You think your figures are accurate; but it is tremendously important that your figures and our figures are resolved.

MR. DOMINY: Well the Bureau of Reclamation has represented the people of the West for 62 years. We do operate the structures on the river. We do keep accurate records, and we do have the figures that represent the true facts of inflow and outflow, and they are readily obtainable. I don't know how the error came about, but I repeat; there is an error obviously.

THE CHAIRMAN: Commissioner Johnson, Governor Clyde has a question to ask here.

COM. CLYDE: Mr. Chairman, you know you don't grind grain with water that has gone over the dam. It seems to me that we are talking about some things now which are important and have been important in the Basin, but we are not getting at the nubbin of this thing. I think it is rather simple, I am sure, in answer to Mr. Weinberg, no one wants to create a lawsuit. We don't make water by going to court. But there are times when you have to resort to final action when a decision has to be made.

Now as Mr. Dominy has just said, we have enjoyed--I say "we"--the people of the West have enjoyed cooperating with the Bureau of Reclamation for over 60 years. We have had good relations with them. We have had our differences of opinion; they have been legitimate. Errors have been made; nobody is invulnerable. Maybe we are making errors now.

But the fact remains that this Colorado River Storage Project, which was predicated upon a division of water between the two Basins, was also predicated upon long-time storage, long-time holdover storage which makes this thing function. We have got to do everything within our power to build up and establish that storage so that we can get this program functioning as it was intended, and you can't do that overnight.

Now as we sit here and argue, the water is going down the river, that is the thing that I am fearful of. And I think we will lose nothing by getting our affairs in order so that we can take immediate and quick action if it is dictated by the information which we get day by day and hour by hour from here on out. And it seems to me that that is all we are asking as of the present.

MR. WEINBERG: Governor Clyde, I couldn't agree with you more. It wasn't my purpose to suggest that the Upper Basin should do other than seek the earliest filling of the Upper Basin reservoirs. I think you and I are in full agreement.

COM. CLYDE: No question.

MR. WEINBERG: It was my purpose to suggest that we lawyers can argue some of these questions endlessly. But that is not the immediate problem before the House, with all due deference. The Department of the Interior is in full agreement with you that the machinery should be gotten ready so that when a decision is taken it can be put into effect, and this is exactly what the Department of the Interior is proceeding to do.

COM. CLYDE: That is the question that I would like to put specifically to Mr. Dominy, and whether or not you can speak for the Secretary at this moment I don't know. But it seems to me there is only one question before us: Is the Secretary willing to sit down in the light of the information which we have received as late as yesterday and go over this whole situation and bring these minds together--and no man has got a corner on brains in this matter--and bring these minds together to work out a solution to this problem? We are interested in solutions, not more problems.

But the solution immediately at hand is this: We want to so operate, if the good Lord gives us the water, so that on the first of August when those generators at Glen Canyon are ready to turn, we will have the water to turn them with, and that is all we are asking.

Therefore, Mr. Dominy, do you feel that the Secretary would be willing to sit down with representatives of this Commission, with representatives of the utilities who have made an offer which I believe is a solution to this thing, under the principle of providing capacity and energy to meet the impairment of the operation at Hoover, so that we might put this water where it will be most effective, to get to my original proposition?

MR. DOMINY: Yes, I can speak without hesitation that Secretary Udall continues to be available to discuss any of these important matters over which his Department has jurisdiction with any organized group from the states involved in an attempt to work out the best possible solution at any time.

And we have been working with Lower Basin power interests to get some figures from them as to replacement of power. Now we have a proposal from the Upper Basin group.

COM. CLYDE: We feel a little badly about that, if I might inject this in there, because the letter that I sent to the Utah Power and Light Company which precipitated this approach to the thing and was done because I believed--and I believe it more now than I did then because I didn't have the information then--that between these private utilities they can provide the capacity and the energy and the transmission and all of the mechanical facilities necessary to make this function to do the job we have to do. That is the thing we were trying to establish and it was established finally as late as yesterday, and that report which the utilities submitted to the Commission has been forwarded to the Secretary.

My question then is: Would the Secretary be willing now to sit down with the interested parties, all of them, and see if we can't work out an action which will reach this goal which we are all seeking? I don't think there is any difference in us on the goal.

MR. DOMINY: I am sure we would be happy to sit down and debate the issues.

COM. CLYDE: That answers my principal question, Mr. Chairman.

MR. DOMINY: I would like to make one statement here. I would like to have you all familiar with the actual releases from Lake Mead in 1962 and 1963. Now for all practical purposes, Commissioner Johnson and members of the Commission, we started with 1962 because that was the year we did fill Lake Mead and actually under the flood control criteria under which we were operating, we overfilled; and there was actually water that normally would be released which we held up for sluicing purposes.

COM. JOHNSON: What was the point in 1962 when Lake Mead was full?

(Mr. Dominy turns to staff.)

B. R. STAFF MEMBER: 1204.2 on the 24th of July 1962.

MR. DOMINY: How many acre-foot capacity have you got? We infringed on the flood curve in 1962.

B. R. STAFF MEMBER: 24,578,000 acre-feet.

COM. JOHNSON: I said a moment ago 24,600,000 and you challenged that.

MR. DOMINY: That wasn't on July 1.

MR. GOSLIN: Let me clarify that figure for these two gentlemen.

COM. JOHNSON: Give me that figure again please, twenty-four million what?

B. R. STAFF MEMBER: 24,578,000. The figure we are giving you is on the 24th of July and the figure I believe you had was on the 1st of July.

COM. JOHNSON: And the amount of water was 24,578,000?

B. R. STAFF MEMBER: 24,578,000.

COM. JOHNSON: I want to get these figures accurate.

B. R. STAFF MEMBER: That is taken from the area capacity release on Lake Mead.

COM. JOHNSON: But that is the figure and what is the date? I want to get that date.

MR. DOMINY: The 24th of July.

COM. JOHNSON: The 24th of July?

MR. DOMINY: 1962.

COM. JOHNSON: 1962.

MR. DOMINY: The content of Lake Mead was 24,578,000 acre-feet.

COM. JOHNSON: I had the date wrong in that I gave you July 1. That wasn't the fault of our office, Ival; it was my fault.

MR. GOSLIN: We gave you a different date.

COM. JOHNSON: I got a chart and I thought it would be the 1st of July instead of the 24th.

MR. DOMINY: Let us clear up one thing more.

COM. JOHNSON: Okay.

MR. DOMINY: There was no water released from Lake Mead in either 1962 or 1963 specifically for the production of power. The only water released was that necessary in the river to meet downstream diversion requirements. And in 1962 we released at Lake Mead a total of 8,615,000 acre-feet of water.

COM. CLYDE: In connection with that, what was the run of the river that year?

MR. DOMINY: About 14 something, wasn't it (turning to staff)?

COM. CLYDE: 14,000,000?

MR. DOMINY: 14,800,000. That was my recollection.

COM. CLYDE: That is in addition to your discharge from storage?

MR. DOMINY: Well the run of the river. Of course you have to take our evaporation and bank storage, phreatophytes. We released that from Lake Mead.

COM. CLYDE: Out of storage?

MR. DOMINY: Well, yes.

COM. CLYDE: What was the total consumptive demand below the dam in that year?

MR. DOMINY: This in effect was it.

COM. CLYDE: The 8,000,000. Where did the run of the river come in then?

B. R. STAFF MEMBER: At the Compact point, Governor, in 1962 it was 14,800,000 acre-feet. Released from Lake Mead, as Commissioner Dominy stated, was 8,600,000 acre-feet.

MR. DOMINY: At Lee Ferry you had a 14,800,000 acre-feet runoff.

COM. CLYDE: And you took in addition to that 8,000,000 out of the reservoir?

MR. DOMINY: No, we took out 8,600,000 acre-feet.

COM. JOHNSON: And part of that 14,000,000--it wasn't all delivered by July 24th?

MR. DOMINY: No, that is for the entire year.

COM. JOHNSON: But there was part of the 14,000,000 that still wasn't delivered to Lake Mead by July 24th.

COM. CLYDE: What were the consumptive requirements for that year below Hoover?

MR. DOMINY: When you talk about consumptive requirements--

COM. CLYDE: The Compact says you shall not discharge any water past Hoover Dam for purposes of generating power only. That means the waters discharged should be for consumptive purposes.

MR. DOMINY: This is true.

COM. CLYDE: All of them.

MR. DOMINY: And this is what I have said, we delivered 8,000,000 out of Lake Mead, 8,615,000 acre-feet, for diversionary requirements below Lake Mead, none for power specifically.

COM. CLYDE: The answer to my question is then, all of this was for consumptive purposes?

MR. DOMINY: Yes. Now in 1963 we delivered out of Lake Mead 8,533,000 acre-feet.

COM. CLYDE: Well now on the 31st day of July in 1962 you had 24,548,000 acre-feet in the reservoir. Now there is 10,000,000 acre-feet of that that has disappeared between then and now because it is down below 14,500,000 now.

MR. DOMINY: Well yes, it is down to 14,500,000; and we are holding it at that level. But you want to remember in 1963 we put very little water down below Glen Canyon. We released only a thousand second-feet for most of the time and stored it. We stored 3,100,000 acre-feet in Glen Canyon. And, of course, there was some bank storage loss and everything else involved in filling a new reservoir too, and there continues to be evaporation losses and all the other things that go into operating a river.

MR. WEINBERG: Governor Clyde, the Compact does not prohibit the release of Lake Mead solely for power purposes. I think your premise is--

COM. CLYDE: You say it doesn't?

MR. DOMINY: At any rate it is an academic point because 1960 we haven't done it, and we don't intend to do it.

COM. CLYDE: Do you have in your records that would be available to us an accounting of the water distribution?

MR. DOMINY: This is actually available in the reply to Congressman Aspinall; and if you decide to put that in your record here, I think all of these logs are in the detailed reply to Congressman Aspinall.

I wanted you to get this one figure here. You see actually if you take the Compact requirement of the Lower Basin States of 7,500,000 acre-feet and you add to it the million and a half for the Mexican Treaty, you have got 9,000,000 acre-feet. I don't mean to imply that the Upper Basin has to deliver 1,500,000 acre-feet for the Mexican Treaty under the Compact; I merely say the use contemplated in the Compact is 9,000,000 acre-feet to the Lower Basin, the consumptive use.

COM. JOHNSON: The burden.

MR. DOMINY: All right, the burden, the consumptive use as contemplated in the Compact. The last two years we have delivered 8,615,000 acre-feet in 1962 and 8,533,000 acre-feet in 1963.

Now I am not arguing that it shouldn't have been less than that. There were overdeliveries to Mexico; there were illegal diversions. It may well be that a careful husbanding of the actual needs and the beneficial use to both Arizona and the diverters in critical runoff years, we could get by with less diversions than we have been.

Unfortunately our contracts are not too explicit and they talk in terms of reasonable beneficial use and so on, and we don't have any firm acre-foot commitments one way or the other. And when the people who operate it say, "We want so much on such-and-such a date", we have very little basis on which to say, "We are sorry, you don't need that many second-feet. We are only going to give you 90 percent."

COM. CLYDE: Mr. Dominy, one additional question: As of today or yesterday, how much water was running into Lake Powell? What was your inflow?

MR. DOMINY: Do you have that (turning to staff)?

MR. CLINTON: It is running around 5,000 now.

COM. CLYDE: Second-feet?

MR. CLINTON: Yes.

COM. CLYDE: And what is the discharge out of Lake Powell?

MR. CLINTON: 12,000.

COM. CLYDE: So you are pulling down at the rate of 7,000 second-feet?

MR. CLINTON: About that.

MR. DOMINY: Didn't you get up to as high as 12,000 inflow there? Didn't you have one or two days where you got up that high?

MR. CLINTON: It should start up again with these warm days.

COM. BLISS: Mr. Chairman--

COM. JOHNSON: Did you want to make a statement, Mr. Bliss?

COM. BLISS: I would like to ask a question if I could, Governor.

COM. JOHNSON: Fine. I don't want to lose the floor.

COM. BLISS: Why don't you go ahead with your questioning, and I will raise this question later.

COM. JOHNSON: I am glad to have Commissioner Clyde and Governor Clyde interrupt and make the very fine statement that he made here today. I subscribe wholeheartedly to every word that he said. I am in complete agreement with what he said, and I am glad that he interrupted our discussion over at this end of the table to make that statement. I think it was timely, and I think it was very necessary that it be made at that very point.

Some questions have been raised about the accuracy of some of my figures. All of my figures I have gotten from the Commission. We knew that this meeting was coming; in fact, it was coming a week earlier, and it was postponed so that we could get replies to the questions that Congressman Aspinall had asked the Department. We wanted to get the figures from Washington for this meeting, but we didn't get them. They didn't show up. They didn't leave Washington until the day that we met.

Now it is necessary in arguing points of this nature to have accurate figures. I believe that our figures are completely accurate, but there was this difference that Mr. Dominy very properly called attention to between July 1 and July 24. And that was my error; that wasn't the error of the Commission office. They gave it to me in the form of a chart, and the chart showed July 1 and it is pretty hard to show 24 days' difference on a chart.

Now I have some other figures that I want to ask Mr. Dominy about that I have quoted in my statement. I stated in my statement that in the current 10-year period we delivered at Lee Ferry, the Upper Basin delivered at Lee Ferry, 93,700,000 acre-feet of water; that we were required to deliver 75,000,000.

Now whether we are required to deliver in addition to that 75,000,000 the part that goes to Mexico or not is another question. But even if we were required to deliver to Mexico, that would only be 7,500,000 and that would mean that in this current 10-year period we have delivered more than 11,000,000 acre-feet above our obligation.

And I want to ask Mr. Dominy if he cares to discuss that figure, 93,700,000 acre-feet. If I had the figure that has been submitted to Congressman Aspinall, there wouldn't be this question. But we were diligent up here at this end in trying to get accurate figures from Washington so that there would be no dispute about the figures.

And I would like to ask Mr. Dominy if he is satisfied with the 93,700,000 acre-feet delivered at Lee Ferry in the current 10-year period?

MR. DOMINY: That is up through 1963. My staff tells me that that figure is the accurate running average over the most recent 10-year period.

I have this comment to make: That had we been able to get Glen Canyon built a year sooner, of course, then 1962 would be a wonderful year to have filled our dead storage. We just were unfortunate in that we weren't prepared in 1962 to capture a pretty good flowing river.

I for one think it is a little academic to think and to talk about a 10-year average, a moving average that goes back beyond the time that we were capable of storing water at Lake Powell, because in the years that you had no capability, the water was there and it went down.

COM. JOHNSON: We delivered it.

MR. DOMINY: Yes.

COM. JOHNSON: It was our burden to deliver it. The point that you raised there about the dry years, the point we want to make or at least I want to make in the Upper Basin is that the Upper Basin ought not to be saddled with the total responsibility of what happens during a drouth. We ought not to have to carry the whole load.

We built Glen Canyon for the very purpose of giving us protection and in giving protection to the Lower Basin of a constant delivery of water, which is very advantageous to the Lower Basin. And we have undertaken to meet our responsibilities, heavy and terrible as they are--and they are terrible and they are heavy--but we are trying to get in shape so that we can meet our responsibilities on that river; and we think that we should not be condemned for that, that it should be recognized that we were just merely meeting our responsibilities.

Now I want to check another set of figures here. Here is a record of the excess of delivery of water to Mexico over and above the required deliveries of 1,500,000 acre-feet, beginning with 1958. In 1958, 4,909,000 acre-feet we delivered over and above what we needed to deliver, what we were required to deliver. Do you have any figures on that? You have my figures there, Mr. Dominy?

MR. DOMINY: Yes, I have them. Mr. West is looking at his chart.

MR. WEST: That is a year we were able to give Mexico 1,700,000 acre-feet, and that was a year in which power was produced.

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MR. DOMINY: Yes, I have them. Mr. West is looking at his chart.

MR. WEST: That is a year we were able to give Mexico 1,700,000 acre-feet, and that was a year in which power was produced.

COM. JOHNSON: If Mexico requires it, they can ask us for 1,700,000 instead of 1,500,000, if they ask it, but if they don't ask it--they haven't asked it.

MR. WEST: Mexico is entitled to 1,700,000 if it is available. She is not entitled to ask for 1,700,000 if we are not able to give more than 1,500,000.

COM. JOHNSON: That's right, but I didn't take that into consideration here because I knew that there was no dispute on that point.

MR. DOMINY: Commissioner Johnson, we can debate figures as far back as we have records, if that is your view, if that is your purpose. But let us remember that in 1962, regardless of what went on before that, Hoover filled and anything that went before that is academic because we had enough water to fill in 1962. As recently as 1962 we impinged on the flood curve at Hoover Dam, Lake Mead.

So that whatever happened before that is of no concern. We couldn't have done anything about it, as Governor Clyde said a moment ago. We ought to start where we are and look at the problem from here on.

COM. JOHNSON: Were all your reservoirs completely filled in 1962?

MR. DOMINY: Yes.

COM: JOHNSON: What is the capacity of Lake Mead?

MR. DOMINY: Well it has a maximum capacity, including flood storage and surcharge pool, of something like 29,000,000 acre-feet.

COM. JOHNSON: That is what I was figuring, 29,000,000.

MR. DOMINY: But the Corps of Engineers gives us flood curves to follow on all of our principal river structures, and Hoover has a flood control function to perform too. We are not permitted to encroach on the flood curve except for a minimum period of time. That is not conservation storage.

COM. JOHNSON: It looks to me, at a time when you knew Lake Powell was coming up for filling and that there would be an extreme shortage of water anyway and a critical time, that you would have stored all the water that you could in your reservoir.

MR. DOMINY: We did. We did. We infringed on the flood curve, and we got the Corps to change it and move it up by a million acre-feet by reason of Navajo and Flaming Gorge being on the river and by reason of Glen Canyon being imminent on the river.

We have not operated this river negligently in spite of your position, Commissioner Johnson.

COM. JOHNSON: All I was going by was statistics, and I took the capacity of Lake Mead. I didn't know that 24,600,000 acre-feet was all that Lake Mead could hold.

MR. DOMINY: We have a conservation space limit and a flood space as established under the flood criteria. With Glen on the river we will be able to change that. We have already got them to move it up by a million acre-feet, and we think there is a good chance that we can get that released to a further extent but this doesn't help us in the future.

COM. JOHNSON: It would help us at the present time if we had that water that has gone down and been dumped into the Gulf of California, if that water was stored in Lake Mead and the other lakes below Lake Mead.

MR. DOMINY: This is where you and I differ because in 1962 we did not have the control on the river. The water came down uncontrolled in an amount that filled Lake Mead to the then current operating criteria, and we even infringed upon it and held all that we possibly could, Commissioner Johnson. There was no waste of water.

COM. JOHNSON: I was not aware of that fact and I did not understand it that way. But I did think that you could put more water in Lake Mead, and I think you had the water there to put in.

MR. DOMINY: I am sorry, sir, but the facts dispute your contention, and I shall stick with the facts.

COM. JOHNSON: Mr. Chairman, that concludes my questions.

THE CHAIRMAN: Mr. Bliss.

COM. BLISS: Mr. Chairman, I would like to echo what Governor Clyde has said as to the need for action. It seems to me that what our Commission is up against at the present time is this: We feel that analyses have been made, that the reports of the power companies have been made which show that they can take care of any deficiencies which may be created by starting to fill Glen Canyon at this time. We feel that now is the time to do it.

It is a calculated risk--we recognize that, you recognize it--but we feel that in any event it is the Upper Basin which will stand the loss if there is indeed a loss and later we have to effectuate the power capacity in Glen Canyon.

We feel that now is the time to proceed, for the Secretary to close the gates, and we would certainly like an opportunity to convince him that this is the time to do it.

MR. DOMINY: Let us take a look at this picture. Today is the 15th of April. We will have the May 1 snow survey available by May 8th.

I have asked Frank Clinton to get on this negotiating with the power companies immediately. We have the proposal as presented; we don't find rates and various details in there that will be necessary to discuss.

COM. BLISS: I think those have to be negotiated.

MR. DOMINY: And I personally don't see how this could possibly be negotiated into any final document ready for execution on the part of the companies and the Department of the Interior prior to May 8th in any event.

And I am willing to put full pressure behind it with Mr. Bennett, my Assistant Commissioner for power matters, and Regional Director Clinton and Regional Director West, who have the day-to-day on-the-job task of operating this river, to work to get everything we need for a final definitive decision as to the best course of action by May 8. And I think that the Secretary's interim announcement as to the operation should and will continue until that date.

I repeat again that the releases from Powell greater than inflow up until that time is not a critical factor, if we make the decision then that replacement power can be purchased and that we do have reasonable prospect of a runoff that will build up to 6,100,000 acre-feet at Lake Powell.

COM. CLYDE: You are fully aware I am sure, and I think you pointed this out, Mr. Dominy, that it takes some time to negotiate these agreements. There have got to be agreements between companies and there have to be agreements between the Secretary and the utilities as a group. There have to be agreements and understandings with the states. That all takes time.

Today is the 15th. The 1st of May will be here before we know it. I think it is quite important that action be taken immediately to enter into those negotiations to set up the machinery which can be put into effect once this decision is finally made without the necessary delay then of going through these things.

MR. DOMINY: I don't see how physically we could have all the answers required to adjust to the course of action the Commission is arguing for earlier than May 8th.

We have got to work with the Lower Basin power users and make arrangements for the delivery of the exchange power, if that is to be done; and we have got to ascertain with finality the means of delivering this power.

COM. CLYDE: Why can't that be done now by the 1st of May?

MR. DOMINY: I think I said by the 8th of May we can have these things resolved. I don't think we can do it prior to that, nor do I think the Secretary would want to make a final decision until the May 8th snow survey is available.

COM. CLYDE: But is the Secretary going to oppose the working out of the details of this thing? You may never use the details; that is entirely possible.

MR. DOMINY: I have already authorized Frank Clinton, as my agent, to proceed to consider the proposal with the companies right out in the West where the companies are, where our people are that are informed on the details of it. They will be working on it immediately.

COM. CLYDE: I think we ought to have more than a discussion, Floyd. I really think--

MR. DOMINY: My definition of "discussion" was actually negotiating details, getting into line and item contract detail.

COM. CLYDE: Are you authorizing him to enter into agreements if such agreements are found mutually acceptable?

MR. DOMINY: Of course we will give him that authority as soon as we see what the facts are. Meanwhile I have already told you that we haven't been idle; we have been discussing this same problem with the Lower Basin.

COM. CLYDE: We haven't been able to--and I would like to make it clear we do have a few brains--to work out this problem and we don't think we should be completely ignored on it. I think that is part of this cooperative program we have conducted for more than 50 years with good results.

MR. DOMINY: Let me state I have been a little bit distressed by some of the stories that made it sound like you people were completely unaware of this problem until the directive went out on March 26, and this I will not accept as a fact.

As early as last fall Frank Clinton told this Commission that because of the very dry year in 1963, that if we had a repetition of it we were in real trouble.

As early as January and February I had several discussions with Ival Goslin and other people out here who are interested in this problem.

We were all aware that we had a bear by the tail unless the snow started to fall. We haven't kept you uninformed.

COM. CLYDE: No one has ever questioned that, Floyd. But you remember through all these discussions we have mutually--and I say this honestly--we have mutually expressed the opinion that we should work together for the solution of these problems. I have sat in meetings with you and other members of your staff, and these other men have done the same thing. We hope we can continue to do that.

But in this particular case, this thing was dropped in our lap and that is the thing that prompted the first correspondence to see if we had the machinery to do this with. We didn't know whether we had or not.

MR. DOMINY: Once again, Governor, you say it was dropped in your lap. Everyone was aware of the published criteria that the Department had announced they would follow.

COM. CLYDE: That is true but no one knew, not even the Bureau, whether or not there was capacity and energy in such shape that it could be quickly and effectively utilized; that is the thing we had to find out. The report came in yesterday as to whether or not that could be done.

MR. DOMINY: You had a report from some Upper Basin power companies yesterday.

COM. CLYDE: That is right.

MR. DOMINY: We already had assurance from the Lower California companies we could do it. Now we have a choice as to who can do it the cheapest and the best arrangements for the financial return. But we have known that, if we elected, and when the water conditions will permit--

COM. CLYDE: You know this as well as we do, this has to be done with both Upper and Lower Basin utilities.

MR. DOMINY: We have known for many weeks that the California companies as well as Arizona Public Service Company have the capacity to make up the deficiency if we could afford to do it, and if the water supply availability made it practical to do it. And now we have the Upper Basin proposal. We will be in a position to evaluate them.

COM. CLYDE: That is the reason we all ought to sit down immediately and see what we can work out.

MR. DOMINY: This we are prepared to do.

MR. GOSLIN: By "immediately", Mr. Commissioner, what do you mean? You yourself stated that the point of no return is somewhere in May.

MR. DOMINY: It is in May.

MR. GOSLIN: Presumably early in May I think.

MR. DOMINY: Our charts indicated about the middle of May.

MR. GOSLIN: That is close enough we aren't going to quibble over a few days.

MR. DOMINY: We ought to have the most accurate snow survey we can get, which is May 1, available to us.

MR. GOSLIN: In the meantime we should be working out the details of a plan to implement, if those snow surveys bear it out, the manner in which you can store water, or that it can be done.

We have with us today representatives of the utilities who were here yesterday, Floyd. They have expressed a willingness to sit down any time and negotiate with the Secretary's representatives.

MR. DOMINY: They can start with Frank Clinton at once today, as far as I am concerned.

MR. GOSLIN: Fine, I would like to see that done.

MR. CLINTON: Let's wait until after lunch.

MR. GOSLIN: I think now is the time for action. I know full well, and so do you, that it is going to take more than one meeting to do this. It is going to take a series of negotiations. And the only real criticism that I have at all about this is it has been delayed so long. Further I think that you should have made a request of the power companies for this information that we had to go get. We have transmitted it officially to the Secretary as of yesterday, and representatives of your office were in a meeting yesterday and were given copies of the proposal. I am sure that the representatives of the utilities that are here today would be perfectly willing to hand you additional copies and to sit down this afternoon and start getting it done.

The problem now is one of immediacy. I see no further reason for delays. If there is anything that our Commission can do at the staff level, or any level, or the Commissioner level, I think I am authorized to speak up and say that we will be very happy to help you get together.

MR. DOMINY: I don't want the record to indicate here that we have been completely unaware of this problem and that we haven't been doing something about preparing for the day that we might be able to change this tentative decision to one more palatable to the Upper Basin.

I would like to have Commissioner Bennett stand up and give you a little review of the considerations we have been making.

MR. GOSLIN: We appreciate that, I know.

THE CHAIRMAN: Mr. Bennett, could we have a five-minute recess before you start?

COM. BLISS: In the interest of eating, let's eat.

THE CHAIRMAN: If the Commission would rather recess for lunch, when do you want to come back?

COM. BLISS: One-thirty.

THE CHAIRMAN: Without objection then we will recess until one-thirty.

(12:10 p.m., Noon Recess.)

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(1:30 p.m., Meeting resumed. All Commissioners present.)

THE CHAIRMAN: It is our pleasure to have Governor Love with us this afternoon.

(Applause.)

GOVERNOR LOVE: Thank you very much.

THE CHAIRMAN: We had Mr. Bennett partly take the floor.

MR. DOMINY: Mr. Chairman, just before Mr. Bennett does the thing that I asked him to do with your permission just before lunch, I just want to

let you know that my statement that we were prepared now to move with dispatch to meet with the Upper Basin group to explore in detail the propositions which they are prepared to offer, was taken very seriously and Frank Clinton has arranged a conference, he met with each of the company representatives during the noon hour, and they will get together in Phoenix next Tuesday.

And I want to tell the Commission if you want your Executive Secretary or any officials from the Commission to participate in that meeting, that they will be more than welcome.

And I want to tell each of the Governors of the Upper Basin States, if they would like to have a personal representative in that meeting, they will be more than welcome.

We in the Bureau of Reclamation recognize that our sole business is to represent the best interests of the Nation and the public that we serve, and we are willing to operate in a goldfish bowl at all times. You will be welcome to participate in these meetings as they progress, and I have every reason to think that we can get definitive answers by the May 8th deadline.

Now, Mr. Bennett, I would like to have you tell them of some of the things we have already done that are essential in order to be able to weigh this proposal that will be coming from the Upper Basin States.

MR. BENNETT: Gentlemen, immediately following the availability of the February forecast, I personally contacted the Arizona Public Service Company to see what power they might have available for sale to us for Hoover replacement in the event it looked like that was the thing to do. We didn't have any idea at that time as to quantities of power, so we could sound them out only on generalities: How much do you have?

At that time Mr. Foreman told me that he thought they could make available about 400 megawatts. That was as I recall on February 11.

On February 20th I had our Region 3 people contact the City of Los Angeles and the Southern California Edison Company, who are also Hoover allottees, to see what they might do. This was a preliminary contact. We decided at that time to talk first to those people because they were the affected allottees and they were also closest to the market, shall we say, right in the market area, involving the shortest transmission and an ability to put power immediately into the load area affected by any diminution at Hoover.

We are happy to report that even in those early days, both the City of Los Angeles and the Southern California Edison Company reported they thought

they could handle--Edison its own load and Metropolitan Water District the City of Los Angeles--that it could handle its load and the load of the surrounding small communities who are also Hoover allottees.

I subsequently received a letter from Arizona Public Service in which they confirmed our discussion and told us that they had up to 400 megawatts of power which they could make available.

We also began looking at that time into ways and means that the Hoover units might be switched or rewired or otherwise made available for use into the Coastal areas. The Coastal areas we have seen are our problems in terms of ability to transmit.

I am sure you are aware, most of you at least, that the Hoover powerplant is not one powerplant the way it is presently hooked up. It is two powerplants to start with, one on each side of the river; and within each powerplant it is separate powerplants. Now we did explore back in 1960 what it might take and how we might make this one powerplant, but that is quite a job in itself.

We do know that we can make rearrangements on certain Hoover units. N8, for example, can be switched over to put its generation on the City line; and its power that Nevada otherwise would have can be replaced over the Parker-Davis system. That amounts to 70 megawatts. There are many things of that nature that can be done.

I think at that point, prior to yesterday, we were to a point where we could have entered into a contract within a week with any one of these entities or all of them actually to do the job. Now the receipt of the proposal by the Upper Basin utilities is something we want to study, we want to know more about it after Frank and his people have had an opportunity to work out more details. We are very happy to have that proposal in order to compare it with what might be done by these other approaches.

We want to do this job, if it is to be done, in the most economical manner possible. We think that helps the Upper Basin. It helps the Upper Basin Fund, and it, of course, over-all, aids the entire river payout situation.

So be assured we have not been idle in this regard. We will make these comparisons just as quickly as we can and bring contract negotiations, if that is the proper term, up as far as we can in order to make a final decision.

THE CHAIRMAN: Thank you, Mr. Bennett. Is it your intent, Mr. Commissioner, that if the Commissioners have questions to ask, they all come through you for reference or--

MR. DOMINY: Yes, I think that is the orderly process.

THE CHAIRMAN: Are there any questions from the Commissioners in regard to Mr. Bennett's report?

COM. CLYDE: Mr. Chairman.

THE CHAIRMAN: Governor Clyde.

COM. CLYDE: I understand that under this arrangement, Mr. Clinton has already been discussing this matter with the utilities who are here today?

MR. DOMINY: Yes.

COM. CLYDE: I appreciate this very much. I think this is the kind of action we need to get this show on the road.

I would like to make a motion at this time that the Commission authorize Mr. Goslin, its Secretary, to join with this group in these deliberations, I so move, Mr. Chairman.

THE CHAIRMAN: You have heard that motion.

COM. VAN CAMP: Second the motion.

THE CHAIRMAN: And its second.

COM. BLISS: I would agree with the motion if it is understood that this will be Ival and the staff.

COM. CLYDE: Yes, that is my interpretation.

(Thereupon a vote was taken.)

THE CHAIRMAN: Motion is carried.

COM. CLYDE: Mr. Chairman, I should also like as one of the Governors to take advantage of the opportunity to have a personal representative sit in on these meetings.

GOVERNOR LOVE: I join in that too.

GOVERNOR HANSEN: Wyoming also wishes to join in this.

MR. DOMINY: I am delighted that is what you are going to do. We want your participation, we want your guidance, and we want you to be in on all these meetings because we know the importance of the Colorado River to the economy of the Upper Basin.

GOVERNOR LOVE: I would like, Mr. Chairman, if I could make a very brief statement in addition to that.

THE CHAIRMAN: We would be happy to have you, sir.

GOVERNOR LOVE: I unfortunately have not been able to be present in the beginning to participate in the prior deliberations here. Certainly as far as Colorado is concerned we are delighted that active measures are evidently being taken to determine the feasibility of working out a proposition on the exchange of power which will allow Glen Canyon to be filled to its minimum power pool level. I would also like to say we are happy to cooperate in this area and aid in any way we can.

But in so doing I would like to state my understanding of this situation. It may be repetitious in that it may have been said before by representatives of Colorado, able representatives such as Governor Johnson. But first let me state that it is my understanding that the delivery of water to the Lower Basin States is controlled by the Compact, and it is my interpretation of the Compact from the advice I have received that the requirement measured in acre-feet is a running 10-year requirement rather than an annual requirement. If this is true, there is an implication perhaps of placing another requirement for delivery of water to the Lower Basin States than under the Compact, and that is the generation of power at Hoover Dam. It is my understanding that that is the position you have taken, Governor Johnson?

COM. JOHNSON: Yes, I take the position that we ought to follow the provisions of the Compact without any variation whatsoever, and the Compact provides for the burden of water that we must deliver to the Lower States, and it is a preference right, and we have fulfilled that right. And the Compact has stated the amount of water that the Upper Basin is entitled to, and this water that we are putting in Glen Canyon is part of the water that the Compact has awareded to us.

GOVERNOR LOVE: Under the terms of the Compact if we had means to retain it, if I understand it correctly, there would be no annual requirement of any water necessarily going downstream this year, is that right?

COM. JOHNSON: That is correct. We have delivered 18,000,000 acre-feet in the current 10-year period in excess of the 75,000,000 acre-feet that we are required to deliver. We are ahead of the game. But we have not

consumed the 7,500,000 acre-feet which the Compact gives to us for annual consumption, and so we are ahead. We are not putting any water into Glen Canyon. We won't put any water into Glen Canyon that is not our own water. I think we have a title to it, a clear title to it under the Compact.

And I think this other thing ought to be said--I have said it a good many times--that we realize that there is a grave difficulty because of the shortage of rainfall; and that out of the goodness of our hearts and not by any compulsion of the Compact, we are willing to let just as much water go down the stream as we can as soon as we get enough water stored at Glen Canyon that will permit us to produce power.

The moment we get enough in there to produce power, we will let the whole river at Glen Canyon go on down to Lake Mead--out of the goodness of our hearts and not because the Compact compels us to let it go down.

GOVERNOR LOVE: I agree, Mr. Chairman, and that may be repetitious without knowing what has gone before. But I certainly want to make it clear for the record that that is Colorado's position on this; and that any agreement or negotiation or exploration leading to the exchange of power--which we are for--should not be construed as any precedent which goes to the contrary of that position.

THE CHAIRMAN: Thank you, Governor. At the meeting yesterday the Chairman of the Legal Committee made a report in which he had framed certain questions. He is asking for the floor now to explore those questions. Mr. Sparks.

MR. SPARKS: Thank you, Mr. Chairman. Gentlemen, Governors: First, the letters that were mentioned this morning from Congressman Aspinall and the reply thereto by Assistant Secretary Holum, have been reproduced by our staff upstairs and those letters are available here on the corner of the desk. However, the appendices we did not have time to reproduce, and they will be reproduced by the Commission staff during this week, and will be available. Appendix 7, which involves the squatter problem, is being reproduced upstairs and will be available in about another hour.

Mr. Chairman, Gentlemen of the Commission and Governors, Mr. Commissioner Dominy: As has been stated, the Legal Committee Report to the Commission yesterday recommended that certain action be taken in connection with the Colorado River problem now facing us.

The Legal Committee is fully aware of the pitfalls of attempting to institute litigation to resolve the many problems of the Colorado River. As a

long-time practicing attorney and a former Justice of the Supreme Court of this State, along with the able representation we have from the other states--the Attorney Generals of Utah and Wyoming are on our Legal Committee along with representatives from the Interstate Stream Commission of New Mexico--we are all in full accord with the proposition that it is futile to institute legal action unless it is a case of final resort. And we informed the Commission that it was our opinion that there were methods to solve the various problems without resorting to litigation; but if they could not be so solved, eventually some of these issues would have to be presented to the United States Supreme Court.

Specifically we are concerned, Mr. Commissioner, with newspaper accounts originating from Washington to the effect that an agreement was reached on the adoption of the filling criteria. We are fully aware that newspaper accounts sometimes are at least partially erroneous or exaggerated. But nevertheless, I head your explanation this morning that there was no formal agreement entered into on the filling criteria.

What I want to ask you? Is it your impression that an informal agreement was reached on the approval of these filling criteria?

MR. DOMINY: My impression, Mr. Sparks, and members of the Commission, was that my able representatives, meeting with your able technical experts and political scientists, agreed pretty completely that there was not possible a document outlining a precise filling criteria that the Upper Basin States and the Lower Basin States could formally agree to and accept with finality.

My understanding further was that we narrowed the differences of opinion between what the Upper Basin States felt was fully proper from their point of view and what the Lower Basin States felt was fully proper from their point of view to protect their interests, into as narrow a range of differences as was humanly possible, short of a court adjudicated settlement of a number of touchy elements. And our filling criteria was deliberately announced within that range as being the closest we could come to that reconciled two widely differing points of view between two able and intelligent groups of people representing vastly different views as to what was right and proper for their own interests on the Colorado River.

MR. SPARKS: To return to my question: The true statement is then that the Upper Basin never agreed to these filling criteria?

MR. DOMINY: And neither did the Lower Basin. We asked neither of you to formally say, "This is a criteria that we will bind ourselves to irrevocably." We didn't ask for that, nor did we receive it.

MR. SPARKS: All right, then there was no agreement on the filling criteria?

MR. DOMINY: No, sir.

MR. SPARKS: That clears up that point. We were probably misinformed by the newspapers.

The second question, Mr. Dominy: It was stated that no water is being utilized for the generation of power in the Lower Basin since these filling criteria were adopted. May we ask you, Mr. Dominy, what is the purpose of ordering the release from Glen Canyon during the last few weeks?

MR. DOMINY: The purpose of ordering the release of water from Glen Canyon is to maintain a minimum head and--

MR. SPARKS: For what purpose?

MR. DOMINY: It is not for the purpose of putting water through the powerplants that would not go through independent of downstream diversionary requirements.

MR. SPARKS: For what purpose are you maintaining a minimum head at Hoover Dam?

MR. DOMINY: The purpose is to maintain a head so that what water is released at Lake Mead will give us the rated power head at the plant.

MR. SPARKS: Well to put it in simple language, it is to generate power, is it not, at Hoover Dam?

MR. DOMINY: It is not to generate power; it is to keep the level of the late at a rated head on the powerplant so that what water we do release, we create the maximum amount of power possible for the units that are there, and not just put the same water downstream at a lower head and decrease the power.

MR. SPARKS: Let us get at the problem another way then, Mr. Dominy. The filling criteria provide that no water shall be utilized from the Colorado River flow for the Lower Basin with the exception for the purposes of irrigation and municipal uses, isn't that correct?

MR. DOMINY: That is correct, and that is exactly the way we are operating Lake Mead.

MR. SPARKS: Is that the purpose of the withdrawal today from Glen Canyon?

MR. DOMINY: The purpose of the withdrawal, as I have stated, is to preserve the level of Lake Mead so as to maintain a rated head on the powerplants.

MR. SPARKS: For the generation of power?

MR. DOMINY: For the generation of power with the water that would be otherwise released regardless of the level of Lake Mead to meet downstream requirements.

MR. SPARKS: Let us be practical, Mr. Dominy. Then the purpose of the withdrawal of Glen Canyon Reservoir today is for generation of power in the Lower Basin, is that correct?

MR. DOMINY: It is to maximumize the generation of power with the same water releases so required irrespective of the head maintained there.

MR. SPARKS: Isn't it true that the water released from Glen Canyon is for generation of power in the Lower Basin and not for beneficial use as specified in the Compact?

MR. DOMINY: It is to maintain rated head but the same quantities of water would be released for downstream uses whether Lake Mead was 1080, 1100, 1120 or 1123. It just happens that we maintain it at 1123. This gives us the best economic management of the river under the kind of runoff conditions we have and protects the Upper Basin to that extent.

MR. SPARKS: For the generation of power.

MR. DOMINY: For the maintenance of maximum power generation in a powerplant that is already in existence with all units in place.

GOVERNOR LOVE: Just a matter of clarification: If it were not for the process of generating power at Hoover Dam, is there sufficient water in Lake Mead to meet agricultural and municipal needs downstream.

MR. DOMINY: Yes, sir. Yes, sir, we could release that even if we were to pull Lake Mead down to 1050.

MR. SPARKS: I think we all understand the problem, Mr. Dominy. I merely want to correct the impression that was put out this morning, that this problem is not created because of the generation of power at Hoover Dam actually.

MR. DOMINY: Mr. Sparks, I read the newspapers, too, and the newspapers have interpreted you as saying we have been releasing water at Lake Mead specifically for the generation of power, and this is incorrect. We have not done so since 1960, we will not do so in 1964, and as far as I can see we will not do so hereinafter because of the Upper Basin requirements. I doubt if the river will ever--

MR. SPARKS: This is a clever decision: You do not release it from Hoover for power, you release it from Glen Canyon instead, and that is what we are complaining about.

MR. DOMINY: Apparently you were absent when I pointed out the runoff projections of this river are such that if we followed apparently what is your recommendation, we could end up with both reservoirs at an inadequate level to generate power; and this I do not consider would be carrying out my responsibility as Commissioner to protect the investment of the United States in the Colorado River system.

MR. SPARKS: I am glad you touched on the point of investment, Mr. Dominy. How much Federal investment remains in Hoover Dam?

MR. DOMINY: Hoover Dam is well on schedule of its repayments. It has been a very fine economic--

MR. SPARKS: It is less than a hundred million dollars, isn't that right?

MR. DOMINY: I think that is right.

MR. SPARKS: How much has Congress authorized for the Upper Basin Projects at the present time?

MR. DOMINY: Glen Canyon, $345,000,000 roughly and we have had authorized $760,000,000 for participating projects.

MR. SPARKS: Plus about $300,000,000 in addition to that?

MR. DOMINY: With the San-Juan Chama and Navajo Indian Projects, yes.

MR. SPARKS: So Congress to date has authorized in excess of one billion dollars for the Upper Basin Projects?

MR. DOMINY: That is correct.

MR. SPARKS: And the Federal investment is protected and is best being served by protecting the less than one hundred million at Hoover, is that the implication?

MR. DOMINY: No, you are again deliberately apparently overlooking the fact that we have specifically and repeatedly said, that our studies indicate that to protect the Upper Basin account we cannot now reconcile the burden of power replacement when we have no assurance that even were we to do so we could get 6.1 million at Lake Powell in 1964, and there is no way of knowing what 1965 will bring.

MR. SPARKS: That is what is worrying us. Mr. Dominy, let us get back to a basic question. Of course, when the filling criteria were discussed, and they have been discussed for many years, we only had essentially two basic objections to that filling criteria.

One was the fact, the situation we clearly pointed out at the time that we now find ourselves in today, and that was that the entire burden of deficient streamflow was placed on the Upper Basin. When you made the remark, you said, "We are in trouble," you meant the Upper Basin. We are wondering why you remark that "we" in the Upper Basin are in trouble and not the Lower Basin.

That is one of the basic objections we had which was never satisfied in the filling criteria.

The other one, and the important one, is that we were not willing to quibble about how money is exchanged back and forth as long as the Upper Basin Fund was made whole. In other words, the diversions of electric power or money that are being made today to recompense Hoover power contractors, if that were returned in whole to the Upper Basin Fund, we said that we could go along with that criteria.

Unfortunately that was not done. The criteria was modified slightly to provide a return on certain funds, a minor part of the funds after 1987.

The Legal Committee yesterday proposed that the Boulder Canyon Project Act and Adjustment Act be amended to the effect that the Colorado River Development Fund therein provide $500,000 a year be utilized to provide the purchase of substitute energy.

Does your Department have any objection to that procedure?

MR. DOMINY: Not at all. And we have publicly stated that this could be possible only by Congressional action, and that we would not

object in any way if Congress wanted to do it in this fashion. As a matter of fact we would very probably endorse it.

MR. SPARKS: Would you have any objection if we said 100 percent of the return to the Upper Basin, including secondary energy and any other benefits that are diverted from the Upper Basin for the benefit of Hoover power contractors?

MR. DOMINY: Well I can't speak for the Department on that particular element. Certainly if Congress chose to use the Fund for that purpose and passed a law, we would have no objection whatever. I am not at all certain that we would not report favorably on such a proposal.

MR. SPARKS: This is something that has baffled us over the several years we have had numerous negotiations with the Lower Basin States and power users and other people, we have never found them to be unreasonable in any case.

We have been repeatedly told and were told at the time these filling criteria were adopted that the Lower Basin would not stand still for return to the Upper Basin of 100 percent of the revenues which were diverted for the Hoover power contractors. Now can you or anyone on your staff tell me who in the Lower Basin made that statement?

MR. DOMINY: Well Assistant Commissioner Bennett represented me in all the discussions.

MR. SPARKS: Mr. Bennett is the gentleman who made that statement to me, so I would assume he can explain it.

MR. BENNETT: Well I am trying to get back in my mind these events.

We discussed at some length with the Lower Basin people, particularly the power allottees, the idea that I believe Mr. Goslin had initially of this repayment.

And I think it is a fair statement, collectively they were opposed to a hundred percent repayment, by that meaning that if you spent $3,000,000 today, the amount repaid in 1987 or thereafter would be the $3,000,000 with accumulated interest. They told us flatly--and I say "they," as I say I think it was and is a fair statement now that every one of them told us that at the time--that they would not put up any major objection to a return on a dollar-for-dollar basis; but that they would object vigorously as a matter of fact to a return of, what you term, total cost.

MR. SPARKS: I assume that the Department has no objection if arrangements can be worked out with the Lower Basin on some method to reimburse the Upper Basin Fund 100 percent.

I think, Mr. Dominy, this points up one of our major problems that has occurred in this whole controversy. The Upper Basin and Lower Basin have been dealt with at arms' length with an intervening force in Washington, D. C.

We urged repeatedly some years ago that some type of coordinating committee be established between the Upper and Lower Basin States to the end that we could work out our own problems. We are told one thing that happens in negotiations between the Bureau and the Lower Basin, and then when we meet with the Lower Basin we are told something else. This points up a total lack of communication between the Upper and Lower Basins.

I don't think the problems are very great between the two Basins, and I at this time would like to again urge that through the jurisdiction of the Secretary of the Interior, the Upper and Lower Basins be entitled to participate jointly with the Bureau of Reclamation, not separately as has been done in the past. I think this is a large part of our trouble, is a lack of communication among all parties concerned.

MR. DOMINY: Well certainly even if I were disposed to do so--which I am not--I could not prevent the Lower Basin and the Upper Basin from getting together and setting up a joint board of control of some kind to meet and discuss their problems, and we would not object to it at all. In fact, I think it is a good idea.

MR. SPARKS: The problem is created--I think the gentleman from Nevada summed it up very well yesterday--he said that the Lower Basin power allottees had no reason to get into this picture at all. The reason is very obvious: They haven't had to do anything because they haven't had anything to worry about. Their interests have been fully protected by the criteria that has been adopted.

So there is no incentive on their part to try to work out any mutual arrangements and in our recent negotiations with Southern California Edison Company, for instance, we were given pretty much a cold shoulder on the grounds that, well, this was a matter they would have to take up with the Bureau. And it is this type of exasperating run-around which has made it impossible for the Lower and the Upper Basins to try to get together.

MR. DOMINY: I would like to point out, Mr. Sparks, when we decided in 1962 to start operating Lake Mead and Hoover Dam as though Glen Canyon gates had already been closed, that the Lower Basin power allottees objected quite strenuously that we should not interpose the criteria until we actually were physically capable of storing water at Lake Powell--but we did.

I wish it were true that one element on this river were completely satisfied with the manner in which I am operating it. I remain in the middle and this is a very uncomfortable position, because the Commissioner of Reclamation as a Federal employee must never embrace the extreme on either side of a controversy.

MR. SPARKS: Is there any objection then with the Bureau people to the Upper and Lower Basins appointing representatives and meeting together so we can determine what the actual disputes are?

MR. DOMINY: Certainly not.

I would like to call your attention to Senate Document No. 7, 88th Congress 1st Session, which is "The Sixth Annual Report on the Status of the Colorado River Storage Project and Participating Projects, together with a Statement to govern, and operating criteria for, Glen Canyon Reservoir (Lake Powell) and Lake Mead during the Lake Powell filling period and related documents."

On Page 9 of this document you will find in discussing Principles 9 and 10, the following statement:

> "The suggestion was again advanced that the Upper Basin should be formally represented on a river operations committee. It was suggested also that working committees should be formed which would include representation of Lower Basin water users as well as power contractors who would have an effective voice in secretarial decisions in resolving problems which may arise in filling Lake Powell. In both cases it was indicated that Congressional authorization of such committees probably would be necessary or desirable. Responsibility for operation of the Federal projects involved is now vested in the Secretary of the Interior and, we believe, properly should remain so. Creation of new bodies with statutory powers which might tend to complicate and make more difficult the coordinated operation of a widespread river basin system."

Now I don't think you are talking about, as I understand it, a group with statutory powers; you are talking about a group advisory in nature?

MR. SPARKS: That is correct.

MR. DOMINY: Which would meet and try to reconcile your own differences and thereby help us resolve some of the controversies that exist.

MR. SPARKS: That is exactly correct.

MR. DOMINY: I think this would be splendid.

MR. SPARKS: We have urged this for a number of years. We asked for it some five years ago. And as I say, I still think it accounts for a large part of our troubles. The communication we get from the Lower Basin is not the same communication we get from your office in Washington; somebody has lied to us, and one of these days we are going to find out.

One other point is: By what authority does the Secretary think that you can divert funds from the Upper Basin to make good Hoover power contracts?

MR. DOMINY: I will call upon my counsel, Mr. Weinberg.

MR. SPARKS: I am anxious to hear this.

MR. WEINBERG: I will be brief; I will also be unpopular. In our opinion this is properly classified by the Secretary as an operating expense or a construction expense of constructing and operating the Upper Basin projects, and it is on that basis that we obtain the funds.

MR. SPARKS: An operating expense?

MR. WEINBERG: Right.

MR. SPARKS: By what contract, law, authority or Congressional act is the United States obligated to deliver water for power generation at Hoover Dam?

MR. WEINBERG: Well, Mr. Sparks, you are right back to the same question that you have been sparring around with Mr. Dominy.

MR. SPARKS: I am not sparring; I am trying to get an answer.

MR. WEINBERG: Mr. Sparks, you are attempting to put into Mr. Dominy's mouth and now into my mouth an answer that you want. We are not going to give you that answer because we do not agree with your answer.

MR. SPARKS: Because you do not have an answer. That is what I want, is to get an answer.

MR. WEINBERG: No.

MR. SPARKS: You are doing it. Why are you doing it, by what authority?

MR. WEINBERG: Mr. Sparks, we have an answer. The difficulty with our answer is that it doesn't satisfy you.

MR. SPARKS: What is the answer?

MR. WEINBERG: It is a matter of regret but this is something that we can't help.

MR. SPARKS: Well try us with the answer; maybe we can understand.

MR. WEINBERG: We have given you the answer.

MR. SPARKS: Mr. Dominy, I will say yesterday a great deal was said about the regulatory wastes below Hoover Dam, and I will state after reading the letter that was received by Congressman Aspinall, there is a very fine explanation of the actions that are being undertaken to eliminate a major part of that condition. And we fully realize that the illegal diversion of water has existed for many, many years prior to anybody now in the Bureau having any responsibility in connection with it.

We can only assure you that you have our support in attempting to evict people down here or to stop the illegal diversions. I think the Commission when they read the answers that were given on that problem will find they are quite satisfactory. That was another problem that we brought up in the Legal Committee.

MR. WEINBERG: May I comment on that. We certainly are going to need your help. We have had a very difficult time in our trespass actions. One action Mr. Dominy referred to in his speech was commenced over five years ago. I will not use names, but I will give you the facts in that case. The facts are very simple.

An individual went on to withdrawn land, proceeded to subdivide it, sell it on quitclaim deeds. Five years ago we brought an action to enjoin him, to evict him, and for an accounting.

The District Court refused to enter an order that the United States was entitled to damages. The eviction was stayed. We had to go to the Court of Appeals, which reversed the District Court on the question of the entitlement of the United States to damages; directed the District Court to determine damages.

We are back in court, it is five years later, and that man is still not off the property. These are the problems that we are encountering. This is one case.

So it is not an easy job, and we certainly appreciate your support, and we feel that it is going to take an aroused public opinion to overcome the feeling of sympathy with the underdog which has obtained when the United States in all of its majesty goes in there to evict a man who says, "I am a twentieth century pioneer. If this had been in 1865 I would have been a hero." And unfortunately this gives us problems.

MR. SPARKS: We realize that. We also realize that we in the Upper Basin have been laggard in not insisting on action prior to this time. We don't care whether or not the land is actually open to homestead. We would prefer that the land be opened up for sale and put into private ownership. But the situation being what it is, until that is done, why we don't want our water used.

There are only two other points, Mr. Dominy: First is the interconnection that has already been mentioned. Is there a real program to try to interconnect the powerplants at Hoover Dam?

MR. DOMINY: Mr. Bennett mentioned that he is looking at every possible way to get that power across through the plant which is not now interconnected; and they do think that there may be some bypassing in the switchyards that would be possible to satisfy the movement of that power within the requirements.

MR. SPARKS: This is a situation which we have all known about for some 25 years and it still has not been corrected; and of course like many of these other problems we are impatient now to get them corrected.

MR. BENNETT: Let me add to this one--two thoughts actually: That we started studying that situation seriously when we began to study the joint operation of Glen and Hoover. We found at that time that the hydrology didn't produce a greater power operation jointly than it did the sum singularly. This was a surprise to us. We thought the other would be true; it wasn't.

We found at that time it would cost between $8,500,000 and $10,000,000 to place Hoover in a situation such that it could be operated as a single plant. It was not worth it at that time for the purposes we were trying to gain.

However two things are now in the picture: Bridge Canyon and Marble Canyon coming on the line will require that something be done at Hoover, and the intertie line with the Pacific Northwest will require that something be done at Hoover, either one of which would be a cost not against Hoover but whatever the plan might be at that time.

So from those three standpoints, this matter has been explored in some depth.

MR. SPARKS: Only one final point, Mr. Dominy. I want to correct an impression that was left this morning. I think it was brought up that the releases from Hoover have been in the last few years in the magnitude of some 8,500,000 acre-feet for various purposes, Mexico and the contracts downstream.

Isn't it true that in addition to that 8,500,000 acre-feet that was released from Hoover, there is some additional 3,000,000 acre-feet used from the Lower Basin tributaries by the Lower Basin States?

MR. DOMINY: Mr. West.

MR. WEST: No, I think 3,000,000 is too high a figure. A million perhaps from the Gila; the Gila has been frequently referred to as a source of around a million acre-feet.

MR. SPARKS: Arizona at one time claimed 4,000,000.

MR. WEST: That is the year it flooded us out and we tried to put a siphon under it.

MR. SPARKS: Anyway, the beneficial use being made by the Lower Basin, it is not just the releases from Hoover but it is the tributaries as well?

MR. WEST: There is no tributary water that reaches the Colorado except for some very slight flow from the Little Colorado above Hoover Dam.

MR. SPARKS: But the Gila is used in Arizona?

MR. WEST: Yes, it is.

MR. SPARKS: So the releases to the Lower Basin, their beneficial consumptive use, is the total of the Lower Basin tributaries plus the releases from Hoover?

MR. WEST: Well yes. The decree separates the tributaries from the main stream.

MR. SPARKS: The what?

MR. WEST: The Colorado River decree.

MR. SPARKS: Not the Colorado River Compact.

MR. WEST: I think it is moot. Eddie, you are the lawyer here.

MR. WEINBERG: Under the Boulder Canyon Project Act as construed by Arizona-California, tributary uses are not included in determining the apportionment of the 7,500,000 acre-feet.

MR. SPARKS: In the Lower Basin.

GOVERNOR LOVE: That was only as between California and Arizona?

MR. WEINBERG: That is right.

GOVERNOR LOVE: The Supreme Court does not carry that context into the division between the Upper and Lower Basins?

MR. WEINBERG: No. The Supreme Court made it quite clear it was not interpreting the Compact.

MR. SPARKS: Mr. Chairman, that is all I have. Thank you.

THE CHAIRMAN: Mr. Commissioners, the field is open. Our visitors are here waiting to answer questions.

MR. BARLOW: Mr. Chairman, at this point, at his pleasure, we have our Governor from Wyoming here. He has been very attentive and a good listener, and sometimes when he gets out with his cattle he talks out loud. I wonder if he didn't have a word or two to say at this point.

GOVERNOR HANSEN: Mr. Commissioners and Mr. Dominy: I was delighted to be here. I was sorry I too could not have been here yesterday. I am a relative neophyte at this operation. We have been interested for some years past in the Snake River and Columbia River systems of the Pacific Northwest. We have a very real interest in water in Wyoming as do these other Upper Colorado River Basin States.

It seems to me that if I were to try to summarize some of the things I heard here this morning that are of importance, I would point out that it is necessary, if we are to get on with the project, if we are to get on with the work that we recognize must be done--and as was so eloquently pointed out by Senator-Governor Johnson this morning--that we have got to fill these upstream reservoirs. It is obvious that there is not enough water, a dependable source of supply, every year that can fulfill the commitments that we are called upon under the terms of the Compact to meet. So it is important, it is terribly important that we get the Upper Basin reservoirs filled.

It is important too that we get this job done so that the powerplants at these Upper Basin reservoirs can go on stream to help with the repayment of the projects that we recognize must be brought into being before we can bring about the full development of our agricultural and water potential in the Upper Basin system.

There have been several proposals made here this morning that I think are particularly meritorious. I recognize, as was pointed out by the Commissioner here, that it has been a tough job for him and for those in his Department to try to reach a consensus; and I am not criticizing what may have been done in the past.

But I would say to you, sir, that I hope with an open mind you will consider and mull over seriously the proposals that have been made here in the last two days; and if you find merit in these proposals--and I sincerely believe there is merit in these proposals--that you take a second look at the filling criteria you have set up.

It seems to me that fairness and equity would certainly proclaim that over the past ten years there has been a significant contribution made to the power supply of Hoover because of the inability as of that ten-year period of time for us to put the waters that were rightly ours to good use here. I think that it would not be out of the way at all for the Lower Basin States under your tutelage to say, "Now we are going to make whatever rearrangements we can in the impounding of these waters at Glen Canyon so as to assure the early onstream development of the powerplant"--that will be, I understand, capable of turning out juice early this autumn. If this can be done, then it makes awfully good sense to me that we can use this water twice.

I know that we have had two dry years and it seems to me that the two dry years we have had might well have been anticipated by the hydrologists who have been observing the precipitation pattern throughout this great arid southwest for a number of years.

I can't think that the Upper Basin States haven't contributed far more than they have gotten. All these benefits of extra water, all the benefits of our lack of development of our potential here, have accrued to the advantages of the states downstream. And I think we have a good reason now to say, "We are entitled to a little bit of a break."

Wyoming will have someone sit in with the officials of your Department along with the private power people who have come in and have offered to fill this breach. I am appreciative of this great effort, this indication of a willingness to resolve problems on the part of private enterprise along with Government. And we will have someone there from Wyoming to sit in with Ival Goslin.

I repeat again, I think we have contributed far more than we have gotten. I think it is time that justice and equity demand that we receive more consideration than we have up to this time. Thank you, sir.

MR. DOMINY: Mr. Chairman, may I comment for just one word or two.

I can't disagree with anything my good friend, the Governor of Wyoming, has said. The Bureau of Reclamation, the Department of the Interior, is in the unenviable position here of having on the one side a developed area that has its projects and has an economy built upon the use of those projects, and who from the extreme point of view would like to see that all the filling be done with flood waters above and beyond anything that they can store and use in their reservoirs already established.

Now this position we have not accepted in the filling criteria. We have compromised seriously from that position.

Contrasting that with the position so ably represented by Commissioner Johnson in what I have seen of his statements previously and today, that now that the Upper Basin has the structures on the river we ought to close them up and stop all water until the minimum filling is acquired without regard to downstream needs and uses. This also is an extreme position which we cannot accept and have not accepted in the filling criteria.

We have tried to find a realm between those two extremes that represent an equitable point of view accepting the facts of life and the Federal investment in total on the river.

Now to the extent that we haven't satisfied anybody, it sort of convinces me that we are in the realm of possibly being fairly right in what we are doing.

COM. JOHNSON: Mr. Chairman.

THE CHAIRMAN: Commissioner Johnson.

COM. JOHNSON: Mr. Dominy does not agree with me when I contend that the Secretary of the Interior has no authority to open the gates of Glen Canyon. I regret that he does not agree with me, but I am very pleased that eight members of the Supreme Court do agree with me, and I would like to read four or five lines here in the Arizona versus California case. It's the copy that was presented by Mr. Hayden as a Senate document, and on Page 34, in that decision I find these words:

> "He"--and that is the Secretary--"He and his permittees, licensees, and contractees are subject to the Colorado River Compact,

and therefore"--get these words, please--"and therefore can do nothing to upset or encroach upon the Compact's allocation of Colorado River Water between the Upper and Lower Basins."

COM. BLISS: Mr. Chairman, I have no desire to cut off anyone who desires to talk; but it seems to me that we have explored this thing pretty fully.

We have the assurance from Commissioner Dominy, and from the Secretary I think, on what we came here to obtain. We have received an excellent report from the power companies of the Upper Basin. I think we are on the way toward arriving probably at a settlement which I hope will be favorable to the Upper Basin.

I would like to thank the power companies personally for the immense amount of work they have done in preparing this report; and I would like to thank Commissioner Dominy and his group for coming here and talking with us today.

If there is nothing further, I would move, sir, we adjourn.

COM. VAN CAMP: Second the motion.

THE CHAIRMAN: It has been moved and seconded that we adjourn, with all the felicities that Mr. Bliss has stated. (Thereupon a vote was taken.)

Motion carried. We are adjourned.

(2:40 p.m., Wednesday, April 15, 1964, Adjourned Regular Meeting adjourned.)

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

Volume	Exhibits	Volume	Exhibits
1	A, B, C	17	Y-2_pgs 82-167
2	D, E	18	Z, AA
3	F, G	19	AB
4	H	20	AC
5	I-1_pgs i-88	21	AD
6	I-2_pgs 89-219	22	AE-1_pgs i-60
7	I-3_pgs 220-App II	23	AE-2_pgs 61-155
8	J, K-1_pgs i-80	24	AF, AG, AH
9	K-2_pgs 81-168, L, M, N, O, P	25	AI, AJ, AK
10	Q, R	26	AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU
11	S, T	27	AV, AW, AX
12	U-1_pgs i-60	28	AY-1_pgs i-103
13	U-2_pgs 61-134	29	AY-2_pgs 104-221
14	V, W	**30**	**AZ, BA**
15	X	31	BB, BC, BD, BE, BF
16	Y-1_pgs i-81	32	BG, BH, BI

Public Law 90-535

AN ACT

September 28, 1968
[S. 1440]

To include in the prohibitions contained in section 2314 of title 18, United States Code, the transportation with unlawful intent in interstate or foreign commerce of traveler's checks bearing forged countersignatures.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 2314 of title 18, United States Code, is amended by inserting after the third paragraph thereof a new paragraph as follows:

Crimes.
Forged traveler's checks, transportation.
62 Stat. 806.

"Whoever, with unlawful or fraudulent intent, transports in interstate or foreign commerce any traveler's check bearing a forged countersignature; or".

Approved September 28, 1968.

Public Law 90-536

AN ACT

September 28, 1968
[S. 1637]

To amend the Tennessee Valley Authority Act of 1933 with respect to certain provisions applicable to condemnation proceedings.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the last six paragraphs of section 25 of the Tennessee Valley Authority Act of 1933 (48 Stat. 70), as amended (16 U.S.C. 831x), are hereby repealed.

TVA property condemnation proceedings.

SEC. 2. The amendment made by this Act shall be effective only with respect to condemnation proceedings initiated after thirty days following the date of enactment of this Act.

Effective date.

Approved September 28, 1968.

Public Law 90-537

AN ACT

September 30, 1968
[S. 1004]

To authorize the construction, operation, and maintenance of the Colorado River Basin project, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—COLORADO RIVER BASIN PROJECT: OBJECTIVES

Colorado River Basin Project Act.

SEC. 101. That this Act may be cited as the "Colorado River Basin Project Act".

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SEC. 102. (a) It is the object of this Act to provide a program for the further comprehensive development of the water resources of the Colorado River Basin and for the provision of additional and adequate water supplies for use in the upper as well as in the lower Colorado River Basin. This program is declared to be for the purposes, among others, of regulating the flow of the Colorado River; controlling floods; improving navigation; providing for the storage and delivery of the waters of the Colorado River for reclamation of lands, including supplemental water supplies, and for municipal, industrial, and other beneficial purposes; improving water quality; providing for basic public outdoor recreation facilities; improving conditions for fish and wildlife, and the generation and sale of electrical power as an incident of the foregoing purposes.

(b) It is the policy of the Congress that the Secretary of the Interior (hereinafter referred to as the "Secretary") shall continue to develop, after consultation with affected States and appropriate Federal agencies, a regional water plan, consistent with the provisions of this Act and with future authorizations, to serve as the framework under which projects in the Colorado River Basin may be coordinated and constructed with proper timing to the end that an adequate supply of water may be made available for such projects, whether heretofore, herein, or hereafter authorized.

TITLE II—INVESTIGATIONS AND PLANNING

SEC. 201. Pursuant to the authority set out in the Reclamation Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto, and the provisions of the Water Resources Planning Act of July 22, 1965, 79 Stat. 244, as amended, with respect to the coordination of studies, investigations and assessments, the Secretary of the Interior shall conduct full and complete reconnaissance investigations for the purpose of developing a general plan to meet the future water needs of the Western United States. Such investigations shall include the long-range water supply available and the long-range water requirements in each water resource region of the Western United States. Progress reports in connection with these investigations shall be submitted to the President, the National Water Commission (while it is in existence), the Water Resources Council, and to the Congress every two years. The first of such reports shall be submitted on or before June 30, 1971, and a final reconnaissance report shall be submitted not later than June 30, 1977: *Provided*, That for a period of ten years from the date of this Act, the Secretary shall not undertake reconnaissance studies of any plan for the importation of water into the Colorado River Basin from any other natural river drainage basin lying outside the States of Arizona, California, Colorado, New Mexico, and those portions of Nevada, Utah, and Wyoming which are in the natural drainage basin of the Colorado River.

43 USC 371.
42 USC 1962 note.

Reports.

SEC. 202. The Congress declares that the satisfaction of the requirements of the Mexican Water Treaty from the Colorado River constitutes a national obligation which shall be the first obligation of any water augmentation project planned pursuant to section 201 of this Act and authorized by the Congress. Accordingly, the States of the Upper Division (Colorado, New Mexico, Utah, and Wyoming) and the States of the Lower Division (Arizona, California, and Nevada) shall be relieved from all obligations which may have been imposed upon them by article III(c) of the Colorado River Compact so long as the Secretary shall determine and proclaim that means are available and in operation which augment the water supply of the Colorado River system in such quantity as to satisfy the requirements of the Mexican Water Treaty together with any losses of water associated with the performance of that treaty: *Provided*, That the satisfaction of the requirements of the Mexican Water Treaty (Treaty Series 994, 59 Stat. 1219), shall be from the waters of the Colorado River pursuant to the treaties, laws, and compacts presently relating thereto, until such time as a feasibility plan showing the most economical means of augmenting the water supply available in the Colorado River below Lee Ferry by two and one-half million acre-feet shall be authorized by the Congress and is in operation as provided in this Act.

SEC. 203. (a) In the event that the Secretary shall, pursuant to section 201, plan works to import water into the Colorado River system from sources outside the natural drainage areas of the system, he shall make provision for adequate and equitable protection of the interests of the States and areas of origin, including assistance from funds specified in this Act, to the end that water supplies may be available for use in such States and areas of origin adequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water to the Colorado River system.

(b) All requirements, present or future, for water within any State lying wholly or in part within the drainage area of any river basin from which water is exported by works planned pursuant to this Act shall have a priority of right in perpetuity to the use of the waters of that river basin, for all purposes, as against the uses of the water delivered by means of such exportation works, unless otherwise provided by interstate agreement.

SEC. 204. There are hereby authorized to be appropriated such sums as are required to carry out the purposes of this title.

TITLE III—AUTHORIZED UNITS: PROTECTION OF EXISTING USES

SEC. 301. (a) For the purposes of furnishing irrigation water and municipal water supplies to the water-deficient areas of Arizona and western New Mexico through direct diversion or exchange of water, control of floods, conservation and development of fish and wildlife resources, enhancement of recreation opportunities, and for other purposes, the Secretary shall construct, operate, and maintain the Central Arizona Project, consisting of the following principal works: (1) a system of main conduits and canals, including a main canal and pumping plants (Granite Reef aqueduct and pumping plants), for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative, which system may have a capacity of 3,000 cubic feet per second or whatever lesser capacity is found to be feasible: *Provided*, That any capacity in the Granite Reef aqueduct in excess of 2,500 cubic feet per second shall be utilized for the conveyance of Colorado River water only when Lake Powell is full or releases of water are made from Lake

Powell to prevent the reservoir from exceeding elevation 3,700 feet above mean sea level or when releases are made pursuant to the proviso in section 602(a)(3) of this Act: *Provided further*, That the costs of providing any capacity in excess of 2,500 cubic feet per second shall be repaid by those funds available to Arizona pursuant to the provision of subsection 403(f) of this Act, or by funds from sources other than the development fund; (2) Orme Dam and Reservoir and power-pumping plant or suitable alternative; (3) Buttes Dam and Reservoir, which shall be so operated as not to prejudice the rights of any user in and to the waters of the Gila River as those rights are set forth in the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Numbered 59); (4) Hooker Dam and Reservoir or suitable alternative, which shall be constructed in such a manner as to give effect to the provisions of subsection (f) of section 304; (5) Charleston Dam and Reservoir; (6) Tucson aqueducts and pumping plants; (7) Salt-Gila aqueducts; (8) related canals, regulating facilities, hydroelectric powerplants, and electrical transmission facilities required for the operation of said principal works; (9) related water distribution and drainage works; and (10) appurtenant works.

(b) Article II(B)(3) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340) shall be so administered that in any year in which, as determined by the Secretary, there is insufficient main stream Colorado River water available for release to satisfy annual consumptive use of seven million five hundred thousand acre-feet in Arizona, California, and Nevada, diversions from the main stream for the Central Arizona Project shall be so limited as to assure the availability of water in quantities sufficient to provide for the aggregate annual consumptive use by holders of present perfected rights, by other users in the State of California served under existing contracts with the United States by diversion works heretofore constructed, and by other existing Federal reservations in that State, of four million four hundred thousand acre-feet of mainstream water, and by users of the same character in Arizona and Nevada. Water users in the State of Nevada shall not be required to bear shortages in any proportion greater than would have been imposed in the absence of this subsection 301(b). This subsection shall not affect the relative priorities, among themselves, of water users in Arizona, Nevada, and California which are senior to diversions for the Central Arizona Project, or amend any provisions of said decree.

(c) The limitation stated in subsection (b) of this section shall not apply so long as the Secretary shall determine and proclaim that means are available and in operation which augment the water supply of the Colorado River system in such quantity as to make sufficient mainstream water available for release to satisfy annual consumptive use of seven million five hundred thousand acre-feet in Arizona, California, and Nevada.

SEC. 302. (a) The Secretary shall designate the lands of the Salt River Pima-Maricopa Indian Community, Arizona, and the Fort McDowell-Apache Indian Community, Arizona, or interests therein, and any allotted lands or interests therein within said communities which he determines are necessary for use and occupancy by the United States for the construction, operation, and maintenance of Orme Dam and Reservoir, or alternative. The Secretary shall offer to pay the fair market value of the lands and interests designated, inclusive of improvements. In addition, the Secretary shall offer to pay toward the cost of relocating or replacing such improvements not to exceed $500,000 in the aggregate, and the amount offered for the actual relocation or replacement of a residence shall not exceed the difference between the fair market value of the residence and $8,000. Each community and

each affected allottee shall have six months in which to accept or reject the Secretary's offer. If the Secretary's offer is rejected, the United States may proceed to acquire the property interests involved through eminent domain proceedings in the United States District Court for the District of Arizona under 40 U.S.C., sections 257 and 258a. Upon acceptance in writing of the Secretary's offer, or upon the filing of a declaration of taking in eminent domain proceedings, title to the lands or interests involved, and the right to possession thereof, shall vest in the United States. Upon a determination by the Secretary that all or any part of such lands or interests are no longer necessary for the purpose for which acquired, title to such lands or interests shall be restored to the appropriate community upon repayment to the Federal Government of the amounts paid by it for such lands.

62 Stat. 986; 46 Stat. 1421.

(b) Title to any land or easement acquired pursuant to this section shall be subject to the right of the former owner to use or lease the land for purposes not inconsistent with the construction, operation, and maintenance of the project, as determined by, and under terms and conditions prescribed by, the Secretary. Such right shall include the right to extract and dispose of minerals. The determination of fair market value under subsection (a) shall reflect the right to extract and dispose of minerals and all other uses permitted by this section.

(c) In view of the fact that a substantial portion of the lands of the Fort McDowell Mohave-Apache Indian Community will be required for Orme Dam and Reservoir, or alternative, the Secretary shall, in addition to the compensation provided for in subsection (a) of this section, designate and add to the Fort McDowell Indian Reservation twenty-five hundred acres of suitable lands in the vicinity of the reservation that are under the jurisdiction of the Department of the Interior in township 4 north, range 7 east; township 5 north, range 7 east; and township 3 north, range 7 east, Gila and Salt River base meridian, Arizona. Title to lands so added to the reservation shall be held by the United States in trust for the Fort McDowell Mohave-Apache Indian Community.

(d) Each community shall have a right, in accordance with plans approved by the Secretary, to develop and operate recreational facilities along the part of the shoreline of the Orme Reservoir located on or adjacent to its reservation, including land added to the Fort McDowell Reservation as provided in subsection (b) of this section, subject to rules and regulations prescribed by the Secretary governing the recreation development of the reservoir. Recreation development of the entire reservoir and federally owned lands under the jurisdiction of the Secretary adjacent thereto shall be in accordance with a master recreation plan approved by the Secretary. The members of each community shall have nonexclusive personal rights to hunt and fish on or in the reservoir without charge to the same extent they are now authorized to hunt and fish, but no community shall have the right to exclude others from the reservoir except by control of access through its reservation or any right to require payment by members of the public except for the use of community lands or facilities.

(e) All funds paid pursuant to this section, and any per capita distribution thereof, shall be exempt from all forms of State and Federal income taxes.

SEC. 303. (a) The Secretary is authorized and directed to continue to a conclusion appropriate engineering and economic studies and to recommend the most feasible plan for the construction and operation of hydroelectric generating and transmission facilities, the purchase of electrical energy, the purchase of entitlement to electrical plant capacity, or any combination thereof, including participation, operation, or construction by non-Federal entities, for the purpose of supplying the power requirements of the Central Arizona Project and

augmenting the Lower Colorado River Basin Development Fund: *Provided*, That nothing in this section or in this Act contained shall be construed to authorize the study or construction of any dams on the main stream of the Colorado River between Hoover Dam and Glen Canyon Dam.

(b) If included as a part of the recommended plan, the Secretary may enter into agreements with non-Federal interests proposing to construct thermal generating powerplants whereby the United States shall acquire the right to such portions of their capacity, including delivery of power and energy over appurtenant transmission facilities to mutually agreed upon delivery points, as he determines is required in connection with the operation of the Central Arizona Project. When not required for the Central Arizona Project, the power and energy acquired by such agreements may be disposed of intermittently by the Secretary for other purposes at such prices as he may determine, including its marketing in conjunction with the sale of power and energy from Federal powerplants in the Colorado River system so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates. The agreements shall provide, among other things, that—

(1) the United States shall pay not more than that portion of the total construction cost, exclusive of interest during construction, of the powerplants, and of any switchyards and transmission facilities serving the United States, as is represented by the ratios of the respective capacities to be provided for the United States therein to the total capacities of such facilities. The Secretary shall make the Federal portion of such costs available to the non-Federal interests during the construction period, including the period of preparation of designs and specifications, in such installments as will facilitate a timely construction schedule, but no funds other than for preconstruction activities shall be made available by the Secretary until he determines that adequate contractual arrangements have been entered into between all the affected parties covering land, water, fuel supplies, power (its availablity and use), rights-of-way, transmission facilities and all other necessary matters for the thermal generating powerplants;

Operation and maintenance costs.

(2) annual operation and maintenance costs shall be apportioned between the United States and the non-Federal interests on an equitable basis taking into account the ratios determined in accordance with the foregoing clause (1): *Provided, however*, That the United States shall share on the foregoing basis in the depreciation component of such costs only to the extent of provision for depreciation on replacements financed by the non-Federal interests;

(3) the United States shall be given appropriate credit for any interests in Federal lands administered by the Department of the Interior that are made available for the powerplants and appurtenances;

(4) costs to be borne by the United States under clauses (1) and (2) shall not include (a) interest and interest during construction, (b) financing charges, (c) franchise fees, and (d) such other costs as shall be specified in the agreement.

Recommendations to Congress.

(c) No later than one year from the effective date of this Act, the Secretary shall submit his recommended plan to the Congress. Except as authorized by subsection (b) of this section, such plan shall not become effective until approved by the Congress.

Arizona, apportionment of diverted water.

(d) If any thermal generating plant referred to in subsection (b) of this section is located in Arizona, and if it is served by water diverted from the drainage area of the Colorado River system above Lee Ferry,

other provisions of existing law to the contrary notwithstanding, such consumptive use of water shall be a part of the fifty thousand acre-feet per annum apportioned to the State of Arizona by article III(a) of the Upper Colorado River Basin Compact (63 Stat. 31).

Irrigation restriction.

SEC. 304. (a) Unless and until otherwise provided by Congress, water from the Central Arizona Project shall not be made available directly or indirectly for the irrigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, and, with the approval of the Secretary, State-administered wildlife management areas.

Water supply, repayment contracts.

(b) (1) Irrigation and municipal and industrial water supply under the Central Arizona Project within the State of Arizona may, in the event the Secretary determines that it is necessary to effect repayment, be pursuant to master contracts with organizations which have power to levy assessments against all taxable real property within their boundaries. The terms and conditions of contracts or other arrangements whereby each such organization makes water from the Central Arizona Project available to users within its boundaries shall be subject to the Secretary's approval, and the United States shall, if the Secretary determines such action is desirable to facilitate carrying out the provisions of this Act, have the right to require that it be a party to such contracts or that contracts subsidiary to the master contracts be entered into between the United States and any user. The provisions of this clause (1) shall not apply to the supplying of water to an Indian tribe for use within the boundaries of an Indian reservation.

(2) Any obligation assumed pursuant to section 9(d) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(d)) with respect to any project contract unit or irrigation block shall be repaid over a basic period of not more than fifty years; any water service provided pursuant to section 9(e) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(e)) may be on the basis of delivery of water for a period of fifty years and for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits and from such other points of delivery as the Secretary may designate; and long-term contracts relating to irrigation water supply shall provide that water made available thereunder may be made available by the Secretary for municipal or industrial purposes if and to the extent that such water is not required by the contractor for irrigation purposes.

53 Stat. 1195.

(3) Contracts relating to municipal and industrial water supply under the Central Arizona Project may be made without regard to the limitations of the last sentence of section 9(c) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(c)); may provide for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits; and may provide for repayment over a period of fifty years if made pursuant to clause (1) of said section and for the delivery of water over a period of fifty years if made pursuant to clause (2) thereof.

Water conservation.

(c) Each contract under which water is provided under the Central Arizona Project shall require that (1) there be in effect measures, adequate in the judgment of the Secretary, to control expansion of irrigation from aquifers affected by irrigation in the contract service area; (2) the canals and distribution systems through which water is conveyed after its delivery by the United States to the contractors shall be provided and maintained with linings adequate in his judgment to prevent excessive conveyance losses; and (3) neither the contractor nor the Secretary shall pump or permit others to pump ground water from within the exterior boundaries of the service area of a contractor receiving water from the Central Arizona Project for any use outside

said contractor's service area unless the Secretary and such contractor shall agree, or shall have previously agreed, that a surplus of ground water exists and that drainage is or was required. Such contracts shall be subordinate at all times to the satisfaction of all existing contracts between the Secretary and users in Arizona heretofore made pursuant to the Boulder Canyon Project Act (45 Stat. 1057).

43 USC 617t.

Water exchanges.

(d) The Secretary may require in any contract under which water is provided from the Central Arizona Project that the contractor agree to accept main stream water in exchange for or in replacement of existing supplies from sources other than the main stream. The Secretary shall so require in the case of users in Arizona who also use water from the Gila River system to the extent necessary to make available to users of water from the Gila River system in New Mexico additional quantities of water as provided in and under the conditions specified in subsection (f) of this section: *Provided*, That such exchanges and replacements shall be accomplished without economic injury or cost to such Arizona contractors.

Water shortage priorities.

(e) In times of shortage or reduction of main stream Colorado River water for the Central Arizona Project, as determined by the Secretary, users which have yielded water from other sources in exchange for main stream water supplied by that project shall have a first priority to receive main stream water, as against other users supplied by that project which have not so yielded water from other sources, but only in quantities adequate to replace the water so yielded.

New Mexico users, water exchange contracts.

(f) (1) In the operation of the Central Arizona Project, the Secretary shall offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources in amounts that will permit consumptive use of water in New Mexico of not to exceed an annual average in any period of ten consecutive years of eighteen thousand acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340). Such increased consumptive uses shall not begin until, and shall continue only so long as, delivery of Colorado River water to downstream Gila River users in Arizona is being accomplished in accordance with this Act, in quantities sufficient to replace any diminution of their supply resulting from such diversion from the Gila River, its tributaries and underground water sources. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved.

(2) The Secretary shall further offer to contract with water users in New Mexico for water from the Gila River, its tributaries, and underground water sources in amounts that will permit consumptive uses of water in New Mexico of not to exceed an annual average in any period of ten consecutive years of an additional thirty thousand acre-feet, including reservoir evaporation. Such further increases in consumptive use shall not begin until, and shall continue only so long as, works capable of augmenting the water supply of the Colorado River system have been completed and water sufficiently in excess of two million eight hundred thousand acre-feet per annum is available from the main stream of the Colorado River for consumptive use in Arizona to provide water for the exchanges herein authorized and provided. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved.

(3) All additional consumptive uses provided for in clauses (1) and (2) of this subsection shall be subject to all rights in New Mexico and Arizona as established by the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Numbered 59) and to all other rights existing on the effective

date of this Act in New Mexico and Arizona to water from the Gila River, its tributaries, and underground water sources, and shall be junior thereto and shall be made only to the extent possible without economic injury or cost to the holders of such rights.

Newly irrigated lands, restriction.

(g) For a period of ten years from the date of enactment of this Act, no water from the projects authorized by this Act shall be delivered to any water user for the production on newly irrigated lands of any basic agricultural commodity, as defined in the Agricultural Act of 1949, or any amendment thereof, if the total supply of such commodity for the marketing year in which the bulk of the crop would normally be marketed is in excess of the normal supply as defined in section 301(b)(10) of the Agricultural Adjustment Act of 1938 (52 Stat. 38), as amended (7 U.S.C. 1301), unless the Secretary of Agriculture calls for an increase in production of such commodity in the interest of national security.

63 Stat. 1051.
7 USC 1421 note.

62 Stat. 1251.

Main stream water cost.

SEC. 305. To the extent that the flow of the main stream of the Colorado River is augmented in order to make sufficient water available for release, as determined by the Secretary pursuant to article II(b)(1) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340), to satisfy annual consumptive use of two million eight hundred thousand acre-feet in Arizona, four million four hundred thousand acre-feet in California, and three hundred thousand acre-feet in Nevada, respectively, the Secretary shall make such water available to users of main stream water in those States at the same costs (to the extent that such costs can be made comparable through the nonreimbursable allocation to the replenishment of the deficiencies occasioned by satisfaction of the Mexican Treaty burden as herein provided and financial assistance from the development fund established by section 403 of this Act) and on the same terms as would be applicable if main stream water were available for release in the quantities required to supply such consumptive use.

Water salvage programs.

SEC. 306. The Secretary shall undertake programs for water salvage and ground water recovery along and adjacent to the main stream of the Colorado River. Such programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife in the area, as determined by the Secretary.

Dixie project, integration.

SEC. 307. The Dixie Project, heretofore authorized in the State of Utah, is hereby reauthorized for construction at the site determined feasible by the Secretary, and the Secretary shall integrate such project into the repayment arrangement and participation in the Lower Colorado River Basin Development Fund established by title IV of this Act consistent with the provisions of the Act: *Provided*, That section 8 of Public Law 88-565 (78 Stat. 848) is hereby amended by deleting the figure "$42,700,000" and inserting in lieu thereof the figure "$58,000,000".

43 USC 616hh.

Fish and wildlife conservation and development.

SEC. 308. The conservation and development of the fish and wildlife resources and the enhancement of recreation opportunities in connection with the project works authorized pursuant to this title shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213), except as provided in section 302 of this Act.

16 USC 460*l*-12 note.

Central Arizona project, appropriation.

SEC. 309. (a) There is hereby authorized to be appropriated for construction of the Central Arizona Project, including prepayment for power generation and transmission facilities but exclusive of distribution and drainage facilities for non-Indian lands, $832,180,000 plus or minus such amounts, if any, as may be justified by reason of ordinary fluctuations in construction costs as indicated by engineering cost indices applicable to the types of construction involved therein and, in addition thereto, such sums as may be required for operation and maintenance of the project.

Non-Indian lands facilities, appropriation.

(b) There is also authorized to be appropriated $100,000,000 for construction of distribution and drainage facilities for non-Indian lands. Notwithstanding the provisions of section 403 of this Act, neither appropriations made pursuant to the authorization contained in this subsection (b) nor revenues collected in connection with the operation of such facilities shall be credited to the Lower Colorado River Basin Development Fund and payments shall not be made from that fund to the general fund of the Treasury to return any part of the costs of construction, operation, and maintenance of such facilities.

TITLE IV—LOWER COLORADO RIVER BASIN DEVELOPMENT FUND: ALLOCATION AND REPAYMENT OF COSTS: CONTRACTS

SEC. 401. Upon completion of each lower basin unit of the project herein or hereafter authorized, or separate feature thereof, the Secretary shall allocate the total costs of constructing said unit or features to (1) commercial power, (2) irrigation, (3) municipal and industrial water supply, (4) flood control, (5) navigation, (6) water quality control, (7) recreation, (8) fish and wildlife, (9) the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by performance of the Water Treaty of 1944 with the United Mexican States (Treaty Series 994; 59 Stat. 1219), and (10) any other purposes authorized under the Federal reclamation laws. Costs of construction, operation, and maintenance allocated to the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by compliance with the Mexican Water Treaty (including losses in transit, evaporation from regulatory reservoirs, and regulatory losses at the Mexican boundary, incurred in the transportation, storage, and delivery of water in discharge of the obligations of that treaty) shall be nonreimbursable: *Provided*, That the nonreimbursable allocation shall be made on a pro rata basis to be determined by the ratio between the amount of water required to comply with the Mexican Water Treaty and the total amount of water by which the Colorado River is augmented pursuant to the investigations authorized by title II of this Act and any future Congressional authorization. The repayment of costs allocated to recreation and fish and wildlife enhancement shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213): *Provided*, That all of the separable and joint costs allocated to recreation and fish and wildlife enhancement as a part of the Dixie project, Utah, shall be nonreimbursable. Costs allocated to nonreimbursable purposes shall be nonreturnable under the provisions of this Act.

16 USC 460*l*-12 note.

Indian lands, repayment capability.

SEC. 402. The Secretary shall determine the repayment capability of Indian lands within, under, or served by any unit of the project. Construction costs allocated to irrigation of Indian lands (including provision of water for incidental domestic and stock water uses) and within the repayment capability of such lands shall be subject to the Act of July 1, 1932 (47 Stat. 564; 25 U.S.C. 386a), and such costs that are beyond repayment capability of such lands shall be nonreimbursable.

Lower Colorado River Basin Development Fund. Establishment.

SEC. 403. (a) There is hereby established a separate fund in the Treasury of the United States to be known as the Lower Colorado River Basin Development Fund (hereafter called the "development fund"), which shall remain available until expended as hereafter provided.

Ante, p. 887.

(b) All appropriations made for the purpose of carrying out the provisions of title III of this Act shall be credited to the development

fund as advances from the general fund of the Treasury, and shall be available for such purpose.

(c) There shall also be credited to the development fund—

(1) all revenues collected in connection with the operation of facilities authorized in title III in furtherance of the purposes of this Act (except entrance, admission, and other recreation fees or charges and proceeds received from recreation concessionaires), including revenues which, after completion of payout of the Central Arizona Project as required herein are surplus, as determined by the Secretary, to the operation, maintenance, and replacement requirements of said project; *Ante*, p. 887.

(2) any Federal revenues from the Boulder Canyon and Parker-Davis projects which, after completion of repayment requirements of the said Boulder Canyon and Parker-Davis projects, are surplus, as determined by the Secretary, to the operation, maintenance, and replacement requirements of those projects: *Provided, however*, That the Secretary is authorized and directed to continue the in-lieu-of-tax payments to the States of Arizona and Nevada provided for in section 2(c) of the Boulder Canyon Project Adjustment Act so long as revenues accrue from the operation of the Boulder Canyon project; and 54 Stat. 775. 43 USC 618a.

(3) any Federal revenues from that portion of the Pacific Northwest-Pacific Southwest intertie located in the States of Nevada and Arizona which, after completion of repayment requirements of the said part of the Pacific Northwest-Pacific Southwest intertie located in the States of Nevada and Arizona, are surplus, as determined by the Secretary, to the operation, maintenance, and replacement requirements of said portion of the Pacific Northwest-Pacific Southwest intertie and related facilities.

(d) All moneys collected and credited to the development fund pursuant to subsection (b) and clauses (1) and (3) of subsection (c) of this section and the portion of revenues derived from the sale of power and energy for use in Arizona pursuant to clause (2) of subsection (c) of this section shall be available, without further appropriation, for— Development fund revenue use.

(1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the projects, within such separate limitations as may be included in annual appropriation Acts; and

(2) payments to reimburse water users in the State of Arizona for losses sustained as a result of diminution of the production of hydroelectric power at Coolidge Dam, Arizona, resulting from exchanges of water between users in the States of Arizona and New Mexico as set forth in section 304(f) of this Act.

(e) Revenues credited to the development fund shall not be available for construction of the works comprised within any unit of the project herein or hereafter authorized except upon appropriation by the Congress.

(f) Moneys credited to the development fund pursuant to subsection (b) and clauses (1) and (3) of subsection (c) of this section and the portion of revenues derived from the sale of power and energy for use in Arizona pursuant to clause (2) of subsection (c) of this section in excess of the amount necessary to meet the requirements of clauses (1) and (2) of subsection (d) of this section shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit of the projects or separable feature thereof authorized pursuant to title III of this Act which are allocated to irrigation, commercial power, or municipal and industrial water supply, pursuant to this Act within a period not

exceeding fifty years from the date of completion of each such unit or separable feature, exclusive of any development period authorized by law: *Provided*, That return of the cost, if any, required by section 307 shall not be made until after the payout period of the Central Arizona Project as authorized herein; and

(2) interest (including interest during construction) on the unamortized balance of the investment in the commercial power and municipal and industrial water supply features of the project at a rate determined by the Secretary of the Treasury in accordance with the provisions of subsection (h) of this section, and interest due shall be a first charge.

(g) All revenues credited to the development fund in accordance with clause (c)(2) of this section (excluding only those revenues derived from the sale of power and energy for use in Arizona during the payout period of the Central Arizona Project as authorized herein) and such other revenues as remain in the development fund after making the payments required by subsections (d) and (f) of this section shall be available (1) to make payments, if any, as required by sections 307 and 502 of this Act, and (2) upon appropriation by the Congress, to assist in the repayment of reimbursable costs incurred in connection with units hereafter constructed to provide for the augmentation of the water supplies of the Colorado River for use below Lee Ferry as may be authorized as a result of the investigations and recommendations made pursuant to section 201 and subsection 203(a) of this Act.

Interest rate.

(h) The interest rate applicable to those portions of the reimbursable costs of each unit of the project which are properly allocated to commercial power development and municipal and industrial water supply shall be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which the first advance is made for initiating construction of such unit, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations which are neither due nor callable for redemption for fifteen years from the date of issue.

Annual budgets, submittal to Congress.

(i) Business-type budgets shall be submitted to the Congress annually for all operations financed by the development fund.

Report to Congress.

SEC. 404. On January 1 of each year the Secretary shall report to the Congress, beginning with the fiscal year ending June 30, 1969, upon the status of the revenues from and the cost of constructing, operating, and maintaining each lower basin unit of the project for the preceding fiscal year. The report of the Secretary shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

TITLE V—UPPER COLORADO RIVER BASIN: AUTHORIZATIONS AND REIMBURSEMENTS

SEC. 501. (a) In order to provide for the construction, operation, and maintenance of the Animas-La Plata Federal reclamation project, Colorado-New Mexico; the Dolores, Dallas Creek, West Divide, and San Miguel Federal reclamation projects, Colorado; and the Central Utah project (Uintah unit), Utah, as participating projects under the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620), and to provide for the completion of planning reports on other participating projects, clause (2) of section 1 of said Act is hereby further amended by (i) inserting the words "and the Uintah unit" after the

word "phase" within the parenthesis following "Central Utah", (ii) deleting the words "Pine River Extension" and inserting in lieu thereof the words "Animas-La Plata, Dolores, Dallas Creek, West Divide, San Miguel", (iii) adding after the words "Smith Fork:" the proviso "*Provided*, That construction of the Uintah unit of the Central Utah project shall not be undertaken by the Secretary until he has completed a feasibility report on such unit and submitted such report to the Congress along with his certification that, in his judgment, the benefits of such unit or segment will exceed the costs and that such unit is physically and financially feasible, and the Congress has authorized the appropriation of funds for the construction thereof:". Section 2 of said Act is hereby further amended by (i) deleting the words "Parshall, Troublesome, Rabbit Ear, San Miguel, West Divide, Tomichi Creek, East River, Ohio Creek, Dallas Creek, Dolores, Fruit Growers Extension, Animas-La Plata", and inserting after the words "Yellow Jacket" the words "Basalt Middle Park (including the Troublesome, Rabbit Ear, and Azure units), Upper Gunnison (including the East River, Ohio Creek, and Tomichi Creek units), Lower Yampa (including the Juniper and Great Northern units), Upper Yampa (including the Hayden Mesa, Wessels, and Toponas units)"; (ii) by inserting after the word "Sublette" the words "(including a diversion of water from the Green River to the North Platte River Basin in Wyoming), Ute Indian unit of the Central Utah Project, San Juan County (Utah), Price River, Grand County (Utah), Gray Canyon, and Juniper (Utah)"; and (iii) changing the period after "projects" to a colon and adding the following proviso: "*Provided*, That the planning report for the Ute Indian unit of the Central Utah participating project shall be completed on or before December 31, 1974, to enable the United States of America to meet the commitments heretofore made to the Ute Indian Tribe of the Uintah and Ouray Indian Reservation under the agreement dated September 20, 1965 (Contract Numbered 14–06–W–194).". The amount which section 12 of said Act authorizes to be appropriated is hereby further increased by the sum of $392,000,000, plus or minus such amounts, if any, as may be required, by reason of changes in construction costs as indicated by engineering cost indices applicable to the type of construction involved. This additional sum shall be available solely for the construction of the Animas-La Plata, Dolores, Dallas Creek, West Divide, and San Miguel projects herein authorized.

Report to Congress.

43 USC 620a.

Authorization increase.
43 USC 620k.

(b) The Secretary is directed to proceed as nearly as practicable with the construction of the Animas-La Plata, Dolores, Dallas Creek, West Divide, and San Miguel participating Federal reclamation projects concurrently with the construction of the Central Arizona Project, to the end that such projects shall be completed not later than the date of the first delivery of water from said Central Arizona Project: *Provided*, That an appropriate repayment contract for each of said participating projects shall have been executed as provided in section 4 of the Colorado River Storage Project Act (70 Stat. 107) before construction shall start on that particular project.

43 USC 620c.

(c) The Animas-La Plata Federal reclamation project shall be constructed and operated in substantial accordance with the engineering plans set out in the report of the Secretary transmitted to the Congress on May 4, 1966, and printed as House Document 436, Eighty-ninth Congress: *Provided*, That construction of the Animas-La Plata Federal reclamation project shall not be undertaken until and unless the States of Colorado and New Mexico shall have ratified the following compact to which the consent of Congress is hereby given:

Animas-La Plata Federal reclamation project; consent of Congress.

"ANIMAS-LA PLATA PROJECT COMPACT

"The State of Colorado and the State of New Mexico, in order to implement the operation of the Animas-La Plata Federal Reclamation Project, Colorado-New Mexico, a proposed participating project under the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620) and being moved by considerations of interstate comity, have resolved to conclude a compact for these purposes and have agreed upon the following articles:

"ARTICLE I

"A. The right to store and divert water in Colorado and New Mexico from the La Plata and Animas River systems, including return flow to the La Plata River from Animas River diversions, for uses in New Mexico under the Animas-La Plata Federal Reclamation Project shall be valid and of equal priority with those rights granted by decree of the Colorado state courts for the uses of water in Colorado for that project, providing such uses in New Mexico are within the allocation of water made to that state by articles III and XIV of the Upper Colorado River Basin Compact (63 Stat. 31).

"B. The restrictions of the last sentence of Section (a) of Article IX of the Upper Colorado River Basin Compact shall not be construed to vitiate paragraph A of this article.

"ARTICLE II

"This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States."

(d) The Secretary shall, for the Animas-La Plata, Dolores, Dallas Creek, San Miguel, West Divide, and Seedskadee participating projects of the Colorado River storage project, establish the nonexcess irrigable acreage for which any single ownership may receive project water at one hundred and sixty acres of class 1 land or the equivalent thereof, as determined by the Secretary, in other land classes.

(e) In the diversion and storage of water for any project or any parts thereof constructed under the authority of this Act or the Colorado River Storage Project Act within and for the benefit of the State of Colorado only, the Secretary is directed to comply with the constitution and statutes of the State of Colorado relating to priority of appropriation; with State and Federal court decrees entered pursuant thereto; and with operating principles, if any, adopted by the Secretary and approved by the State of Colorado.

(f) The words "any western slope appropriations" contained in paragraph (i) of that section of Senate Document Numbered 80, Seventy-fifth Congress, first session, entitled "Manner of Operation of Project Facilities and Auxiliary Features", shall mean and refer to the appropriation heretofore made for the storage of water in Green Mountain Reservoir, a unit of the Colorado-Big Thompson Federal reclamation project, Colorado; and the Secretary is directed to act in accordance with such meaning and reference. It is the sense of Congress that this directive defines and observes the purpose of said paragraph (i), and does not in any way affect or alter any rights or obligations arising under said Senate Document Numbered 80 or under the laws of the State of Colorado.

SEC. 502. The Upper Colorado River Basin Fund established under section 5 of the Colorado River Storage Project Act (70 Stat. 107; 43 U.S.C. 620d) shall be reimbursed from the Colorado River Development Fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a) for the money expended heretofore or hereafter from the Upper Colorado River Basin

Fund to meet deficiencies in generation at Hoover Dam during the filling period of storage units of the Colorado River storage project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Fed. Reg. 6851, July 19, 1962). For this purpose, $500,000 for each year of operation of Hoover Dam and powerplant, commencing with fiscal year 1970, shall be transferred from the Colorado River Development Fund to the Upper Colorado River Basin Fund, in lieu of application of said amounts to the purposes stated in section 2(d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1987, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin Fund from the Lower Colorado River Basin Development Fund, as provided in subsection (g) of section 403.

62 Stat. 284.
43 USC 618a.

TITLE VI—GENERAL PROVISIONS: DEFINITIONS: CONDITIONS

SEC. 601. (a) Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994; 59 Stat. 1219), the decree entered by the Supreme Court of the United States in Arizona against California and others (376 U.S. 340), or, except as otherwise provided herein, the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a) or the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620).

43 USC 617t.

(b) The Secretary is directed to—

Reports to the President, Congress, etc.

(1) make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1970. Such reports shall include a detailed breakdown of the beneficial consumptive use of water on a State-by-State basis. Specific figures on quantities consumptively used from the major tributary streams flowing into the Colorado River shall also be included on a State-by-State basis. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River Compact; and

(2) condition all contracts for the delivery of water originating in the drainage basin of the Colorado River system upon the availability of water under the Colorado River Compact.

Federal officers and agencies, compliance.

(c) All Federal officers and agencies are directed to comply with the applicable provisions of this Act, and of the laws, treaty, compacts, and decree referred to in subsection (a) of this section, in the storage and release of water from all reservoirs and in the operation and maintenance of all facilities in the Colorado River system under the jurisdiction and supervision of the Secretary, and in the operation and maintenance of all works which may be authorized hereafter for the augmentation of the water supply of the Colorado River system. In the event of failure of any such officer or agency to so comply, any affected State may maintain an action to enforce the provisions of this section in the Supreme Court of the United States and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

63 Stat. 31; 59 Stat. 1219.

70 Stat. 105; 45 Stat. 1057; 54 Stat. 779. 43 USC 620, 617t, 618o.

SEC. 602. (a) In order to comply with and carry out the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, and the Mexican Water Treaty, the Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of the Colorado River Storage Project Act, the Boulder Canyon Project Act, and the Boulder Canyon Project Adjustment Act. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River storage project and releases of water from Lake Powell in the following listed order of priority:

(1) releases to supply one-half the deficiency described in article III(c) of the Colorado River Compact, if any such deficiency exists and is chargeable to the States of the Upper Division, but in any event such releases, if any, shall not be required in any year that the Secretary makes the determination and issues the proclamation specified in section 202 of this Act;

(2) releases to comply with article III(d) of the Colorado River Compact, less such quantities of water delivered into the Colorado River below Lee Ferry to the credit of the States of the Upper Division from other sources; and

(3) storage of water not required for the releases specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three Lower Division States and taking into consideration all relevant factors (including, but not limited to, historic stream-flows, the most critical period of record, and probabilities of water supply), shall find this to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River Compact: *Provided*, That water not so required to be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the Lower Division to the uses specified in article III(e) of the Colorado River Compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell.

Criteria, review and comment.

(b) Not later than January 1, 1970, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the Governors of the seven Colorado River Basin States and to such other parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than July 1, 1970, the Secretary shall adopt appropriate criteria in accordance with this section and publish the same in the Federal Register. Beginning January 1, 1972, and yearly thereafter, the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year. As a result of actual operating experience or unforeseen circumstances, the Secretary may thereafter modify the criteria to better achieve the purposes specified in subsection (a) of this section, but only after correspondence with the Governors of the seven Colorado River Basin States and appropriate consultation with such State representatives as each Governor may designate.

Publication in Federal Register.

Report to Congress, etc.

43 USC 620f.

(c) Section 7 of the Colorado River Storage Project Act shall be administered in accordance with the foregoing criteria.

SEC. 603. (a) Rights of the upper basin to the consumptive use of water available to that basin from the Colorado River system under the Colorado River Compact shall not be reduced or prejudiced by any use of such water in the lower basin.

(b) Nothing in this Act shall be construed so as to impair, conflict with, or otherwise change the duties and powers of the Upper Colorado River Commission.

SEC. 604. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the projects herein and hereafter authorized, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902; 32 Stat. 388, and Acts amendatory thereof or supplementary thereto) to which laws this Act shall be deemed a supplement. 43 USC 371 note.

SEC. 605. Part I of the Federal Power Act (41 Stat. 1063; 16 U.S.C. 791a–823) shall not be applicable to the reaches of the main stream of the Colorado River between Hoover Dam and Glen Canyon Dam until and unless otherwise provided by Congress.

SEC. 606. As used in this Act, (a) all terms which are defined in the Colorado River Compact shall have the meanings therein defined; Definitions.

(b) "Main stream" means the main stream of the Colorado River downstream from Lee Ferry within the United States, including the reservoirs thereon;

(c) "User" or "water user" in relation to main stream water in the lower basin means the United States or any person or legal entity entitled under the decree of the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), to use main stream water when available thereunder;

(d) "Active storage" means that amount of water in reservoir storage, exclusive of bank storage, which can be released through the existing reservoir outlet works;

(e) "Colorado River Basin States" means the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming;

(f) "Western United States" means those States lying wholly or in part west of the Continental Divide; and

(g) "Augment" or "augmentation", when used herein with reference to water, means to increase the supply of the Colorado River or its tributaries by the introduction of water into the Colorado River system, which is in addition to the natural supply of the system.

Approved September 30, 1968.

Public Law 90-538

AN ACT

September 30, 1968
[H.R. 18763]

To authorize preschool and early education programs for handicapped children.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Handicapped Children's Early Education Assistance Act". Handicapped Children's Early Education Assistance Act.

PROGRAM AUTHORIZED

SEC. 2. (a) The Commissioner of Education (hereafter in this title referred to as the "Commissioner") is authorized to arrange by contract, grant, or otherwise with appropriate public agencies and private nonprofit organizations, for the development and carrying out by such agencies and organizations of experimental preschool and early education programs for handicapped children which the Commissioner determines show promise of promoting a comprehensive and strength-

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OFFICIAL RECORD

Volume 21

UPPER COLORADO RIVER COMMISSION

1969

OFFICIAL RECORD

Volume 21

UPPER COLORADO RIVER COMMISSION

1969

EXPLANATORY NOTE

This document consists of a series of verbatim transcripts of meetings of the Upper Colorado River Commission. The records for each calendar year are in a separate volume.

The meetings of each Volume are separated by blue insert sheets.

A subject index is to be found at the beginning of each Volume with an explanation of its use.

At the beginning of the transcript of each meeting, there is a Table of Contents that refers to the major actions or decisions of the Commission.

Volume 21 includes transcripts of the following meetings of the UPPER COLORADO RIVER COMMISSION

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109	Salt Lake City, Utah	March 17, 1969
110	Salt Lake City, Utah	September 15, 1969
111	Denver, Colorado	October 1, 1969
112	Denver, Colorado	December 5, 1969

FOREWORD

The Upper Colorado River Commission is an interstate administrative agency created under the terms of the Upper Colorado River Basin Compact executed at Santa Fe, New Mexico, on October 11, 1948, and subsequently ratified by each of the legislatures of the states and by the Congress of the United States. The Commission represents the states of Colorado, New Mexico, Utah and Wyoming and the Federal Government.

The major purposes of the Upper Colorado River Basin Compact are: (1) to provide for the equitable division of the use of water of the Colorado River System among the Upper Basin States, namely, Arizona, Colorado, New Mexico, Utah and Wyoming; (2) to establish obligations of each state with respect to the delivery of water to the Lower Basin; (3) to promote interstate harmony; (4) to remove causes of controversies; (5) to secure the expeditious agricultural and industrial development of the Upper Basin states, the storage of waters, and the protection of life and property from floods.

The Commission, in order to fulfill the major purposes of the Compact, has been granted broad and comprehensive powers and charged with well-defined duties and responsibilities. Among its powers and duties are: adopting rules and regulations; locating and establishing water-gaging stations; making forecasts of water runoff; engaging in cooperative studies of water supplies; collecting, analyzing, correlating and preserving all types of water supply data; determining the quantity of water used each year in the Upper Colorado River Basin and in each state, and delivered to the Lower Basin; determining extent of curtailment of use, if necessary; determining reservoir losses and their apportionment; making findings of fact concerning obligations under the Mexican Treaty; acquiring and holding property; performing all functions required of it under the Upper Colorado River Basin Compact; reporting annually on its activities to the Governors of the signatory states and to the President of the United States.

This volume contains the transcripts of all meetings of the Commission during the 1969 calendar year.

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Diplomat Motor Hotel
Denver, Colorado
February 13, 1969

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UPPER COLORADO RIVER COMMISSION

355 South Fourth East Street
Salt Lake City, Utah 84111

COMMISSIONERS

H. P. Dugan	Chairman United States of America
John H. Bliss	State of New Mexico
Felix L. Sparks	Acting Commissioner State of Colorado
Thorpe Waddingham	State of Utah
H. T. Person	State of Wyoming

SECRETARY

Ival V. Goslin

STAFF

Ival V. Goslin	Executive Director
Cecil B. Jacobson	Chief Hydraulic Engineer
Paul L. Billhymer	General Counsel
Mrs. Charline K. Scoggin	Reporter

ADVISERS and OTHERS PRESENT

COLORADO:

Hon. John A. Love	Governor of the State of Colorado Denver, Colorado
Robert W. Fischer	Denver Water Board Denver, Colorado
R. E. Wiedemann	Chief of Water Resources, Denver Water Board, Denver, Colorado
Lew Williams	Southwestern Water Conservancy District, Norwood, Colorado
Bill Raley	San Miguel Water Conservancy District, Norwood, Colorado
Dan D. Noble	San Miguel Water Conservancy District, Norwood, Colorado
Fred L. Boydston, Jr.	Colorado Water Conservation Board Denver, Colorado
George A. Brown	Colorado Water Conservation Board Denver, Colorado
Loren L. Swick	Colorado Water Conservation Board Denver, Colorado
Francis M. Bell	Colorado Water Conservation Board Denver, Colorado
Donald H. Hamburg	Colorado Water Conservation Board Denver, Colorado
L. D. Morrill	Colorado Water Conservation Board Denver, Colorado
J. R. Barkley	Northern Colorado Water Conservancy District, Loveland, Colorado
John M. Sayre	Northern Colorado Water Conservancy District, Denver, Colorado

Gordon H. Scheer	Colorado Water Congress Denver, Colorado
William Nelson	Grand Junction Daily Sentinel Grand Junction, Colorado
Bruno Lukens	Pacific Oil Company Denver, Colorado

NEW MEXICO:

Claud S. Mann	Legal Adviser, Interstate Stream Commission Albuquerque, New Mexico
David P. Hale	Engineering Adviser, Interstate Stream Commission Santa Fe, New Mexico

WYOMING:

Floyd A. Bishop	State Engineer Cheyenne, Wyoming
Jack R. Gage	Assistant Attorney General Cheyenne, Wyoming
Delbert L. Boyer	Assistant State Engineer Cheyenne, Wyoming

UTAH:

L. Y. Siddoway	Central Utah Water Conservancy District, Vernal, Utah
Hugh W. Colton	Uintah Water Conservancy District, Vernal, Utah
Dallin W. Jensen	Assistant Attorney General Salt Lake City, Utah
Daniel F. Lawrence	Director of Water Resources Salt Lake City, Utah

BUREAU OF RECLAMATION:

J. Stuart McMaster	Regional Soliciter Salt Lake City, Utah
D. L. Crandall	Regional Director, Region 4 Salt Lake City, Utah
J. R. Riter	Denver, Colorado
Richard W. Nash	Denver, Colorado

GEOLOGICAL SURVEY:

E. J. Tripp	Denver, Colorado
E. A. Moulder	Water Resources Division Denver, Colorado

PROCEEDINGS

The Special Meeting of the Upper Colorado River Commission was called to order by Mr. H. P. Dugan, Chairman, on Thursday, February 13, 1969 in the Summit Room of the Diplomat Motor Hotel, 1840 Sherman Street, Denver, Colorado, at 10:00 o'clock a.m.

CHAIRMAN DUGAN: Gentlemen, we have called the Special Meeting of the Upper Colorado River Commission to order. I would like to say at the outset that it is with a great deal of pleasure that I become a member of this Commission. I have been interested in the activities of the Upper Colorado River Basin for many, many years, and I was a member of the Engineering Advisory Committee to the Upper Basin Compact Commission when the Compact was being negotiated. And so it is with real pleasure that I again resume my association with this Commission.

I was appointed as U.S. Commissioner by President Lyndon Johnson on November 4, 1968, and I would like to have my appointment made a part of this record. (A copy of President Johnson's letter appointing Mr. Dugan to the Commission appears on page 5.)

I would like to ask at this time that the Commissioners introduce the representatives they have here from their states, and I would like to call on Mr. Sparks.

THE WHITE HOUSE
WASHINGTON

November 4, 1968

Dear Mr. Dugan:

Pursuant to Public Law 81-37, approved April 6, 1949, granting the consent of the Congress to a compact among the States of Arizona, Colorado, New Mexico, Utah, and Wyoming relating to the equitable division and apportionment of the waters of the Colorado River among the States of the Upper Basin according to the Colorado River Compact of November 24, 1922, you are hereby appointed as United States Commissioner on and Chairman of the Upper Colorado River Commission. You shall participate in deliberations of the Commission, pursuant to Article VIII of the Compact as the United States Commissioner and carry out all of the duties and responsibilities of that office.

I have informed the Governors of the Compact States of your appointment, and am asking the Director of the Bureau of the Budget to notify the affected Federal agencies.

You are requested to report to me through the Director of the Bureau of the Budget.

Sincerely,

/s/ Lyndon B. Johnson

Honorable H. P. Dugan
3232 Nelson Street
Wheat Ridge, Colorado

Mr. Sparks, would you like to introduce your Colorado Representatives?

MR. SPARKS: My Chief Engineer, Mr. Larry Morrill; Water Resource Analyst, Don Hamburg; one of our Senior Engineers, Frank Bell; another Water Resource Analyst, Warren Swick; Senior Engineer, George Brown; Supervising Engineer, Fred Boydston. Is that all we have from our state? I guess that's -- no, Lew Williams, a former member of our board, from over in western Colorado; Dan Noble from the San Miguel Water Conservancy District, Bob Fischer, of the Denver Water Board; and Bill Raley, from the San Miguel Water Conservancy District and Bruno -- am I seeing right -- is that Bruno? Bruno Lukens, from an oil company. (Laughter.)

CHAIRMAN DUGAN: Mr. Bliss, do you have some representatives from New Mexico?

COM. BLISS: Yes. I have with me David Hale, who is the Engineer on the Interstate Stream Commission and has been my consultant for a number of years, and Claud Mann, Special Attorney General and my Legal Consultant.

CHAIRMAN DUGAN: Thank you, gentlemen.

COM. WADDINGHAM: I believe we have four here. We have Mr. Hugh Colton, Adviser to the Commissioner, Central Utah Water Conservancy District; Mr. Siddoway, right next to him, who is representing the Central Utah Conservancy District. We have Dallin Jensen, from the State Engineer's Office and the Adviser to our Natural Resources Department. And Dan is just coming in -- Dan Lawrence, who is the head of our Water Resources Department in Utah.

CHAIRMAN DUGAN: Mr. Person.

COM. PERSON: Mr. Chairman, we have Floyd Bishop, State Engineer. I am sure you all know him. Jack Gage, Assistant Attorney General, and Delbert Boyer, Assistant State Engineer.

CHAIRMAN DUGAN: We do have a few federal representatives here: Stuart McMaster, Interior Solicitor, Salt Lake City, and John R. Riter, Technical Adviser to the Chief Engineer; David Crandall, Regional Director, Bureau of Reclamation, Salt Lake City, and Richard Nash, Chief Engineer's Office, U. S. Bureau of Reclamation.

Any other federal representatives here?

MR. GOSLIN: Mr. Chairman, Governor Love has just arrived.

CHAIRMAN DUGAN: Governor, it is indeed a pleasure to have you with us. Would you like to say a few words to the Commission at this time?

GOVERNOR LOVE: Only that, unfortunately, without advance notice, I am not going to be able to stay for the entire meeting, but I did want to come by and participate. But, in any event, it might not even conform to the purpose of this particular meeting, so I won't say any more at this time.

CHAIRMAN DUGAN: Thank you very much, Governor. It is indeed a pleasure to have you with us.

Mr. Goslin, would you read the Notice of the Meeting?

MR. GOSLIN: Mr. Chairman, the Notice of this meeting was sent to the Commissioners and other interested parties in compliance with the By-Laws. It is dated January 30, 1969. It is a Notice of a Special Meeting that says:

> "In accordance with Article VI of the By-Laws, notice is hereby given that Chairman H. P. Dugan has called a Special Meeting of the Upper Colorado River Commission to be held beginning at 10:00 o'clock a.m. on Thursday, February 13, 1969, in Denver, Colorado.
>
> "The meeting will be held in the Summit Room of the Diplomat Motor Hotel, located at 1840 Sherman Street, Denver, Colorado 80203. The phone number is 303+234-4171. Each person should make his own room reservation."

And this is signed, in accordance with the By-Laws, by Ival V. Goslin, Secretary.

CHAIRMAN DUGAN: Thank you, Mr. Goslin.

The meeting of September 23, 1968, was held in Page, Arizona, and the Minutes of that meeting are available. Is it the pleasure of the Commissioners that these minutes be read?

COM. BLISS: Mr. Chairman, I have looked over the Minutes. I find nothing wrong with them. I move that the Minutes of the Page meeting be approved as set out.

COM. PERSON: Second the motion.

CHAIRMAN DUGAN: It's been moved and seconded that the Minutes of the September Meeting, 1968, at Page, Arizona, be approved as written. Is there any discussion?

(No response.)

Question?

COM. WADDINGHAM: Yes.

CHAIRMAN DUGAN: All in favor?

(Ayes.)

The Minutes of the Adjourned Meeting of September 23, 1968, are approved.

CHAIRMAN DUGAN: Gentlemen, as a brief Report of the Chairman, I would like to remark briefly about the plans of the Bureau of Reclamation. In connection with the responsibility that was given to the Secretary of Interior under the Colorado River Basin Act passed during the last session of the Congress, and, particularly, as it pertains to Section or Title Two of that Act, this Act calls for the reconnaissance study of the water supply needs, the water resources, and the means possible for augmenting the water resource needs of the western states, wholly or partially west of the Continental Divide.

Now this, gentlemen, means that there are eleven western states to come under the scope of this study. And the first progress report on this work is to be presented by the Secretary on June 30, 1971. A final reconnaissance report is to be presented by the Secretary June 30, 1977. I know that the Commission and the states of the Upper Basin, as well as all of the states of the west, and the various individual interests, and formal groups have a real and vital interest in this study. The Secretary of the Interior was directed by the Act to conduct full and complete reconnaissance pursuant to reclamation law, and the Water Resources Planning Act of 1965 to develop this general plan to meet the future water needs of these western states, as specified.

The legislative history connected with the Act gives some guidelines that must be followed. The reference to the Water Resources Planning Act is to assure that cooperation and coordination among all the federal

agencies, affected states, river commissions, and study commissions be made to the fullest to eliminate duplication and to assure that all parties have a part in the activities at the outset.

Now, as I am sure many of you know, for a period of ten years from the date of the Act, the Secretary cannot undertake studies of any plan for importation of water into the States of Arizona, California, Colorado and New Mexico, and that portion of Nevada, Utah, and Wyoming, which are in the natural drainage basin of the Colorado River.

The investigations and studies do not end with the submission of the initial report in 1967. This is only the first phase. It is intended that following the completion of the initial phase, the Secretary shall continue pursuant to existing authority to pursue vigorously the stated objective of Section 201, which is to develop a general plan to meet the future water needs of western states.

Now, the restrictions that are imposed in considering trans-basin works lead us to examine into very thoroughly what can be done with weather modifications, potential surpluses of water that might be developed in northern California, salvage of waste waters, and a very important aspect would be taking advantage of desalinization of sea water.

In implementing the studies, it is the plan of the Bureau of Reclamation to use the existing organization that we have, buttressing it as might become necessary to carry out the work, and we are, of course, certain that buttressing of the staff will be required to do a thorough and competent job. We will take fullest advantage of any information that has been made available through planning reports of all federal agency reports of all federal and state agencies, of comprehensive planning work that has been in progress in many parts of the west, of on-going work in the way of project investigations and complement the available information with what is available from any and all sources. I know that the Upper Basin Commission will have a very vital interest, and we would expect the Commission to display a very leading role in working with the Department of the Interior in the conduct of these studies.

Now, all of our planning on procedures has not been done. We are still holding meetings, the Bureau of Reclamation, staff, to finalize plans, and it is anticipated that some formal communication will be forthcoming to the Commission and to the interested states in the very near future.

If any of you have questions or comments about this activity, I would be very happy to have them now.

MR. GOSLIN: Mr. Chairman, what is going to be the relationship between the Type-1 Comprehensive River Basin Studies that are now under way and the studies that the Secretary is directed to make under Public Law 90-537?

CHAIRMAN DUGAN: We intend to make fullest use of the Type-1 Comprehensive Study work that is in progress or has been available at the time the reconnaissance report is being finalized. However, as I am sure all of you are acquainted with problems of this type know, it will be necessary to implement the information that we get from the Type-1 Studies, and so whatever needs to be done in the way of implementation will be pursued and injected into these activities.

MR. GOSLIN: Will the Type-1 Studies have to be completed first before they get into these other studies?

CHAIRMAN DUGAN: No, certainly not. We will proceed with dispatch on the studies under Title Two of the Act, but taking advantage of whatever concurrent information is available from Type-I Studies.

MR. BILLHYMER: May I ask you one question, too? Under this study, you will notice that there is nothing -- the final report is due in 1977.

CHAIRMAN DUGAN: Yes, Bill.

MR. BILLHYMER: Does that mean that until 1977, the Interior is not going to do anything other than reconnaissance studies for augmentation?

CHAIRMAN DUGAN: Well, certainly not. We do have on-going programs in regard to weather modification, desalinization. We plan to buttress our studies on waste water renovation and improvement.

MR. BILLHYMER: I mean, are you going to submit any feasibility plans for this type of thing prior to 1977?

CHAIRMAN DUGAN: Well, of course, we will have to pursue any feasibility study that is authorized and is going work. This would go on concurrently.

MR. BILLHYMER: That isn't what is indicated in the Conference Report, though, is it? If you study that, you can get the idea that there may be some limitation on feasibility presentations under this program of Title Two.

CHAIRMAN DUGAN: Well, I am not aware of any. Are you, David?

MR. CRANDALL: No, I would say that our regular investigation program would proceed on the basis of the merit of the individual development proposal.

CHAIRMAN DUGAN: I am sure this would be correct. Any other comments or questions?

(No response.)

If not, gentlemen, we would like to move to the report of Director Goslin.

MR. GOSLIN: Mr. Chairman, there are copies of the report available. I think they have all been distributed. If they have not, there are certainly others here.

I might remark at the beginning that what I have tried to do in this report is to condense this notebook here (indicating) into my report this morning. The bulk of this has to do with one major problem, and that is the use of the 50,000 acre-feet of water by Arizona in the Upper Basin.

Now, to get at the report, at our last meeting we discussed the study made by the members of the Commission Staff and the Bureau of Reclamation of the consumptive use of water by Arizona in the Upper Basin. The Bureau of Indian Affairs and the Navajo Tribe also cooperated in making the study. The report on the study was referred to the Engineering and Legal Committees where it was reviewed and revised. This study was a fact-finding study. The objective of which was to determine the amount of consumptive use of water remaining within Arizona's compact apportionment of 50,000 acre-feet per year for a coal-fired powerplant, other new uses, and expansion of present uses.

From the study it appeared that if the Indians successfully claimed rights under the Winters doctrine, if a large, three-unit, thermal-electric powerplant were constructed, if new water uses developed, and if existing uses expanded, there would be a real possibility of the total consumptive use of water in the Upper Basin portion of Arizona exceeding her compact-apportionment. The next logical step, therefore, was to provide some effective means of limiting the total uses of water to the ceiling of 50,000 acre-feet per

year through a relinquishment of Winters doctrine rights by the Indians, as was done for the San Juan-Chama and Navajo Indian Irrigation Projects in New Mexico, or by some other means, if those rights were not relinquished.

For one reason, and one reason only, that of protecting the interests of the Upper Division States in their future water development, our staff participated in making the water supply study and participated in the events described in the following paragraphs. It is fortunate that there developed an atmosphere of cooperative efforts on the part of the public and private utility participants in the proposed Page powerplant, led by the Salt River Project as the contractor for water with the Federal Government, and the Department of the Interior directed toward obtaining an effective limitation on total uses of water, by Indians and non-Indians, in the Upper Basin in Arizona within the 50,000 acre-feet compact apportionment to Arizona. This type of limitation would protect the Upper Division States against a combination of future uses of Upper Basin water that could exceed 50,000 acre-feet under Winters doctrine claims by the Indians, the powerplant, and all other present and potential water uses. The utility participants in the construction of the proposed powerplant desire the limitation in order to clarify the water availability question, which, in turn, aids in assuring their ability to obtain financial aid. We were told that the Secretary of the Interior desired such a limitation, also, in order to clarify the water availability-question, and to avoid future controversy over the water contract in the Congress or in the courts. I cannot help but add the thought at this point that had the idea of an effective limitation not been raised, the Secretary may have executed a water-commitment contract that would have been much less desirable than the one he signed on January 17.

At the request of officials of the Bureau of Indian Affairs and the Bureau of Reclamation, on December 5, 1968, I attended a meeting in Phoenix of these officials and representatives of the Salt River Project. The purpose of this meeting was to discuss procedure to assure that the total uses of water by Arizona in the Upper Basin would be limited to 50,000 acre-feet per year -- including the use by the thermal-generating powerplant proposed to be built near Page in conjunction with the Central Arizona Project, and in which the United States may participate by prepaying the costs of part of the generating capacity. The discussions clearly revealed that such a limitation is necessary, not only to protect the future water resource development of the four Upper Division States, but also, to assure financing of the portion of the powerplant that would be constructed at the expense of non-federal utilities and to avoid future controversy.

On December 9, 10, and 11, 1968, representatives of the Bureau of Reclamation, Bureau of Indian Affairs, Salt River Project, an Associate Solicitor of the Department of the Interior, and I attended meetings of the Navajo Tribal Council at Window Rock, Arizona. The reason for attending these meetings was that we had learned that on those dates the Tribal Council was going to consider matters relating to a contract between the Secretary of the Interior and the Salt River Project, operator of the coal-fuel powerplant, committing the consumptive use of 34,100 acre-feet of water per year for the powerplant to be located on the Navajo Indian Reservation near Page, Arizona. It appeared to the above-mentioned representatives that the time had come to formally present to the Tribe the opportunity for the thermal-electric development on the reservation, and at the same time clearly set forth the necessity for a water-use limitation in the Tribe's resolution to assure the utilities building the powerplant, as well as the Upper Basin States, that the Indians will not make demands upon the 50,000 acre-feet of water per year allocated to the State of Arizona, pursuant to the Upper Colorado River Basin Compact, that will cause the total consumptive use of water in that part of Arizona in the Upper Basin to be in excess of 50,000 acre-feet of water per year.

The Bureau of Reclamation representative explained, with modification, the details of the study of the consumptive use of water in the Upper Basin portion of Arizona that had been made jointly by the Bureau and the Commission with the cooperation of the Navajo Tribe and Bureau of Indian Affairs.

An official of the Salt River Project described the coal-fired, thermal generating plant proposed to be constructed near Page and the great monetary and social benefits that would accrue to the Navajo Indians from its construction and operation.

A resolution on the subject had been prepared by the Solicitor's office and BIA in Washington and transmitted to the Navajo Tribe some time prior to our trip to Window Rock. This resolution, so far as the limitation of all uses in Arizona to 50,000 acre-feet of water per year is concerned, was OK. This resolution was distributed to the Tribal Council. During the proceedings all copies were collected from the Council members. The Tribe's attorney was asked to prepare another resolution. The first draft of the resolution by the Tribal Attorney was completely unsatisfactory on the point in question; and, so far as the Associate Solicitor of the Department of the Interior was concerned, on this point and several others it was not satisfactory.

When the objectionable nature of the Tribal attorney's draft resolution was made known to tribal leaders, the Associate Solicitor, a Salt River Attorney, and I were requested to work in the evening with the Tribe's attorney to redraft the resolution. When we left the Tribal attorney's office after an involved evening session we felt the resolution was in good shape.

On the following day when the newly drafted resolution was distributed to the Tribal Council we noticed that it had been changed to say that the Indians would agree to limit their demands upon the water allocated to Arizona to 50,000 acre-feet per year, of which 34,100 acre-feet shall be used by the coal-fired powerplant to be located on the reservation near Page. The language of the resolution excluded non-Indian uses of water, such as, by the City of Page, by the Glen Canyon Powerplant, by recreational establishments, or by other non-Indian users.

After reading the new draft of resolution the Associate Solicitor and I asked the Tribe's attorney why the agreed language of the evening before was not included in the resolution. We were told that the changed form was the form in which he had been instructed to prepare the resolution and that he could not change it; and furthermore, that the Tribe was going to consider the resolution in that form, and that any further changes in the resolution would have to be made by amendments offered from the floor of the Council meeting. We then talked to several Tribal leaders before noon and requested an opportunity to explain to the Council the reasons why the resolution should be amended to include all uses of water within the 50,000 acre-feet allocated to Arizona. We were assured that such an opportunity would be granted after lunch. In the afternoon while listening to the extended debate, we were informed that the decision had been reached to restrict any further talk about the resolution to Council members only, thus foreclosing any further explanations.

During the afternoon one of the Council members asked if the Salt River Project would contribute $35,000 per year for five years instead of $25,000, as stated in the resolution, for establishing a professorial chair at the Navajo Community College as part of the consideration for the privilege of building a powerplant on the reservation. A spokesman for the Salt River Project was called upon to answer the question. His answer was affirmative.

At another point in the proceedings a Council member said that he knew that a representative of the Upper Colorado River Commission was in the room and wanted to know if he could have an explanation of

the source of the 50,000 acre-feet figure that was being discussed. I explained that the 50,000 acre-feet of consumptive use of water was a grant or allocation of water in the Upper Colorado River Basin Compact to the State of Arizona, that the Compact also included all uses of water by the Indians within the 50,000 acre-feet, and that the original intention of the Compact negotiators was that this block of water would be used almost entirely in the Upper Basin in Arizona by the Indians from tributaries of the San Juan River. I also took advantage of the opportunity to explain the economic, practical reasons why it was necessary for the resolution to be amended to express a willingness on the part of the Indians to limit their future uses of water in such a manner that all consumptive uses of water in the Arizona portion of the Upper Basin would not exceed 50,000 acre-feet as their part of the consideration for the opportunity to receive the many benefits from having the powerplant on their reservation.

The Tribal Council adopted the resolution, as written, without amendment with respect to raising the $25,000 per year contribution by the Salt River Project for the college to $35,000, or to limiting their uses so that all consumptive uses of water in the Arizona portion of the Upper Basin would remain within 50,000 acre-feet. A telephone call by the Associate Solicitor and myself to the Solicitor of the Department in Washington confirmed the fact that he could not advise the Secretary of the Interior to execute a contract with the Salt River Project committing 34,100 acre-feet of consumptive use of water in view of the terms of the adopted resolution.

After leaving the Tribal Council meeting, the BIA Area Director requested a number of us to meet in his office for a discussion of what might be done to make the situation more palatable to the interested parties. At this session were representatives of the Bureau of Reclamation, the Bureau of Indian Affairs, the Tribe, the Salt River Project, the Associate Solicitor, and myself. We learned that the Indians would like to have a certain piece of land, known as Antelope Point, that was withdrawn by the Secretary for reservoir purposes, transferred to Indian ownership. Under the law (41 Stat. 34) this transfer cannot be made without action by the Congress. The legislation to authorize such a transfer has been drafted and transmitted to the Interior Department in Washington. It is my understanding that the Bureau of Reclamation and other Interior Department agencies have no objections to the transfer of Antelope Point to the Indians. It was suggested that it might be much less difficult to get this piece of legislation through the Congress if the Indians would revise their resolution concerning the 50,000 acre-feet of Upper Basin water. Presently, there is some evidence that the Indians may agree to modify their resolution in exchange for support for their land-transfer legislation.

Since the meetings at Window Rock, and in anticipation of the Indians not agreeing to the desired amendment of their resolution, the Salt River Project, after informal consultation with the Bureau of Reclamation and other department representatives, has offered another plan to provide a future water supply in excess of the 50,000 acre-feet apportioned to Arizona (with a limit of 3,000 acre-feet per year) for the City of Page, recreational areas and other non-Indian lands lying within the Upper Basin in Arizona. The elements of this plan are described in a letter of December 27, 1968 from Mr. V. I. Corbell, President of the Salt River Project, to Governor Jack Williams of Arizona.

They are as follows:

1. Salt River Project would make available from the water for which it proposes to contract under the Central Arizona Project in the Lower Basin up to 3,000 acre-feet, when and if uses within the Upper Basin part of Arizona exceed 50,000 acre-feet. This 3,000 acre-feet of water would be for the City of Page and other non-Indian purposes in Arizona in the Upper Basin.

2. The 3,000 acre-feet would be Lower Basin water that would be diverted from Lake Powell in the Upper Basin.

3. In order to implement this plan some arrangement involving agreement of all seven basin States is required.

On December 30, 1968 a letter dated December 27, 1968 was received from Governor Williams in which he endorsed the Salt River Project's proposal and stated that he is willing to use the full powers of his office to implement the Salt River project proposal by legislation, changes in existing compact, or agreement among all of the interested States, or whatever may be necessary. The Governor also asked for an indication to him and to the Secretary of the Interior whether our Commission is willing to proceed in any way which is agreed to be appropriate to effectuate the Salt River Project's proposal.

Governor Williams also stressed the urgency of the matter. This urgency was based upon the assumption that the water commitment contract between the federal government and the Salt River Project should be signed by the former Secretary of the Interior before he relinquished the reins of his office on January 20, 1969. Representatives of Arizona said that they were fearful that time required by a new Secretary and his top staff to become acquainted with the complex problems would not result in an executed contract soon enough to provide the necessary lead time for design and construction.

Early in January we tried to schedule a special meeting for January 10th, but failed because unanimous agreement of all members of the Commission to convene such a meeting could not be obtained.

Subsequent conversations with representatives of the Salt River Project and the Interior Department revealed that both of those contracting parties felt strongly that there should be an expression from our Commission in response to the Arizona Governor's letter prior to execution of the contract. Therefore, attempts were made to schedule another special Commission meeting. It was learned that the only day on which a meeting could be scheduled was January 20th, the last day in which the former Secretary would be in office. After ascertaining from representatives of the Department and of Arizona that arrangements could and would be made to receive a telephonic communication from our Commission on the subject as late as January 20th we proceeded with scheduling a special meeting in Denver on that date.

Among the various facets of the over-all problem that should be examined by our Commissioners in their consideration of the Arizona Governor's request are the following:

1. We learned on January 17, 1969 that the Secretary of the Interior that morning had executed the contract with the Salt River Project committing the consumptive use of 34,100 acre-feet of Arizona's Upper Basin water for a thermal-electric generating plant near Page, Arizona. It is presumed that he proceeded with the contract signing, because he did not want to wait until after 12:00 o'clock noon, January 20th to hear from our Commission, which was planning to meet on that date, concerning any action it might desire to take. He may also have believed that a 50,000 acre-feet limitation on the total Arizona water uses in the Upper Basin could be satisfactorily effectuated.

2. The Secretary in a letter of January 17, 1969 told Chairman Aspinall ". . . that the problem of protecting the upper basin States against the possibility that Arizona's upper basin uses might exceed 50,000 acre-feet per annum has, as a practical matter, been resolved." It has not.

3. Prior to January 17th it was understood that an expression from our Commission of its willingness to recommend to the Upper Division States that they proceed by some appropriate means to validate the water transfer would be regarded as clearing the way for the Secretary to execute such a contract. I do not mean to infer that a negative response by the Commission would have caused the Secretary to refrain from signing the

contract. It may have -- or it may not have. As soon as it was learned that the Secretary had signed the contract with the Salt River Project the special Commission meeting of January 20, 1969 was cancelled.

4. The Upper Colorado River Commission cannot commit its four member States individually or collectively to a future course of action because it cannot commit its four legislatures or Governors to a course of action.

5. About all our Commission can do in a matter of this kind would be to recommend a course of action to its member States. Therefore, when viewing the situation in the light of what we can do, the Arizona Governor is asking if our Commission is willing to recommend to our four States the transfer of up to 3,000 acre-feet of Lower Basin water for diversion and use in the Upper Basin portion of Arizona to be made valid in the future "by legislation, changes in existing compacts, or agreement among all of the interested states, or whatever may be necessary in this regard."

6. Agreement by all seven States of the basin is necessary in order to make such a water transfer valid by the process outlined in the Arizona governor's letter. So far as I know, California and Nevada have not expressed willingness that they would proceed.

7. Amendment of the compact, enactment of legislation, or some other procedure which is agreed to be appropriate might take months or years.

8. Should the Indians as part of the price for the transfer of Antelope Point to the Tribe amend their resolution of December 11, 1968 to state that they will not make demands upon the 50,000 acre-feet of water per year allocated to the State of Arizona, pursuant to the Upper Colorado River Basin Compact, that will cause the total consumptive use of water in Arizona in the Upper Basin to be in excess of 50,000 acre-feet of water per year, the need for a seven-State agreement, such as the one suggested by the Arizona Governor would be eliminated.

9. When we transmitted the memorandum-report on consumptive uses of Upper Basin water in Arizona, as revised and approved by the Engineering Committee and our Commissioners, to the Secretary of the Interior on December 2, 1968 it was recommended that:

"(a) if all or a substantial portion of the unused balance of Arizona's compact-apportioned, Upper Basin water is to be

consumed by a powerplant or powerplants, contracts for the use of such water to be predicated upon a relinquishment by the Indian Tribes of any rights to use of Arizona's Upper Basin water that might be claimed under the Winters doctrine, and

"(b) contracts for the use of Arizona's Upper Basin water specify that water will not be delivered under the contract if such delivery would cause the sum of all consumptive uses of water under contract plus consumptive uses for any and all other purposes in the Upper Basin in Arizona to exceed 50,000 acre-feet per annum."

GOVERNOR LOVE: May I interrupt you just a moment?

MR. GOSLIN: Yes, sir.

GOVERNOR LOVE: I am going to have to leave you, but I want to say two things very briefly. As you know, Governor Johnson, who has served on this Commission so long and so well, has submitted his resignation. For the purposes of this meeting, I am going to ask, as I believe your minutes indicate, that Larry Sparks serve as Acting Commissioner. A permanent appointment will be made later.

But I also on the subject that you are discussing wanted to say that it seems to me that I agree with the thrust of the report that we cannot allow this matter to stand in its present situation. I mentioned the matter to Secretary Hickel yesterday. He was not familiar with it but certainly is willing to re-examine. I don't know whether a re-examination at that level can produce anything or some of these other suggested forms are necessary. But it is a matter of concern, and I will be interested in any action the Commission seeks to take on it.

MR. GOSLIN: Thank you, Governor Love.

CHAIRMAN DUGAN: Thank you, very much, Governor.

MR. GOSLIN: By the way, I am sure that every single one of us is going to miss Governor Johnson on this Commission. I know I certainly shall. He has been a regular fellow with me over many, many years.

GOVERNOR LOVE: He has made a tremendous contribution, and I would perhaps be out of line, but I would suggest that perhaps the Commission might so indicate in its proceedings and send a copy to him.

MR. GOSLIN: We will take care of that.

CHAIRMAN DUGAN: Thank you, Governor.

(Off the record discussion.)

MR. GOSLIN: We were informed that placing a limitation in the contract on water deliveries to the powerplant would preclude construction of the plant because water deliveries to such an installation must be dependable and constant-in-quantity. Therefore, the only other reliable limitation is dependent upon the agreement of the Indians to relinquish their Winters doctrine rights as they did in the case of the San Juan-Chama and Navajo Indian Irrigation projects legislation. If such a relinquishment is not forthcoming there will always be a dark cloud on water rights of the Upper Division States because the Indians are serious about their paramount claims under the Winters doctrine -- claiming that they are not subject to the terms of the compacts. If the Indians could successfully claim additional water under the Winters doctrine the total compact grant of 50,000 acre-feet o Arizona might be expanded to 60,000 -- 80,000, or 100,000 acre-feet -- depending upon how many water-consuming industries, irrigation enterprises, recreational facilities, thermal-generating plants, and so forth are constructed in the future on the reservation. If the Indians do not wish to limit their uses of water so that the total water consumption in Arizona in the Upper Basin will stay within the compact grant of 50,000 acre-feet, a powerplant of the size contemplated near Page should not be allowed to be constructed. The problem is that simple if the Upper Division States wish to protect their future compact rights under a document to which Arizona, as well as our member states, is a party.

10. The Secretary in his letter of January 15, 1969 to the Chairman of the Navajo Tribal Council said that:

> "Subject to the usual Executive Branch clearance processes and to the views of my successor, it would seem appropriate that there be accepted as compensation, an assurance from the Tribe that, for so long as the proposed Navajo thermal-electric power plant is operated, the Tribe will not assert claims to water which would result in its present and future water uses in that part of Arizona in the upper basin, together with approximately 34,100 acre-feet of water needed for the Navajo thermal-electric power plant and approximately 3,000 acre-feet of water for community and recreational requirements associated with the Glen Canyon Unit, exceeding the 50,000 acre-feet of Colorado River water apportioned for use in Arizona under the Upper Basin Colorado River Compact."

The 3,000 acre-feet limitation that the Secretary placed upon non-Indian water uses, and that he infers should be included in the Indian's resolution, may not be sufficient to keep the total water consumption in Arizona under 50,000 acre-feet per year, if the thermal generating plant is constructed under the terms of the Secretary's contract.

11. In the event the Indians do not amend their resolution a commitment from Arizona, such as that suggested by the Governor, that Arizona is willing to implement in the future if the other six States are willing, for 3,000 acre-feet of Lower Basin water to be added to the Upper Basin supply would be better than nothing -- but, again, this quantity may not be sufficient to keep the total water consumption under 50,000 acre-feet per year, if the plant is constructed under the terms of the Secretary's contract. In the light of the Indians' December 11, 1968 resolution wherein they agree to limit their uses to 50,000 acre-feet per year, including 34,100 acre-feet for the steam plant, they have only relinquished Winters doctrine rights above 50,000 acre-feet, and the Lower to Upper Basin transfer proposed by Salt River, if it can be effectuated, would become a partial cushion, limited to 3,000 acre-feet, against expansion of water uses in Arizona in the Upper Basin.

12. If the Commission should decide to explore ways of effectuating the proposal of the Salt River Project to transfer the use of 3,000 acre-feet of Lower Basin water to non-Indian purposes in the Upper Basin part of Arizona, such a transfer should be subject to the proviso that such Upper Basin diversions shall be charged as part of the Upper Division States' delivery of water to the Lower Basin at Lee Ferry; and, provided, that the Upper Basin Fund is fully compensated for energy losses and capacity impairment at the Glen Canyon powerplant that are attributable to diversions of Lower Basin water in the Upper Basin.

13. After talking to several of our Commissioners and others, it is believed that amending the compact or compacts should not be attempted at this time, and that this process should be excluded from the list of ways to be explored to effectuate the water transfer. If proper recognition is given to equities, the making of such a transfer, in reality, becomes a mechanical process. It may be possible to write the necessary elements of an operable transfer into the criteria for the coordinated long-range operation of the Colorado River reservoirs required to be formulated under section 602 of the recently enacted Colorado River Basin Project Act -- or there may be other ways suggested.

From paragraphs 10 and 11 above, it appears that there may not be enough water within the 50,000 acre-feet apportioned to Arizona for three 800 MW (nameplate) generating units near Page, the expansion of

present uses of water, and new uses of water by agriculture, industry, municipalities, recreation areas, etc. -- even with 3,000 acre-feet reserved by resolution of the Indians for non-Indian uses or supplied by Arizona on a transfer basis from the Lower Basin. First, let's examine the process by which this 3,000 acre-feet figure was derived. Secretary Udall in paragraph five of his letter of January 17, 1969 to Congressman Aspinall said:

> "Currently those uses total about 750 acre-feet per annum. That amount is included in the quantification of the maximum historical single-year use of water on the western Navajo reservation, which is estimated by the Bureau of Reclamation, the Bureau of Indian Affairs, and representatives of the Upper Colorado River Commission to be just over 13,000 acre-feet."

This quoted paragraph is not true. So far as I know, no member of the Commission, its Engineering Committee, or its staff participated in the mathematical gymnastics behind the 13,000 acre-feet figure. This figure was developed by the Department of the Interior. It is the result of scaling down the data of the study made jointly by the Bureau of Reclamation and the Commission staffs and approved by the Engineering Committee of this Commission. The scaling down may have been done for the purpose of obtaining a paper consumptive-use figure that would show the total uses under 50,000 acre-feet per year when considered together with the amounts of consumptive use in the Secretary's contract. The Indians have not agreed that they would be willing to accept such scaled-down irrigation activities. In fact, there are several proposals for adding new irrigation projects on the reservation.

It might be inferred that the Indians did agree to that when they adopted their resolution, but in view of the fact that there are new irrigation projects being proposed on the reservation and because I have talked to several of the Tribal leaders since, and because they did not specifically mention an agreement to this scaling-down in their resolution, it is my opinion that the Indians have not agreed that they would be willing to accept such scale-down irrigation activities.

Columns (1) and (2) of the table on the next page show a comparison of the scaled-down data with that in the joint memo-report of the Bureau of Reclamation and the Commission.

The principal differences between the joint study and the Bureau's scaled-down study are: (a) in the scaled-down study the acres irrigated

	Joint Memorandum Bureau of Reclamation and Commission	Bureau of Reclamation scaled-down study	Max. Year (1965) Bureau study with no shortage of supply
Acreage with Irrigation History (acres)			
Indian lands	7,459	---	---
Non-Indian lands	40	---	---
Total	7,499		
Maximum Acres irrigated in any one year (1965)			
Indian Lands	---	6,291	6,291
Non-Indian Lands	---	40	40
Total		6,331	6,331
Annual Consumptive Use Rates (af/acre)			
Indian Lands	1.36	0.89	1.36
Non-Indian Lands	1.50	1.00	1.50
Total	(1.36)	(0.89)	(1.36)
Present Annual Consumptive Use (acre-feet)			
Irrigation	10,171	5,636	8,610
Incidental use (10%)	1,017	564	861
Reservoir Evaporation	5,370	5,370	5,370
Indian Communities	814	814	814
Rural Indians	0	0	0
Page	741	741	741
Wahweap	10	10	10
Sub-total	18,123	13,135	16,406
Future Increase in Annual Consumptive Use (acre-feet)			
Irrigation	---	0	0
Reservoir Evaporation	---	0	0
Indian Communities	---	1,400	1,400
Rural Indians	---	0	0
Page	---	2,000	2,000
Wahweap	---	0	0
Tourism	---	250	250
Page Powerplant	---	34,100	34,100
Sub-total		37,750	37,750
Balance Remaining	31,877	---	---
TOTAL ANNUAL Consumptive Use (Acre-feet)	50,000	50,885	54,156

in the maximum year (1965) were used in place of the total acreage with an irrigated history which was an accumulation of maximum annual use figures for a number of individual projects; and (2) the Bureau, on the maximum year (1965) acreage applied a consumptive-use factor which was only 65% of that used in the joint study. In the process the Bureau discarded 1,168 acres or 16% of the 7,499 acres having an irrigation history, and to the 1965 acreage applied a consumptive-use factor of 0.89 instead of 1.36. The Bureau's annual use figure (13,135 acre-feet) then became almost 5,000 acre-feet less than the 18,123 acre-feet of the joint study.

It is interesting to note from col. 2 that the Bureau -- even after the scaling-down process -- shows an overdraft of 885 acre-feet beyond the Arizona apportionment. Since the Secretary has now signed a contract for 34,100 acre-feet consumptive use of water per year for the powerplant, and assuming that the other items in the Bureau's tabulation remain the same, except irrigation, the 1965 irrigated lands (6,331 acres) could actually receive only a 56% water supply without causing an overdraft of Arizona's apportionment.

$$\frac{(5636 + 564 - 885) \times 0.9}{6331 \times 136} = 56\%$$

In that formula, gentlemen, in the typing process we lost a figure. There should be inside the parenthesis a minus 885. That should be 5636, which is the irrigated acreage consumptive use assumed by the Bureau for 1965. The 564 is the incidental uses, ten percent of the first figure, and the 885 is the overdraft. And the 885 got lost somewhere in typing, I presume.

In other words, the Indians would have to abandon 16% of their lands having an irrigated history and receive only a 56% water supply on the remainder every year limited to no more lands than were irrigated in 1965 -- or cut their irrigated acreage substantially below the 1965 figure in order to have a larger percentage water supply per acre. Again, in my opinion, the Navajo Tribe has not agreed to do this.

Column 3 of the tabulation shows the situation if only the lands farmed in 1965 were supplied with a full water supply. (These are the lands for which the Bureau assumed a 65% or 56% supply.) In this instance the consumptive-use would be 16,406 acre-feet, compared with 13,135 acre-feet used by the Bureau, a difference of almost 3300 acre-feet. Under the assumption of a full water supply for the 1965 farmed lands and keeping the other Bureau figures constant the Arizona compact-apportionment would be exceeded by about 4,200 acre-feet. If you go back

to the tables for just a moment and study that at your leisure, the 3,000 acre-feet figure that we have been talking about, that would be transferred either by Arizona from the Lower Basin to the Upper Basin, or it would be put in the Indians' resolution, would be found, if you look in Column (2) in the lower part of the column where it says, "Indian Communities -- 1,400 acre-feet; Page -- 2,000 acre-feet; Tourism -- 250 acre-feet, et cetera."

I assume that what the Bureau did there was assign 2,000 acre-feet to the City of Page, 250 acre-feet for the recreational areas under the heading "Tourism," and the other 750 acre-feet is now being used by the City of Page, which totals 3,000 acre-feet.

Note that the discussion to this point is based upon the assumption that 34,100 acre-feet of water is adequate for "three nominally 800 mega-watt rated generating units."

The question of whether the consumptive use of 34,100 acre-feet of water is sufficient for three 800 MW units requires close scrutiny. On the subject of water availability the contract includes the following three important paragraphs:

> "7. (a) The Contractor's right to water service from Lake Powell during the term of this contract shall be in accordance with the following schedule:
>
> | Year | Acre-Feet |
> |---|---|
> | 1974 | 15,000 |
> | 1975 | 30,000 |
> | 1976 | 40,000 |
>
> and for each successive year thereafter during the term of this contract, provided that the difference between the amounts of water diverted under this contract and the amounts of water returned, both measured in a manner approved by the Contracting Officer, shall not exceed 34,100 acre-feet in any calendar year. If the Secretary determines there is additional water for consumptive use which the United States may make available to Contractor under this contract, the parties agree to amend this contract by increasing the 34,100 acre-feet set forth in this subarticle (a) and Article 9 by the amount of such additional water."

* * *

"9. The Contractor anticipates constructing three units of 750 MW or 800 MW nominal capacity each with cooling towers for each unit. The Contractor may elect to construct one of these units to be cooled by a 'flow through' method whereby the cooling water diverted is returned to Lake Powell after use provided that the total depletions under this contract will not exceed 34,100 acre-feet. In the event of such election, Contractor shall be permitted to divert a maximum of 30,000 acre-feet per annum to serve the two units having cooling towers with payment therefor as provided in Article 8. Contractor may also divert additional quantities of water as may be necessary to operate the 'flow through' unit, provided the cooling water for said 'flow through' unit is returned to Lake Powell. Contractor shall pay $105,000 annually in quarterly payments as provided in Article 8(a), as payment for the water diverted to the 'flow through' unit. Designs and plans for the diversion and return of water utilized in the 'flow through' unit shall be subject to approval of the Secretary as provided in Article 15 (a)."

* * *

"15. (b) The Contractor shall have the right to return water from the Navajo Power Project to Lake Powell at locations and under measurement procedures approved by the Secretary so long as the temperature of such water shall not average more than 90° Fahrenheit, for any 24-hour period."

It has been ascertained from reliable sources that the proposed Page (Navajo) powerplant now under consideration is one that would consist of three nominal 800 MW units with a maximum load capability of 853 MW. I think the exact figure is 852.9. A number of people to whom I have talked have questioned whether 34,100 acre-feet of water per year are sufficient for 2559 MW. This amounts to 14.21 acre-feet per year per MW on basis of nominal rating; or 13.33 acre-feet per year per MW on basis of maximum load. According to the Federal Power Commission and to several power plant authorities a rule-of-thumb allowance of 20 acre-feet per MW is usually made for design purposes. Answers to inquiries have revealed that in actual practice several thermal generating plants consume less than 20 acre-feet per MW. Around 18 acre-feet per MW, or perhaps as low as 16 acre-feet per MW, are considered by some authorities as reasonable figures for modern, efficient powerplants with cooling towers. I have found no authorities who could state that experience has been had with any powerplants that consume in the range of 13-14 acre-feet per MW per year. In fact, all seem to agree that

these figures appear to be too low. Three important factors that determine the amount of water consumed are the design of the cooling tower, the meteorology of the area, and the quality of the water.

Under the terms of the Secretary's contract one of the generating units at Page can be of the flow-through design with the heated water returned to Lake Powell. It is generally conceded that the flow-through cooling system consumes less water than a cooling tower for the same size generating unit. How much less seems to be a point of difference among authorities. One authority claims that the flow-through system will consume the same amount of water as a cooling tower if all uses and losses are counted; especially if full account is taken of the induced evaporation from the lake caused by dumping the heated water into it. Some authorities said that a flow-through system consumes 50% of the water used by a cooling tower; another said 58%; and others said less than a cooling tower, but could not say how much less.

There has been considerable rumor, even in newspaper accounts, that sponsors of the Page powerplant take the position that none of the evaporation from Lake Powell should be charged against the Arizona apportionment. Evaporation from the lake, induced by adding heated water to it, certainly should be chargeable because such loss reduces the overall supply. Also, there may be some merit in insisting that a proportionate part of the natural evaporation should also be charged to the powerplant because the compact negotiators originally intended that the Arizona upper basin water would be used for irrigation near tributaries, in which case the evaporation would be part of the evapotranspiration from cropped lands and small reservoirs, instead of from Lake Powell, a reservoir built primarily for Upper Basin purposes.

Because of the large amount of confusion concerning the consumptive use of water by the proposed Page powerplant and the real danger of Arizona exceeding her compact apportionment it may be prudent to have a completely independent investigation made by a competent organization under the exclusive auspices of the Upper Colorado River Commission. Furthermore, the Commission may also wish to recommend a reevaluation of the contract by the new Secretary of the Interior and the House Committee on Interior and Insular Affairs. The chairman of this Committee left the door open for such a request in his letter of October 28, 1968 to the former Secretary.

In the absence of an agreement by the Indians that they will not make demands upon the 50,000 acre-feet of water per year allocated to the State of Arizona pursuant to the Upper Colorado River Basin Compact,

that will cause the total consumptive use of water in that part of Arizona to be in excess of 50,000 acre-feet of water per year, the Upper Division States cannot allow a situation to be created under which the compact can be violated. Once the situation is created and the water is put to use, the chances of getting it back may be slim.

Newsletter on Legislation

At our last meeting the Commission was informed that Mr. Billhymer, our General Counsel, beginning with the 91st Congress, would periodically send a newsletter on pertinent proposed resource legislation. WATER NEWSLETTER No. 1 was mailed about February 1, 1969. We want this publication to be useful. If you have any criticisms or suggestions, please send them to us. Also, if you encounter any particular legislative Bill, law, regulation, etc. that you would like to have analyzed, please make a request to our office and we will do our best to be of service. We are continuing to develop one of the best water document libraries in the country. It should be constructively used. Copies of the first Newsletter are available here today for those who want them.

Appropriations of Funds for Reclamation Projects

At its last meeting the Commission adopted a resolution urging the support and maintenance of a reclamation project construction program of at least $500 million per year until the backlog of unfunded authorized projects is reduced by construction activities to a more reasonable level. This resolution has been transmitted to the 91st Congress, to Governors and legislatures of the reclamation States and to others as directed. Many letters in response have been received.

President Johnson's budget request for fiscal year 1970 was sent to the Congress on January 15, 1969. We have prepared a summary of the amounts requested by President Johnson for the Colorado River Storage Project and participating projects and other reclamation projects in our four States. Copies of this summary have been distributed to our Commissioners, their advisers, and to other interested parties. Copies are also available today for those who may desire them.

We have written to the Committee on Appropriations and requested opportunity for witnesses to testify concerning the budget items. If the Commission desires we will also attempt to coordinate and correlate the testimony and presentations before the subcommittees in order to show an effective, unified position of the States, as we have done in the past. Representatives of our States probably have examined the budget as it affects each State and are able to determine the nature of the testimony they wish to present.

Annual Report

The 20th Annual Report of the Commission is at the printer's. It will be distributed as soon as it is ready.

Bureau of Reclamation Activities

Regional Director Crandall will report on progress of the Bureau of Reclamation on the construction, advance planning, investigations, and other activities related to the Colorado River Storage Project and participating projects.

Mr. Chairman, before I conclude, I might also say that several of the documents to which I have referred in my report are here in multiple copies; for instance, we have our letter of transmittal to the Secretary, that we transmitted our Water Use Study. We have a copy of Udall -- Secretary Udall's letter to Mr. Nakai, who is Chairman of the Navajo Tribal Council. We have copies of the Secretary's letter to Congressman Aspinall, and we also have copies of Mr. Aspinall's letter of last autumn to the Secretary, in which he laid out the various problems; copies of the Salt River Project Proposal that were transmitted to us by the Governor of Arizona, and also copies of the Secretary's news release at the time he signed the contract with Salt River.

CHAIRMAN DUGAN: Thank you, Mr. Goslin. I am sure that the Commissioners will wish to discuss in some depth the report of the Executive Director. We will call on Colorado. Mr. Sparks?

MR. SPARKS: Mr. Chairman, we have followed this matter quite closely concerning the contract recently executed by the Secretary of the Interior. We were considerably disturbed that the contract was executed without any guidance from this Commission, although we well understood that there was some urgency in getting the contract executed.

I think as far as Colorado is concerned, we are anxious to see the Page plant constructed, if at all possible. We think that continued efforts must be made to persuade the Navajo Tribe to execute the resolution, which was at one time agreed upon, in which they agreed to limit their uses to 50,000 feet, including the uses at Page and at the proposed thermal-plant.

It seems to me that this is the best way to proceed at this time, is to follow efforts to get the Navajo Tribe to execute such a resolution. This was a problem in the State of New Mexico, as the people here from New Mexico well know, in connection with the Navajo Project. New Mexico was successful in getting an agreement with the Indians that permitted development of the Navajo Project along lines that were mutually satisfactory to the people in New Mexico.

As far as amending any compact at this time, we are in agreement that this would be rather futile to attempt to amend the compact, and I personally do not consider that any amendment is necessary if a satisfactory agreement can be worked out with the Navajo Tribe, despite the fact that technically we might be violating some provisions of either the Upper Basin or the Colorado River Compact. I don't think we want to quibble about technicalities at this point. We all worked long and hard in putting that Senate Bill 1004 together and getting it enacted last year. And Colorado is not in a position to try to create any unreasonable roadblocks.

I think it will be perhaps necessary for the Legal Committee of this Commission to formulate some legal policy that we could recommend to the Commission in the near future. We think that the staff of of the Commission has done an outstanding job of preparing the material and the surveys necessary for the Commission to adopt a position in connection with this problem.

I have nothing further.

CHAIRMAN DUGAN: Thank you, Mr. Sparks. Mr. Bliss?

COM. BLISS: Mr. Chairman, I think Larry Sparks has outlined the situation in pretty fair shape. I think, basically, the problem of the Upper Basin states is to see that the compact is not violated and that the total uses in Arizona do not exceed the 50,000 acre-feet permitted by the compact. How this may be done and what action should be taken at the present time, I am not prepared to say. There are several possible courses that could be taken, and I would like to explore them with our people and with the Commission.

CHAIRMAN DUGAN: Utah?

COM. WADDINGHAM: Mr. Chairman, I have nothing constructive to add to what has been said by the two commissioners preceding me except to say that after a full discussion in Utah, that we are, of course, agreed that we should take whatever action is necessary to see that the contract limitations are complied with, and we, of course, would agree that if the Indians can be talked into the proposition of passing the proper resolution, that this would solve all of the problems, but if not, we would want to pursue whatever other options we would have available.

CHAIRMAN DUGAN: Wyoming?

COM. PERSON: Well, I will say that Wyoming is disturbed that the Secretary has entered into a contract which clearly is going to violate the compact, and now that the contract has been entered into, it's going to be a little hard maybe to get a resolution from the Indians. We could have gotten the resolution before the contract was entered into, or possibly, and we think we should be doing something about it, not sitting by agreeing to a violation of the compact.

MR. MANN: Mr. Chairman, may I ask Mr. Sparks a question? My name is Mann.

CHAIRMAN DUGAN: Yes, sir.

MR. MANN: Larry, assuming that such a resolution would be adopted by the Navajos, wouldn't it, as a protective measure, be required that the contract be amended to clarify the resolution and incorporate enough of it to protect everybody?

MR. SPARKS: Yes, very definitely, the contract would have to be predicated upon the agreement reached by the Indians because the whole crux of this problem, as everyone is well aware, is that Winters doctrine.

MR. MANN: That was my conclusion. I just wanted to get your opinion on it.

MR. GOSLIN: That then would require a complete reevaluation of the contract by the new Secretary, as suggested by Governor Love.

MR. SPARKS: That is right.

CHAIRMAN DUGAN: Does the Commission wish to consider some course of action at this time to bear upon the situation we are confronted with in regard to use of the water by Arizona?

MR. GOSLIN: I think the Commission should.

MR. DUGAN: Mr. Sparks has suggested that a review by the Legal Committee should be undertaken, and that efforts should be made to obtain from the Tribal Council a satisfactory resolution regarding the restriction of use. Are there suggestions as to how to proceed?

COM. WADDINGHAM: Mr. Chairman, could I ask Director Goslin a question? Ival, would you explain for my benefit, if no one else's, what would be involved in your statement in your report that the Commission may wish to recommend a reevaluation of the contract by the new Secretary and the House Committee?

MR. GOSLIN: I think a communication with the new Secretary, making such a request, would be about all that is required. Also, a request to the Chairman of the House Committee, I think would be very much in order. I think that he certainly is waiting at this moment to see what the position of the Commission might be with respect to this problem.

COM. WADDINGHAM: I suppose we maybe ought to authorize the writing of such a letter, shouldn't we, Mr. Person?

COM. PERSON: Yes.

COM. WADDINGHAM: Do you want to wait until after lunch?

COM. BLISS: Mr. Chairman, it seems to me that we might make some progress here if we go ahead with whatever additional business we have here on the agenda and give each state a chance to discuss this at the noon recess and come back, and we might be in a better position to state what we want to do.

CHAIRMAN DUGAN: Mr. Bliss' suggestion is that this matter be tabled until after the noon recess and that we resume the remaining business of the Commission. Is this agreeable to the members of the Commission?

(All members of the Commission indicate affirmatively.)

Mr. Sparks?

MR. SPARKS: Yes.

CHAIRMAN DUGAN: Very well, then.

(Off the record discussion.)

CHAIRMAN DUGAN: Well, on the record, we will recess at a quarter to twelve and resume discussion of the Executive Director's Report and the situation as it applies to the use of water in Arizona, at 1:15. Do we have a Report of the Treasurer?

MR. GOSLIN: Mr. Chairman, we do have a report of the Treasurer. If Mr. Bliss would condescend to do so, I would like to ask him to give it so my voice won't give out.

COM. BLISS: If I can find it here, I will read it. This is the Report of the Treasurer for the period July 1, 1968 through January 31, 1969. I don't know how many of you have copies of it, but the balance on deposit at the bank as of July 1, 1968 is $19,048.58; less outstanding checks in the amount of $5,768.08; leaving an actual balance of $13,280.50. Cash received during the period from assessments to the states, $98,337.50. The certificate of time deposits and interest, $66,807.88. The total, $165,145.38; and a grand total of just over $178,000.00. Cash disbursements during the period; expenses of the prior year, $314.77; operating expenses, $60,849.79; and the purchase of certificates of time deposit, $97,000.00; for a total of $158,164.56; leaving a balance of $20,261.32; to which you add the checks outstanding as of January 31, 1969 of $2,225.80, justifying the bank statement of $22,487.12.

"The Operating Cash Statement and Financial Statement prepared in the office of the Executive Director of the Upper Colorado River Commission for the period ending January 31, 1969, have been distributed to the Commissioners, Treasurer, Assistant Treasurer, and the Finance Committee Chairman." Signed, "I. J. Coury, Treasurer."

Mr. Chairman, I move the acceptance of the Report of the Treasurer.

COM. PERSON: Second the motion.

CHAIRMAN DUGAN: Any discussion or questions?

(No response.)

COM. BLISS: Question.

CHAIRMAN DUGAN: All in favor of the motion say "Aye."

(Ayes.)

The Report of the Treasurer is adopted.

UPPER COLORADO RIVER COMMISSION

Salt Lake City, Utah
January 31, 1969

REPORT OF THE TREASURER

The following figures summarize the financial transactions of the Upper Colorado River Commission for the period July 1, 1968 through January 31, 1969.

Balance on Deposit per bank statement July 1, 1968		$ 19,048.58
Less outstanding checks at July 1, 1968		5,768.08
		$ 13,280.50
Cash received during period:		
Assessments	$98,337.50	
Certificate of Time Deposit and Interest	66,807.88	
		$165,145.38
		$178,425.88
Less cash disbursements during period:		
For expenses of prior year	$ 314.77	
For operating expenses	60,849.79	
Purchase of Time Certificates of Deposit	97,000.00	
		$158,164.56
		$ 20,261.32
Add outstanding checks, January 31, 1969		2,225.80
Balance per bank statement, January 31, 1969		$ 22,487.12

The Operating Cash Statement and the Financial Statement prepared in the office of the Executive Director of the Upper Colorado River Commission for the period ending January 31, 1969, have been distributed to the Commissioners, Treasurer, Assistant Treasurer, and the Finance Committee Chairman.

/s/ I. J. COURY
I. J. COURY
Treasurer

CHAIRMAN DUGAN: Is there a Report of the Engineering Committee?

MR. GOSLIN: Mr. Chairman, the Engineering Committee did meet on October 14, 1968 to discuss the Consumptive Use Study to which reference was made in my report. Since that time copies of the Engineering Committee's Report have been transmitted to practically all interested parties, including the Legal Committee, and action has been taken upon the result of the Report and our transmittal to the Secretary of the Interior; therefore, I think the answer would be that there would be no other special report at this time.

CHAIRMAN DUGAN: Is there a report of the Legal Committee?

MR. SPARKS: I have no report.

CHAIRMAN DUGAN: I will move to unfinished business.

COM. BLISS: Mr. Chairman, I suggest at this time that we recess for lunch.

CHAIRMAN DUGAN: If this is agreeable with the other members of the Commission, we will adjourn.

(Whereupon, the Special Meeting was recessed at 11:45 a.m. and reconvened at 1:15 p.m.)

AFTERNOON SESSION

CHAIRMAN DUGAN: Gentlemen, the Commission meeting will reconvene, and we will return to discussion of the Report of the Executive Director. Now, are there additional observations on the part of the Commission?

COM. PERSON: Are we ready to take some action on this, in that case?

CHAIRMAN DUGAN: Would you care to propose some, Mr. Person?

COM. PERSON: I move that the Commission request the new Secretary of the Interior to reevaluate this contract.

COM. WADDINGHAM: Would you include in your motion that the same request be made to the House Committee on Interior and Insular Affairs?

COM. PERSON: Yes, I will add that to the motion.

COM. WADDINGHAM: I will second that motion.

CHAIRMAN DUGAN: It's been moved and seconded that the Commission ask for review of the contract and to express its views to the Chairman of the Interior and Insular Affairs Committee. Is that the sense of your motion?

COM. PERSON: Yes.

CHAIRMAN DUGAN: Is there discussion of the motion?

COM. BLISS: Mr. Chairman, I was wondering just -- and we have discussed -- in what manner this thing should be presented to the powers that be. I might suggest that one of the very interested parties would be the power people, particularly the Salt River people because they are the contractee in this thing, and further, of course, the Governor of Arizona has asked for some sort of a commitment. I think we should make our opinion known to him as some sort of reply to the request he made and which was not -- well, not ignored by our Commission, but which we are unable to reply to because of the events that occurred the latter part of January. I am wondering if it would not be just as effective if we directed the secretary to make this request, both to the Secretary of the Interior and to the Committee, Interior and Insular Affairs Committee in both the Senate and the House, and also request that each of the states contact their own Congressional representatives to the end that they can apply what pressure and what evidence they need to present.

COM. PERSON: I am sure, as far as Wyoming is concerned, our Congressional delegation is going to be contacted.

MR. MANN: Mr. Chairman, may I ask Dean a question? Dean, as I understand your motion, it's to request a review of the contract?

COM. PERSON: Reevaluation.

MR. MANN: Reevaluation. I wonder if it would be well to say, "reevaluate and amend"? They can reevaluate, and if they don't do anything about it, it doesn't make a bit of difference.

COM. PERSON: I like that, "reevaluate and amend."

COM. WADDINGHAM: I will second that in that form.

CHAIRMAN DUGAN: Is there further discussion?

MR. SPARKS: I assume that when the secretary writes this letter, that we will point out in what respect we think an amendment should be made. Is that understood as part of the motion?

CHAIRMAN DUGAN: Yes.

COM. BLISS: I think it would be a very essential part of the motion. In discussing this contract, it seems to me that not only is the Upper Basin not fully protected, or at least potentially not fully protected, it seems to me that the power contractees are not fully protected, certainly not protected by the resolution adopted by the Navajo Tribe.

Now, that is not a direct concern, I suppose, of the Upper Colorado River Commission. Our basic and perhaps only concern is that uses in Arizona of Upper Basin water do not exceed the 50,000 acre-feet, but it seems to me this is an added reason why the Secretary should reevaluate the contract, reexamine it.

CHAIRMAN DUGAN: Any further discussions?

(No response.)

Well, gentlemen, it seems to me that Mr. Sparks' remarks were very pertinent in that the agreement with the Tribal Council is not totally clear and satisfactory, and that efforts should be made to amend this agreement.

Now, it would seem that this is a very desirable goal and that the Secretary's efforts should be solicited in this regard and that any communication that the Commission might choose to have with the Secretary, that this point be brought out. The understanding that is held in the Department, and I think Mr. Crandall might confirm this, is that the contract is limited to an amount of 50,000 acre-feet, including any and all uses, and I believe that this is to be construed as including evaporation losses.

MR. BLISS: Excuse me, Mr. Chairman. You don't mean any and all uses, including the uses of Page, do you?

CHAIRMAN DUGAN: Well, I think this is the purpose of revising the agreement with the Indians, to clarify this one issue.

COM. BLISS: I see what you're saying.

CHAIRMAN DUGAN: And I would like to ask Mr. Crandall to comment on the point I have just made in regard to the 50,000 acre feet.

MR. CRANDALL: Well, the contract itself says that it must be in accordance with the compacts and the other specific rules of the river and without presuming that they would be violated, the consumption of water in Arizona could not exceed 50,000 acre-feet. The concern, as Ival has so well expressed it in his statement, is that the contract, plus other understandings, would set up a situation where uses in combination would go over 50,000 acre-feet, and everyone on the river would have the practical problem then of trying to shrink back to that, and so the whole thrust is to avoid setting up circumstances where this might take place. But the contract itself says that it has to be in accord with the compact, which very clearly limits Arizona's use to 50,000 acre-feet.

MR. GOSLIN: Mr. Chairman, may I ask Mr. Crandall a question on a point I think you brought up, but he didn't answer? That is this: In the event there is a flow-through unit involved at this Page powerplant, is it the position of the Department of the Interior that the induced evaporation be counted as a part of the consumptive use?

MR. CRANDALL: That has been our position all the way along, and I should have made that clear, Ival. The consumption that results from the man made activity associated with this plant, even though it be an induced, greater amount of evaporation at Lake Powell, is a charge and would be counted in any calculation to see whether the 50,000 acre-feet was being exceeded. And I have confirmed this with our Washington office, and I know it to be so and our understandings all the way through in our negotiations.

MR. GOSLIN: That is what you wanted, wasn't it?

CHAIRMAN DUGAN: Yes. Thank you, Mr. Crandall.

Any further discussions on the motion?

COM. BLISS: Mr. Chairman, so I can clarify this in my own mind, I wonder if I may restate this motion as it has developed? May I ask the mover the question: Is it your desire or motion that the secretary be directed --

COM. PERSON: Asked.

COM. BLISS: Be asked. I mean the secretary of our Commission.

COM. PERSON: Oh, he is directed. (Laughter.)

COM. BLISS: To contact the Secretary of the Interior and the appropriate Chairmen of the Congressional Committees, setting forth the reasons why we feel that the contract at the present time is not adequate to protect either the Upper Basin States or, for that matter, the power contractees, and requesting that the contract be reviewed and amended.

COM. PERSON: Yes.

COM. BLISS: That is basically it?

COM. PERSON: Yes, basically, that is what we intended.

CHAIRMAN DUGAN: Any further discussion?

(No response.)

I think Mr. Bliss' remarks might clarify the nature of the communications that are proposed in the motion.

COM. BLISS: Do you want some clarification of those now?

CHAIRMAN DUGAN: No, I think you have clarified it.

COM. BLISS: I think they have been pretty obvious from the discussions this morning and from the Report of the Secretary, and if you will, from the Report of the Engineering Committee, which went forward to the Secretary in December.

CHAIRMAN DUGAN: Any further discussion?

(No response.)

COM. BLISS: Question.

CHAIRMAN DUGAN: Colorado?

MR. SPARKS: Aye.

CHAIRMAN DUGAN: New Mexico?

COM. BLISS: Aye.

CHAIRMAN DUGAN: Utah?

COM. WADDINGHAM: Aye.

CHAIRMAN DUGAN: Wyoming?

COM. PERSON: Aye.

CHAIRMAN DUGAN: The motion is carried.

Is there any further discussion of the Executive Director's report?

COM. PERSON: Ival, would you give me your reason you suggested may be we should get somebody to evaluate the water consumption in the coal-fueled plant? What was your thinking on this? Why?

MR. GOSLIN: Well, I tried to bring out in the report, Prof, the fact that there is a lot of confusion about how much water is actually consumed by a thermal-electric generating plant. There is confusion among the various authorities with regard to how much water a cooling tower uses. As I mentioned, a design figure of about 20 acre-feet per megawatt is usually assumed when you're beginning to design a project of this type. But, also, I ran into the situation where it's known that a lot of thermal-electric generating plants with cooling towers consume only about 18 or maybe as low as 16 acre-feet per megawatt. This particular one that is being talked about, the capacity of three 853 megawatt units, is based upon the assumption that it will only use about 13 and a third acre-feet per megawatt, and I could find no authority that would say that they had any experience with a powerplant of that magnitude using that little water, so that the question came to my mind immediately, "Well, maybe this should be investigated."

Now, I know this much about these powerplants, that the design of the cooling towers is a very important factor. You can design cooling towers that are much more highly efficient than other cooling towers, but at some point you have to draw the line because of the economics.

Another aspect of the situation that made me think the way I did was that there seems to be a lot of difference of opinion among authorities as to how much water is lost by induced evaporation from the surface of the lake, if one of these 800 megawatt units were to be a flow-through unit. So that all these things combined lead me to make the suggestion, I guess you wish to call it, that I had in the report.

COM. PERSON: Actually, what are we going to use this for? To try to convince the Secretary that this contract needs to be amended, is that the purpose?

MR. GOSLIN: Well, this might be a purpose. On the other hand, if the Indians would come through with the proper type of resolution, you wouldn't need this information because it would be immaterial whether they had a plant that used 13 acre-feet per megawatt or 20 feet per megawatt. We could still say to the Indians, "You have abrogated your Winters doctrine rights, and you have to cut back in order to make the total consumption of water come under the ceiling of 50,000 acre-feet." But if you are going to have hearings on this issue, and if you are going to be talking to other experts about it, then it was my feeling that we should be armed with the very best evidence that we could get, and the way to get it would be through having a first class investigation made by a qualified engineering firm or other organization that someone might wish to suggest. Certainly, our staff is not a staff that is qualified to make the investigation by ourselves. We are none of us power-plant designers. None of us are thermal dynamic experts, either.

COM. PERSON: Well, I think in all this fillibuster, Ival, you have finally told me what we are going to use it for, and I would be inclined to agree with you. (Laughter.)

CHAIRMAN DUGAN: Is there further discussion?

MR. BISHOP: Floyd Bishop from Wyoming. I would make one point and take a minor exception with one thing that Ival has just said. He said if the Indians are willing to limit their uses, then there would be no reason to object on the basis of the power use, but from his own figures, if 20 acre-feet per megawatt is a valid figure, you're going to exceed the 50,000 acre-feet without any Indian uses. So I think we should be concerned, and I think we should make a determination of what these power uses really are going to be.

CHAIRMAN DUGAN: Commissioner Bliss?

COM. BLISS: Mr. Chairman, I don't know what the timing is on this. From my own personal standpoint, I would hope that Ival would let me see a draft of his letter before it goes forward to the various interested parties.

(Off the record discussion.)

MR. GOSLIN: Certainly, I would want to clear it with some experts on this problem.

CHAIRMAN DUGAN: It would seem appropriate, Mr. Goslin, that all of the Commissioners be afforded this opportunity. I am sure they would all want to be.

MR. GOSLIN: That is right.

MR. HALE: Mr. Chairman, might I ask Mr. Crandall to comment on the uses by a powerplant of this size? What are your computations on consumptive use of an 800 megawatt plant? We have got one in the process in New Mexico, and this is why I raise the question.

MR. CRANDALL: Well, this is a matter that is being very thoroughly analyzed and studied. I don't have any real professional outside determination as related to these particular plants.

As everyone knows, there has been a Steering Committee working for some time on siting new thermal-electric generation in the Southwest, and from their study of this matter, they show water requirements for cooling and the associated uses in a plant of something with little safety factor in it of over 30,000 acre-feet. So they have satisfied themselves to the extent that their planning has progressed that this amount of 34,100, though it is a very close amount, austere amount, it is workable. The portion of the calculation that is less precise is the so-called "sensible heat" in the cooling tower. That is the amount of air it carries out of the cooling tower rather than the water vapor, and I think the companies are going to study some existing plants to get a better definition of that amount. But that is all I can tell you now. We put together a little study on our own. Which I think all the people interested in this have, and it is certainly something we would like to comment on, and it is not final, but there is good engineering judgment that this is an amount that can work.

CHAIRMAN DUGAN: Any further discussion from the Commission?

(No response.)

MR. CRANDALL: Excuse me. Then the second part of it, the amount of evaporation induced by putting warmer water into a reservoir like Lake Powell. There has been some research, but it hasn't been translated to a situation like this, and as Ival pointed out here, there needs to be some very comprehensive investigation into this part of the determination.

MR. HALE: Your 30,000 was with cooling towers?

MR. CRANDALL: Yes, that is cooling towers, and then if you have a flow-through unit in that plant, just how much of it is caused by induced evaporation from the reservoirs still needs a lot of study.

MR. GOSLIN: Is this 30,000 acre-feet you're talking about for an 800 megawatt nominal, or is this for an 853 megawatt plant such as they are talking about?

MR. CRANDALL: Ival, it is based on an 800 megawatt nominal unit. It can operate at a peak of 850 in round numbers, but then there is a certain amount of down time every year that offsets that. So the figures would be 800, 800 megawatts nominal.

MR. JACOBSON: Is that three units?

MR. GOSLIN: Is that three units?

MR. CRANDALL: Yes.

MR. GOSLIN: I have a document here that says it takes about 34,000 acre-feet.

MR. CRANDALL: Well, I said 30, plus an allowance for safety factor and outside use, so it's within the 34,100. I wasn't attempting to be real precise because it isn't real precise.

COM. BLISS: Mr. Chairman.

CHAIRMAN DUGAN: Yes, Mr. Bliss.

COM. BLISS: It seems to me that in addition to the action taken here directing our secretary to transmit certain letters, it seems to me that each of the states should, and I am sure they have it in mind, if they would contact their own representatives about this problem and give all the support -- get all the support from them that they can for getting this matter straightened out. I don't know that that requires any motion or needs a motion, but I think each Commissioner, each state, should take it upon themselves to take appropriate action.

CHAIRMAN DUGAN: All right, sir. Thank you.

MR. GOSLIN: Mr. Chairman, I assume that it is the general consensus that we continue to cooperate with the interested parties with respect to trying to obtain the proper type of resolution from the Indian Tribe. Am I correct in this assumption, or not?

COM. BLISS: Mr. Chairman, it seems to me that there is no objection to getting a better agreement with the Indians, but it seems to me that, basically, this is a matter between the State of Arizona and the Indian Tribe because the State of Arizona is the one that is under the obligation not to exceed their contract supply, and, of course, with the Secretary himself and his relation to the Indian Tribe in arriving at this contract.

CHAIRMAN DUGAN: I know that the Executive Director has been extremely active in attempting to see that an adequate agreement is reached with the Indians, and I am sure he would like to have the consensus of the Commission as to whether he should pursue these efforts.

MR. GOSLIN: As I understand you, Commissioner Bliss, it would be all right for us to cooperate but not take the lead in doing it.

COM. BLISS: I am sure this is right. In other words, the obligation is between the Secretary, the Indians, and the State of Arizona, basically. And any cooperating help that we can give them, I am sure they will appreciate.

CHAIRMAN DUGAN: I think that should clarify the matter, and it is agreed by all the Commissioners.

Now, is there any further discussion of the Director's Report?

(No response.)

COM. PERSON: Mr. Chairman, I am not quite through with this yet. I move we ask the Engineering Committee to investigate the possibility, and soon, of getting this analysis that the Secretary discusses in his report on the water consumption by a coal-fired powerplant of this size at this location. I would like to know how much this is going to cost.

COM. BLISS: Are you saying -- you're talking about hiring an outside firm of consultants?

COM. PERSON: Yes.

COM. BLISS: Well, I would think that it would be very proper that this be investigated and we find out how much it is going to cost.

COM. PERSON: Yes.

CHAIRMAN DUGAN: Does your position go to asking the Engineering Committee to explore this with a consulting firm?

COM. PERSON: Yes. How much would it cost?

CHAIRMAN DUGAN: I believe you made a motion, Mr. Person, to the effect that the Engineering Committee investigate the cost of having a consulting firm evaluate the water uses of steam-fired plants?

COM. PERSON: Yes, at this location.

CHAIRMAN DUGAN: All right.

COM. BLISS: I will second the motion, and then let me observe that this would take very little action on the part of the Engineering Committee. Perhaps they could take it upon themselves to make some study on their own.

COM. PERSON: Yes.

COM. BLISS: Otherwise, there would be little point in giving the problem to them.

CHAIRMAN DUGAN: Does the Chairman of the Engineering Committee have any comment on the motion?

MR. GOSLIN: I suspect I should say I am a little confused as to whether the Engineering Committee is to investigate the cost of hiring an outside consulting firm, or whether we are to make a study of water consumption at the powerplant ourselves.

COM. PERSON: Well, I think you ought to do both. (Laughter.)

MR. GOSLIN: All I can say is we are willing to try, but I am not sure we are qualified to make a study ourselves.

MR. BISHOP: Mr. Chairman, as a member of the Engineering Committee, maybe I can speak to that point. I don't think the Engineering Committee has the expertise that Ival is talking of for a study of this

kind. I personally feel we need to go to a consulting firm that has the expertise in this field that is necessary to make us an accurate and reliable study of the amount of water we are talking about.

MR. GOSLIN: Mr. Chairman, may I suggest this as a procedure: Why not ask the Engineering Committee first to investigate the cost of hiring such an outside consulting firm, and then meet and decide what recommendations it wishes to make to the Commission with regards to hiring it. As a matter of fact, if the Commission wished to so direct, the staff could investigate these costs of the consulting firm and then call a meeting of the Engineering Committee and discuss it with them. I don't believe this would take the whole Engineering Committee to talk with various firms.

CHAIRMAN DUGAN: I think there may be some merit in that procedure. I think it would be a valuable contribution of the Engineering Committee to define the scope of any study an engineering firm might make and would provide a consensus among the engineers themselves as to what was requested.

Is there further discussion on the motion?

COM. PERSON: You mean the Engineering Committee is going to recommend to the Commission whether or not we should do this? This is really what we want, how much it is going to cost and whether or not you should do it?

CHAIRMAN DUGAN: And what will be done.

COM. PERSON: And what will be done, that is right.

CHAIRMAN DUGAN: In essence, as I understand the motion, it charges the Engineering Committee with evaluating the scope of a study by a consulting firm, determining the cost, and reporting to the Commission on their findings, with recommendations. Does that seem to be the consensus?

COM. BLISS: I would second the amendment.

CHAIRMAN DUGAN: Is there a second to Mr. Person's motion?

COM. WADDINGHAM: I thought Mr. Bliss seconded it.

COM. BLISS: Yes, I did.

CHAIRMAN DUGAN: Question. Colorado?

MR. SPARKS: Aye.

CHAIRMAN DUGAN: New Mexico?

COM. BLISS: Aye.

CHAIRMAN DUGAN: Utah?

COM. WADDINGHAM: Aye.

CHAIRMAN DUGAN: Wyoming?

COM. PERSON: Aye.

CHAIRMAN DUGAN: The motion is passed. I hope it's clear to the Chairman of the Engineering Committee.

MR. GOSLIN: Mr. Chairman, as I interpret the motion, and please correct me if I am wrong. We would have a meeting of the Engineering Committee, as the first step, to define the scope of the study that we might wish to have made. The second step would be to find the cost of such a study under the auspices of some competent engineering firm. Third, the Engineering Committee then would recommend to the Commission whether it should or should not make such a study. Is this a correct understanding?

CHAIRMAN DUGAN: That is the Chairman's understanding. Any objection?

(No response.)

MR. GOSLIN: I just wanted to know what I had to do.

CHAIRMAN DUGAN: I guess you know. (Laughter.)

Is there further discussion of the Director's Report?

(No response.)

If not, we will move to unfinished business.

At this time, could we have a report from the Regional Director Crandall?

MR. CRANDALL: Mr. Chairman, Members of the Commission, and guests, I have in somewhat of a departure from my custom assembled the Report of Region 4 of the Bureau of Reclamation in outline form, condensing the key facts. I will speak to this outline, and if you will follow it, then the statistics which tend to make a dreary subject more dreary will be available under your eyes, and for later reference.

An item of good news in the Colorado Basin is the amount of water supply that is available, based on the February 1st forecast. For the first time since I have been with you, we are predicting an above-average run-off for the April-July period at Lee Ferry, and we hope that Mother Nature continues to confer her favors for the remainder of the snow accumulation season.

I'll begin with the situation in our storage project reservoirs, starting at Glen Canyon. Lake Powell is now at about elevation 3541. With the run-off predicted it will go above rated head for the first time and allow us to test the units in the powerplant, and we will be in that comfortable position of having the full rated capacity to operate with.

The key factor on the Lake Powell operation, of course, is the delivery to the Lower Basin. The amounts that have been delivered up to now, plus 35,000,000 acre-feet for the next four years, will bring us right to 75,000,000 acre-feet, which is the ten year compact requirement.

At Flaming Gorge Reservoir, we should get a rise there by the end of the spring. We have been moving water out of Flaming Gorge, but we will move it with full recognition of the multipurpose values there, the most significant of which is the amount required to preserve the very valuable fishery resource. More than a million people visit Flaming Gorge every year, and much of the attraction is due to the scenic and recreational opportunities, including fishing.

Navajo Reservoir - we will be above the recreation elevation formerly worked out with New Mexico and Colorado at elevation 6,030. Then the reservoir will recede to 6,030 and be held as constant as practical for the coming summer season. This is in turn based on the 630,000 acre-feet of water expected.

Blue Mesa Reservoir - We will have the spring recession and then will refill the reservoir back to the normal maximum level. We have been studying very extensively the relationship of this new Reservoir to ice jam flooding problems that have been epidemic along the

Gunnison River above there. Just a couple of weeks ago during the freezing weather, one of the ranches with some cabins had four feet of water through the buildings. Then it froze. It has been a very difficult situation. We are proceeding with a program of easements and acquisition, hopefully to minimize and control this problem in the future, working, of course, with the Corps of Engineers and the local interests.

Lake Mead has been accumulating storage because the deliveries of water to meet the Compact 10-year total have been exceeding releases there. The amounts are, as you see them in the summary.

Now, moving on to our construction program, the construction at Glen Canyon Unit is substantially finished. We have some rather minor modification programs that relate to the community at Page and to the unit itself. We had a ravelling from the surface of the concrete on the dam roadway area near the Visitors' Center exit. It is being repaired, because of the rather heavy foot traffic that takes place.

Curecanti - it is satisfying to announce to you that we have awarded the powerplant completion contract. This is the key contract that puts the Morrow Point powerplant in operation when it is finished. The items involved are listed for you. The generators, turbines, and major machinery items are fabricated and will be delivered as needed.

Bonneville Unit of the Central Utah Project - the work at the Starvation Dam Complex is proceeding somewhat ahead of schedule, as you will note. We had been concerned that the capibility to reroute traffic around the Starvation Reservoir would be available to us this spring before the peak run-off. The combination of capacity to release water at the dam and a very high flow from all the snow in the hills could cause the level of the reservoir to cover the present highway 40 bridge crossing over Strawberry River. So we have had an accelerated program to get the highway relocation in shape so it could be used as a rerouting or a detour, if necessary.

The Strawberry Reservoir and Collection Works is moving along well. We have a mole that is digging away under the mountain for the Water Hollow Tunnel, having gone along almost 2,500 feet since last November.

We have started -- or awarded a contract for the Fish and Wildlife Mitigation Reservoir at Bottle Hollow, which is near Fort Duchesne.

Emery County - a small project there, minor clean-up and repair work.

The same at Flaming Gorge.

Bostwick Park Project is somewhat ahead of schedule. We did have a slide above a spillway excavation that has required some special treatment and scheduling of our construction activities. It appears well controlled now, so we look forward to substantial progress on the remainder of the work this coming summer.

The Lyman Project - the work status is as you see it, no particular concern. The contractor had a little difficulty finding working weather all last year. It seems a combination of the late spring, an early fall, and a rainy summer didn't help.

Paonia Project - we have had a small problem there with rock falls on the main road around the reservoir, which is well on its way to being taken care of.

Seedskadee Project - the Fontenelle powerplant is now operating. I noticed in the Daily Report that the peak power production has been 11 megawatts, which is one megawatt above plant capacity. When we had the water bypass through the abutment of the Fontenelle Dam, the reservoir was dropped very abruptly after being at a high level. This caused some earth slides and settlement contributory to some instability in the relocated highway. With the agreement of the Wyoming Highway Department, we are going to observe a few cycles of filling and withdrawal, followed by a correction program.

We are continuing our program of drains and minor construction work on Hammond project.

Eden Project - the water supply improvement program is continuing with the items that are listed. We are meeting with the Eden Project people and their board, looking forward to first payments on construction now due under the terms of the contract. We are hopeful that some solution can be worked out to the rather difficult financial circumstances that relate to repayment of the Eden Project.

I have included in my report here, on pages 9 and 10, the construction status of the Fry-Ark Project, the Navajo Irrigation Project, and the San Juan-Chama Project. I am personally not well conversant with these construction programs, since they are under the administration of other regions. On the Fry-Ark Project we are working very closely with the people on both sides of the Continental Divide that have an interest in Ruedi, and with Region 7, to work out the water marketing, utilization

of the reservoir, the amount required for replacement, and the assignment of costs, and so on. So that work is being actively pursued now.

Next the general investigation program. The Ute Indian Unit was converted from a reconnaissance to a feasibility study by the Colorado River Basin Project Act. We look forward to putting out some kind of a status report before the end of the calendar year to serve the State of Utah in their consideration of the wilderness relationship to development in that area.

The Green River Project - we have mobilized a study team in Rock Springs and have been gathering basic information, conferring with state and local interests, and have scheduled the completion of what we view as a very significant reconnaissance report in FY-1971.

The Paria-San Rafael Investigation is being worked on in cooperation with the State of Utah to assess the development opportunities of this arid, southern portion of Utah and to aid the State in development of their state water plan.

I have a rough draft of the San Juan County reconnaissance report on my desk now, so it will not be too long before we have it available for the people in Utah that are interested in it.

Mr. Goslin is the Chairman of the Upper Colorado River Comprehensive Basin Study group and the work is therefore well understood by this Commission so I will not elaborate.

Feasibility Investigations - the work on the Basalt Project is coming along, leading to a report completion in '71.

Battlement Mesa, we have had a preliminary report out for review Obtaining all the comments and putting them into a final report is still work that is pending.

Bluestone Project is scheduled for completion in the near future, and, likewise, the Uintah Unit will be finished by the end of this fiscal year.

The other investigations are as you see them outlined in your summary. We are getting started on the Juniper with somewhat different delineations than presented in the earlier report of quite some time ago.

I might comment briefly on the Yellow Jacket Project. We are working closely with the State Fish, Game, and Parks Department, the

U.S. Fish and Wildlife Service, the local Conservancy District, and other people who are interested in the big game mitigation features of the Yellow Jacket Project. There has been concern about the conversion of private lands to big game mitigation, and I report to you very active, cooperative, and harmonious treatment of this particular problem, looking at various alternatives to see what we can put together.

Our cooperative quality of water study with the Federal Water Pollution Control Administration continues. The pilot program of well plugging did reduce the salt contribution to the Colorado River rather appreciably, considering the amount of investment. Of course, the general aim of this program is to minimize salt in the river to make way for additional depletions and water uses without aggravating the salinity problem.

COM. BLISS: May I interrupt? Is that the plugging of old oil wells?

MR. CRANDALL: Yes, old oil wells that have been abandoned. In one case, I think the land had reverted back to the state. The salt was flowing uncontrolled into the river.

The Advance Planning Program - we are winding up our report on the Jensen Unit. The Upalco Unit report is drafted and it is in the internal review process now.

Fruitland Mesa - our preconstruction activities have been proceeding, mostly in the area of settlement plans and repayment contract negotiations. Our repayment contract has been recently approved as to form.

Savery-Pot Hook Project - we are entering the final phases of the investigation. We have meetings scheduled there with representatives of both states and the local people and our cooperating agencies to consider the economic factors that relate largely to the agricultural features of Savery-Pot Hook. The development of agriculture in the high altitude areas present the very challenging problem of formulating a plan that meets the economic criteria.

Power Operations - I will not review all these statistics. You might find them interesting, but coming back to the conclusive part of it (which is the repayment), we have received revenues at a rate in the past fiscal year which allowed us to meet for the first time all our operating costs, all of the accumulated interest for that year, and have a surplus to apply to back interest. There is about $3,364,000 of back interest yet to be repaid.

The twelfth annual report, which is the report on the status of the storage projects and the financial and operating picture, has been finished and distributed. A few of the highlights from it are tabulated for you, along with the succeeding paragraphs on the amount of power generation and transmission capacity now installed.

So, gentlemen, that concludes the Reclamation Program summary. In addition we have continued our water service contracting activities. More recently, the El Paso Natural Gas and Consolidated Coal Company of Gallup, New Mexico, have renewed their interest in obtaining water from the San Juan system, as controlled by storage in the Navajo Reservoir. The amount that is being sought is 27,500 acre-feet, which with the other commitments, comes up pretty close to the 100,000 acre-feet that has been determined as available for this interim contracting out of the San Juan and Navajo.

We have been negotiating water service for a long period of time with Resources, Inc., on the development at Kapairowitz. The company has been working on final details directly with the Department, and it is my understanding that most of the contract specifics have been settled. There remains just the general subject of power coordination, which applies across the board to all of these power developments where the Department has an interest in the lands and waters.

The water service contract for the proposed Page-Navajo Plant has been well covered here. I would like to say something about the present water use feature of it, as related to the Indian interests, prefacing that by acknowledging that the principal responsibility I have, of course, is to the Upper Basin. It is one I cherish and feel very strongly about. These determinations that were presented to the Tribal Council are those that our Regional staff worked out and that I personally was very much involved in. So I am saying this not in apology at all but to convey to you that your interests are certainly the Bureau's and mine.

We were not trying to put together estimates of present water use that would necessarily meet a predefined conclusion. But the objective was to make a determination of the amount of water that the Indian people had consumed for agriculture in the greatest year that we could make such a determination as an actual fact of their having experienced the consumption. It was not intended as a determination of what was a consumption opportunity or what, presuming coincident peak demands or a full water supply they would use, or perhaps what might be a proper reservation for their potentials. I wouldn't argue

that point. Our effort was to try to define by our best judgment what they actually had consumed. We presented this to the Tribe, perhaps not as effectively as it should have been to gain that understanding, so we could then say to them: "If you use no more than you have used, there is this amount remaining, when you consider the opportunities for other uses." It was done to give them a bench mark for understanding.

Now, our hydrologic judgment is that with the system for use that they have, the manner in which they use water (which is rather erratic), the precipitation and cropping patterns, the type of crops, the way their cultivation practices, plus our own experience in studying many, many supplemental water projects under circumstances that have a relationship, was that they did not, in this peak year of cultivation, have a full water supply. So we discounted it, as Mr. Goslin has shown in his tabulation, to attempt to arrive at a realistic figure. So that is how this estimate of consumption on the reservation came about.

I will conclude by saying that we recognized, as you all have, that one of the promising avenues for a solution to this question of water uses fitting under the 50,000 acre-foot entitlement, including the steam plant, is a limitation agreement by the Indian people. We expect we may be going back to them because their limitation excludes the uses for the Glen Canyon Unit. When we go back to them, I pledge to you a most specific and conscientious effort to clarify and be sure that the Indian people have a full understanding of the basis for the factors presented to them. We fully subscribe to the team Engineering Report, in which we participated.

So with that, Mr. Chairman, I will conclude. I have probably taken more time than I should have, anyway.

CHAIRMAN DUGAN: Thank you, Mr. Crandall. Do you have any questions?

(No response.)

MR. SPARKS: I have one, Mr. Crandall, you made reference to this flood condition on the Gunnison River, that flooding which occurred in the last few weeks. Is that attributable to the Blue Mesa Reservoir?

MR. CRANDALL: Larry, that is a question we have asked ourselves and studied quite extensively. The record this year, and it is my understanding last year too, was that the freezing started at the upper margin of the reservoir, creating an ice jam at the head of this frozen perimeter as it moved upstream. In the autumn and early winter, when we had the steep gradient of the river without the reservoir, this slush

ice went on down. You didn't get the jams and floods until in the spring when the ice break-up took place, clogging the channel at the islands, and other restricted locations. So we feel we would be in a rather difficult and precarious situation trying to defend ourselves against not having made a contribution to the trouble.

MR. SPARKS: Having lived in that country for some years, I know that was always a chronic problem on the Gunnison River, and I wondered whether or not Blue Mesa had aggravated it, because this has come to our attention with great frequency.

MR. CRANDALL: And intensity.

MR. SPARKS: I have been arguing that the reservoir was not the cause of it. I just wanted to get our story straight here. (Laughter.)

MR. CRANDALL: Well, we place a limit on how far this influence goes, and there are certain areas that are subject to flooding far beyond any reasonable application of this. The Corps of Engineers is studying it, and perhaps their program can be helpful in complementing what we do plus what the Fish and Wildlife Service may do, and perhaps we can get rid of the difficulty.

CHAIRMAN DUGAN: Any further questions?

MR. GOSLIN: Have you determined how far back up the river you would have to purchase easements in order to keep this on federal property, or is that part of the investigation that is now going on?

MR. CRANDALL: I can give you just an off-the-cuff figure, and I hope off-the-record here, because we are involved in negotiations that involve purchases of something like two and a half or three miles, I think, Ival. That is the figure that comes to mind. It's not a great distance upstream.

CHAIRMAN DUGAN: Thank you very much, Mr. Crandall. Any other unfinished business? Do you have any Ival?

MR. GOSLIN: Mr. Chairman, that is the only item I hadn't listed, unless the Commission has something else. (No response.)

CHAIRMAN DUGAN: We will move on to new business. Does the Director care to discuss the Appropriation Committee's hearings at this time?

MR. GOSLIN: Mr. Chairman, as I mentioned in my report, we have requested time for witnesses to appear before the Appropriations Committee. We have not received a reply back from the Chairman of the Appropriations Committee at this time, probably because they don't know themselves when they are going to schedule these hearings. Ordinarily, they come the last part of April or the first part of May. And the question, of course, that I had was: Does the Commission wish to operate as we have in the past and attempt to coordinate this testimony of the various states and also, of course, before the Appropriations Committee? There has always been a lot of work that has to be done after the hearings, talking to various members of the Appropriations Committees, and so on, and this would not need to be covered with a motion because we do that as part of our regular job. But the hearings themselves, if you wish to proceed as you have in the past, I think the Commission should say so.

COM. WADDINGHAM: We do, don't we, Dick?

CHAIRMAN DUGAN: What is your feeling on this, Mr. Sparks?

MR. SPARKS: Well, I think this testimony presented by the Commission has been extremely valuable in the past, and I believe it should be continued. We, of course, like the other states here, we have a considerable interest in those appropriations, and this year a particular interest; although, we are all being cut down on funds, which is understandable because of the national fiscal situation.

As a result of the passage of the Colorado River Basin Project legislation last year, we were constantly assured by officials of the Department of Interior that there would be no problem in getting some funds to commence definite plan reports on the Colorado Projects authorized in that legislation if, in fact, funds were going to be sought for the State of Arizona. We were, therefore, somewhat annoyed when the President's Budget was released, and Arizona -- there was some $900,000 budgeted for Arizona and none for Colorado. We have taken slight issue with that budget, and we intend to press it at these hearings and at other places.

CHAIRMAN DUGAN: Mr. Bliss?

COM. BLISS: Well, I think my only observation is I think we should continue to work together toward the obtaining of adequate funds for the operation of the project, and I think we should continue this.

CHAIRMAN DUGAN: Mr. Waddingham?

COM. WADDINGHAM: Utah concurs that we should continue the activities as we have in the past with each state to work with Ival on who should present what part of the picture.

CHAIRMAN DUGAN: Mr. Person?

COM. PERSON: Yes, that is okay.

CHAIRMAN DUGAN: The consensus is that the Director should continue as he has in the past.

MR. GOSLIN: I guess that is instruction enough.

CHAIRMAN DUGAN: Any other new business?

COM. BLISS: Mr. Chairman, when the Governor was here, he announced that Governor Ed Johnson has submitted his resignation, and I am sure I express the opinion of everyone here that we certainly appreciate the work that he has done over the years and the help he has been to the Commission, and I feel it only fitting and proper that the Commission should prepare a proper resolution which would go to Mr. Johnson. I suggest that since our secretary has nothing else to do, that we direct him to prepare such a resolution and that it be sent to Governor Johnson and Governor Love. (See Page 59)

CHAIRMAN DUGAN: Would you care to put that in the form of a motion, Mr. Bliss?

COM. BLISS: I thought I did. I will so move.

COM. PERSON: Second.

CHAIRMAN DUGAN: Question. All in favor say "Aye." (Ayes.)

You are so directed, Mr. Goslin.

MR. GOSLIN: Yes, sir.

CHAIRMAN DUGAN: Any other new business?

(No response.)

If not, I will entertain a motion for adjournment.

MR. SPARKS: I move we adjourn, Mr. Chairman.

COM. PERSON: Second.

CHAIRMAN DUGAN: All in favor please say "Aye."

(Ayes.)

Adjourned.

(Whereupon, the Special Meeting was adjourned at 2:40 p.m. of the same day.)

* * * * *

I, CHARLINE K. SCOGGIN, Certified Shorthand Reporter in and for the State of Colorado, do hereby certify that I was present at and reported in stenotype the above proceedings, and that the same were reduced to typewritten form under my supervision, and that the above and foregoing constitute a full and true record of the proceedings had therein.

/s/ Charline K. Scoggin
CHARLINE K. SCOGGIN, C.S.R.

RESOLUTION
by
UPPER COLORADO RIVER COMMISSION

108-59

WHEREAS, the Hon. Edwin C. Johnson was appointed Commissioner on the Upper Colorado River Commission for the State of Colorado on April 8, 1957 by Governor Stephen L. R. McNichols and served as Colorado's Commissioner until he retired in February, 1969 in order to preserve his health; and

WHEREAS, the Hon. Edwin C. Johnson, prior to said appointment, had served in the General Assembly of the State of Colorado for four terms and as an outstanding Governor of Colorado for three terms; and

WHEREAS, the Hon. Edwin C. Johnson had faithfully served the State of Colorado as one of the most able and respected Members of the United States Senate for a period of 18 years; and

WHEREAS, the Hon. Edwin C. Johnson throughout his entire career always maintained a keen interest in all matters pertaining to the development, conservation, and utilization of the water and related resources of the State of Colorado and the Upper Colorado River Basin; and

WHEREAS, the Hon. Edwin C. Johnson brought to the Upper Colorado River Commission a special expertise which resulted from his unique experience as a member of State and National legislative bodies and public administrator in his beloved State of Colorado; and

WHEREAS, the Hon. Edwin C. Johnson vigorously and honorably performed his duties as a Commissioner for the State of Colorado with a deep respect for the integrity and abilities of his fellow Commissioners, staff members, and other interested parties with whom he was related in Commission affairs; and

WHEREAS, the Hon. Edwin C. Johnson after devoting so much of his efforts, abilities and time to the welfare of Colorado and of the Nation has more than earned his retirement, and his vivid personality and voice of experience are going to be greatly missed by all of his friends and associates;

NOW, THEREFORE, BE IT RESOLVED that the Upper Colorado River Commission at a Special Meeting held in Denver, Colorado on February 13, 1969, does hereby express the gratitude and appreciation of the Commission and its staff for the untiring service and wise counsel rendered by the Honorable Edwin C. Johnson in solving the many technical and political resource problems which have confronted the Commission during his tenure as Colorado's Commissioner, and the Upper Colorado River Commission, its advisers, and staff sincerely wish him and his family the best of health, happiness, and prosperity in all of his future endeavors;

BE IT FURTHER RESOLVED that the Secretary of the Upper Colorado River Commission is hereby directed to forward a copy of this Resolution to the Hon. Edwin C. Johnson and to the Governor of the State of Colorado.

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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2	D, E	18	Z, AA
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15	X	**31**	**BB, BC, BD, BE, BF**
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OFFICIAL RECORD

Volume 21

UPPER COLORADO RIVER COMMISSION

1969

OFFICIAL RECORD

Volume 21

UPPER COLORADO RIVER COMMISSION

1969

EXPLANATORY NOTE

This document consists of a series of verbatim transcripts of meetings of the Upper Colorado River Commission. The records for each calendar year are in a separate volume.

The meetings of each Volume are separated by blue insert sheets.

A subject index is to be found at the beginning of each Volume with an explanation of its use.

At the beginning of the transcript of each meeting, there is a Table of Contents that refers to the major actions or decisions of the Commission.

Volume 21 includes transcripts of the following meetings of the UPPER COLORADO RIVER COMMISSION

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109	Salt Lake City, Utah	March 17, 1969
110	Salt Lake City, Utah	September 15, 1969
111	Denver, Colorado	October 1, 1969
112	Denver, Colorado	December 5, 1969

FOREWORD

The Upper Colorado River Commission is an interstate administrative agency created under the terms of the Upper Colorado River Basin Compact executed at Santa Fe, New Mexico, on October 11, 1948, and subsequently ratified by each of the legislatures of the states and by the Congress of the United States. The Commission represents the states of Colorado, New Mexico, Utah and Wyoming and the Federal Government.

The major purposes of the Upper Colorado River Basin Compact are: (1) to provide for the equitable division of the use of water of the Colorado River System among the Upper Basin States, namely, Arizona, Colorado, New Mexico, Utah and Wyoming; (2) to establish obligations of each state with respect to the delivery of water to the Lower Basin; (3) to promote interstate harmony; (4) to remove causes of controversies; (5) to secure the expeditious agricultural and industrial development of the Upper Basin states, the storage of waters, and the protection of life and property from floods.

The Commission, in order to fulfill the major purposes of the Compact, has been granted broad and comprehensive powers and charged with well-defined duties and responsibilities. Among its powers and duties are: adopting rules and regulations; locating and establishing water-gaging stations; making forecasts of water runoff; engaging in cooperative studies of water supplies; collecting, analyzing, correlating and preserving all types of water supply data; determining the quantity of water used each year in the Upper Colorado River Basin and in each state, and delivered to the Lower Basin; determining extent of curtailment of use, if necessary; determining reservoir losses and their apportionment; making findings of fact concerning obligations under the Mexican Treaty; acquiring and holding property; performing all functions required of it under the Upper Colorado River Basin Compact; reporting annually on its activities to the Governors of the signatory states and to the President of the United States.

This volume contains the transcripts of all meetings of the Commission during the 1969 calendar year.

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ADJOURNED REGULAR AND ANNUAL MEETING
Denver, Colorado
October 1, 1969

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UPPER COLORADO RIVER COMMISSION

355 South Fourth East Street
Salt Lake City, Utah 84111

COMMISSIONERS

H. P. Dugan	Chairman United States of America
John A. Love	State of Colorado
John H. Bliss	State of New Mexico
Thorpe Waddingham	State of Utah
H. T. Person	State of Wyoming

SECRETARY

Ival V. Goslin

TREASURER

I. J. Coury

STAFF

Ival V. Goslin	Executive Director
Paul L. Billhymer	General Counsel
Cecil B. Jacobson	Chief Hydraulic Engineer
Vesta Wine	Reporter

ADVISERS and OTHERS PRESENT

COLORADO:

Felix L. Sparks	Director, Colorado Water Conservation Board, Denver, Colorado
L. D. Morrill	Deputy Director, Colorado Water Conservation Board, Denver
Loren L. Swick	Water Resources Analyst, Colorado Water Conservation Board, Denver
William R. Smith	Deputy State Engineer, Division of Water Resources, Denver, Colorado
K. L. Broadhurst	Attorney, Denver Water Board Denver, Colorado
Robert W. Fischer	Denver Water Board Denver, Colorado
E. F. Phipps	Assistant Manager, Northern Colorado Water Conservancy District, Loveland, Colorado
J. R. Barkley	Manager, Northern Colorado Water Conservancy District, Loveland
Charles L. Thomson	General Manager, Southeast Colorado Water Conservancy District, Pueblo, Colorado
Gordon Scheer	Executive Director, Colorado Water Congress, Denver, Colorado
Dick Edmondson	Manager, Tri-County Water Conservancy District, Montrose, Colorado
E. J. Currier	Engineer, Colorado Water Conservation Board, Denver, Colorado
Raphael J. Moses	Attorney, Colorado Water Conservation Board, Boulder, Colorado

NEW MEXICO:

S. E. Reynolds	State Engineer Santa Fe, New Mexico
David P. Hale	Interstate Streams Engineer, New Mexico Interstate Stream Commission, Santa Fe, N. Mex.
Claud S. Mann	Special Assistant Attorney General Albuquerque, New Mexico
F. Harlan Flint	Special Assistant Attorney General Santa Fe, New Mexico

UTAH:

George D. Clyde	Consulting Engineer Salt Lake City, Utah
Daniel F. Lawrence	Director, Division of Water Resources Salt Lake City, Utah
Barry C. Saunders	Engineer, Division of Water Resources Salt Lake City, Utah
Lynn S. Ludlow	Manager, Central Utah Water Conservancy District, Orem, Utah
L. V. Siddoway	Manager, Uintah Water Conservancy District, Vernal, Utah

WYOMING:

Floyd A. Bishop	State Engineer Cheyenne, Wyoming

BUREAU OF RECLAMATION:

L. E. Holmes	Salt Lake City, Utah
D. L. Crandall	Salt Lake City, Utah
J. R. Riter	Denver, Colorado
Richard W. Nash	Denver, Colorado
J. Stuart McMaster	Regional Solicitor, Department of the Interior, Salt Lake City, Utah

PROCEEDINGS

THE CHAIRMAN: The Adjourned Regular and Annual Meetings of the Upper Colorado River Commission will come to order.

Secretary Goslin, would you state the documents that are necessary to conform the meeting?

MR. GOSLIN: Mr. Chairman, yes, sir, I will do so.

I think the record should show that all the Commissioners are present with the exception of Commissioner Love who, I understand, will be here later, and that Mr. Sparks, Director of the Colorado Water Conservation Board, will act as his proxy.

Also, we have been officially notified by Governor Love that he is personally going to fill the vacancy created on the Upper Colorado River Commission by the resignation of former Commissioner Edwin C. Johnson.

The necessary documents to conform this meeting to the By-Laws consist of the following: Unless there is objection from the Commission, I will not read these but will merely submit them to the reporter to be included in the proceedings of this meeting.

First, there is a Notice of Regular Meeting, dated February 28, 1969.

NOTICE OF REGULAR MEETING

In accordance with Article IV, paragraph 4, of the By-Laws, notice is hereby given that the Regular Meeting of the Upper Colorado River Commission will be held, beginning at 8:00 o'clock a.m., on Monday, March 17, 1969 in the principal office of the Commission located at 355 South Fourth East Street in Salt Lake City, Utah.

/s/ IVAL V. GOSLIN
Secretary

Second, there is an Agreement to Extend Adjournment of the Regular Meeting that was signed by all five Commissioners in compliance with Article IV, paragraph 12 of the By-Laws.

AGREEMENT TO EXTEND ADJOURNMENT OF THE REGULAR MEETING

In compliance with Article IV (12) of the By-Laws of the Upper Colorado River Commission, I hereby agree that the Regular Meeting

of the Commission, formerly scheduled on March 17, 1969 in Salt Lake City, Utah and adjourned for lack of a quorum, shall be adjourned beyond the 30-day limit for such adjournment to a date and place to be determined by the Chairman and Secretary after consultation with each Commissioner.

(Documents reading as above, dated April 8, 1969, signed by the following: H. P. Dugan, Commissioner for the United States; John A. Love, Commissioner for the State of Colorado; John H. Bliss, Commissioner for the State of New Mexico; Thorpe Waddingham, Commissioner for the State of Utah; and H. T. Person, Commissioner for the State of Wyoming.)

There was then a Notice of Annual Meeting that was dated August 28, 1969.

NOTICE OF ANNUAL MEETING

In accordance with Article IV, paragraph 4, of the By-Laws, notice is hereby given that the Annual Meeting of the Upper Colorado River Commission will be held, beginning at 8:00 o'clock a.m., on Monday, September 15, 1969 in the principal office of the Commission located at 355 South Fourth East Street in Salt Lake City, Utah.

/s/ IVAL V. GOSLIN
Secretary

Next, there was an Agreement to Establish Time and Place of 1969 Adjourned Regular and Annual Meetings, also signed in person by each of the five Commissioners.

AGREEMENT TO ESTABLISH TIME AND PLACE
OF 1969 ADJOURNED REGULAR AND ANNUAL MEETINGS
UPPER COLORADO RIVER COMMISSION

In accordance with Article IV of the By-Laws, I, the undersigned, Commissioner for the _____, agree that the Adjourned Annual Meeting of the Upper Colorado River Commission shall be held in Denver, Colorado on Wednesday, October 1, 1969, and that the Adjourned Regular Meeting for 1969 shall be held concurrently with the Adjourned Annual Meeting.

(Documents reading as above, dated September 12, 1969, signed by the following: H. P. Dugan, Commissioner for the United States of America; John A. Love, Commissioner for the State of Colorado; John H. Bliss, Commissioner for the State of New Mexico; Thorpe Waddingham, Commissioner for the State of Utah; and H. T. Person, Commissioner for the State of Wyoming.)

And last, a Notice of this meeting, which was dated September 19, 1969, and reads as follows:

NOTICE OF ADJOURNED REGULAR AND ANNUAL MEETINGS
OF THE UPPER COLORADO RIVER COMMISSION

In accordance with Article IV of the By-Laws, notice is hereby given that the Adjourned Regular and Annual meetings of the Upper Colorado River Commission will be held, commencing at 10:00 o'clock a.m., on Wednesday, October 1, 1969, in Room 320-E of the Colorado State Capitol in Denver, Colorado.

/s/ IVAL V. GOSLIN
Secretary

Mr. Chairman, that constitutes the submission of all the documents.

THE CHAIRMAN: Thank you, Mr. Goslin.

Do you have the minutes?

MR. GOSLIN: The Minutes of the Special Meeting of the Upper Colorado River Commission of February 13, 1969, were distributed to all of the Commissioners soon after that date. Do the Commissioners wish to have them read?

COM. PERSON: I move the minutes be approved as submitted.

COM. BLISS: Second the motion.

THE CHAIRMAN: Question? (Question) All in favor say "Aye." Opposed. They are approved.

The minutes of March 17.

MR. GOSLIN: Mr. Chairman, the minutes of the Regular Meeting of the Upper Colorado River Commission of March 17, 1969, have also been distributed. In order to have a record of this meeting, I would like to ask the reporter to include a copy in the proceedings. Do you wish these read?

COM. WADDINGHAM: I move that they be approved as submitted.

COM. BLISS: I will second that motion.

THE CHAIRMAN: All in favor say "Aye." Opposed? Carried.

MINUTES OF REGULAR MEETING
of
UPPER COLORADO RIVER COMMISSION
March 17, 1969

Upon arriving at the place of the Regular Meeting of the Upper Colorado River Commission at the appointed hour the Secretary observed that there were no members of the Commission present, prepared these minutes to make a record of the situation, and noted that arrangements will be made to hold an adjourned regular meeting at a time and place to be determined by the members of the Commission.

/s/ Ival V. Goslin
Secretary

MR. GOSLIN: Mr. Chairman, the minutes of the Annual Meeting of the Upper Colorado River Commission of September 15, 1969, have likewise been distributed, and I would like to ask the reporter to include a copy of these minutes in the proceedings in order that we have a record of that meeting. Do you wish to have these read?

COM. WADDINGHAM: I move the same motion as to the previous minutes.

COM. BLISS: Second the motion.

THE CHAIRMAN: All in favor? Opposed? Approved.

MINUTES OF ANNUAL MEETING
of
UPPER COLORADO RIVER COMMISSION
September 15, 1969

No members of the Upper Colorado River Commission were present at the appointed hour. The Secretary immediately commenced arrangements for the holding of an Adjourned Annual Meeting at a time and place to be determined by members of the Commission.

/s/ Ival V. Goslin
Secretary

THE CHAIRMAN: We are, indeed, fortunate today to have Governor Clyde present, former member of the Commission. We are all very happy to see you here, Governor.

The Chairman has no report to make at this meeting and I would like to move on to the report of the Director, Mr. Goslin.

MR. GOSLIN: Mr. Chairman, each member of the Commission has a copy of this report in his folder, and the rest of the copies have been distributed to the people who are present. There are a few left on the table if anybody desires a copy.

Seven months have elapsed since the last official meeting of the Upper Colorado River Commission. During that period we have attempted to keep our Commissioners and their advisers informed through memoranda and correspondence.

Appropriations of Funds by the Congress for the CRSP

President Johnson's budget request for fiscal year 1970 was transmitted to the Congress on January 15, 1969. The total recommended to be appropriated to the Bureau of Reclamation for its construction program on the Colorado River Storage Project amounted to $26,000,000, which, when considered together with reductions due to anticipated delays and financing from other sources was supposed to initially finance a program amounting to $29,447,000. The largest items included in the budget were $8,000,000 for the Bonneville Unit of the Central Utah Project, $6,300,000 for the San Juan-Chama Project, $3,672,000 for transmission lines, and $3,500,000 for the Curecanti Storage Unit. The budget also contained $3,500,000 to be appropriated to the Bureau of Indian Affairs for continuing construction of the Navajo Indian Irrigation Project.

The Operation and Maintenance Program for the Colorado River Storage Project to be financed through the Upper Colorado River Basin Fund amounted to $7,551,800. In addition to the operation and maintenance activities on the Flaming Gorge, Glen Canyon, Navajo, and Curecanti Storage Units, the power transmission division, and Emery County, Florida, and Seedskadee participating projects, the 1970 program also provided for the continued purchase of power to cover requirements caused by diminutions in energy generation and capacity impairment created at Hoover Dam powerplants as the result of operations of dams and reservoirs of the Colorado River Storage Project, and provided for quality-of-water studies.

The total fiscal year 1970 program of $7,551,800 will be funded with $15,000 advanced by the water users and $7,536,800 by revenues received from the sale of electric energy and water.

The Upper Colorado River Commission and the State of New Mexico on April 1, 1969 submitted testimony to the Subcommittee of the Department of the Interior and Related Agencies of the Committee on Appropriations of the House of Representatives in support of construction funds for the Navajo Indian Irrigation Project. The need for accelerating the construction of this project at a rate greater than that of the past five years was emphasized in the statements to the Subcommittee.

Witnesses representing the Upper Colorado River Commission and various water agencies in the States of Colorado, New Mexico, Utah, and Wyoming on June 2 and 3, 1969 testified before the subcommittees of the House and Senate Appropriations Committees.

On April 15, 1969, President Nixon sent his recommendation to the Congress for reductions to be applied to the proposed federal budget. Under these recommendations the Bureau of Reclamation's budget was reduced $39,720,000 from $289,200,000 to $249,480,000, but the budget item for the Colorado River Storage Project was not reduced. Early last month the President made known his recommendation that new federal public works construction would be reduced 75%.

At the time of writing this statement the Interior Department Bill has been passed by the House and has been reported to the Senate. The Public Works appropriation bill containing the Bureau of Reclamation and Corps of Engineers funds has not been "marked up" by the subcommittee of the House. It is anticipated that the consideration of this House Bill will be further delayed pending information from the Bureau of the Budget concerning how the 75% new construction slice is to be applied. The Bureau of the Budget has asked most federal agencies for a temporary freeze on new contracts until it can formulate guidelines. Currently, Congress is working on several appropriation bills for different government agencies. What action the committees will take is not known. They could either accept the reductions or base their recommended legislation on the original budget and ignore the cut backs.

On the salmon-colored sheets in each Commissioner's folder is a resume' of the Bureau of the Budget Bulletin No. 70-5, which describes the Construction Reduction Plan. Copies are available for others in the room who may find this information useful or interesting.

Currently, Congress is working on several appropriation bills for different government agencies. What action the Committees will take is not known. They could either accept the reductions or base their recommended legislation on the original budget and ignore the recommended cutback.

Type I Comprehensive River Basin Study

The Upper Colorado River Commission is the lead agency for the Upper Colorado Region Type I Study. Representatives of the five upper basin States and about 20 federal agencies are participating. This study is progressing, but not at the rate initially anticipated. Reductions in funds and personnel for the federal agencies have caused, and will continue to cause, delays. Innumerable meetings at the State-Federal Interagency level, staff level, and of the various task forces are requiring a lot of time and energy of our staff.

When completed, the Type I study report will consist of a main report document and 18 appendices, and an analytical summary report. The appendices will contain an inventory of resources of the Upper Colorado Region, and projections of resource development for the years 1980 - 2000 - and 2020. A plan of development based upon economic projections made by the Office of Business Economics of the Department of Commerce and the Economic Research Service of the Department of Agriculture will be described and evaluated. In addition, it is anticipated that an alternative plan of development, based upon more accelerated rates of water resource usage, will also be outlined and evaluated.

Inputs of data, other basic information, ideas, and opinions are being contributed by each State and federal agency.

The Type I Study is not the "full and complete reconnaissance investigations for the purpose of developing a general plan to meet the future water needs of the Western United States" required to be conducted by the Secretary of the Interior by title II of P.L. 90-537, the Colorado River Basin Project Act of 1968. The Type I Study is under the auspices of the national Water Resources Council and was authorized by the Water Resources Planning Act. It is hoped that some of the information developed by the Type I Study can be used for the westwide study.

Colorado River Development Fund

Section 2 (d) of the Boulder Canyon Project Adjustment Act created a $500,000 per year fund from Hoover Dam power revenues for the years ending May 31, 1938 to May 31, 1987. This fund is known as the Colorado River Development Fund. The first $1,500,000 of this CRD Fund was earmarked for comprehensive Colorado River Basin studies by the Secretary of the Interior.

The next receipts to the end of fiscal 1955 were specified to be used "for the investigation and construction" of projects in the Upper Colorado River Basin. In 1948 Senator Barrett of Wyoming sponsored an amendment (P. L. 570 of the 80th Congress, 2d Session) requiring an equal division of the $500,000 among the Upper Division States for the years 1949-1955. After 1955 the law provides that the CRD Fund is to be used "equitably" in all seven States of the Basin for the investigation and construction of projects.

In accordance with P. L. 90-537, the Colorado River Basin Project Act of September 30, 1968, the annual $500,000 payment will be transferred to the Upper Colorado River Basin Fund, beginning with fiscal year 1970, as reimbursement "for the money expended heretofore or hereafter from the Upper Colorado River Basin Fund to meet deficiencies in generation at Hoover Dam during the filling period of storage units of the Colorado River Storage Project pursuant to the criteria for the filling of Glen Canyon Reservoir."

On the attached blue sheets are tables showing the distribution of the CRD Fund among the basin States for fiscal year 1969, the distribution of all CRD Fund revenues since 1938, and a summary showing its division between the Upper and Lower Divisions.

I thought these sheets would be of interest to you, certainly from a historical viewpoint.

You might, as a matter of interest, take a look at the next to the last blue sheet, which is sort of a summary. You will get an idea of what has happened to this CRD Fund up until June 1st of 1969.

You will notice that in the last column, the "Total" column, that the Upper Basin has received from this fund about $11,828,229, and across the bottom the distribution of this percentage is shown, so far as each State is concerned.

In the lower part of the page, the "Total" column shows that the Lower Basin has received slightly over three and a third million dollars, and the bottom line shows the distribution of that among the Lower Division States, and as mentioned in the body of my report, from now on this Fund will all go to the Upper Colorado River Basin Fund to help pay for these deficiencies in generation that have been charged against that Fund as a result of filling the Upper Basin Reservoirs.

UPPER COLORADO RIVER COMMISSION

355 South Fourth East Street
Salt Lake City, Utah 84111

October 1, 1969

MEMORANDUM

TO: Upper Colorado River Commissioners

FROM: Ival V. Goslin, Executive Director

SUBJECT: Distribution of CRD Fund Revenues

Section 2 (d) of the Boulder Canyon Project Adjustment Act created a $500,000 per year fund from Hoover Dam power revenues for the years ending May 31, 1938 to May 31, 1987. This fund is known as the Colorado River Development Fund. The first $1,500,000 of this CRD Fund was earmarked for comprehensive Colorado River Basin studies by the Secretary of the Interior.

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In accordance with P.L. 90-537, the Colorado River Basin Project Act of September 30, 1968, the Annual $500,000 payment will be transferred to the Upper Colorado River Basin Fund, beginning with fiscal year 1970, as reimbursement "for the money expended heretofore or hereafter from the Upper Colorado River Basin Fund to meet deficiencies in generation at Hoover Dam during the filling period of storage units of the Colorado River Storage Project pursuant to the criteria for the filling of Glen Canyon Reservoir."

Table I shows the distribution of the CRD Fund among the states for fiscal year 1969. Table II shows the distribution of all CRD Fund revenues to the end of June 1969. Table III is a summary showing the division of the CRD Fund between the Upper Division and Lower Division States.

TABLE I

Distribution of Colorado River Development Fund Costs to States for fiscal year 1969

Regions 4, 5, and 7 [1] Upper Division States					
Grouping	Colorado	New Mexico	Utah	Wyoming	Total
FY 1969 Totals	$ 81,527	$ 25,449	$ 97,915	$ 45,109	$250,000
Percent of TOTAL	32.6%	10.2%	39.2%	18.0%	100.0%

Region 3 Lower Division States						
Grouping	Arizona	California	Nevada	New Mexico	Utah	Total
FY 1969 Totals	$212,441		$ 22,845	$ 14,714		$250,000
Percent of TOTALS	85.0%		9.1%	5.9%		100.0%

[1] Region 7 costs transferred to Region 4 accounts

TABLE II

Distribution of Colorado River Development Fund Costs to States as of June 30, 1969

Regions 4, 5, and 7 [1] Upper Division States					
Grouping	Colorado	New Mexico	Utah	Wyoming	Total
Intrastate Projects	3,727,622		1,116,694	568,351	5,412,667
Interstate Projects	583,110	188,829	92,871	41,846	906,656
Overall Basin Investigations	223,492	223,491	223,492	223,490	893,965
Washington Office Costs					
Subtotal	4,534,224	412,320	1,433,057	833,687	7,213,288
Transfer to Construction	1,134,420	1,236,593	1,335,411	918,517	4,624,941
TOTAL CRDF COSTS	$5,668,644	$1,648,913	$2,768,468	$1,752,204	$11,838,229
Percent of TOTAL	47.88%	13.93%	23.39%	14.80%	100.00%

Region 3 Lower Division States						
Grouping	Arizona	California	Nevada	New Mexico	Utah	Total
Intrastate Projects	1,361,512		404,309			1,765,821
Interstate Projects	591,301	165,277	166,294	189,974	2,323	1,115,169
Overall Basin Investigations	70,745	70,744	70,745			212,234
Washington Office Costs	917	917	916			2,750
Subtotal	2,024,475	236,938	642,264	189,974	2,323	3,095,974
Transfer to Construction		26,198	277,395*		239,630	543,223*
TOTAL CRDF COSTS	$2,024,475	$263,136	$919,659*	$189,974	$241,953	$3,639,197*
Percent of TOTAL	55.63%*	7.23%*	25.27%*	5.22%*	6.65%*	100.0%

[1] Region 7 costs transferred to Region 4 accounts

*The figures reflect information received by letter of October 22, 1969 from Mr. Wilbur Kane, Assistant Commissioner of Reclamation, advising that costs allocated for the CRD Fund through June 30, 1969 had been revised to include a Region 3 transfer to a construction project. IVG

TABLE III

Summary

Upper Division States		
Colorado River Development Fund Investigations		
Region 4	$7,138,084	
Region 5 (Colorado Rio Grande Diversion, Colorado)	75,204	
		$ 7,213,288
Construction Projects		
Region 4	3,436,236	
Region 5 (Navajo Indian Irrigation and San Juan-Chama Projects, New Mexico)	984,721	
Region 7 (Fryingpan - Arkansas Project)	203,984	
		4,624,941
Total Upper Division States		$11,838,229
Lower Division States		
Colorado River Development Fund, Region 3	3,095,974	
Construction Projects, Region 3	543,223*	
Total Lower Division States		3,639,197*
GRAND TOTAL		$15,477,426*

* The figures reflect information received by letter of October 22, 1969 from Mr. Wilbur Kane, Assistant Commissioner of Reclamation, advising that costs allocated for the CRD Fund through June 30, 1969 had been revised to include a Region 3 transfer to a construction project. --IVG

Long-Range Reservoir Operating Criteria

The Colorado River Basin Project Act of last year (P.L. 90-537), which authorized the Central Arizona Project, also established legislative guidelines for the operation of certain reservoirs of the Colorado River system. Section 602 of the Act in paragraph (a) states in part that ". . . the Secretary (of the Interior) shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of the Colorado River Storage Project Act, the Boulder Canyon Project Act, and the Boulder Canyon Project Adjustment Act. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River Storage Project and releases of water from Lake Powell in the following listed order of priority."

(1) releases to supply 1/2 the deficiency in delivery of water to Mexico under the Mexican Water Treaty, if any such deficiency exists and is chargeable to this Commission's four member States;

(2) releases to supply 75,000,000 acre-feet of water in any period of 10 consecutive years at Lee Ferry under Article III (d) of the Colorado River Compact of 1922;

(3) storage of water not required for (1) and (2) above to the extent that the Secretary, ". . . after consultation with the Upper Colorado River Commission and representatives of the three Lower Division States. . ." shall find such storage to be reasonably necessary to assure deliveries for supplying 1/2 the deficiency in the Mexican Treaty burden and for the delivery of the 75,000,000 acre-feet of water at Lee Ferry in every period of 10 consecutive years without impairment of consumptive uses of water in the upper basin that were apportioned to it by the Colorado River Compact. It is further provided that water not required to be stored shall be released from Lake Powell:

(i) to the extent that it can be reasonably used in the Lower Division States for domestic and agricultural purposes (Article III (e)), but no such releases can be made when the active storage in Lake Powell is less than the active storage in Lake Mead;

(ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to that in Lake Powell; and

(iii) to avoid anticipated spills from Lake Powell.

Section 602 (b) directs that "not later than January 1, 1970, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the governors of the seven Colorado River Basin States and to such parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than July 1, 1970, the Secretary shall adopt appropriate criteria in accordance with this section and publish the same in the Federal Register. Beginning January 1, 1972, and yearly thereafter, the Secretary shall transmit to the Congress and to the governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year."

Late in 1968 the Bureau of Reclamation established a task force within its own organization to formulate a preliminary draft of proposed criteria. Under the auspices of the Department of the Interior a meeting of Federal and State representatives was held in Denver on July 25, 1969 for the purpose of reviewing basic data pertinent to the preparation of operating criteria for the Colorado River pursuant to section 602 of P. L. 90-537. The most important developments to emerge from this meeting were:

(a) the formation of a small working group of State and Federal technicians to review the Bureau's draft of criteria, to consider all problems related to reservoir operations, and to suggest additional or alternative information and studies;

(b) a review and explanations by USBR personnel of the data presented by the Bureau at the meeting;

(c) a beginning of recognition of the principal issues between the Upper and Lower basins concerning the proper operation of the river.

Subsequent meetings of the main Task Force on Reservoir Operating Criteria have been held on August 7, 1969 in Salt Lake City, and on September 15, 1969 in Los Angeles.

The Salt Lake City meeting was held for the purpose of obtaining the views of the States on the Bureau's draft of criteria. At this session the issues associated with the criteria became more apparent. Representatives of the Lower Basin raised questions about the amounts of bank storage, reservations for flood control, estimates of lower basin stream depletions, upper basin depletions, etc., that had been used in studies upon which the Bureau's original draft was based. The Upper Basin raised questions concerning the definition of such terms as "excess," "surplus," and "spill" used in the criteria; and releases of water from Lake Powell used in the Bureau's study. We also pointed out that the 1962 Lake Powell reservoir filling criteria should be terminated in their entirety, particularly the payments for the so-called "deficiencies" in generation at Hoover Dam, with the advent of the long-range operating criteria. The filling criteria can be terminated by the Secretary under any one of three conditions: (1) when Lake Powell is completely full at elevation 3700 feet and Lake Mead is at elevation 1146 feet; (2) on May 31, 1987; or (3) by declaration of the Secretary when he determines that conditions warrant. It appears that condition (1) may not be possible due to the mandatory equalizing of active storage in the two reservoirs and the releases to avoid anticipated spills from Lake Powell. Condition (2) has never been satisfactory because its effect is that the upper basin is forced to submit to a priority for power generation at Hoover Dam. The Secretary should now invoke condition (3) and operate the reservoirs under the long-range criteria of P. L. 90-537 since both reservoirs are now above rated head elevation.

We were told that the matter of terminating the "deficiency" payments is beyond the assignment of the Task Force and that this was not the proper forum for considering this problem. I disagree with this conclusion for several reasons: (1) the "deficiency" payments were a part of the 1962 reservoir filling criteria which will be superseded by the new long-range operating criteria, therefore, this must be the proper time to polish the whole ball of wax; (2) the nature of the guidelines for criteria in P. L. 90-537 could be interpreted to preclude the termination of the "deficiency" payments; (3) when new long-range operating criteria are put into effect is the logical time to abandon the "deficiency" payments; (4) both reservoirs are now at elevations above rated head, and, therefore, possess their full generating capacity; (5) water that is now in storage in the two reservoirs is not being held there for the exclusive benefit of the Upper Basin; firm power could be generated at Hoover Dam by releasing water from Lake Mead in a manner similar to that before the construction of Lake Powell and there would be no deficiency, but this type of operation would be impractical from the standpoint of water conservation; (6) there is no precedent for the so-called "deficiency" charges;

(7) continuation of the policy of charging the Upper Basin Fund for "deficiencies" will continue to have an adverse effect on the future Upper Basin water resource development by depriving that fund of many millions of dollars in the form of revenue foregone by the use of upper basin energy and capacity to fill the "deficiencies" and by associated interest costs over and above the dollar amounts that will be returned to the Upper Basin Fund under the terms of P.L. 90-537; and (8) the decision to continuously charge the Upper Basin Fund for "deficiencies" in power generation was not based upon justice and equity but has always appeared to the Upper Basin to be a form of "political blackmail" which should now be stopped.

At the Salt Lake City meeting it became evident that differences in interpretation of section 602 of P.L. 90-537 were the causes of differences of opinion concerning what should and should not be the terms of the operating criteria. It should be remembered that the language of section 602 provides guidelines for criteria. The manner of implementing section 602 and the nature and manner of application of the basic data in studies upon which the final terms of the criteria will be based will determine whether the operating rules will accomplish what the Upper Division States were seeking to accomplish when we insisted that section 602 be included in the legislation. It has become obvious that there is a wide spectrum of possible implementations of section 602 and basic data applications that can influence the outcome.

A number of small committees were appointed at the Salt Lake City meeting to study various aspects of the overall operations problem about which there are differences of opinion. Some of these items were: (a) losses and consumptive uses along the reach of the river Hoover Dam to Mexico; (b) reservoir bank storage; (c) upper basin depletions; (d) definitions of terms; (e) test studies and probabilities.

At the Los Angeles meeting on September 15th the above committees reported their findings, and certain parameters were defined for 26 computer studies to be run on the weekend of September 20-21. The results of these computer studies have been analyzed, and another group of analyses was to be run through the computers on this past weekend.

In summary, the differences between the Upper and Lower Basins as related to the long-range operating criteria are as follows:

Upper Basin

1. One objective is to maintain the required stored water in Colorado River Storage Project reservoirs to guarantee that 75,000,000

acre-feet of water can be delivered at Lee Ferry in every period of ten consecutive years without impeding the desired rate of resource development in the Upper Basin or curtailing consumptive uses of water. This objective was the primary principle underlying the authorization of the CRSP and the primary purpose of section 602 of P. L. 90-537. Section 602 was also designed for the purpose of guiding the Secretary of the Interior in his operations under Article III (e) of the Colorado River Compact.

2. Another objective - which I regard as secondary to No. 1 above - is to produce sufficient power revenues in the basin fund to pay for costs of water development projects beyond the ability of water users to pay.

Lower Basin

To be explicit, the lower basin objectives are to maximize water deliveries at Lee Ferry and to maximize power production at Hoover Dam powerplants. In attempts to satisfy these objectives the lower basin is trying to show the highest possible demands for water. One means being employed is to shift as much of the lower basin depletions as possible into the "river losses" column. Then the total downstream demands, which are being construed as the sum of the court-approved apportionments (4.4 maf to California, 2.8 to Arizona, and 0.3 maf to Nevada), and Mexican Treaty burden, and river losses are increased by the amount shifted to the loss category.

Another part of the lower basin strategy is to minimize upper basin water-in-storage requirements, because water not stored in upper basin reservoirs can be used in the lower basin under Article III (e) of the compact. More specifically the strategy here is (1) to decrease Upper Basin demands on storage by assuming that in the future, as in the past without reservoirs, less water will be used in the upper basin in dry years than during wet years; (2) to build into the computer studies increases in the allowable "probability" of an upper basin shortage; and (3) overemphasize the possibility of "spills" (undefined) which would result from a higher probability of satisfying the upper basin objective of delivering 75,000,000 acre-feet in ten years without impairing consumptive uses.

In my opinion the proper interpretation of section 602 of P.L. 90-537 and long-range reservoir operating criteria based thereon to implement it is one of the most important problems to face our Commission and its member States in a long time. The effects will be felt into the indefinite future. My recommendation is that the member States of this Commission should

formulate a well-defined set of objectives concerning the items related to the reservoir operating criteria and should pursue those objectives with a solidly united front. This will take some work, but past history has demonstrated that it can be done.

Legal

The legal staff has continued to collect the necessary information for the production of a water newsletter. The letter has been limited to the interests of the four states of this Commission. Suggestions for the making of the letter more useful will be gladly received.

A great deal of time has been spent in bringing together the necessary material for the "Legal and Institutional Appendix" for the Upper Colorado Region Type I Study. The first draft of this work is now in its final stages of preparation.

Other Activities

Regional Director Crandall's report will cover progress of the Bureau of Reclamation on the construction, advance planning, and investigations related to the Colorado River Storage Project and the present status of plans for the construction of a powerplant at Page, Arizona as part of the Central Arizona Project.

MR. GOSLIN: Mr. Chairman, the report was rather long, but there it is.

THE CHAIRMAN: Thank you, Mr. Goslin.

Are there comments on the Director's report?

COM. BLISS: Mr. Chairman, I move that it be received and at the proper time in the minutes we will discuss the items he has brought out for action.

COM. PERSON: Second the motion.

THE CHAIRMAN: It has been moved and seconded that we receive the report and take up the items that may require action at a later point in the meeting. Is there discussion? Are you ready for the question? (Question) All those in favor say "Aye." The motion is carried.

The next item on the agenda is the report of the Treasurer, Mr. Coury.

MR. COURY: Mr. Chairman, this is the report of the Treasurer for the period ending August 31, 1969.

REPORT OF THE TREASURER

The following figures summarize the financial transactions of the Upper Colorado River Commission for the period July 1, 1969 through August 31, 1969.

Balance on Deposit per bank statement July 1, 1969		$ 19,972.67
Less outstanding checks at July 1, 1969		7,397.00
		$ 12,575.67
Cash received during period:		
Assessments	$ 97,625.00	
Redemption of certificate of deposit - principal + interest	66,625.00	
Sale of surplus property	15.00	
		$164,265.00
		$176,840.67
Less cash disbursements during period:		
For expenses of prior year	$ 500.93	
For operating expenses	11,420.63	
Purchase of Time Certificates of Deposit	123,000.00	
	$134,921.56	
Deduct:		
Cash disbursements charged to operating expenses above but actually paid out prior to July 1, 1969 $409.98		
Amounts withheld from employees for payroll taxes and insurance 330.88		
	$ 740.86	
		$134,180.70
		$ 42,659.97
Add outstanding checks, August 31, 1969		2,528.60
Balance per bank statement, August 31, 1969		$ 45,188.57

The Operating Cash Statement and the Financial Statement prepared in the office of the Executive Director of the Upper Colorado River Commission for the period ending August 31, 1969, have been distributed to the Commissioners, Treasurer, Assistant Treasurer, and the Finance Committee Chairman.

/s/ I. J. COURY
Treasurer

MR. COURY: I might say, too, Mr. Chairman, $45,188.57 is the amount in the checking account and the Commission has a time certificate deposit in the amount of $123,000. I think every Commissioner has been supplied with a copy of this statement.

THE CHAIRMAN: Any comments on the report of the Treasurer?

COM. BLISS: I move it be received and filed.

COM. PERSON: Second.

THE CHAIRMAN: All those in favor? Approved.

Mr. Coury, may we move to the Report of the Auditor.

MR. COURY: Have the Commissioners been given a copy?

MR. GOSLIN: No, that is yours to distribute, not mine.

MR. COURY: This audit was made by McNulty, Chadwick & Steinkirchner of Grand Junction, Colorado, who have prepared the audit for the Commission for a great number of years, and this is the audit that covers the period of the fiscal year ending June 30, 1969.

It has been my custom, Mr. Chairman, whenever I get the audit, to skip everything and see what the comments are and see if there is anything wrong. I noted that the Auditor's comments were practically zero and the audit speaks for itself, unless you want me, Mr. Chairman, to go through this in detail, but I think it is unnecessary unless some member of the Commission would like to ask a question.

(Commissioner John A. Love enters the hearing room.)

THE CHAIRMAN: We will entertain questions in a moment.

It is a pleasure to welcome Governor Love to our meeting today and also to welcome the Governor as a Commissioner.

COM. LOVE: Thank you very much. I am sorry to be late. It just takes a little time to get here from Durango is all.

THE CHAIRMAN: Are there any comments on the Auditors' report?

MR. COURY: I might say, Mr. Chairman, that the assets and liabilities and reserve funds and the inventory of the assets of the Commission are all listed out and itemized.

There is a note on the Pension Trust Fund, where the revenue came from, and the expenses. I might mention this, too, for the benefit of the audience, that the budget for fiscal year June 30, 1969, is $115,000. The actual amount spent was $97,485.03. We under-spent, which is, in my opinion, Mr. Chairman, one of the rare things to find in this day and age, we under-spent it by $17,514. We very seldom see a budget that is under-spent. Most of them are always over-spent. I would like to congratulate the Executive Director for the fine job that he does in operating the money for the Commission.

THE CHAIRMAN: We have a very efficient Executive Director.

Are there any further comments or observations on the Auditor's report?

MR. COURY: I have none, Mr. Chairman.

MR. GOSLIN: Mr. Chairman, I would like to add this comment, that if any member of the Commission, after he has taken this home and examines it, has any questions, if he will write either to the Auditor or to my office or to Mr. Coury, we will be happy to answer the questions, or at least attempt to.

MR. COURY: Of course, you know every Commissioner gets a copy of the Treasurer's report every month. You get them by the quarter, also. This is just really a compilation of what you get. It is just audited on a CPA basis in order to check it out.

THE CHAIRMAN: Thank you, Mr. Coury. Do I hear a motion that the report be accepted?

COM. PERSON: I so move.

COM. WADDINGHAM: Second.

THE CHAIRMAN: All in favor say "Aye." Approved.

The next item on the agenda is the report from Mr. Crandall, Regional Director of Region Number 4.

I understand, Mr. Crandall, you have some slides to show. Would you like the Commission to move into the audience?

MR. CRANDALL: Perhaps they can see the screen from where they are. Governor Love and Larry might want to take another seat.

Members of the Commission, and gentlemen: I have prepared in outline form the basic facts that constitute my report to you. I will comment on the items as we go through and have a few slides to give you a picture of some of the physical settings that are involved. This is printed in bold type, as you will notice, and I hope there is enough light for you to follow it and at the same time to make the pictures worthwhile.

Mr. Ivar, who is from Region 7, is helping me with the projection and we will see how it goes.

For Item I here, we vary between high hopes and despair, as usual, on the water supply. The early part of the season was excellent. We had a very dry period after mid-March, and then we got bailed out by some fine late spring rainstorms, and all in all, in the four years I have been here, this is the best water supply year, we also made average.

The amounts are as you see them here, and the disposition of the water supply, the total for the year adds up to 11,500,000 acre-feet.

Now, at Lake Powell we reached another milestone of getting up to and exceeding slightly the rated head on the power plant.

I will proceed along, maybe we will have to dispense with the illustration portion of this. Why don't we turn it off, Mr. Ivar, and we will go along.

Lake Powell is now dropping and will continue to diminish slightly in elevation until we reach our buildup of runoff again this spring. We have, of course, the continuing requirement to deliver to the Lower Basin the amount of water necessary to meet the 75 million acre-foot commitment in the ten-year period that started when they closed the gates in 1963. We were able to provide 8.9 million acre-feet consistent with our power operations this past year, and we will have to continue for the remainder of this period at about that level.

Flaming Gorge has dropped into an annual operating pattern of filling to the amounts roughly that you see here, and then subsiding in the spring to the minimum -- not the minimum in the reservoir, but the low point you see, then building back up again. We do not contemplate accumulating more storage in Flaming Gorge.

Fontenelle -- I am very pleased to report our troubles are over there. The reservoir is completely restored. We are doing some repairs

in the powerplant and will be operating in the pattern of fill and release seasonally. Because of the relationship of the reservoir capacity to the annual runoff, we will have to bypass water almost every year at Fontenelle.

We have, with all the interests in the Colorado Basin, worked to optimize the non-consumptive uses. We have adopted criteria at Fontenelle to preserve uniformity in the stream flows, to recognize wild life values, and I hope that this will be one place where we can demonstrate some of these very exceptional values of storage on the unregulated streams for the public purposes.

Navajo Reservoir reached an all-time high and we are shooting for the basic criteria worked out with New Mexico and Colorado. We are going up to about 6030, then not coming back below 5990, which gives an adequate recreation pool but doesn't build up an amount of storage, that to do so would impair our head at Lake Powell.

Curecanti Unit. Blue Mesa has reached an all-time high. The reservoir will be operated through this annual cycle of fill and withdrawal to the amounts that are indicated here.

Morrow Point has been filled and spilled. There have been certain tests made there and the rest of that impoundment has been drawn down now to complete some grouting and to do some vibration testing.

Lake Mead, because of the delivery to meet the seventy-five and ten has been receiving more water than released from it each year. So there has been a gradual buildup in the water levels at Lake Mead, and this will continue.

Now, the operating criteria for the Colorado River, I will skip past that. Mr. Goslin gave you a very comprehensive report on that situation, and we, of course, are proceeding as rapidly as we can with the completion of the basic computer studies which will provide the input information to the determination of the criteria.

Status of Construction. This is over on page 5. Region 4 as a whole is at a low construction ebb because of the austere budgetary situation. We are completing the powerplant at Morrow Point. The machinery is now being installed and we expect to have the first unit ready to operate late next spring or early summer, the second unit following after that.

Glen Canyon Unit. We have what are relatively minor construction units going on in the powerplant and in the community at Page.

Bonneville Unit. We are making progress there at a much slower rate than development really warrants, but at Starvation Dam there are some milestones that are being reached. Starvation Dam is about finished, the Water Hollow tunnel is well along.

Bottle Hollow. The two dams that provide the fish and wild life replacement reservoir are well underway.

Bostwick Park. We had a rather severe land-slide in the right abutment since I reported to you last, which required a relocation of the spillway and other remedial work draining the slide area, and so on, which was set back at some additional cost, but the work is proceeding. The contractor likely will not be as far along with the embankment as we had hoped by the end of this working season.

Paonia. The corrective work on the roadway that parallels the reservoir on the right side is finished and there is some minor work being done there. This, incidentally, will eliminate a rather nasty problem of rock slides interfering with the roadway in the winter and the movement of the school children from that area down to Paonia.

Lyman Project is moving along very well. We expect that the dam will not be topped out before weather forces the contractor out, although there is a possibility with a little bit of luck he will make it.

We do have as part of that project the establishment of gaging stations within the water delivery area, and that is getting underway.

The Fryingpan-Arkansas Project. I have included the facts concerning it. This is not in our region but it does concern the Colorado River, of course.

The same with the Navajo Indian Irrigation Project and the San Juan-Chama Project.

This will give you a capsule of where those individual projects stand.

The Transmission Division of the Storage Project, on page 10, is essentially completed. A series of capacitator work being done on the 345 line south and the Midway Substation, has been finished and energized in the summer.

Now, moving on to page 11, the status of our power operations. This is very significant in that this is where the project revenue comes from, and I would make the general observation that the marketing of the storage project is basically committed. We have in the past few months advised all of the people who had allotments that were made initially, that these allotments were being withdrawn unless then contracted for them.

In addition to that, we have placed a deadline for the customers to contract for their '75-'76 requirements, and the applications that we have received in our perspective I think will more than match our capability up through '75-'76. So the marketing and the employment of this important part of the overall project is going along very well.

The accumulated revenue through the 1st of September this year is $71-1/2 million. We are paying for back interest now. We expect to have the back interest paid up by 1970, and then we will begin to retire capital cost.

Our Project Planning Activities. This summary is broken down by our reconnaissance investigations and our basin and feasibility studies. We are cooperating with the State of Colorado in their State water plan, presuming, of course, that FY-70 appropriations include this item.

There is the very important Green River Project study. Reconnaissance investigation being conducted to determine the needs and resources in the Green River Basin in Wyoming is moving into the stages of analysis and compilation. Coordination, of course, with the State in their water plan is an implicit and a very important part of this study.

We have basically finished the reconnaissance on the Paria-San Rafael area, mostly in -- excuse me, our San Juan County Study. It is basically finished and a report should be available soon.

Paria-San Rafael is getting underway.

Basin Surveys. We are continuing, of course, with the Type I Comprehensive Studies.

The Feasibility Investigations. Basalt is generally on schedule. This project, of course, is to make use of water out of Ruedi Reservoir and is one of the participating projects. We recently somewhat enlarged the scope of it to include the M & I water supply for the community of Aspen.

Bluestone Project is well along in its final stages.

Central Utah Project, which is a very broad complex investigation, which relates to the utilization of the remainder of Utah's share of Colorado River water, has been carefully coordinated with the development of the State water plan and the Conservation District has recently voted to contribute $100,000 to expediting this rather important investigation for Utah.

The Uintah Unit is very well along. This is the feasibility study being made to satisfy the requirement of the Colorado River Basin Act, which gave a conditional authorization to this study but required a feasibility report from the Secretary.

Grand Mesa Project is well along. We are in the estimating and analysis stage.

Lower Yampa is getting underway. We have contributions from the State to initiate this study, and they have been received and contracted for and we are moving into this very extensive investigation.

Yellow Jacket. The report has been finished and we are working with state and local interests in the resolution of a problem relating to the use of lands for mitigation of the impact on big game values.

We have the special study in Colorado for salinity amelioration, or determining ways and means of reducing the salt contribution to the river to make way for new development; this in cooperation with FWPCA is in its final stages of compilation and review and should be available for you in the not too near distant future.

We are embarking on a rather intriguing study of impacts on salinity from the application of irrigation water in the Vernal area. I think this will provide a very needed and basic data, considering this overall salinity problem in the Colorado Basin and elsewhere.

Advance planning is finished on the Jensen Unit and the Upalco Unit and the Fruitland Mesa. On the Fruitland Mesa the repayment contract has been executed, and we are continuing preconstruction activities and are prepared, as soon as funds become available, to begin construction there.

Savery-Pot Hook. We are into the more final stages of that definite plan investigation and should have a report about a year from now.

The Five Western Colorado Projects. We are anticipating that these will move into the advance planning stage sometime, hopefully in the not too distant future when funds become available.

On page 17 are the items of general interest and water service contracts, which is that part of our business that concerns the disposition of water from the storage project reservoirs. Utah Mining and Construction Company has been negotiating with us for some time for a short-term contract for the use of water out of the San Juan River that occurs in the form of accretions below. This contract does not increase the amount of consumption that was provided for under their basic Congressionally approved contract, but it does allow them to fill in the gaps in times of shortage. Actually, it allows us to deliver water out of the stream and thus maximize the use of the reservoir to store water.

Emery County. This is a rather interesting, perhaps, sign of the times. The Utah Power and Light Company is very actively working to define a water supply out of that project area, which was basically set up for thermal power development.

The Kaiparowits service contract. I think, as has been publicly announced, its terms are pretty well agreed to and the execution of the contract shouldn't be too far away. This is between Southern California Edison, Arizona Public Service Company, and San Diego Gas and Electric Company, as a joint effort, for 102,000 acre-feet out of Lake Powell in Utah.

I have a statement here concerning the status of the Navajo Plant, which is a thermal-electric joint venture development in which the United States is a participant, that would provide the power supply for the Central Arizona Project. This possibility was anticipated in Public Law 90-537, and I will read through this for you since the statement in itself is in the nature of a summary.

Public Law 90-537 provides the authority for the Secretary to enter into agreements with non-federal interests to acquire, for the CAP, the rights to a portion of thermal plants constructed by the non-federal interests. The plan which the Secretary has developed involves federal participation in a thermal-electric plant being planned by various southwest utility companies. The plant will be located on Navajo Indian Reservation near Page, Arizona, and will consist of three 770-megawatt units. Coal will be obtained from the reservation about 80 miles southeast of Page under lease from Navajo and Hopi tribes. Transportation will be required to move the coal from mine to plant site.

Water would be provided from Lake Powell under the January 17, 1969, contract between the Secretary and Salt River Project. The Navajo tribe has adopted two resolutions which give priority against their future uses of Arizona's 50,000 acre-foot upper basin entitlement for 34,100 acre-feet for the plant and 3,000 acre-feet for Glen Canyon Unit. Prospective rights are not relinquished and transfer of about 750 acres of project land is involved. Air pollution equipment would be installed with a design standard of 99.5 percent removal and a 97 percent performance limit. Ash would be disposed of either by the participants or Peabody Coal Company in a disposal site near the plant.

Some of the documents which are being negotiated prior to plant construction are as follows:

1. Principles of Participation: A document to be signed by all parties including the United States which commits all the parties to proceed with construction of Navajo Powerplant.

2. Coal Supply Agreement: A contract between participants (excluding United States who will be represented in this contract by Salt River Project) and Peabody Coal Company for a coal supply for plant throughout its lifetime.

3. Memorandum of Agreement between participants (excluding United States) and Peabody which provides for execution of coal supply agreement as soon as certain precedent conditions are met or waived. This would probably precede the coal supply agreement since some of the conditions included in Coal Supply Agreement may require some time to complete. This document also provides for formation of a transportation company to deliver coal about 80 miles from mine to plant site.

4. Water Service Contract. A contract for water service from Lake Powell for cooling water for plant between United States and Salt River Project. This contract has been executed. Salt River will assign its interest to participants (of which the United States is one.)

5. Navajo Plant Indenture of Lease: This is lease with tribe covering the Navajo Plant site and associated transmission facilities. It was signed by Navajo tribal representatives 9/29/69. Departmental approval pending.

6. Section 323 Grant: This has been approved by Navajos and will be approved by Secretary as soon as or with the understanding that final surveys are acceptable.

7. Power Coordination Contract: This agreement is a precedent condition to taking water under the water contract and provides for the coordination between the United States and participants.

8. Principles of Interconnected Operation: This document is basically an operating agreement covering requirements of all parties to maintain proper amounts of reserve capacity and capacity for unforeseen future load growth. Special provisions are made for purchase and sale of emergency energy.

9. Memorandum Transmission Agreement -- Moenkopi: This document will also be signed by all participants and Southern California Edison Company. Southern California is a party to Four Corners Project which will connect with the Navajo Project Transmission system at Moenkopi near Tuba City, Arizona. The two sources of power will, therefore, become commingled and all systems essentially will be operating a common high-voltage transmission system.

10. Interim Use of United States Entitlement in Navajo Project-- (Layoff Contracts): During period from time the Navajo Plant is operative until the Central Arizona Project requires power, the Bureau must dispose of its share of power. The amounts of power to be sold and purchases are as follows: -- and you see those numbers there, I will not repeat them.

The documents that I have outlined here are in the final stages of negotiation by the Steering Committee consisting of representatives of Arizona Public Service Company, Salt River Project, City of Los Angeles, Nevada Power Company, Tucson Gas & Electric, and Department of the Interior. When finalized, they will be forwarded to Washington for final approval.

Mr. Chairman, that constitutes my report.

THE CHAIRMAN: Thank you.

MR. COURY: May I ask the gentleman a question?

MR. CRANDALL: Yes, sir.

MR. COURY: Under the contract signed the 29th of September, 1969, the Navajos retain their rights under the Winters Doctrine?

MR. CRANDALL: This is the one that was signed, yes, sir, day before yesterday. I haven't seen that document and I can't answer your

question specifically, but my impression is, this dealt with the land matters, the lease and use of the lands and did not relate to water service or the water interests of the tribe. But when we get that, I have every intention of getting copies of these documents to Ival for distribution to the Commission members.

COM. LOVE: Let me make sure -- I would like to come back to that water service contract, but first on a broader basis I want to make sure I understand. You mentioned, of course, the 75 million feet over a ten-year period, but what have we delivered to the Lower Basin over the past ten years?

MR. CRANDALL: I would guess something around 26 million.

MR. L. E. HOLMES: You mean the ten years including this particular year?

COM. LOVE: Yes.

MR. CRANDALL: Excuse me, we have 26 remaining out of the 75. I misunderstood.

COM. LOVE: My point being, when you report out of the 11.5 million acre-feet the delivery of 8.9, the 8.9 is not necessary to satisfy our obligation under the Compact, is it?

MR. CRANDALL: Not as an annual amount, but as an accumulated amount over this ten-year period we have to deliver 8.8 for the four-year period, including this year, to make the total equal 75.

COM. LOVE: This was the question I was asking; that is, we are above the 75 million, or we are not above?

MR. CRANDALL: No, in a sense, we have to rush to make it.

MR. GOSLIN: As of this time, this moment, we have delivered 75 million acre-feet.

COM. LOVE: That is what I want to know, just 75 million on the nose?

MR. GOSLIN: No, it is in excess, but here is the problem, Governor, that Dave was trying to bring out. In the next three years, between now and 1972, we have to deliver about 8.8 million acre-feet per year in order to have the ten years, including 1972, show 75 million acre-feet in ten years.

COM. LOVE: I see. There were the low production years that we are going to have to look ahead and catch up.

MR. CRANDALL: But this year and every year up to that, we will be well over.

MR. SPARKS: On the initial figure it was less than 4 million feet released. We got way behind.

COM. LOVE: The other question I wanted to ask, I assume, if I understand, the water service contract is the contract on the powerplant at Page to provide water for cooling and for other purposes.

MR. CRANDALL: Yes, sir.

COM. LOVE: Does it specify the amount?

MR. CRANDALL: Yes, sir. It is limited to a consumption of 34,100 acre-feet.

COM. LOVE: There has been concern expressed in the past, in any event, that this, indeed, would not be sufficient to do the job. Are you satisfied that that will, indeed, take care of the powerplant needs?

MR. CRANDALL: Yes. This question was thoroughly considered by the plant participants and they had two studies made, which went into this from a technical viewpoint very thoroughly, and they did satisfy themselves that the 34,100 would be adequate to operate the plant with three, at that time, 800 megawatt units. But they have since reduced the capacity to 770. So there is a little more leeway.

COM. LOVE: It is my understanding that Arizona is entitled to 50,000 acre-feet of Upper Basin water.

MR. CRANDALL: Yes, sir, that is correct.

COM. LOVE: Is it true, too, that there is documentation which does assign Arizona entitlement in the Upper Basin water to this purpose to the extent necessary?

MR. CRANDALL: The contract with the Secretary identifies 34,100 acre-feet. There are two resolutions which have been executed by the Navajo people, and all of this Upper Basin portion of Arizona is within

the reservation, with minor exceptions, down around the Paria River, which said that the Indians will limit their future uses of this 50,000 feet to the degree they have entitlement of this 50,000, so that the 34,100 will be there for the powerplant and so there will be 3,000 acre-feet for the community of Page and its associated recreational development.

COM. LOVE: State that again. The Indians have agreed to relinquish their right in this regard to this extent, it that right?

MR. CRANDALL: Right, to the 50,000. But they also have said that this is not to constitute a relinquishment of their prospective rights.

COM. PERSON: What does this mean, Dave? I am completely confused on this. The Indian use today, just the 34,100 acre-feet, will use all of the 50,000?

MR. CRANDALL: The Indian use plus Page, so on. That adds up to 50,000. But there is the question of whether, under the Winters Doctrine or other prospective rights that the Indians might acquire, that they would not want this resolution to act as a relinquishment against that opportunity.

COM. PERSON: Didn't the State of Arizona, in the Upper River Compact, agree to provide the Indians under the 50,000 granted?

MR. CRANDALL: I would guess that was the intention. I am not an expert on this, as you know. But all of the Upper Basin portion of Arizona is in the Reservation, so you can conclude from that fact that this was intended to be an Indian water supply.

COM. PERSON: I am a little puzzled; that is, the Indians, the Navajo Tribe, have not agreed to limit their use, so the total use will be 50,000. In fact, I think they have done just the opposite, haven't they?

MR. CRANDALL: They have said so far as their uses of the 50,000 are concerned, they will stay within it.

COM. PERSON: They will stay within the 50,000.

MR. CRANDALL: Yes.

COM. PERSON: Then there wouldn't be any water for the powerplant, would there?

MR. CRANDALL: No. They will limit their uses of the 50,000 so the powerplant and the community of Page will have a supply. But they have not gone beyond and said that they, in a sense, forego any opportunities to work out the water that is different than the 50,000 acre-feet.

MR. GOSLIN: As a matter of fact, they made it very plain that they intend to assert this Winters Doctrine rights in the future. So that there is a distinct possibility of having the 50,000 acre-feet used by the steam plant, by the City of Page, by Indian uses on the reservation, and having uses over and above the 50,000 by the Indians up to an unlimited extent if they assert their Winters right.

MR. CRANDALL: To the extent they would be successful in asserting such a claim, but they don't limit themselves on this assertion.

MR. COURY: The point I am trying to bring out --

(Off the record.)

COM. PERSON: Why don't we build a powerplant some place where there is water that can be used without violating the Compact, Dave? You can build a powerplant in Wyoming. We will give you water and you won't violate the Compact.

MR. CRANDALL: The water service contract with Salt River requires that it be in conformance with the terms of the Compact and the various rules and laws that apply.

COM. PERSON: I can't agree with this 34,100 in view of the Navajo resolution and the Navajo statements, and they are clear, that they are going to use whatever water they need, even if it is in violation of the Compact; this contract is a violation of the Compact.

MR. CRANDALL: Would it not seem that when uses got to 50,000, that they would have to take what action is necessary to perfect a claim for the use of more than that? We have always had that threat and that possibility, and this doesn't change it.

COM. PERSON: Shouldn't there be a provision in this contract that the use in Arizona will never be more than 50,000 acre-feet in accordance with the Compact?

COM. LOVE: I think you would have to go beyond that and say if it does exceed that, it can be charged against the amount that the Upper Basin is required to deliver.

MR. COURY: The point I am trying to bring out, the State of New Mexico, when they authorized the Navajo Indian Irrigation Project, demanded of the tribe that they relinquish any rights under the Winters Doctrine, which they did. They cannot exceed it. They cannot ask for any more water. In the State of Arizona it is the reverse. They have not relinquished their rights under the Winters Doctrine. So the State of Arizona agrees she will limit herself to 50,000 acre-feet, but the Navajo tribe have not said that. That is the point I am trying to get across.

COM. PERSON: By Compact, hasn't the State of Arizona already said they will limit the use in Arizona to 50,000 acre-feet? So if the Indians use 40,000, you have 10,000 acre-feet for a powerplant and that won't be a very good powerplant.

MR. CRANDALL: Then the burden goes to the State to keep the uses within 50,000 acre-feet.

COM. PERSON: I think it does according to the Compact.

COM. BLISS: Mr. Chairman, may I ask a couple of questions? One, as I understand what the Indians have done, they have agreed, in effect, that for the time being, and possibly for the life of the powerplant, that they can assure the powerplant the 34,000 that will serve its needs but that they do not give up their right, at some future time possibly, to exercise the Winters Doctrine?

MR. CRANDALL: Yes.

COM. BLISS: In that event, then, if something occurs in the construction, chiefly, which, added to the uses of the water plant in the Paria area, would exceed 50,000, would the Bureau be willing to cut down on the uses at the powerplant so that Arizona would not exceed their 50,000 acre-feet allotment? Something's got to give.

MR. CRANDALL: Yes, it surely has. I'm not trying to be evasive here at all. That is a very profound question. It goes right to the heart of the whole problem. But if they would be able to develop this kind of construction, would there not have to be a clarification of their entitlement to the use beyond 50,000, and that being the case, then the total would be over 50,000 and the administration of the Compact would take effect and the State would have to follow whatever they determine to be a proper order of curtailment, come down to meet it. I think the administration of the Compact is something that rests with this Commission, in compliance with its terms, and the Secretary surely would be responsive to that administration.

MR. COURY: Let me call your attention --

MR. CRANDALL: Whether it would be the steam plant or what would have to give would be a matter to be worked out within the State's use of that water to comply with the Compact.

THE CHAIRMAN: Mr. Crandall, it seems to me that in this instance, if the United States has ratified this Compact, the United States is bound to respect and honor the Compact and the Secretary of the Interior, in carrying out his administration, is bound also.

MR. CRANDALL: Right.

COM. PERSON: This is a precarious investment, I am going to tell you, in view of the Indian and the Navajo Tribe's stand, and I suggest we build a powerplant some place else to have a safe investment.

MR. COURY: I just want to call his attention to the five signatory States to the Upper Basin Compact agreeing that they would take responsibility for any uses the Indians have within their allocation.

MR. CRANDALL: Right.

MR. COURY: That is the reason the State of New Mexico insisted that the tribe waive any rights under the Winters Doctrine before the authorization of the Navajo Indian Irrigation Project, so that they can never come back to the State of New Mexico and say, "We need more water." We foreclosed that door. That is what we are asking, why don't they do the same thing to Arizona?

MR. BILLHYMER: Mr. Chairman, may I add a caveat to Mr. Coury's remarks? He ought to read the recent brief that the Navajo lawyers are putting out now. They intend to abdicate on that agreement with New Mexico, too. The effect of it will be they will get all the water of the San Juan anyway, so they won't have to abide by their New Mexico agreement.

MR. COURY: I have to answer you that way, that they will still have to fight the Congress of the United States, because they authorized the project under those premises.

MR. BILLHYMER: They recognize that in the brief.

MR. GOSLIN: They will have to go to the Supreme Court, won't they Paul?

MR. BILLHYMER: I am not sure they will go to the Court, but they are advocating a quiet title action to establish their rights on the Colorado and its tributaries.

COM. LOVE: Mr. Chairman, if I understand this thing right, I think it should be made abundantly clear to the Department, to the State of Arizona, and to anybody else a party in interest, that our obligation in the Upper Basin is to deliver the 75 million, and that, of course, was based on an erroneous estimate of what the river produces, actually, and we are on the short end to begin with. I don't see that it should concern us, if I understand it, that it should be our business so long as anything in excess, whether it is Indian or Arizona or powerplant or whatever, in excess of the 50,000 that is the entitlement of Arizona under the Upper Basin allotment, anything above that must be credited against our obligation to deliver the 75 million acre-feet.

MR. CRANDALL: Incidentally, this was an avenue that Mr. Goslin suggested might be pursued to solve this problem.

MR. GOSLIN: This is one suggestion that we made last winter, but it was never consummated.

COM. PERSON: Isn't that a means of starting eroding this Compact? Just because Arizona agrees to limit themselves to 50,000, and I think this is important, I think it is important that the Bureau of Reclamation, the Department of the Interior, realize this and they should limit themselves. Now, if the Indians try to go over the 50,000, of course that will have to be settled at that time, but if they use more than the seventeen or sixteen thousand that you say they are using at the present time, then the powerplant has to cut down, and I think this should be abundantly clear in the contract.

MR. CRANDALL: The Indians have agreed to limit themselves so the powerplant will have 34,000 acre-feet.

MR. GOSLIN: Of the 50,000.

MR. CRANDALL: Of the 50,000.

MR. GOSLIN: Not of the total; of the 50,000.

COM. PERSON: That isn't the way I read their resolution, Dave.

MR. CRANDALL: That was the very clear intention of the fifty, the Indians will limit their uses so thirty-four one will be there for the

plant, but at the same time they did not go the next step and say that they would not assert prospective claims under future circumstances.

COM. BLISS: Mr. Chairman.

THE CHAIRMAN: Mr. Bliss.

COM. BLISS: Following the Governor's statement, it seems to me this would be a violation of the Compact if, in effect, if I understand the Governor's statement, we allowed Arizona to run over their 50,000 Compact allowable and simply charge the overrun to the Lower Basin. I believe that was your statement.

COM. LOVE: Yes. I think that probably would be a technical violation, but at the same time it is my belief that, practically, once that water is in Lake Powell, we are not going to use it in Colorado or New Mexico or anywhere, and the thing that makes the difference to us is the amount we have to deliver on a ten-year running basis.

MR. GOSLIN: Mr. Chairman.

THE CHAIRMAN: Mr. Goslin.

MR. GOSLIN: The suggestion that Governor Love made about crediting us against our delivery at Lee Ferry is the suggestion that you will recall I made about a year ago, and I am like the Governor, it looks as if it might be a practical solution to it, but when we tried to implement it, we ran into the fact we had to amend the Upper Colorado River Basin Compact and perhaps the Colorado River Compact in order to make it workable. So what "Prof" says is true there, this would involve a violation of the Compact, certainly until we had some other agreement or means of implementing.

COM. LOVE: Larry suggests there may be legal concepts, or whatever, that in terms of constructive delivery would perhaps allow it.

MR. BILLHYMER: I think you would not get California to accept constructive delivery.

COM. BLISS: To go to another subject here, an inquiry of Mr. Crandall, in speaking of the powerplant, at the top of page 18, "Air pollution equipment would be installed with a design standard of 99.5 percent removal and 97 percent performance limit"; would you explain how this works?

MR. CRANDALL: The equipment would be designed -- that would be the way it was built and designed to operate, but it is recognized that they have mechanical failures and maintenance and other things come along. So if you take the total performance over a period of time, like a year, that you don't one hundred percent achieve your design standard. But there should be an absolute floor on performance, and that's the thought that this is intended to convey.

MR. COURY: I wish you would come down and testify before the Air Pollution Committee of the State of New Mexico because they have got it 99.5, period.

MR. CRANDALL: Have they? That's the upper limit of practicability, I understand, I. J.

COM. LOVE: How do you explain that plant outside of Farmington?

MR. GOSLIN: Good question.

MR. COURY: Governor, at the Constitutional Convention I am known as "the fly-ash delegate."

THE CHAIRMAN: Any further questions?

MR. SPARKS: I might observe, obviously we are going to have trouble with the noble Red Skin, but aside from that, the State of Colorado is conducting a trip to Glen Canyon in about two weeks now and some of our legislators object to those water stains on the canyon wall and we would therefore appreciate it if you would slow down your releases of water for the next two weeks.

MR. GOSLIN: Somebody should take a paint brush down there and obliterate them.

MR. CRANDALL: Well, we have the man that operates the reservoir right here and I am sure he is taking it all in.

THE CHAIRMAN: Thank you very much, Mr. Crandall.

MR. CRANDALL: Thank you, gentlemen.

COM. LOVE: I don't know whether this is the proper gentleman to answer, but I am not up to date on the current status of the appropriation.

THE CHAIRMAN: I think Mr. Goslin has some current information.

MR. GOSLIN: This is covered in the first part of my report, Governor. It was given before you arrived, of course.

COM. LOVE: I am sorry.

MR. GOSLIN: First, the bill that covers the Navajo Indian Projects has been passed by both the House and the Senate. There are some big differences between the House and the Senate Bills, so they have had to appoint conferees. Each side is insisting on its amendments, and, incidentally, in this bill there is one increase that I know about and in which we are interested. That is for the Navajo Indian Irrigation Project. They did insert some extra money, I have forgotten the exact amount. I think it is about two million dollars.

The Public Works Appropriation Bill is the one in which we are primarily interested because it has all the Reclamation projects and flood control projects. It is in a real state of flux back there. President Nixon, as you know, ordered this 75 percent cutback, and consequently, because the Congressional Committees have not been sufficiently informed about how this cutback shall be applied to the new construction, they are sitting there awaiting instructions from the Bureau of Budget. They haven't even marked the bill up in the Subcommittee. It will be one of the last bills marked up in the session of Congress, I presume, as it usually is.

COM. LOVE: I believe the order of the President went out on September 4, and subsequent to that the Bureau of the Budget sent communications to the various operating agencies, the Corps of Engineers, the Bureau, HEW, and everybody engaged, and asked them within the limits of that 75 percent-25 percent, to identify the projects which should go ahead and those which should not, and I don't believe the answers on that have come back or will for perhaps another week or so.

MR. GOSLIN: I think this is correct. Incidentally, there is a copy of the Bureau of the Budget's Bulletin No. 70-5 here, that is, a resume' of it, that gives instructions to these various departments. You may be interested in that, especially here in Colorado.

MR. CRANDALL: There is one statement I can give. In answer to the Governor's question there, I have the amounts by each of the years that we have delivered at Lee Ferry.

MR. GOSLIN: Do you want to include that in the record, Mr. Crandall, so it will be available to everybody, and we will send the Governor a special copy of it.

MR. CRANDALL: Right. In 1968 the accumulated total was 77 million acre-feet. These are round numbers. In 1969, 79 million, and then delivering our projected eighty-eight, in 1970 it will be about seventy-nine, in '71 about eighty-one, then '72, the critical year, will be seventy-five. That is the way the numbers add up.

MR. FLINT: I thought it might be helpful, in view of Mr. Billhymer's reference to that legal brief, to point out that it was a brief prepared by an O.E.O.-sponsored group of lawyers on the Reservation who travel under the name of DNA. So it shouldn't be made to appear that the Tribal Council itself has officially taken this position. As a matter of fact, there is quite a bit of legal conflict between the Tribal attorney, official Tribal attorney, and this DNA.

THE CHAIRMAN: Thank you.

MR. GOSLIN: Off the record for just a moment.

(Discussion off the record.)

THE CHAIRMAN: We will recess at this point and reconvene at 1:15.

(At 11:45 a.m. the meeting was recessed until 1:15 p.m.)

AFTERNOON SESSION 1:15 p.m.

THE CHAIRMAN: The meeting will reconvene.

The next item is the Report of the Committees. Chairman Goslin, do you have a report for the Engineering Committee?

MR. GOSLIN: Yes, sir. There are copies of it on yellow paper in each Commissioner's packet and copies are available for others who want them.

Mr. Chairman, the report of the Engineering Committee dated October 1, 1969, is as follows:

Report of Engineering Committee
Upper Colorado River Commission
October 1, 1969

The Commission's engineering committee has met twice since our last Commission meeting.

Pursuant to instructions of the Commission the committee met in Denver on March 12, 1969 to define the parameters for a study by a consulting firm of the consumptive use of water by a large powerplant such as that proposed to be constructed at Page, Arizona, to investigate the cost of such a study, and to report its findings to the Commission with recommendations.

Persons present at the meeting were:

Dan Lawrence	Utah
Burt Page	Utah
David Hale	New Mexico
Larry Morrill	Colorado
Floyd Bishop	Wyoming
Cecil B. Jacobson	Upper Colorado River Commission
Ival V. Goslin	Upper Colorado River Commission

The Engineering Committee concluded: (1) the question of use of water by such a powerplant warranted close scrutiny because Arizona may be reaching the limits of that State's upper basin apportionment of water; (2) attempts should be made to secure all of the information obtainable; (3) that to outline parameters for such a study would be impossible without having the design of the powerplant; and (4) that the making of such a study by consultants should not be recommended at this time.

The committee also discussed the desirability of making an analysis of a future projected level of water resource development for the Type I comprehensive study of the Upper Colorado region as an alternate to the study being made based upon projections of economic growth forecast by the Department of Commerce and the Department of Agriculture. It was the consensus of the committee that in order to reflect a more rapid and rational rate of development for the Upper Colorado region the representatives of the States involved in the Type I study should decide on such a "regional choice" alternative analysis.

At the request of its chairman, the Engineering Committee convened again on July 31, 1969 at the Commission office in Salt Lake City, Utah.

The following were present:

S. E. Reynolds	New Mexico
David Hale	New Mexico
Carl Slingerland	New Mexico
Barry Saunders	Utah
Larry Morrill	Colorado
H. T. Person	Wyoming
Floyd Bishop	Wyoming
Cecil B. Jacobson	Upper Colorado River Commission
Ival V. Goslin	Upper Colorado River Commission

The following paragraphs briefly describe the problems discussed and their disposition:

1. A proposal had been received from the Chief Engineer of the Colorado River Board of California that the seven States of the Colorado River Basin should join in hiring consultants to monitor the Bureau of Reclamation's Project Skywater which is a Colorado River pilot project concerned with precipitation management, commonly referred to as weather modification. After a detailed examination of the proposal and supporting materials the Engineering Committee decided that it would recommend against the Commission's participation in such monitoring activities.

2. Various proposals for a "regional choice" alternative plan for the Type I Study of the Upper Colorado Region were again discussed. It was the consensus of the committee that a study involving three levels of ultimate water resource development at an upper basin consumptive use of 7.5 million acre-feet of water, 6.3 maf, and some level greater than 7.5 maf should be considered. It was agreed that the States would submit the necessary information for such a study.

3. The Pacific Southwest Inter-Agency Committee had requested information for the Pacific Southwest Region Type I studies on possibilities for desalting water in the Upper Colorado Region. The consensus of the Engineering Committee was that except for small isolated desalting plants for specific purposes such as for industries or improving the water supply for small municipalities there is little opportunity for desalination of water in the Upper Division States under present technology and economics.

4. A preliminary discussion was held on the long-range operating criteria required under section 602 of P.L. 90-537. A detailed study made by Chief Engineer Jacobson showing the relationship of payments from the Upper Colorado River Basin Fund for diminutions in power generation at Hoover Dam powerplants, attributed to the filling of Storage Project reservoirs, to reservoir operating criteria was examined and discussed. It was the opinion of the committee that diligent attention should be given by the Commission, its staff, and member States to the matter of long-range reservoir operating criteria, and that the Upper Division States should adopt a firm and united position with reference to the criteria.

COM. PERSON: The last sentence, Ival, "It was the opinion of the committee that diligent attention should be given by the Commission, its staff, and member States to the matter of long-range reservoir operating criteria, and that the Upper Division States should adopt a firm and united position with reference to the criteria," what do you mean by that "and member States to the matter of long-range reservoir operating criteria"?

MR. GOSLIN: Well, I thought the statement was self-explanatory, but certainly I think we should adopt a firm position and we should pursue it in the interests of the Upper Basin, by seeing that Section 602 of Public Law 90-537 is interpreted to do the things that we expected it to do when that piece of legislation was insisted upon by the Upper Division States.

COM. PERSON: On page six of your report this morning, the second paragraph, "We were told that the matter of terminating the 'deficiency' payments is beyond the assignment of the Task Force and that this was not the proper forum for considering this problem" What is the proper forum?

MR. GOSLIN: Well, I think that inasmuch as the Task Force is involved in the formulating of new long-range operating criteria, that that is the proper forum because the deficiency payments are tied directly to the filling criteria that are supposed to be superseded by the long-range operating criteria. I would propose that we take this back to the Task Force in rather firm tones and say it is going to be considered. If the Task Force continues to say that it cannot consider that item, then I say let's take it directly to the Secretary of Interior's office in Washington.

COM. PERSON: Are there other items in this operating criteria as important as this one, or probably more important?

MR. GOSLIN: Well, there are several other matters in there. The relative importance of each matter is difficult to weigh, but another matter that is being discussed at the present time that I could mention is this idea that the Lower Basin has of introducing into the studies probabilities, and thereby eroding away the rule curve under which the reservoirs would be operated. That's an important item, certainly.

COM. PERSON: I happen to agree with you, Ival, very much, but I don't know what we should do now. That is what I am trying to find out. Certainly I think the Commission should take a firm stand on this deficiency payment. I think it is high time these stopped.

MR. GOSLIN: Of course, what I was seeking to do here, Prof, was to get an expression from the Commission. I think we should have

some instructions from the Commission or perhaps they don't want to give us any specific instructions. The Commissioners could say, "Pursue this thing to the bitter end and see what you can get out of it."

COM. BLISS: Mr. Chairman.

THE CHAIRMAN: Yes, Mr. Bliss.

COM. BLISS: I would like to hear the arguments as to why, or what the reason is that this is not a function of the Committee in determining permanent operating procedure, why the termination of these deficiency power productions is not part of the function of this group.

MR. GOSLIN: Well, perhaps it goes back to the fact that in the Committee reports there were statements put in there at the insistence of the Lower Basin and with which, of course, we certainly did not and could not agree, that the deficiency payments could be continued in spite of adopting some long-range operating criteria.

COM. BLISS: Try that again. I missed it.

MR. GOSLIN: In the reports on the bill, both the House and Senate Reports, as I recall it, there were statements put in at the insistence of the Lower Basin that the deficiency payments could be continued even under long-range operating criteria. I am not sure that the wording is "could" or "might be" expected to continue, but it is something of that nature.

Steve, maybe you can clarify it.

MR. REYNOLDS: I think the wording was, it was contemplated that the filling criteria would be continued. I don't think it had a specific reference to the term "deficiency" and the word was "contemplated," which clearly does not require that those filling criteria be continued.

Mr. Chairman, further, Mr. Bliss expressed an interest in the arguments as to why this was not a proper subject for the operating criteria committee. When he is interested in the other half of the argument, I will volunteer.

THE CHAIRMAN: Thank you, Mr. Reynolds.

COM. LOVE: Is there anyone who wants to make the argument on the other side?

MR. GOSLIN: There better not be anybody in this crowd.

MR. RITER: I am Chairman of that Task Force. As I construe my job, it is a technical job or not administrative or policy job. In the opening statement in Denver on July 25, Assistant Secretary Smith made the statement that "We assume that the filling criteria will continue to be in operation until they terminate by their own terms."

So, as I view my charge as a member of a technical committee, I am not to get involved in policy problems. That's the reason I say you are in the wrong forum. As a technician, if you will give me some studies, I will be glad to work out and develop the facts for you as a technician, but on the policy you'll have to go to somebody else besides me. I am not a policymaker.

COM. BLISS: Mr. Chairman.

THE CHAIRMAN: Yes.

COM. BLISS: Would Randy object to being overriden by the Commission?

MR. RITER: The Commission can make any recommendations they want. Assistant Secretary Smith invited all the States to come in with what you want us to study.

COM. BLISS: Seriously, I think the Commission should take some action on this matter. Before we adjourn I suggest that maybe we should recess for a short while and draft a resolution regarding this. I feel it is highly important for the Commission to take a stand on this, a firm stand in favor of eliminating the deficiency payments as soon as the long-range operating criteria go into effect.

THE CHAIRMAN: Thank you, Mr. Bliss.

COM. PERSON: I have a question. Has the Engineering Committee been following these operating criteria closely?

MR. GOSLIN: Well, I think it probably has, as individuals.

COM. PERSON: I wish the Engineering Committee had come in here with some recommendations to us. This is what I am feeling for, and I think this is why John says we ought to have a short recess.

COM. BLISS: Mr. Chairman, I may suggest that the Secretary stated rather strongly in his report, although that does not appear in the Engineering Committee Report, I think the call for some action in this connection is indicated.

I would move, Mr. Chairman, that at the proper time - now, if not later - that we recess for a short time and draft a resolution in this regard.

COM. PERSON: I second the motion.

THE CHAIRMAN: It has been moved and seconded that we recess for a discussion and drafting of a resolution on this matter of deficiencies. Any discussion?

COM. BLISS: And return in not later than 15 minutes.

THE CHAIRMAN: Let's not put on a time limit.

MR. GOSLIN: Mr. Chairman, I would suggest, also, that you may wish to express yourselves with reference to the long-range reservoir operating criteria at the same time and as a whole.

COM. BLISS: Well, I would certainly have no objection to amending the motion to that extent.

MR. GOSLIN: Also, Mr. Chairman, if you would like, I will read into the record the language in the report that Mr. Reynolds and I were discussing so that you all know what it actually says:

> "To the extent that it is possible to foresee, reservoir operations under Section 602 will not be inconsistent with reservoir operations permitted under the Glen Canyon filling criteria, promulgated by the Secretary of the Interior and printed in the Federal Register on July 19, 1962 (27 F.R. 6851). Thus, it is expected that the criteria established pursuant to this section will permit the filling criteria to be continued until terminated at some later date.
>
> "No change in the manner of determining deficiencies in Hoover Dam during the remainder of the filling period is anticipated, but the matter of payments for such deficiencies will be governed by Section 502 of this Act."

Maybe you'd like to know something about what the effect of continuing these deficiencies might be on the Upper Colorado River Basin Fund as well as what it has been. I think Mr. Jacobson is rather well prepared to discuss that point if you would like to have it discussed.

COM. BLISS: I would like to hear from him.

MR. RITER: Do you have some written material for us peons?

MR. JACOBSON: To date, as of May 31, 1969, the total effect of deficiency charges on the Upper Colorado River Basin Fund, totals $44,136,418, based on an application of an energy rate of three mills to the energy which had been delivered direct from Glen Canyon powerplant into the Lower Basin System. And the expenditures, actual dollar expenditures from the Fund, both for deficiency energy and impairment energy and impairment capacity, the amount of dollars expended directly from the Fund to purchase energy and capacity to make these replacements, totaled $7,700,156. This is the amount that will be replaced under the procedure of the new bill from the $500,000 per year into the Fund from the Colorado River Development Fund, which is rather insignificant compared with the amount of energy that has been supplied direct, totaling over $18,901,000, and the interest effect in the account of over $25,234,000.

As an added note, had the same rate been applied to this energy which was supplied and fitted into the Lower Basin pool, as that which was sold by the Upper Colorado River Project on the open market, this effect would be over double the 44 million, or approximately $80 million. In other words, this energy valued at three mills, in the Bureau's calculation, its companion energy sold at around six mills, which is also approximately the rate that is used in the repayment studies of the Bureau.

So the effect, actually, would be - on the account - would be in closer to $80 million to date. Now, should this continue at the same rate over the period between now and 1987, when the criteria would automatically cease, the effect on the Upper Basin Fund could be as much as $200 million.

COM. BLISS: No one knows, of course, what the hydrology is going to be, as far as that goes.

MR. JACOBSON: The hydrology has very little to do with it. Actually, it is a misconception to attach the deficiency charges to

the filling process at Glen Canyon, because the amounts of the charges are determined on the difference between contracted firm energy in Hoover Dam and that which was actually delivered. In other words, it is based largely on how much water do you release from Hoover Dam to fulfill downstream consumptive uses, and the balance, which is not generated, is charged to the Upper Basin as deficiencies. So if you increase the deliveries at Hoover Dam, the deficiencies would automatically decrease regardless of how much water you stored at Glen Canyon.

COM. BLISS: I was thinking of the ultimate possibility of filling. Maybe this is beyond the realm of possibility in the immediate future.

MR. JACOBSON: Under the new criteria it is impossible to fill Glen Canyon Dam, because the criteria are based on an equation of the system, Hoover and Glen, and release of water from Glen Canyon as soon as you get equated storage or anything above Hoover's active storage. Also, the criteria require advance releases out of Glen Canyon to prevent spills. So it is impossible to negate the criteria under that one particular phase or aid under which the Secretary can cancel them.

COM. BLISS: I understand that.

THE CHAIRMAN: Mr. Reynolds.

MR. REYNOLDS: Mr. Chairman, Ival's report this morning mentioned one or more of the incompatibilities that Jake is now talking about between the filling criteria and long-term operating criteria. There is one thing I think may have escaped our attention until this point. I would read just briefly to you from the Act. This is Section 602, which outlines the priorities for releases:

> ". . . provided that water not so required to be stored shall be released from Lake Powell (1) to the extent that it can be reasonably applied in the States of the Lower Division to the uses specified in Article III of the Colorado River Compact."

Now, the only way you can make contract firm power at Hoover is to release water and let it run to Mexico. This is where the basic problem arises. This, of course, would be a rather foolish thing to do, but that's the only way, under the method of computing deficiencies now used, that you can make your contract firm power at Hoover, is to release it and let it run to Mexico. I think this could be done. But as soon as you do that, then the Lower Basin could call on no releases from the Upper Basin, because of the provision that says you first store everything needed to protect the Upper Basin's delivery and consumptive uses.

Next, you let water down to the Lower Basin to the extent required for III (e) uses, which does not include power and releases to Mexico. Therefore, I think the operating criteria and the filling criteria are absolutely incompatible, and you must consider the filling criteria if you are going to come to any reasonable result on the operating criteria.

THE CHAIRMAN: Thank you, Mr. Reynolds.

We have a motion before us. (Question called for.) All in favor say "Aye." (Ayes) We will recess for, hopefully, 15 minutes.

(Recess taken.)

THE CHAIRMAN: The Commission will reconvene.

COM. BLISS: Mr. Chairman.

THE CHAIRMAN: Yes, Mr. Bliss.

COM. BLISS: We have come back with a motion or resolution here, which I will not attempt to read. I will hand it over to your amanuensis.

THE CHAIRMAN: Can't you read his handwriting?

COM. BLISS: I can't read it.

MR. GOSLIN: The motion would read: It is the consensus of the Commission that the reservoir filling criteria promulgated by the Secretary of the Interior and printed in the Federal Register on July 19, 1962 (27 FR 6851) should be terminated in their entirety, including payments for the deficiencies in generation at the Hoover Dam with the advent of the long-range operating criteria under Section 602 of Public Law 90-537, and that the Commission's staff be directed to participate in concert with the Commission's Committees in the formulation of the long-range operating criteria in a manner consistent with this consensus.

COM. PERSON: I second the motion.

THE CHAIRMAN: That is a resolution. Do you put that in the form of a motion that this resolution be adopted?

COM. BLISS: I so move.

COM. PERSON: I second the motion.

THE CHAIRMAN: Any discussion? Are you ready for the question?

(Commission members polled individually.)

THE CHAIRMAN: The resolution is adopted unanimously.

Any further discussion of the Engineering Committee report?

MR. RITER: May I ask Mr. Goslin a question?

Ival, will you see that I get a copy of that? I couldn't follow your reading that fast.

MR. GOSLIN: Yes, sir, we will send you a copy.

THE CHAIRMAN: Thank you for your report, Mr. Goslin. Apparently your report passed muster.

MR. GOSLIN: I think it passed muster with everybody except Prof.

THE CHAIRMAN: We are still on the Engineering Report.

COM. PERSON: Well, I put my complaint in. There weren't any positive recommendations. I was disappointed, I still am. As far as I am concerned, we can drop it.

THE CHAIRMAN: Chairman Sparks, does the Legal Committee have a report?

MR. SPARKS: No, we have no report. Mr. Chairman, I will point out, however, I think the Legal Committee is going to have to take a pretty hard look at this proposed criteria. The disturbing thing about this criteria is that it makes little note of the Colorado River Compact. By that I mean this criteria assumes certain releases for Lower Basin purposes without regard to whether it is within the allocation of the Lower Basin States or not. It assumes certain releases for the Mexican Treaty application, regardless of whether or not there is any deficiency chargeable to the Upper Basin States, and it does not follow the criteria specified in last year's Act, because this criteria is proposed entirely to satisfy the requirements of the Lower Basin, and this is all that is mentioned primarily in the criteria, to satisfy certain uses in the Lower Basin, and it assumes that the Lower Basin is going to get seven and a half million plus the river losses, the reservoir losses, and satisfy the Mexican Treaty, all of which has to come at the expense of the Upper Basin. I don't think it complies to any extent

with the Act that Congress passed last year. I think in the State of Colorado we are going to enter some strenuous objection to it until it is based upon what is contained in the Act last year. I think the Legal Committee will have to take a hard look at this.

COM. LOVE: Mr. Chairman, may I ask Mr. Sparks, that being true, what participation, what appellate procedure is there for this Commission, or must it be the individual States to take action to attempt to make certain that the operating criteria do conform to, (1) our Compact, and (2), the Act?

MR. SPARKS: Governor, this is difficult. It is difficult for the Bureau to figure out this operating criteria at this time and try to generalize it later. The problem that occurs is that if the Upper Basin were using all of the water that it was entitled to under the Compact at this time, I am sure the Bureau would have come out -- the Department of the Interior would have come out with somewhat different filling criteria.

What this criteria does, really, is skip the question of what happens when the Upper Basin is using its full allocation of water, just simply ignores that proposition and is directed to satisfying the requirements of the Lower Basin to the extent that the water supply is available. It is a perplexing thing.

For instance, the criteria provides and contemplates a release of the 8.2 million or 8.3 million -- 8.23, I believe it is, from here on out.

Well, this, in our opinion, is in excess of the Compact requirements. At the same time, the argument can be used with some validity, it is not necessary for us to store all of the remaining flow in view of the fact that our consumptive use requirements now are less than five million acre-feet, probably in the neighborhood of four million or something in that magnitude.

COM. LOVE: If they do the 8.2, is this on the basis of allocation of our commitment which has not arisen under the Mexican Treaty?

MR. SPARKS: That 8.2 is arrived at in the computation of the Lower Basin demands, and the fulfillment of the Mexican Treaty and the satisfaction of losses downstream.

COM. LOVE: But my point is, what mechanically, legally, in procedure, is open to us as far as attempting to bring it into line with what we think is right?

MR. SPARKS: I think the first thing, in January of this year, not later than January 1st, I think the law states, the Secretary has to submit these proposed criteria to the Governors of the seven Basin States, and at that time the Governors will submit their comments on the criteria. If they are not revised to reflect what we think the Compact states, I am not sure that at that time any legal remedy is available to us because Congress has charged the Secretary with the responsibility of promulgating these criteria. They have also given him very specific guidelines in the Act of last year to follow out, and any references to the Mexican Treaty obligations and what is a deficiency are completely ignored in these criteria, and they will not become critical, actually, until the Upper Basin has increased its depletion of water, and we have got this interim period that is going to cause us all a great deal of difficulty, and the real crux of the problem is when does the Upper Basin have to have maximum storage in Glen Canyon to protect itself?

The history of the river has shown that if you store all of the water in Glen Canyon and release only seven and a half million or seventy-five million to the Lower Basin in any ten-year period, the Upper Basin only comes up with around 6.2 million acre-feet of water. We are short over a million and a half acre-feet of water if we take every drop of water in Glen Canyon with the exception of releasing 75 million acre-feet. So when you increase the release anything over 75 million feet in any ten-year period, as this criteria clearly contemplates, the eventual shortage of the Upper Basin is considerably more and it brings us way below 6.2. So what you have is a situation where the Lower Basin is getting all the water it is entitled to and the Upper Basin will be shorted in excess of 2 million acre-feet of water.

I don't know at what point in time we are going to be able to demonstrate actual damage as a result of this operation. We certainly are being damaged today by these power deficiencies, there is no question about it. It depletes our Basin Fund to a major extent.

COM. LOVE: But, basically, what you are saying is, we probably, in your opinion at this moment, can't get into court if it becomes necessary prior to the time that we can demonstrate damage?

MR. SPARKS: I think that's the case.

MR. CLYDE: May I ask a question of Mr. Sparks? Do you suppose it is possible to write into this criteria, as written here, tie it to the Compact so that the purposes of this operating criteria is geared to the implementation of the Compact?

MR. SPARKS: Yes, and particularly, Governor, the specific criteria that was contained in the bill enacted last year about these deficiencies. This proposed criteria, while it is attempting to carry it out on a form, really attempts to evade the problems and one of these days we have to come to grips with these problems. It is really an attempt -- not only an attempt, it does evade the problem by trying to satisfy the Lower Basin requirements, and that's about all these criteria do, is satisfy the Lower Basin requirements.

THE CHAIRMAN: Mr. Reynolds.

MR. REYNOLDS: Mr. Chairman, if I may. It seems to me it is not quite that simple at this point. Certainly it is in the Upper Basin's interest to release more than 75 million each period of ten consecutive years for some years to come in order that we give full benefit of the power facilities at Glen Canyon and benefits that we need in our Project Fund. So I agree with Felix, there comes a time when we have to cut off this eight and a quarter million release, but I think the people who are promulgating these criteria have not yet told us that they think the eight and a quarter is our delivery obligation, and I think they will not tell us that.

MR. SPARKS: This is very true. As I say, at this time our consumptive use is not to the point where we can actually argue that we have to store all the excess water in Lake Powell, but, unfortunately, for a long-range operating criteria this does not meet the problem, in my opinion, because it is tied to the powerhead at Hoover Dam, and the powerhead at Hoover Dam has nothing to do with the operation of the Colorado River Compact, and this is what it does, it ties it to the powerhead at Hoover Dam.

MR. RITER: May I ask Mr. Sparks a question, or this Commission a question? Does this Commission have some alternative -- the gate was opened by Secretary Smith to get your bids on what you want; what alternative criteria would you suggest we study?

MR. SPARKS: Well, we have listened with some interest -- of course, I think maybe the Commission may be aware, the main thrust -- what Randy says is entirely true, the gate is open for us to propose alternative criteria -- the main thrust of the negotiations so far have been by the Lower Basin to try to get around the provisions of the Act passed last year, and they do this by coming up with various probabilities. But when you start out with a hundred percent probability that the Upper Basin is not going to get its water, I don't see how they can come up with any other probability and say that we are. This is an acknowledged fact. We have a hundred percent

probability of shortage, to start with, and the thrust of the Lower Basin negotiations to date have been to show that there is a probability that they can get more water, and how they can do that without taking it up from the Upper Basin is beyond me.

COM. LOVE: Well, I would say with the fact that we have been asked to comment and to suggest, that we would be negligent in our duties if we did not devise the appropriate technical staff or whatever is needed to actually propose some operating criteria.

MR. GOSLIN: Mr. Chairman, as another member of the Task Force, I would like to assure Randy that we will have some proposals for you to study at an early date.

MR. RITER: Fine.

MR. SPARKS: I might state as an interim operation these criteria for some period of time to a considerable extent are adequate, but they are supposed to be long-range criteria, and what they do is, they go into the immediate future only and they do not go into the long-term future, and the problem that we always have with this type of operation is what becomes a temporary operation very often is pushed over on somebody as being a long-term operation somewhere down the line, and this is a danger, as I see it. I think these things are adequate, we will say, for 15 to 20 years, or at least until the Central Arizona Project comes on the line, but from there on they are silent, they are not long-range operating criteria, they are very short-range operating criteria.

COM. LOVE: If I understand it correctly, Governor Clyde's suggestion that in any event any criteria carry the reservation that in no event shall the operating criteria be held to nullify or to set aside the terms of the Compact, this would be necessary and would be satisfactory except for the problem that Larry raises, that even without violating the terms of the Compact, that we as a matter of discretion are going to have to seek to store against future deliveries in the Upper Basin in order to protect ourselves, and even though this operating criteria in that sense wouldn't violate the Compact, we need to have that kind of discretion and flexibility; isn't that right?

MR. JACOBSON: One of the areas where they are deficient in the trial runs, and of course the Committee has not completed its work by any means, is, they shut the operations off in the Year 2000, with an upper basin depletion of five-eight, I believe is the maximum that the trial runs are used so far. One of the recommendations I am sure we

are going to come up with, that they go beyond the Year 2000 and go beyond the 5.8, get a little closer to the ultimate use of the Upper Basin. These are merely test trials to see how various aspects of the rule curves and the applications that they are making in the criteria fit the various hydrologic conditions and time periods. So I think they should go a little beyond what some of the studies would run so far.

MR. CLYDE: Mr. Chairman.

THE CHAIRMAN: Governor Clyde.

MR. CLYDE: Has the Commission accepted this position, that the Upper Basin States forever in the future take a second cut on the waters of the Colorado? You see, when this Compact was drawn, it was supposed to be an equal division in the first approximation, seven and a half million acre-feet. But we find ourselves taking the second seven and a half million or such portion thereof as it exists. The Lower Basin takes their initial cut first and we take what's left. Maybe we ought to go on the offensive and challenge that thing. There is no equity.

MR. SPARKS: Governor, there is one angle there we have not previously discussed that I recall to any extent, that offers us, I think, some protection. This is a big source of worry that we have all had. That is, what is a Mexican Treaty deficiency? Now, I know what the Lower Basin is thinking in terms of -- well, they use seven and a half million feet, and there is a deficiency that they are going to have to make up, part of it, out of the seven and a half million feet. In other words, they would reduce their use below the seven and a half million to make up their deficiency. At the same time we may only be able to get, because of the 75 million delivery -- well, we could get only 6.2 million. What we have to argue, and argue hard, and I think it is correct, that no deficiency is ever chargeable to the Upper Basin until the Lower Basin uses are down to ours. In that case, if they are using seven and a half million and we are only getting 6.2, the entire Mexican Treaty burden, the entire million and a half, must come from the Lower Basin under the Compact, as I read it. They are arguing the other way. But this, then, would bring them down pretty close to what we are getting.

I know people like Mike Ely are worried about this particular thing, the parity that you mentioned, and this parity is going to have to come into effect when you start computing this Mexican deficiency, or the Compact means nothing, in my opinion, and this, I think, is one of the things. This criteria, as I say, I think is fine for a short-term basis, but it creates an impression that it is a long-range criteria and this thing is not a long-range criteria, it is short-term.

COM. LOVE: Will the criteria deal with the Mexican Treaty deficiency or the possibility thereof?

MR. JACOBSON: They kind of skirt around that in this way. They say by the year 2000 or 1990, somewhere along there, we are going to be out of water and the river has got to be augmented and that that will be automatically taken care of. But I don't believe that will answer the question. It may answer the Lower Basin situation.

COM. LOVE: Wouldn't this be a good place to raise that Mexican Treaty water at the time we submit our suggestions on operating criteria?

MR. GOSLIN: I think we ought to raise it every time we get a chance.

MR. SPARKS: Even if the criteria adopted by the Congress last year were incorporated into this criteria, the Bureau is not in a position at this time, I don't think, to make a determination as to who has to provide the deficiency. But the criteria itself does hit that question, that is, the bill itself last year touched on that question, and the criteria, I think to a considerable extent -- not only considerable extent, I think the criteria has to incorporate everything that is in this bill.

COM. LOVE: Why do you say the Bureau is not in a position to make a determination on that, that is, isn't the Bureau charged with establishing operating criteria to comply with the Compact and the statutes?

MR. SPARKS: Governor, they could do it, yes. I think that is a responsibility of the Secretary of the Interior. I speak from long experience in saying he will not do it, because one major factor is the great controversy on the Gila River and Arizona's contention that the Gila is not included in the Compact.

COM. LOVE: I flew over it recently. It does flow into the Colorado.

MR. SPARKS: That is what we have argued, it is a tributary of the Colorado River, enters the Colorado River in the United States.

MR. GOSLIN: I think it is inevitable that this problem of accounting for the Mexican Treaty burden is going to have to go to court. I see no other solution to it unless by luck we get a river augmentation program that will wipe it out.

COM. LOVE: It may be, but I think as a matter of posture this Commission is better off to be aggressive than to say the Secretary is not going to settle it for us and they won't make it a part of the operating criteria; I think we should press it, even so.

MR. SPARKS. The Secretary has to make that decision at some time to operate the river. I don't know how else he is going to do it.

THE CHAIRMAN: Mr. Reynolds.

MR. REYNOLDS: Mr. Chairman, I think it might be worthwhile to see that this issue need not be determined for some 20 to 30 years apparently; it could come earlier than that, because your best estimates indicate that the crucial point is two or three decades down the line.

With that thought in mind, looking at the proposed criteria, one can see that there will be more water in Lake Powell if we contemplate an eight and a quarter million delivery than if we contemplate a seven and a half million delivery, and at the time that our differences develop enough, with an eight and a quarter million we have got the reservoir full, will be the time to argue whether our obligation is seven and a half or eight and a quarter.

I think what is tremendously important at this point is that the Upper Basin States make very clear, while they acquiesce in the use of eight and a quarter in establishing the amount of water to be stored in Lake Powell, we do not concede that that bears any relation to our obligation to deliver to the Lower Basin.

One further point. While I think I arrive at the same result that Felix does, I get there a little differently. I think the numbers will show closely enough that the entire Mexican Treaty burden can be met with 75 million in each ten years from the Upper Basin without decreasing the Lower Basin below eight and a half million.

COM. LOVE: Say that again. I can't put that together.

MR. REYNOLDS: The Lower Basin is entitled from the system, including the Gila, to eight and a half million acre-feet.

COM. LOVE: I see.

MR. REYNOLDS: And I say, if we deliver 75 million, if they control the losses on the river reasonably and if you count the evaporation

as beneficial consumptive use, as you should, and you take into account all the uses of the Gila and the other tributaries in the Lower Basin, the full delivery to Mexico can be made without reducing the Lower Basin to less than eight and a half million, with us enjoying 6.3 million.

COM. LOVE: Is there a million generated below the Glen?

MR. REYNOLDS: Yes.

MR. GOSLIN: With the Gila River, more than that.

MR. SPARKS: Considerably more than that if you count the Gila River.

MR. JACOBSON: About 700,000 between Glen and Mead.

MR. SPARKS: I think this is the point. These criteria, I think with some additions to spell out what we consider the long-term obligation, that for some interim period, it seems, as far as I can see, these criteria do the job but they leave too much hanging and they create an impression that this in itself is a long-range operating criteria, which it is not.

THE CHAIRMAN: Any other comments on the Legal Committee's activities?

I think, gentlemen, this serves to point out the great importance of active participation on the part of engineering advisers and legal advisers to the State Commissioners, and Mr. Goslin needs all the help he can get, I know. So I hope he'll have that support forthcoming.

Let's move on to the next agenda item, Unfinished Business.

MR. GOSLIN: Mr. Chairman, I don't think of anything, but I left a couple of blanks here in case some of the Commissioners had something.

THE CHAIRMAN: If not, we will move on to New Business.

Item (a) is listed here as Long-range reservoir operating criteria. I believe we have exhausted that subject.

COM. WADDINGHAM: Mr. Chairman, much of what has been said here I am certain most of the member States will agree with. I am inquiring now as to whether or not it is contemplated that the Commission

will meet again between now and the end of the year to consider and formalize our opinions after we have had the benefit of the Engineering Committee's reports from the contemplated study.

MR. GOSLIN: Mr. Chairman, may I speak to that point?

THE CHAIRMAN: Yes, please.

MR. GOSLIN: I think the answer to the question is yes, certainly it is going to meet again, and I would also like to add to this that I would like very much to see this Commission meet more often than it has been meeting. I don't know whether you realize it or not, but I feel, well, quite flattered, maybe is the word, with the confidence that the Commission places in its staff, but at the same time I find myself very often floundering around in the dark, wondering just exactly how far I should go until I have an opportunity to talk to the Commissioners. I much prefer talking to and with the Commissioners in a group such as this meeting rather than having to talk to them individually on the telephone.

Now, this is a personal reaction on my part, probably it shouldn't be mentioned here, but I have mentioned it. I would like to reiterate, I would like to see the Commission meet oftener if it is possible to do so.

MR. COURY: Mr. Chairman, at the next meeting I would like to invite you to come down to Farmington and show you that fly-ash plant, which will probably be the largest thermal powerplant in continental United States.

THE CHAIRMAN: Thank you, sir.

MR. COURY: I would be happy to be your host.

MR. GOSLIN: I would be happy to schedule the next meeting there if the Commissioners all agree.

THE CHAIRMAN: I share the Director's views that we should have more frequent meetings of the Commission, and I am certain from the business that now is in front of us there is going to be a real need to have them at regular intervals.

COM. WADDINGHAM: I think that answers my inquiry and that was the answer I was hopeful was forthcoming.

The next item on the agenda is hearings by National Water Commission. I think the Director has communicated with all the Commissioners

in regard to a request from the National Water Commission to participate in their conferences and hearings, and so far as I know, the Commissioners have not responded, have they, Mr. Goslin?

MR. GOSLIN: You did.

THE CHAIRMAN: In any event, I am in receipt of a letter dated September 29 from Theodore M. Shad, Executive Director of the National Water Commission, and he says, "We are sorry not to hear the views of the Upper Colorado River Commission at our Denver Conference. We still want your views, however. It has been found advantageous to us in the conferences we have held to have such views presented in person so that they can be discussed directly with the Commissioners.

"If this is also your desire, we would accept a personal presentation at any of our remaining conferences. However, it would fit in best with our schedule if the personal presentation were made at the Los Angeles Conference to be held at the Hotel Intercontinental on Monday, October 27, starting at 9:00 a.m. The presentation at this conference will cover the States of Arizona, California, Hawaii, and Nevada. If you should find that you are unable to make a personal presentation at any of the conferences, we will accept a written statement for the record at any time until about November 15. Such material will be treated the same as the transcript of the conferences in terms of its use by the National Water Commission."

Now, it would seem to me, gentlemen, this Commission should express itself to this National water policy-making body and that we should have some proper representation to do that job, and I would suggest that our Executive Director be licensed to attend this meeting in Los Angeles. I would like your views.

COM. LOVE: I would think if he were to attend and present a position, a policy paper, it should be one that is prepared and circulated to the Commission before the time that he does present it.

THE CHAIRMAN: New Mexico, your views?

COM. BLISS: That sounds good to me.

COM. WADDINGHAM: Utah would be in agreement with the same provision that Governor Love made.

MR. SPARKS: I think some guidance is already available to the Director in that the four States have presented individual statements to the Commission here in Denver last week.

THE CHAIRMAN: Wyoming?

COM. PERSON: We agree to that, but, as you say, I think all the States presented their own position at Denver here.

MR. SPARKS: In looking them over I saw some rather remarkable unanimity among those States.

MR. LAWRENCE: Mr. Chairman, I believe it would be proper for each of the States to furnish the Director, make sure he has the comments, and he could, as Larry says, kind of draw from there. There may be some areas that we didn't completely agree.

MR. GOSLIN: If I am going to do it, I would certainly like to have a copy of each State's statement. Otherwise, I am sure I would be in trouble.

THE CHAIRMAN: It seems to be the consensus that we should have that representation by Mr. Goslin. Mr. Goslin, will you undertake it and advise the States in advance of what your statement will be?

MR. GOSLIN: Certainly, if this is what the Commission wants done.

MR. COURY: I would suggest if the Executive Director is going to go to the meeting, each one of the respective States, if possible, ought to have a representative to go along with him.

THE CHAIRMAN: I am sure he would appreciate that.

MR. GOSLIN: Surely.

THE CHAIRMAN: I am sure that would be welcomed.

COM. BLISS: Mr. Chairman, I move that our Executive Director be authorized to make a presentation at the meeting in Los Angeles and that each State be invited to send a representative, one or more representatives, to that meeting at that time if they so desire.

COM. WADDINGHAM: I will second that motion.

COM. PERSON: Would you include those statements ought to be sent to the Commissioners for approval before being sent?

COM. BLISS: Each State's statement?

COM. PERSON: No. He is going to prepare a statement. It seems to me the Commission should approve it as individuals.

MR. GOSLIN: That was understood.

COM. BLISS: That would be understood in the motion, yes.

THE CHAIRMAN: Any discussion? Are you ready for the question? All in favor say "Aye"? The motion is passed.

MR. GOSLIN: This is late to ask the question, but does this have to be at the Los Angeles meeting?

THE CHAIRMAN: The motion did not say. I think we have to leave it up to our Executive Director to ascertain what his time needs are and to make arrangements to attend one of these meetings. There is another meeting in Washington in November.

MR. BILLHYMER: That is the last one. There is one Friday in Chicago, then the next one is in New Orleans, the next one in Los Angeles, and the one following is in Washington, D. C

COM. LOVE: You better go to Los Angeles.

THE CHAIRMAN: We have left you a free agent on that.

The next agenda item is election of officers, and at this Annual Meeting I believe it is in order to elect the Vice-Chairman. Mr. Goslin?

MR. GOSLIN: This is correct.

THE CHAIRMAN: I will entertain nominations at this time.

COM. PERSON: Mr. Chairman, I nominate Governor Love as Vice-Chairman of the Commission.

COM. LOVE: Mr. Chairman, does this imply in the procedures that you succeed to Chairman? No? My only reason for questioning is that I have some other obligations and I don't want to unknowingly get involved in a position where I take on some more that I won't have time to adequately fulfill.

THE CHAIRMAN: The By-Laws of the Commission provide that the Vice Chairman is elected from the State membership and that he serves as Chairman in case of the inability of the Chairman to serve.

MR. GOSLIN: The Chairman is appointed by the President.

THE CHAIRMAN: Any other nominations?

COM. WADDINGHAM: Mr. Chairman, I move the nominations cease and Governor Love be elected to the position by acclamation.

COM. BLISS: Second the motion.

THE CHAIRMAN: It has been moved and seconded that Governor Love be nominated as Vice Chairman unanimously. All in favor? It is unanimous, Governor.

COM. LOVE: How did Colorado vote?

MR. SPARKS: I voted as the alternate.

THE CHAIRMAN: The next office is the office of the Treasurer, and at this time I will entertain nominations for Treasurer.

COM. PERSON: I nominate Mr. Coury for Treasurer.

COM. BLISS: I second the motion.

THE CHAIRMAN: It has been moved and seconded Mr. Coury be nominated as Treasurer. I presume he is unanimously elected. (Ayes)

MR. COURY: At the same salary?

THE CHAIRMAN: Same salary with the same degree.

MR. COURY: I just want to be sure there is no diminution of salary.

MR. GOSLIN: Mr. Chairman, the By-Laws provide that the Treasurer shall appoint, with the concurrence of the Commission, an Assistant Treasurer, and in order to complete this business, if Mr. Coury would appoint the Assistant Treasurer at this time it would save me a lot of correspondence, and so on, and if the Commission would agree.

MR. COURY: I would like to nominate William Homer, Vice President of First Security Bank of Utah as Assistant Treasurer.

COM. BLISS: To continue to serve?

MR. COURY: To continue to serve.

COM. PERSON: I move we approve this nomination.

COM. LOVE: Second.

THE CHAIRMAN: Moved and seconded. All in favor say "Aye." Unanimous.

MR. COURY: I think one more thing is to designate the depository so there is no argument. The depository is First Security Bank of Salt Lake City, and I think it should be in the minutes to designate that as the depository.

COM. LOVE: So moved.

COM. BLISS: Second.

THE CHAIRMAN: It has been moved and seconded that that be the designation. All in favor say "Aye." Carried.

MR. SPARKS: I hate to see this Commission moved to Southern Utah.

MR. COURY: Larry, you don't hate it any more than I do. I would like to move it down to New Mexico, but I can't.

MR. GOSLIN: I might say both these fellows tried.

THE CHAIRMAN: Any other new business?

MR. GOSLIN: I have no other business, Mr. Chairman.

COM. BLISS: You have no suggestion for the next meeting, Ival?

MR. GOSLIN: If the Commission would like to set a time and place for the next meeting, it would be fine so far as I am concerned. On the other hand, one of the principal items of business would probably be these long-range reservoir operating criteria and it is hard to predict right at this time when the opportune time would be.

COM. BLISS: It just appeals to me you have a great deal of difficulty, and I suppose you would even if you had a set date, to get

everyone there, if we could agree tentatively on a date at the present time maybe we could hold our schedules open for such a meeting.

MR. GOSLIN: I certainly appreciate your statement about having trouble getting meetings set up. I have all the trouble there is. If the Commission wants to set a tentative date, this is fine with me.

MR. COURY: I would still like the invitation to stand that I made a while ago.

MR. GOSLIN: Mr. Chairman, Mr. Jacobson has a suggestion here.

MR. JACOBSON: When will we have an interim report on these criteria, Randy?

MR. RITER: Our next meeting is scheduled October 30. I am hopeful that at that time we won't have to meet any more, the Task Force can work up something and give it to the Secretary. My schedule is to get it to him December 1st so he can meet the January 1st deadline. We may have to have another meeting of the Task Force after October 30, particularly if Ival comes in with criteria that have not been exposed to the members of the Task Force. Our deadline is December 1st to submit the draft to the Secretary.

COM. BLISS: Mr. Chairman, on that basis it seems to me we ought to meet about the middle of November, after you have at least had your last of October meeting, and we may not have all the criteria complete but it should be before the 1st of December, I am quite sure.

MR. GOSLIN: Maybe the thing to do would be to set it for the first week in November, and if there is another meeting of this Task Force, then we might want one at the end of November, too.

MR. JACOBSON: We are going to have our criteria in to this work group committee, this Task Force, in just a matter of a week or so, aren't we?

MR. RITER: The shorter the better.

MR. GOSLIN: We should have.

MR. RITER: Otherwise, it might get neglected.

MR. JACOBSON: We are going to have another meeting on the 17th of that work group, so it is possible we may have something to report by that time, the 1st of November.

COM. LOVE: I think the first week of November is all right.

THE CHAIRMAN: Does that sound as if we might set a date for the first week in November?

COM. BLISS: That would be all right with me.

(Off the record.)

MR. GOSLIN: The Commission left the matter of establishing the time and place of the next meeting at the determination of the Secretary after consultation with members of the Commission.

MR. LAWRENCE: The Utah Board of Water Resources ordinarily would meet the first Thursday and Friday of the month. If you are going to use the 6th or the 7th, I ought to know by this Friday so I could reschedule them.

MR. GOSLIN: It would be impossible to let you know, Dan.

MR. LAWRENCE: Could you kind of skirt around those two days, if possible.

MR. GOSLIN: I will try my best to, yes.

THE CHAIRMAN: Do I hear a motion for adjournment?

COM. PERSON: I so move.

THE CHAIRMAN: Do I hear a second?

COM. WADDINGHAM: Second.

THE CHAIRMAN: Adjourned.

(Meeting adjourned at 3:10 p.m.)

COMMENTS AND RECOMMENDATIONS
of
COLORADO, NEW MEXICO, UTAH, AND WYOMING
on
THE SECRETARY OF THE INTERIOR'S DECEMBER 16, 1969 PROPOSED LONG-RANGE OPERATING CRITERIA FOR COLORADO RIVER RESERVOIRS

March 26, 1970

A. TERMINATION OF GENERAL PRINCIPLES FOR RESERVOIR FILLING INCLUDING "DEFICIENCY" PAYMENTS

It is the unalterable position of the four States of the Upper Division that the "General Principles To Govern, And Operating Criteria For, Glen Canyon Reservoir (Lake Powell) And Lake Mead During The Lake Powell Filling Period," and particularly the charging of the so-called "deficiencies" in firm energy generation at Hoover Dam to the Upper Colorado River Basin Fund in terms of dollars, electric energy, or generating capacity must be terminated simultaneously with the adoption on July 1, 1970 of the long-range reservoir operating criteria of Section 602 of P. L. 90-537.

1. The Colorado River Compact contemplated storage of water in and for both the Upper and Lower Basins. Article I clearly lists the storage of water as one of its major purposes. The compact (Art. IV) also recognizes that water will be used for power generation. Power generation requires water storage. The compact recognizes that due to the erratic flows of the river the Upper Basin without storage cannot use consumptively its full apportionment of water, or so much of it as may be available, and at the same time deliver an average of 7.5 million acre-feet of water per year to the Lower Basin.

2. Art. IV of the compact makes the use of water for power generation subservient to its use for domestic and agricultural purposes. This subserviency is effectuated by Art. III (e) which provides that:

> "The States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural uses."

Even if it is conceded that the Art. III (d) obligation of the Upper Division States to deliver an average of 7.5 million acre-feet of water per year at Lee Ferry gives the Lower Division a priority on the available water supply, that priority is certainly limited by Art. III (e) to domestic and agricultural purposes. The Lower Basin is not entitled to the release of any water from Upper Basin reservoirs except for agricultural and domestic uses. If water is released from the Upper Basin for power generation in the Lower Basin, or if another Upper Basin resource (energy or money) is substituted for water, the effect is to give a priority to the generation of power in the Lower Basin over the storage of water in the Upper Basin for domestic and agricultural purposes. This is clearly inconsistent with the intent of the compact.

3. Hoover Dam, authorized under Section 1 of the Boulder Canyon Project Act, was constructed primarily for the purposes of flood control and water supply. The generation and sale of energy was for the purpose of paying for the project.

> "Sec. 1. That for the purposes of controlling floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters thereof for reclamation of public lands and other beneficial uses exclusively within the United States, and for the generation of electrical energy as a means of making the project herein authorized a self-supporting and financially solvent undertaking, the Secretary of the Interior, subject to the terms of the Colorado River Compact hereinafter mentioned is hereby authorized to construct, operate, and maintain. . . ." (emphasis supplied)

Section 14 (a) of the Secretary's regulations promulgated under the Boulder Canyon Project Adjustment Act provides for adjustments in energy rates due to shortages of water in order to meet the primary purpose for having a powerplant at Hoover Dam, i.e., the repayment of project costs.

> Section 14 (a) . . .
>
> "In the event of a deficiency in the amount of defined firm energy due to shortage of water available for the generation of firm energy, reduction in the amount to be amortized within the period ending May 31, 1987, will be made, . . . in the manner and to the extent provided in this article 14 (a) . . . ."

The last sentence of Section 1 of the Boulder Canyon Project Adjustment Act also gives the Secretary authority to adjust power rates. It says:

> "Such charges may be made subject to revisions and adjustments at such times, to such extent, and in such manner, as by the terms of their promulgation the Secretary shall prescribe."

Article 14 (e) of the Secretary's general regulations further verifies that the primary purpose of the Hoover Dam powerplant was not the generation of cheap hydro-energy and that the Secretary has the authority to meet shortages of water (and energy) situations.

> "(e) As of June 1, 1987, adjustments shall be made, through refunds or collections as the Secretary may find necessary to achieve consummation of the principle that the revenues shall be sufficient but not more than sufficient to provide the amounts set forth in Article 6 of these regulations (project repayment) as modified by the provisions of Articles 14 (a) and 15 (c) hereof."

The charging of Hoover generation "deficiency" costs to the Upper Basin Fund places paramount importance on the energy generated instead of upon the primary purpose of the generation. The laws relating to the authorization and operation of Hoover Dam have provided for adjustments, including adjustments due to water shortage, necessary to accomplish the real purpose of the Hoover powerplant; i.e., the repayment of project costs. Such adjustments are applicable and adequate to cover the situation now facing the Secretary with reference to the termination of the filling criteria.

The operations of the Hoover power facilities are also subject to the Colorado River Compact [Sections 8 (a), 8 (b), 13 (b), 13 (c), and 13 (d) of the Boulder Canyon Project Act]. In Arizona v. California the federal government argued the position that Sections 8 (a) and 13 (b) are for the protection of the Upper Basin to insure that the Boulder Canyon Project does not encroach upon Upper Basin rights (p. 18, U.S. Rebuttal Brief).

As emphasized above, the Colorado River Compact contemplated future resource development in the Upper Basin. When the generation of firm energy at Hoover Dam was first computed, a progressive reduction in power generation to take into account future Upper Basin development was made (House Doc. No. 717). The reduction was on a straight-line, annual basis. This computation had to be made with the knowledge that

such development could not follow a straight-line progression. Since, as the Department of Justice has contended, Sections 8 (a) and 13 (b) of the Project Act were included for the protection of the Upper Basin, the power contracts executed by the Secretary cannot have the effect of limiting Upper Basin development. Therefore, charging the Upper Basin for any "deficiencies" in firm power generation at Hoover Dam attributed to Upper Basin development has no justification and must be stopped.

4. The report of the House Committee on Interior and Insular Affairs (Report No. 1312, 90th Congress, Second Session, on H.R. 3300, Colorado River Basin Project Act) at page 84 states:

> "To the extent that it is possible to foresee, reservoir operations under Section 602 will not be inconsistent with reservoir operations permitted under the Glen Canyon filling criteria promulgated by the Secretary of the Interior and printed in the Federal Register on July 19, 1962 (27 F.R. 6851). Thus, it is expected that criteria established pursuant to this section will permit the filling criteria to be continued until terminated at some later date. No change in the manner of determining deficiencies in Hoover generation during the remainder of the filling period is anticipated, but the matter of payments for such deficiencies will be governed by Section 502 of this Act."

This language does not preclude modification or termination by the Secretary of the 1962 filling criteria, including the cessation of charges for "deficiencies" against the Upper Basin Fund. Since it is now clear that the filling criteria are inconsistent with an Act of Congress, the filling criteria should be terminated.

5. The procedures used to charge the Hoover powerplant "deficiencies" under the 1962 filling criteria are demonstrably detrimental to Upper Basin interests. They are not consistent with the equitable arrangement prescribed by the long-range operating criteria defined by Section 602 of P.L. 90-537. It has been determined that to September 30, 1969 the replacement of these "deficiencies" under the 1962 filling criteria has depleted the Upper Colorado River Basin Fund by $45.4 million, computing Glen Canyon energy transferred to the Hoover power contractors at 3.0 mills per kwhr.

6. Unless the filling criteria are terminated, Section 602 will extend the adverse effects of the filling criteria to the further detriment of the Upper Division. Clause (3)(i) and clause (3)(ii) of Section 602 (a), which have the effect of equating active storage in Lake Powell and Lake Mead after the water required to insure the Upper Division's compact

deliveries and consumptive uses has been stored at Lake Powell, would defer the time at which Lake Powell is full (elevation 3700 ft) and Lake Mead storage is simultaneously at or above elevation 1146 ft -- one of the conditions which would terminate the 1962 filling criteria. Furthermore, clause (3)(iii) of Section 602 (a), which requires releases to avoid anticipated spills from Lake Powell, would also defer the filling of Lake Powell and consequently the termination of the 1962 filling criteria.

To bring Lake Powell to elevation 3700 ft, there would be required an acquisition of 15.5 million acre-feet more storage than is presently in Lake Powell. Lake Mead is above elevation 1146 ft. Under the principle of equalization of storage (P.L. 90-537), an additional 11 million acre-feet must be stored in Lake Mead making a total acquisition of 26.5 million acre-feet necessary to trigger the termination of the filling criteria. In the seven-year period since closure of Glen Canyon dam, 11.5 million acre-feet of surface storage have been acquired at Lake Powell, about 4.0 million acre-feet in the other Upper Basin reservoirs, and Lake Mead has been drawn down 5.5 million acre-fee . Thus, the seven-year net acquisition is approximately 10 million acre-feet of surface storage. With no change in the amount of water in reservoirs above Lake Powell and hydrologic conditions similar to those of the past seven years, 18-1/2 years (1-1/2 years beyond 1987) would be required to acquire the 26.5 million acre-feet in Lake Powell and Lake Mead. It is obvious that extending the filling criteria into the longtime operations of the Colorado River reservoir system is not a "matter seperate and apart from the issuance of operating criteria." The two sets of criteria are not consistent since the operating criteria add an additional 11.0 million acre-feet burden to the filling criteria, a condition that was never contemplated. Therefore, the Secretary should take prompt action to terminate the filling criteria.

7. With demands for water from Lake Mead for domestic and agricultural uses in the Lower Basin and for delivery to Mexico at current levels (about 8.5 million acre-feet annually), contract firm energy cannot be generated at the Hoover powerplant until Lake Mead is nearly full (23.8 million acre-feet at elevation 1206 ft). Even after the Central Arizona Project water requirement is added to the Hoover releases it will still not be possible to generate contract firm energy at Hoover Dam unless the reservoir is at or above elevation 1146 ft. Under the Secretary's formula for determining and charging Hoover powerplant "deficiencies" to the Upper Basin Fund, the amount of energy generated (corrected to 83% efficiency) with releases limited to downstream water requirements, including the Mexican Treaty obligation, is deducted from the amount of energy that would have been generated had releases sufficient to generate contract firm energy been made. The "deficiency" is attributed to Upper Basin water storage and is replaced by purchase of energy with

Upper Basin funds or by energy generated at Glen Canyon Dam. The hypothetical part of this operation implies delivery of water to Mexico in excess of the minimum required by the Treaty.

8. The Hoover power "deficiency," as presently computed, could be eliminated or greatly reduced by releasing water in excess of the downstream requirements. If the 1962 filling criteria, including the replacement of Hoover "deficiencies," are to continue after the Section 602 operating criteria are imposed, the Upper Division could reasonably take the position that the Section 602 criteria should provide for releases sufficient to generate contract firm energy at the Hoover powerplant, although additional releases to Mexico would result. This procedure would conserve financial resources needed for development of Upper Basin water resources.

9. It would not be wise to waste water that ultimately will be needed for beneficial use in the Lower Basin in order to arbitrarily generate contract firm energy. The policy of restricting releases from Lake Mead to the amount of downstream consumptive-use requirements causes the "deficiencies" attributed by the Secretary to Upper Basin storage. The restriction of releases has the desirable effect of salvaging water for Lower Basin use. The inequity of operating Lake Mead to salvage water for the Lower Basin and charging the Upper Basin Fund for Hoover power "deficiencies" resulting from such an operation cannot be allowed to continue.

10. Equity also requires that the filling criteria be terminated at the earliest possible time. Paragraph 5 of the filling criteria says:

> ". . . For each operating year [the Hoover Powerplant] deficiency in firm energy [to be replaced with the Upper Basin funds or Glen Canyon Powerplant energy] shall be computed as the difference between firm energy which, assuming an overall efficiency of 83%, would have been generated and delivered at transmission voltage at Hoover Powerplant in that year if water has not been impounded in the reservoirs of the Colorado River Storage Project storage units. . . ."

This provision is inconsistent with the terms of the Colorado River Compact unless read as if the words "for power" appear after the word "impounded." For purposes of discussion only, let us assume that it is equitable to replace with Upper Basin resources the Hoover powerplant "deficiencies" caused by the storage of water below minimum power head in Upper Basin storage units because that water will never be applied to beneficial consumptive use or delivered to meet compact obligations.

Water thus stored in the Upper Basin reservoirs, including bank storage, aggregates about 8.5 million acre-feet. Hoover powerplant "deficiencies" replaced with Upper Basin resources aggregate to May 31, 1969 about 4.9 billion kilowatt hours. To generate this amount of energy at the Hoover powerplant at rated head would require the release of about 12 million acre-feet of water. Therefore, the Upper Division, having replaced "deficiency" energy equivalent to 12 million acre-feet of water while storing 8.5 million acre-feet below minimum power head, has already more than met any obligation to replace Hoover "deficiencies" caused by the storage of water in the Upper Basin.

11. The intent of Section 602 of P. L. 90-537 is to provide for that amount of water in storage in the Upper Basin reasonably necessary to insure that the Upper Division meets its compact delivery obligations without impairment of the consumptive uses to which it is entitled under the Colorado River Compact. Section 602 is also intended to overcome the ambiguity of Article III (e) of the compact by apportioning water in excess of the amount required to be stored in the Upper Basin between the Upper Basin and the Lower Basin to improve power head in both basins.

To continue the filling criteria has the effect of charging the Upper Division for that to which it is entitled under the compact and the provisions of Section 602.

12. In the event the filling criteria are not terminated, and the Secretary continues to require that the "deficiencies" be replaced, such replacement should come from some source other than Upper Colorado River Basin resources. Since the water between the amount necessary for downstream consumptive uses and that necessary for firm power generation is being stored for future Lower Basin consumptive uses, Lower Basin interests should bear the cost of the "deficiencies."

13. The May 1966 statement of Commissioner Dominy before the House Subcommittee on H. R. 4671 and similar bills (Serial No. 89-17-Part II) contains the following language (page 1358):

> "It is noted, however, that the filling criteria provide greater flexibility to the Secretary in reservoir operations than does Section 601 and this could result in an earlier termination of the filling criteria."*

This statement acknowledges that the Section 602 criteria might restrict operations under the 1962 filling criteria in such a way that the Secretary would find it necessary to exercise his discretion to terminate the latter.

---

*Sec. 601 of H.R. 4671 later became Sec. 602 of H.R. 3300 and of P. L. 90-537.

Summary

a. The 1962 reservoir filling criteria must be terminated in their entirety because they are not compatible with operating criteria to be adopted under Section 602 of P. L. 90-537.

b. To continue charging Hoover power generation "deficiencies" to the Upper Colorado River Basin Fund gives a priority to power generation in the Lower Basin over storage of water in the Upper Basin for agricultural and domestic uses, a clear violation of the Colorado River Compact.

c. The purpose of the Hoover Dam powerplant is to generate energy, the proceeds from which are to pay assigned costs of the Boulder Canyon Project. The purpose was not, and should not be, the perpetuation of a cheap supply of firm power--especially at the expense of the Upper Basin.

d. Making Hoover Dam power contracts whole at the expense of the Upper Basin Fund is inequitable and unnecessary. The Secretary of the Interior, under the Boulder Canyon Project Act, Boulder Canyon Project Adjustment Act, and his own regulations, has the authority to make any necessary adjustments to meet the primary purpose of the Hoover powerplant.

e. Neither the Colorado River Basin Project Act nor the Congressional Committee reports preclude the prompt termination by the Secretary of the 1962 filling criteria.

f. Procedures used to charge the "deficiencies" to the Upper Colorado River Basin Fund are detrimental to the resource development program of the Upper Division, adversely affect payment of project costs, and are not consistent with the equitable operation intended under Section 602. For example, due to a shortage of anticipated revenues in the Upper Colorado River Basin Fund, water resource development in Colorado and Wyoming was adversely affected for a number of years because Wyoming's share of the Basin Fund was insufficient to show payout of her share of the Savery-Pot Hook Project; and now the State of Colorado is facing a difficult situation for an indeterminate number of years so far as future project authorizations are concerned because her share of anticipated Basin Fund revenues is committed to repayment of currently authorized projects.

g. If filling criteria are retained along with the operating criteria of Section 602 the adverse effects of the "deficiency" charges will be prolonged.

h. Contract firm energy cannot be generated by the Hoover powerplant with current releases of water limited to downstream consumptive-use requirements. If water were to be released from Lake Mead in sufficient quantities to make contract firm power, the "deficiencies" could be eliminated or greatly reduced -- but such releases would waste water.

i. Limiting releases of water from Lake Mead to consumptive-use requirements salvages water for future use in the Lower Basin. Charging the Upper Basin Fund for such salvage is inequitable.

j. If it is assumed to be equitable to replace with Upper Basin resources the Hoover powerplant "deficiencies" attributed to storage of water in Upper Basin reservoirs below minimum power head. the Upper Division has already more than met any obligation to replace "deficiencies" caused by storage of water in Upper Basin reservoirs.

k. In the event the filling criteria are not terminated, replacement of the "deficiencies" should be charged to Lower Basin interests because the water between the amount necessary for downstream consumptive uses and that necessary for Hoover firm energy generation is being stored for the benefit of Lower Basin consumers.

l. To continue the filling criteria and the charging of "deficiencies" thereunder to the Upper Basin Fund in terms of dollars, electric energy, or generating capacity has the effect of charging the Upper Division for that to which it is entitled under the Colorado River Compact and the provisions of Section 602 of P. L. 90-537.

B. PROPOSED LONG-RANGE RESERVOIR OPERATING CRITERIA

PREAMBLE

1. In order to express the indispensable reason for the long-range reservoir operating criteria under Section 602 of Public Law 90-537 the first sentence of the preamble of the Secretary's proposed criteria should be changed to read:

> "These operating criteria are promulgated in compliance with Section 602 of Public Law 90-537 in order to assure that Upper Colorado River Basin consumptive uses of water will not be impaired because of failure to store sufficient water to make deliveries of water under Section 602 (a)(1) and (2) of Public Law 90-537."

(Also, see discussion of Article II (1)(f) in paragraph 2. on page 13 of this statement.)

2. The last sentence of par. 1, p. 1 of the proposed criteria says, "The Operating Criteria will be administered consonant with applicable Federal laws, contracts, the Mexican Water Treaty, interstate compacts, and decrees relating to the use of the waters of the Colorado River." In contrast, Public Law 90-537 confines compliance to three basic documents, as stated:

> "Sec. 602. (a) In order to comply with and carry out the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, and the Mexican Water Treaty, the Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of the Colorado River Storage Project Act, the Boulder Canyon Project Act and the Boulder Canyon Project Adjustment Act."

This Section requires that operations under the three designated Acts must carry out and comply with the provisions of those three basic documents.

Inclusion of the terms "contracts," "Federal Laws," and "decrees" as elements of the "law of the river," to which the Secretary in his transmittal letter said he would conform operations, is not appropriate. The contracts are not a part of the "law of the river." They are subservient to the "law of the river." All water-using entities in the Upper and Lower Basins are subject to the "law of the river." All of those entities are not parties to all contracts. Water or power contracts certainly should not be elevated to the stature of interstate compacts or an international treaty to which they are subservient. Further, every Federal law and decree involving use of Colorado River waters is not applicable to all water-user entities in the Colorado River Basin. Had P. L. 90-537 intended such stature for water and power contracts, Federal laws, and decrees, it would have so stated.

It is obvious that the attempt to upgrade "contracts" in the reservoir operating criteria to the point where the Secretary would administer the criteria "consonant with" or in conformity with the contracts as well as with the basic documents is an attempt to upgrade the Hoover Dam water and power contracts to a position that might lead to their enforcement under Lower Basin pressures against the best interests of the Upper Division States. For instance, the indefinite continued use of 700,000 - 800,000 acre-feet of water now being diverted under contracts by California in excess of the 4.4 million acre-feet annually to which she is entitled under court decree, might be considered under the operating criteria as being "administered consonant with" a contract. The same danger is inherent in the contract for 2.8 million acre-feet that Arizona has with the Secretary. The facts show that in a short time after the Central Arizona Project begins using water there will be shortages in the contract amount.

Contracts, Federal laws, and non-applicable decrees should not be elevated to a position from which they might be enforced against the Upper Division States. The experience of the Upper Division States with the Hoover Power contracts and Boulder Canyon Project Act and Adjustment Act and the "deficiencies" in generation at Hoover Dam should be lesson enough.

The Act speaks for itself, and the last sentence of par. 1 on page 1 of the criteria should be changed to read:

> "The Operating Criteria will be administered for the purpose of carrying out the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Mexican Water Treaty and court decrees pertaining to such compacts and treaty, which taken together constitute 'the law of the river.' Under and subject to this authority the criteria will be administered consonant with applicable federal laws and decrees relating to the use of the waters of the Colorado River."

3. The second paragraph of the preamble of the Secretary's December 16, 1969 proposal says that the Secretary "reserves the right to modify the Operating Criteria . . . ," and that formal reviews will be made "with participation by the States, and such other parties and agencies as the Secretary may deem appropriate. . . ."

Under the law it is not by his own reservation that the Secretary has the right to modify the criteria. Sec. 602 (b) authorizes the Secretary to do so. Also, Sec. 602 (b) does not give the Secretary the right to "deem appropriate" those who shall participate in the consultations concerning modifications. The statute says, ". . . but only after correspondence with the Governors . . . and appropriate consultation with such State representatives as each Governor may designate." In order to conform to the law, the second paragraph of the preamble should be changed to read as follows:

> "The Secretary of the Interior (hereinafter the "Secretary") may modify the Operating Criteria from time to time in accordance with Section 602 (b) of P. L. 90-537. The Secretary will sponsor a formal review of the Operating Criteria at least once every five years with participation by State representatives as each Governor may designate."

I. ANNUAL REPORT

1. The Secretary's annual report to be transmitted to the Congress and to the Governors each January 1, beginning January 1, 1972, is to contain information on the operations of the preceding water year and of the projected operation for the current year.

The proposed operating criteria state that the plan of operation shall include such detailed rules and quantities as may be necessary and consistent -- and shall also reflect consideration of the uses of the reservoirs for all purposes including flood control, river regulation, beneficial consumptive uses, power production, water quality, recreation, enhancement of fish and wildlife, and other environmental factors.

The criteria should distinguish between their primary purpose, meeting the objectives of Section 602 (a) which are directly concerned with consumptive uses, and uses of the reservoirs for other purposes, such as flood control, river regulation, power production, water quality control, recreation, enhancement of fish and wildlife, and other environmental factors. The first full paragraph on page 2 of the criteria (2d paragraph under I. ANNUAL REPORT) should be rewritten to say:

> "Such plan of operation shall include such detailed rules and quantities as may be necessary and consistent with the criteria in meeting the primary objectives of Section 602 (a) of P. L. 90-537 and shall reflect appropriate consideration of the uses of the reservoirs for other purposes, including flood control, river regulation, power production, water quality control, recreation, enhancement of fish and wildlife, and other environmental factors. The projected plan of operation may be revised as necessary to reflect the current hydrologic conditions, and the Congress and the Governors of the Colorado River Basin States and their designated representatives advised of any changes by June of each year."

II. OPERATION OF UPPER BASIN RESERVOIRS

1. The Secretary's proposed criteria state "(1) The annual plan of operation shall include a determination by the Secretary of the quantity of water considered necessary as of September 30 of that year to be in storage after consideration of and compliance with the provisions of Section 602 (a) of P. L. 90-537 . . . ." The proposed criteria further state that the quantity of 602 (a) storage shall be determined by the Secretary after consideration of all applicable laws and relevant factors including "(e) The 'Report of the Committee on Probabilities and Test Studies to the Task Force on Operating Criteria for the Colorado River,' dated October 20, 1969, and such additional studies as the Secretary deems necessary;".

This report is a dissertation on a study of relevant factors under a number of assumed parameters. All four States of the Upper Division were in disagreement with the Lower Division States and the Department of the Interior on the application of many of the parameters used. The results of the studies in the report are not conclusive. The results and their interpretation merely constitute an indication of conditions under assumptions pertaining to projected rates of resource development, study periods, probabilities of water supply, etc., with some of which the Upper Division States cannot agree.

The Lower Basin task force members argued that under almost all trial studies of the report, the Upper Division suffered no shortages of water. The lack of Upper Division shortages resulted from the fact that an unreasonably slow rate of Upper Basin growth was assumed and that present reservoir contents were used to commence the studies giving an added advantage of reservoir drawdowns in critical water supply periods. The studies covered only 31 years. If the drawdown-refill cycle had been completed the story would have been different. Also, during the critical periods a "built in shortage" was employed by assuming that the Upper Division water consumption with storage would be less than normal during dry years, as it may have been before storage reservoirs were provided. These assumptions all have the tendency to produce a false finding of "no shortage" in the studies made and thereby to increase the risk of future water shortages to the Upper Division States.

The fact that many of the studies were based upon "probabilities" that obviously place an unwarranted risk upon the Upper Division is ample reason to de-emphasize the report in order to preclude it from attaining undeserved weight in the making of future decisions. Article II (1) (e) on page 3 of the criteria should be eliminated except for the purpose set out in paragraph 4. below. Article II (1)(e) should be modified to read:

> "(e) The 'Report of the Committee on Probabilities and Test Studies to the Task Force on Operating Criteria for the Colorado River,' dated October 30, 1969, to the extent it is applicable to the 98.4+% rule curve developed therein, and such future studies as the Secretary deems necessary;"

2. Another factor listed in the proposed criteria and included for consideration in determining the amount of water to have in storage in Upper Basin reservoirs is: "(f) The necessity to assure that upper basin consumptive uses not be impaired because of failure to store sufficient water to assure deliveries under Section 602 (a)(1) and (2) of P. L. 90-537." Paragraph (f) is of such basic importance that its concept should be expressed as part of the first sentence of the preamble to the criteria. (See p. 9, par. 1 under PREAMBLE.)

3. (a) In the third line of Article II (2)(b) on page 3 of the proposed criteria the word "minimum," as used, is improper because it could prevent the attainment of the objectives of the legislation. If either the active storage forecast of paragraph (2)(a) for Upper Basin reservoirs is less than the 602 (a) storage, or, if the active storage of paragraph (2)(b) for Lake Powell is less than Lake Mead active storage, the objective is to reduce releases from Lake Powell below the Secretary's figure of 8.23 million acre-feet per year in order to fulfill the objective of Section 602 (a). The Upper Division cannot agree to the adoption of any minimum release from Lake Powell except to fulfill the obligation fixed by the Colorado River Compact.

(b) In his letter of transmittal the Secretary stated, "We wish to make clear that the objective of a minimum release of 8.23 million acre-feet annually does not in any way prejudice the position of either the upper or lower basin interests with respect to required deliveries at Lee Ferry pursuant to the Colorado River Compact and the Colorado River Basin Project Act." The Colorado River Basin Project Act should not have been included in the above sentence. This Act does not define the obligation of the Upper Division at Lee Ferry. Only the Colorado River Compact does that. Deliveries of water under the Act must be within the compact-defined amount of water that the Upper Division is obligated to deliver at Lee Ferry, whatever that amount may be determined to be. Furthermore, a statement disclaiming prejudice to the position of either the Upper or Lower Divisions with respect to required water deliveries at Lee Ferry should appear in the criteria.

Article II (2) of the proposed criteria should be rewritten, as follows:

> "(2) The interim releases from Lake Powell pursuant to these criteria are estimated at eight million acre-feet of water annually, but said releases shall be increased or decreased in any water year in conformity with the controlling factors set forth in Section 602 (a) of Public Law 90-537. These releases shall not in any way prejudice the position of either the Upper or Lower Basin interests with respect to required deliveries at Lee Ferry pursuant to the Colorado River Compact.
>
> "If, in the plan of operation, either
>
> (a) the Upper Basin Storage Reservoirs active storage forecast for September 30 of the current year is less than the quantity of 602 (a) storage determined by the Secretary under Article II (1) hereof, for that date, or

(b) the Lake Powell active storage forecast for that date is less than the Lake Mead active storage forecast for that date.

the objective shall be to attain such storage by reducing the release of water from Lake Powell to eight million acre-feet or less for that year. For the years ending September 30, 1971 and 1972, the release may be greater than eight million acre-feet if necessary to deliver 75,000,000 acre-feet at Lee Ferry for the 10-year period ending September 30, 1972."

(c) The figure "8.23" in line 5 of Article II (3) on page 4 of the proposed criteria should be changed to the word "eight."

4. The concept of an Upper Basin rule curve has been eliminated from the Secretary's December 16, 1969 proposed criteria on the grounds that a rule curve under the studies made would not govern operations for many years. It should be emphasized that before a rule curve becomes mandatory, while consumptive use demands are low, it is highly desirable to adopt and begin using a rule curve in order to assure the filling of Upper Basin reservoirs to adequate storage levels. One of the primary purposes of the Colorado River Storage Project was to provide long-term storage to meet compact commitments during periods of low flow. Witnesses for the Department of the Interior, in testimony on the Colorado River Storage Project bill, emphasized the need for Upper Basin storage capacity sufficient to hold over water for as long as 25 or 30 years in order to make optimum use of its compact allotment and to meet its obligation under the Colorado River Compact. They emphasized the need for early filling of the reservoirs for protection during critical water supply periods. Congress, relying on this testimony, approved the Colorado River Storage Project Act.

The objective of Section 602 is to provide for equitable reservoir operations which will comply with the "law of the river" and at the same time protect the Upper Basin's ability to meet its Lee Ferry obligation, including its share, if any, of the Mexican Treaty burden, while making optimum use of its compact apportionment of water. Holdover storage necessary to meet such objective requires the adherence to a rule curve with not less than 98.4+% probability, as defined under the Task Force on Reservoir Operating Criteria studies. A rule curve with a lesser probability designation under those studies will not be acceptable.

The essence of Section 602 requires a rule curve with the characteristics of the one designated 98.4+%. Section 602 was designed specifically to remove some of the unlimited flexibility from the Secretary's powers. If too much flexibility leads to a mistake by the Secretary and there is insufficient water in reservoirs to meet the objective, the water is gone, the damage is done, and the Upper Division has little recourse. There are going to be great pressures from the Lower Basin to use water from Lake Powell on the Central Arizona Project or in California which is required to remain in storage to assure Upper Basin deliveries under Section 602. The Central Arizona Project aqueduct and the Metropolitan Water District aqueduct are designed specifically for conveying excess water. A 98.4+% rule curve would act as an effective check on overuses of water in the Lower Basin to the detriment of the Upper Basin. A 98.4+% rule curve would prevent both mistakes and arbitrary adverse decisions, and would tend to protect the Secretary against the consequences of both.

Section 602 recognizes the need for a certain amount of flexibility in order to benefit from operating experience and to meet unforeseen circumstances. The Secretary's criteria provide the flexibility necessary to alter reservoir operations as experience dictates. Lacking the guidance of an adequate rule curve, there is danger that the Secretary may maintain insufficient storage in Upper Basin reservoirs to supply compact requirements during future periods of critical water supply without curtailment of Upper Division uses or retarding resource growth.

A 98.4+% rule curve for Upper Basin reservoir storage would tend to provide equity with Lower Basin uses. The Lower Basin has always had the benefit of operations under the "rule curve" imposed by the Colorado River Compact on the Upper Basin to deliver 75 million acre-feet every 10 years at Lee Ferry. The Upper Basin expects no less protection.

Should the Secretary fail to adopt a 98.4+% rule curve, the Upper Division States will insist that the Secretary achieve the objectives of Section 602 by operating the reservoirs in essentially the same manner they would be operated under such rule curve.

III. OPERATION OF LAKE MEAD

P. L. 90-537 does not contain guide lines for the operation of Lake Mead. It is appropriate that the Secretary's December 16, 1969 proposed criteria cover operations of Lake Mead. This part of the criteria is of interest to the Upper Division to the extent that it will affect operations of the Upper Basin reservoirs. In this respect the criteria provide that a drawdown of Lake Mead automatically places one-half of the quantity

of the drawdown on Upper Basin reservoirs. As soon as the active storage in Lake Powell becomes less than that in Lake Mead the releases from Lake Powell should be reduced to equalize storage. Also, Lake Powell is not supposed to be drawn below an amount necessary to meet the objectives of Section 602. The problem here is associated with the fact that the Secretary is advocating no rule to define the point above which Lake Powell should be held. This is to be left to the discretion of the Secretary under his annual determinations.

The criteria provide no rule curve for Lake Mead. In the event the charges against the Upper Basin Fund for the so-called "deficiencies" in generation of power at Hoover Dam are not eliminated, a rule curve for Lake Mead should be adopted to require that reservoir to be operated to minimize the "deficiency" charges.

IV. DEFINITIONS

The definition of the word "surplus" should include a statement that it shall not be construed as relating to the word "surplus" in the Colorado River Compact. The following sentence should be added to Article IV (1)(b) of the criteria:

> "The term 'surplus' as used in these criteria is not to be construed as applying to, being interpretive of, or in any manner having reference to the term 'surplus' in the Colorado River Compact."

* * * * * * * * * * * * * * * * * *

COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

EIGHTY-THIRD CONGRESS

SECOND SESSION

ON

H. R. 4449, H. R. 4443, and H. R. 4463

TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

JANUARY 18, 19, 20, 21, 22, 23, 25, 26, 27, AND 28, 1954

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COLORADO RIVER STORAGE PROJECT

MONDAY, JANUARY 18, 1954

HOUSE OF REPRESENTATIVES, SUBCOMMITTEEE ON
IRRIGATION AND RECLAMATION OF THE COMMITTEE
ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to call, at 9:35 a. m. in the committee room, New House Office Building, William H. Harrison (chairman) presiding.

Mr. HARRISON. The Subcommittee on Irrigation and Reclamation will come to order.

We have hearings on three identical bills, H. R. 4449, by Mr. Dawson of Utah, H. R. 4443, by Mr. Aspinall of Colorado, and H. R. 4463, by Mr. Stringfellow of Utah.

Mr. ASPINALL. Mr. Chairman, I wish to correct the opening statement. My bill is not exactly identical, it is a similar bill, but not exactly identical.

Mr. HARRISON. The Chair will stand corrected. I thought they were identical bills. We will change that to similar bills.

(H. R. 4449, H. R. 4443, and H. R. 4463 read as follows:)

[H R 4449, 83d Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the obligation undertaken by the States of the upper division in article III of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the control of floods and for the improvement of navigation, and generating hydroelectric power, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, power plants, transmission facilities, and appurtenant works: Echo Park, Flaming Gorge, Glen Canyon, Navaho, and Curecanti: *Provided, however*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high water line located at seven thousand five hundred and twenty feet above mean sea level; and (2) to construct, operate, and maintain the following additional reclamation projects (including power generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah, Emery County, Gooseberry, Florida, San Juan-Chama, Shiprock-South San Juan Indian irrigation, Hammond, LaBarge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence

Mr. HARRISON. Mr. Larson.

Mr. ASPINALL. Mr. Chairman, I wish we could have the statement before Mr. Larson begins so that we can follow him right along.

Mr. DAWSON. I would like to suggest before you proceed, if you are going to use Mr. Jacobson, it might be a good idea to introduce him.

STATEMENT OF E. O. LARSON, REGIONAL DIRECTOR, BUREAU OF RECLAMATION, ACCOMPANIED BY C. B. JACOBSON, ENGINEER IN CHARGE OF COLORADO RIVER STORAGE PROJECT STUDIES; W. B. HUFFMAN, ENGINEER; AND PAUL SANT, ECONOMIST, FOURTH REGIONAL OFFICE, SALT LAKE CITY, UTAH

Mr. LARSON. I have with me Mr. Jacobson, the engineer in charge of the Colorado River project storage studies, and Mr. Huffman, engineer engaged in those studies, and Mr. Sant, from our regional office, to aid me in furnishing technical information and answering questions and getting facts before this committee.

I shall cover in a general way the basinwide plan of the Colorado River storage project and participating projects and briefly explain the Glen Canyon and Echo Park storage units and 12 irrigation and multiple-purpose participating projects recommended for authorization in the supplemental report of the Secretary of Interior, October 1953

I shall also briefly describe units not contained in the Secretary's supplemental report, but included in the bill now before you.

The plan initiated in the bills is one through which the States of the upper basin of the Colorado River could eventually use all the water of the Colorado River system allotted to them. It would make utilization of the region's abundant natural resources possible and enrich the economy of the area and the Nation.

Without it, development of these valuable resources will be hampered, and the growth of the upper basin States will be stunted.

Through this plan, water would be made available for irrigation, municipal, and industrial use, and power generation. It would create vast new recreational facilities and substantial benefits to fish and wildlife.

It would make possible river regulation and sediment control which are needed at an early date to assure maximum utilization of important power potentialities on the Colorado River below Lee Ferry and above Lake Mead.

It is no exaggeration to say that on it depends the future of the upper Colorado River Basin, and that it would make a material contribution to the lower basin.

The basin plan on which these bills are based is the result of many years of investigation by the Bureau of Reclamation in cooperation with the upper basin States and other agencies of the Federal Government.

In 1946 the Colorado River Basin report was issued by the Bureau of Reclamation, covering potential developments on the entire Colo-

rado River system. Among these developments were over 100 potential irrigation and power projects that could use upper basin water.

This report was an inventory which served as a guide for future planning and compact negotiations. No specific plan of full development was possible in the upper basin until 1948, when the water was apportioned among the upper basin States through the upper Colorado River Basin compact.

With this compact as a foundation, the Bureau of Reclamation in 1950 issued the report on the Colorado River storage project and participating projects with supplements. This constituted a start on a comprehensive plan for the upper Colorado River Basin and was submitted to the President on December 4, 1952.

In December 1953, the Secretary of the Interior submitted a supplemental report to the President which proposed authorization of a part of the total plan consisting of 2 units of the storage project and 12 participating projects.

Some knowledge of the history of Colorado River development is necessary for an understanding of the Colorado River storage project. The early settlements along the river were established in the valleys and desert areas where tributary waters and the main stream flow could be easily controlled and used for irrigation. The deeply entrenched sections of the river, typical of much of its course, could not be used without large and costly works.

The great development in the Imperial Valley and other irrigation projects in California and Arizona made increasing demands on the waters of the Colorado River.

In contrast, the upper basin lagged far behind the lower basin in population increase and irrigation developments. An impending conflict between upstream and downstream use was recognized, and in 1922 the Colorado River compact became the law of the Colorado River. This compact made a division of water between the upper and lower basins.

Projects were soon constructed on the lower river capable of using most of the water allotted to the lower basin. No comparable development took place in the upper basin, and at the present time the upper basin States have works capable of using less than one-third of the water to which they are entitled.

There are serious problems confronting the States of the upper basin in any plan for using their share of Colorado River water which can be resolved only through the comprehensive basinwide plan now proposed.

Paramount among them is the compact requirement that the upper basin States deliver to the lower basin not less than 75 million acre-feet over any period of 10 successive years.

The uneven flow of the river, with its erratic periods of drought and flood, makes the fulfillment of the commitment to the lower basin and substantial development in the upper basin impossible without river regulation. Such regulation would require additional storage facilities on a scale that dwarfs past developments in the upper basin.

In selecting storage sites for river regulation in the plan of full development, we have striven to obtain at the lowest cost the largest yield of water, the maximum power output of the river, and the minimum evaporation from the reservoirs.

There is also the need to design works to make water available to each of the upper basin States in accordance with its allotment under the upper Colorado River compact.

In addition the plan must allow for the changing needs of the upper basin and be flexible enough to meet developments in farming, municipal, and industrial uses, and recreation which cannot be accurately predicted at this time.

Features in the plan for developing the upper Colorado River Basin are broadly divided into two categories: (1) storage project units, and (2) participating projects.

The Colorado River storage project is the backbone of the plan. It comprises a system of nine dams, reservoirs, and powerplants at strategic points above Lee Ferry, on the main stem of the Colorado River and its important tributaries. These nine storage reservoirs would provide the regulation necessary in the discharge of the upper basin's responsibility to the lower basin, thereby permitting uncurtailed use of apportioned Colorado River water in the upper basin.

Bureau of Reclamation studies show that development in the upper basin could proceed with some risk without the benefit of such storage regulation to a limitation of approximately 58 percent of its apportioned water.

In other words, 42 percent of the upper basin's apportioned water cannot be put to use unless excess waters are impounded during periods of prolonged high flows in a system of long-time holdover reservoirs for release during prolonged periods of low flows.

The element of time for construction and initial filling of these reservoirs requires initiation of the work sufficient in advance of the time the actual need is present for supplementing Lee Ferry flows.

During the interim period, however, the powerplants at storage sites would be supplying a large power-deficient area with low-cost hydroelectric energy. When it becomes necessary to operate the reservoirs to supplement the flows at Lee Ferry, the powerplants would continue to service the power demands of the area. This would be possible because there is a high degree of compatability in the functions of river regulation for power and for fulfillment of the compact commitments at Lee Ferry.

The estimated market demands for hydroelectric energy in the upper basin would require the total proposed installed capacity in all 9 powerplants within a 20-year period.

The anticipated net revenues from the sale of energy generated by the storage project would be sufficient under the plan to retire the entire construction cost of the storage project with interest on all features chargeable to power.

In addition these revenues would furnish financial assistance to irrigation under projects known as participating projects and make possible complete repayment of their interest-free construction costs. The repayment studies are based on complete reimbursement of all features of the Colorado River storage project. No nonreimbursable allocations were made in the initial units of the storage project to fish and wildlife conservation, flood control, recreation, sediment retention, and other purposes, although in the future such allocation may be found desirable and justified.

Although the storage project would provide for complete utilization of the waters apportioned the upper basin, full development would

necessarily extend over a great number of years. It has taken 100 years to develop existing projects in the upper basin—allowing for authorized projects and projects under construction—with a total consumptive use of about 2½ million acre-feet, or one-third of the 7½ million acre-foot annual allotment to the upper basin.

The 12 new participating projects being recommended by the Department of the Interior would increase present consumptive uses by an additional 640,000 acre-feet of water annually.

The bill suggests additional participating projects which would require an additional consumptive use of 360,000 acre-feet annually.

With an expedited program in the future, it may be possible in the next 75 years to place the remainder of the upper basin's share of Colorado River water in use.

To accomplish the function of river regulation, the Colorado River storage project would require an aggregate gross capacity of approximately 48 million acre-feet. This is half again as large as the capacity of Lake Mead.

In addition to a necessary 23 million acre-feet of storage capacity for river regulation, the reservoir would provide minimum power heads, capacity for fish propagation, and space for 200 years of sediment deposition. No single site on the upper Colorado River or its tributaries is capable of storing that amount of water.

In selecting a team of nine reservoirs out of a great many possibilities, careful consideration was given to important factors such as physical condition, water supply and its utilization, power production and its distribution, recreation, sedimentation, and reservoir evaporation.

In these respects we have painstakingly examined many combinations. The team of nine selected units would provide maximum water utilization and power production with a minimum loss of water from evaporation at the lowest cost.

Two of the essential units would inundate a portion of the Dinosaur National Monument. We have been unable to find any substitutes for these units that would not materially diminish the effectiveness of the nine-reservoir system. Reservoir evaporation is a very important item in this determination since it constitutes a charge against the upper basin's allotment of Colorado River water.

From the standpoint of evaporation, it is advantageous to store water in large reservoirs, in confined canyons and at high elevations on the river system to hold this loss to a minimum.

The project's power potentials are chiefly dependent on two factors: the quantity of regulated water, and the power head.

The first is related to the size of the reservoir and the magnitude of natural flow.

The second is related to the height of the dam above the river. The power head would not be diminished by sediment deposition, but the power output would be affected by upstream consumptive uses of water. The annual energy output of the system would be reduced from an initial 9 billion kilowatt-hours to an ultimate 6 billion kilowatt-hours annually.

The plan in the supplemental report proposes construction of the Echo Park and Glen Canyon units and an interconnecting basic transmission system. Records over a long period show that there is an

adequate water supply to assure initial filling of these reservoirs even though adverse drought conditions should prevail. Transmission costs and the estimated average rate of 6 mills per kilowatt-hour for the sale of system energy are based on a delivery of power to load centers by either Federal or other means of transmission.

In addition to the Glen Canyon and Echo Park units, the bills contain authorization of other reservoirs and participating projects which would serve as points of regulation, diversions, and sources of local benefits.

The Navaho Dam and Reservoir, formerly considered a potential unit of the storage project, are now included under the Navaho participating project.

The Glen Canyon Dam would be located on the Colorado River in northern Arizona about 13 miles downstream from the Utah-Arizona State line, and 15 miles upstream from Lee Ferry. It would be a concrete curbed gravity-type structure rising 700 feet above bedrock.

The reservoir would offer final regulation for deliveries to the lower basin under the Colorado River compact.

Out of a total capacity of 26 million acre-feet, 20 million acre-feet initially would be active capacity. The reservoir when filled would have a maximum water surface area of 153,000 acres and would extend about 187 miles up the Colorado River, nearly to the mouth of the Green River, and 71 miles up the San Juan River.

The reservoir would be the principal sediment depository in the upper basin.

In 200 years at the present rate of sediment flow in the river and with upstream storage developed as planned, sediment deposits would fill all inactive storage space and reduce the active storage space by more than half.

The powerplant would be located near the toe of the dam. It would consist of 7 generating units for a total installed capacity of 800,000 kilowatts which is approximately one-half the total installed capacity contemplated for the entire Colorado River storage project. The plant would operate under a mean powerhead of 480 feet. The total construction cost of the Glen Canyon unit, with an appropriate assignment of transmission costs, would be approximately $421,300,000.

Although a capacity in excess of 26 million acre-feet is physically possible at the Glen Canyon site, addition in water elevation at Glen Canyon Reservoir might jeopardize the Rainbow Natural Bridge National Monument.

The Echo Park Dam would be located in Colorado on the Green River about 3 miles east of the Utah-Colorado State line and 3 miles below the junction of two major tributaries, the Green and Yampa Rivers, in the tricorner area of Colorado, Wyoming, and Utah.

Percentagewise, the evaporation losses from the remarkable storage vessel at Echo Park would be exceeded by those at all other sites possessing major storage possibilities in the upper basin. Echo Park Reservoir is second only in size and importance to Glen Canyon. Being less subject to the toll of sediment deposition, this disparity in size would diminish with age.

The power potential at Echo Park also is second only to that at Glen Canyon. This difference is actually smaller than it appears considering the great contribution from Echo Park's regulated flows

to increased future production at the downstream Split Mountain and Gray Canyon sites.

Just as Glen Canyon's position favors power markets in the lower part of the upper basin, Echo Park is strategically situated in the heart of the power market in the upper end of the basin. The Echo Park unit, because of its position of strategic control of the Green and Yampa Rivers, would make feasible the storage and power developments of the Flaming Gorge, Cross Mountain, Split Mountain, and Gray Canyon units.

Echo Park Dam would be a concrete curved gravity-type structure rising 690 feet from bedrock. The reservoir would have a storage capacity of 6,460,000 acre-feet, including 5,460,000 acre-feet of live capacity. When filled to capacity, the reservoir would have a surface area of 43,000 acres and would extend 63 miles up the Green River and 44 miles up the Yampa River.

The powerplant at the dam would operate under a mean head of 475 feet and would consist of 50,000 kilowatt units for a total capacity of 200,000 kilowatts. The construction cost of the Echo Park unit is estimated at $176,400,000, including an appropriate part of the basic transmission system.

In addition to the Glen Canyon and Echo Park units of the storage project, the Secretary of the Interior has recommended 12 participating projects for construction in the initial phase. A thirteenth project, the Eden project in Wyoming, was authorized in 1949, and is now nearing completion. The authorization of the Eden project, however, provided that the project be assisted by means of power revenues from the Colorado River storage project.

I will not attempt to go into the details of each of these participating projects except for a brief reference to the attached summary table. However, statements on each of the initial participating projects are attached and further details can be found in the supplements to the Colorado River storage-project report.

In addition, among the attached statements are brief summaries of the LaPlata project, the San Juan-Chama project, and the balance of the Navaho project, namely, the South San Juan Division, all of which are contained in the bill, but on which substantiating information as to feasibility is not available at this time.

For the Gooseberry project, also contained in the bill, a complete feasibility report has been submitted and a statement is included herein. Careful study of all available data shows that the depletions resulting from all the projects contained in the bill would have no appreciable effect on the quality of the streamflow passing Lee Ferry.

Before closing this general statement in which I have attempted to give you an overall picture of the basinwide plan and that part of it for which authorization is now being sought, there are two important phases which should be emphasized, the legal framework and the repayment schedule.

In a plan of this magnitude the authorities and laws under which the various features would be constructed, administered, and operated, would normally present almost unsurmountable problems and certainly would raise some grave questions of jurisdiction. The plan before you is happily free of such complications.

The storage project with its regulatory reservoirs is of interstate significance, and each unit of this part of the plan would be so treated. These units as far as water is concerned could be operated in strict conformance with the upper Colorado River Basin compact, a document so comprehensive that its provisions cover all necessary aspects of such operation.

The participating projects are consumptive-use projects intrastate in character. In the proposed plan, these projects would be constructed, operated, and maintained under reclamation law.

Water rights would, therefore, be obtained and administered under the water code of the State in which the project would be built.

A clear distinction would be maintained between the two categories in the plan. Should it become necessary at some future time for a State to make consumptive use of a portion of the water in one of the regulatory reservoirs in the storage project, the compact provides for such a contingency.

The plan requires payment against irrigation costs by the irrigators up to their ability to repay in 50 years, and the formation of appropriate districts preferably of the water-conservancy type which would assure local participation to the greatest extent in the repayment of construction costs prior to the irrigators' acceptance of assistance from power revenues.

The power features of the project would be repaid with interest to the United States Treasury at 2½ percent on unpaid power investments by project power revenues within a specified 50-year repayment period for individual generating units. The power features recommended in the Secretary's supplemental report would be paid out completely in the first 44 years of operation.

Subsequent power revenues would be sufficient to retire the irrigation costs of the storage project prior to the 50th year of operation of the storage project.

In addition, power revenues would retire in the 50th year of the irrigator's repayment period all irrigation costs in excess of the irrigator's ability to pay for each of the participating projects recommended in the Secretary's supplemental report.

The additional storage units and participating projects recommended in the bill, namely, the Curecanti—940,000 acre-feet capacity—and Flaming Gorge storage units, the Gooseberry, La Plata, San Juan-Chama, and total Navaho participating projects, would require either a slightly longer period of repayment or a slightly higher power rate to supply the necessary irrigation assistance.

The plan also provides for submission to the Congress from time to time of additional storage project units and additional participating projects. These submissions will be made as the needs for such units and projects arise, and when investigations are complete and feasibility reports are available.

Such a procedure, in our opinion, will provide for the greatest possible development of the water and related resources of the Upper Colorado River Basin and will offer sufficient flexibility for future change in economic conditions.

With this statement, Mr. Chairman, I have a summary table of the Colorado River storage project and participating projects, listing first

the Echo Park and Glen Canyon unit, showing the generating capacity and the stream depletion of water, the total cost and the reimbursable allocations, irrigation allocations, and the irrigation allocations assigned to the repayment from net power revenues.

Shown next on the table is the same information for the two additional units included in the bills, namely, the small Curecanti and the Flaming Gorge units.

Then, third, we have the information for the 12 participating projects recommended for authorization in the supplemental report, and the table shows in what State they are located, the acres of new land, the land receiving a supplemental water supply, the generating capacity of powerplants, if any, attached to the participating projects, the amount of municipal water where it applies, the stream depletion amounts, the total cost, the amount of nonreimbursable allocation, and the reimbursable allocations for power, municipal water, and irrigation, and the irrigation allocation repayable by the water users and the irrigation allocation assigned for repayment from net power revenues.

The same information is shown for the additional participating projects in the bill over and above those recommended in the supplemental report of the Secretary, namely, for the Edan, La Plata, San Juan unit of the Navaho and the San Juan-Chama participating projects.

The Eden project is recommended by the Secretary for participation in net revenues, but is not recommended for authorization for the reason that it already has been authorized along those lines.

(The information referred to follows:)

SUMMARY TABLE—*Colorado River storage project and participating projects*

Project	State	Land to be irrigated		Power		Municipal water annually	Stream depletion annually
		New	Supplemental	Generating capacity	Annual generation		
		Acres	*Acres*	*Kilowatts*	*Million kilowatt-hours*	*Acre-feet*	*Acre-feet*
Colorado River storage project:							
Initial units							
Echo Park unit	Colorado, Utah			200,000	1,094		87,000
Glen Canyon unit	Arizona, Utah			800,000	4,100		526,000
Subtotal initial units				1,000,000	5,194		613,000
Additional units in the bill							
Curecanti unit (940,000 acre-feet)	Colorado			40,000	225		18,000
Flaming Gorge unit	Utah, Wyoming			72,000	417		56,000
Subtotal additional units				112,000	642		74,000
12 participating projects							
Central Utah (initial phase)	Utah	28,540	131,840	61,000	373	48,800	189,400
Emery County	do	3,630	20,450				15,500
Florida	Colorado	6,300	12,650				12,900
Hammond	New Mexico	3,670					7,900
La Barge	Wyoming	7,970					14,200
Lyman	do		40,600				0
Navajo project:							
Shiprock division [1]	New Mexico	104,000					240,000
Paonia	Colorado	2,210	14,830				9,000
Pine River project extension	Colorado, New Mexico	15,150					28,300
Seedskadee	Wyoming	60,720					110,400
Silt	Colorado	1,900	5,400				5,800
Smith Fork	do	2,270	8,160				7,500
Subtotal, initial projects		236,360	233,930	61,000	373	48,800	640,900
Additional participating projects in the bill							
Eden	Wyoming	10,660	9,540				32,400
Gooseberry	Utah		16,400				12,500
LaPlata	Colorado, New Mexico		9,800				9,000
Navajo-South San Juan division [2]	New Mexico	47,000					101,000
San Juan-Chama	do		200,000	145,000	260	110,100	235,000
Subtotal additional projects		57,660	235,740	145,000	260	110,100	389,900
Total, participating projects		294,020	469,670	206,000	633	158,900	1,030,800
Grand total		294,020	469,670	1,318,000	6,469	158,900	1,717,800

See footnotes at end of table.

SUMMARY TABLE—*Colorado River storage project and participating projects*—Continued

Project	State	Construction costs: Total (exclusive of nonreimbursable Colorado River development fund expenditures)	Construction costs: Nonreimbursable	Construction costs: Reimbursable allocations [3] (exclusive of interest during construction): Power	Construction costs: Reimbursable allocations [3] (exclusive of interest during construction): Municipal water	Construction costs: Reimbursable allocations [3] (exclusive of interest during construction): Irrigation	Irrigation allocation repayable by water users [4]	Irrigation allocation assigned for repayment from net power revenues
Colorado River storage project								
Initial units								
Echo Park unit	Colorado, Utah	$176,426,000		$128,383,000		$48,043,000		$48,043,000
Glen Canyon unit	Arizona, Utah	421,270,000		370,974,000		50,296,000		50,296,000
Subtotal initial units		597,696,000		499,357,000		98,339,000		98,339,000
Additional units in the bill								
Curecanti unit (940,000 acre-feet)	Colorado	49,305,000		41,205,000		8,100,000		8,100,000
Flaming Gorge unit	Utah, Wyoming	82,942,000		52,042,000		30,900,000		30,900,000
Subtotal additional units		132,247,000		93,247,000		39,000,000		39,000,000
12 participating projects								
Central Utah (initial phase)	Utah	231,044,000	$5,991,000	46,699,000	$45,500,000	127,354,000	$15,191,000	[5]112,163,000
Emery County	do	9,865,500	229,000			9,636,500	3,715,000	5,921,500
Florida	Colorado	6,941,500	437,900			6,503,600	1,711,500	4,792,100
Hammond	New Mexico	2,302,000				2,302,000	370,000	1,932,000
La Barge	Wyoming	1,673,300				1,673,300	495,000	1,178,300
Lyman	do	10,564,000				10,564,000	2,255,000	8,309,000
Navajo project:								
Shiprock division [1]	New Mexico	178,825,000				178,825,000	13,300,000	165,525,000
Paonia	Colorado	6,944,000	152,400			6,791,600	2,414,000	4,377,600
Pine River project extension	Colorado, New Mexico	6,027,000				6,027,000	2,045,000	3,982,000
Seedskadee	Wyoming	23,272,000				23,272,000	4,785,000	18,487,000
Silt	Colorado	3,356,000	73,600			3,282,400	1,020,000	2,262,400
Smith Fork	do	3,367,000	24,000			3,343,000	1,045,000	2,298,000
Subtotal, initial projects		483,181,300	6,907,900	46,699,000	45,500,000	378,574,400	48,346,500	330,227,900
Additional participating projects in the bill								
Eden	Wyoming	7,287,000				7,287,000	1,500,000	5,787,000
Gooseberry	Utah	5,760,500	33,000			5,727,500	2,375,000	3,352,500
LaPlata	Colorado, New Mexico	9,958,500	773,800			9,184,700	1,245,000	7,939,700
Navajo-South San Juan division [2]	New Mexico	[6]3,825,000				53,825,000	6,140,000	47,685,000

San Juan-Chama	do	228,141,000		73,459,000	55,374,000	99,308,000	32,335,000	66,973,000
Subtotal, additional projects		304,972,000	806,800	73,459,000	55,374,000	175,332,200	43,595,000	131,737,200
Total, participating projects		788,153,300	7,714,700	120,158,000	100,874,000	553,906,600	91,941,500	461,965,100
Grand total		1,518,096,300	7,714,700	712,762,000	100,874,000	691,245,600	91,941,500	599,304,100

[1] Exclusive of $37,825,000 for required additional capacities in Navajo Reservoir and main highline canal for the South San Juan division
[2] Includes costs only of required facilities additional to facilities of Shiprock division (See also footnote 1)
[3] Allocations of Colorado River storage project costs to units are only for the purpose of facilitating a payout analysis for the initial units and only illustrative for other units
[4] Repayment by irrigation water users toward construction costs over 50-year repayment period beyond a reasonable development period except 60-year period for Eden project and 68-year period for Paonia project
[5] Exclusive of $5,500,000 allocable to purposes of the ultimate phase of Central Utah project.

I have with me, also, brief statements, 16 of them all told, of the participating projects I named in the table—1 or 2 or 3 or 4 pages—of all the participating projects recommended by the Secretary and additional ones in the bill, for filing with your committee.

I do not know whether you wanted them read.

It would probably take 2 or 3 hours to read them. That is subject to what is desired by the chairman.

Mr. HARRISON. Do any members of the committee want the reports read at this time.

Mr. D'EWART. No.

Mr. ASPINALL. Mr. Larson, do these supplemental statements of participating projects differ materially from the statements that have been made in the previous reports?

Mr. LARSON. I did not hear that.

Mr. ASPINALL. I say, do these supplemental statements of participating projects differ materially from the statements to be found in the previous reports?

Mr. LARSON. They are really summaries of what is contained in the supplemental reports of 1950 except that the costs are brought up to date, 1953 index, and some of the economics are brought up to date on our new procedures.

Mr. REGAN. I would like to know one feature of the report. It says on page 11 that—

> The San Juan-Chama project and the balance of the Navaho project, namely, the South San Juan Division, all of which are contained in the bill, but on which substantiating information as to feasibility is not available at this time.

I want to know if he is putting a report on this San Juan-Chama at this time when he says the feasibility is not yet available.

Mr. LARSON. The San Juan-Chama project is in region 5 of the Bureau of Reclamation. The engineer is here.

I believe this statement is a general statement of all the projects as previously reported.

Mr. REGAN. Is it your idea that you are now asking authorization for the San Juan-Chama project?

Mr. LARSON. As I explained, the Secretary recommends in his supplemental report the authorization of 12 participating projects. The bills contain additional participating projects not in the Secretary's recommendation and the San Juan-Chama I believe is one of those.

Mr. REGAN. You are not at this time recommending the authorization of the San Juan-Chama project?

Mr. LARSON. No. I said I was including statements that would explain the units recommended by the Secretary, the 12, and the 4 additional ones contained in the bill.

Mr. REGAN. Is the San Juan-Chama in the 12, or in the 4 additional?

Mr. LARSON. It is in the four additional.

Mr. HOSMER. Mr. Chairman, I would like to ask a question or two.

Mr. HARRISON. Is it a question as to the introduction of this?

Mr. HOSMER. Yes. It is under date of January 4, 1954; is that the document you are talking about?

Mr. LARSON. Yes.

Mr. HOSMER. This was prepared by the Interior Department; is that right?

Mr. LARSON. Yes; Interior Department, region 5 of the Bureau of Reclamation.

Mr. HOSMER. When was it prepared?

Mr. LARSON. These statements I am filing now, most of them were just prepared recently.

Mr. HOSMER. For what purpose were they prepared?

Mr. LARSON. Informing this committee to give them an idea of the general description, the writeup of the participating projects recommended by the Secretary and the four additional ones included in the bill.

Mr. HOSMER. It is a document of the different regions of the Bureau of Reclamation?

Mr. LARSON. It is an explanation of the project.

Mr. HOSMER. And not of the Department in Washington; is that right?

Mr. LARSON. I would say this is a Department of Interior presentation, the whole thing.

Mr. HOSMER. What I am trying to find out is whether it is a document that has the stamp of approval of the headquarters or was it a document that was prepared and submitted to Washington and the Department simultaneously with its submission here?

Mr. DEXHEIMER. Mr. Chairman, I would like to point out that this particular project is outside of Mr. Larson's regional boundaries. It is in region 5. The document on San Juan-Chama was prepared by region 5 with headquarters in Amarillo. It is only a statement of the information we presently have available on the San Juan-Chama.

It is not one which is included for recommendation by the Secretary at this time.

Mr. HOSMER. In other words, this is the result of the regional office and the information in their file?

Mr. DEXHEIMER. Information that we have up to this time; yes, sir.

Mr. HOSMER. It has not been screened or evaluated by Washington, by the Department in Washington?

Mr. DEXHEIMER. It has been screened, but we don't have enough information yet to recommend it for authorization.

Mr. REGAN. Is it then necessary to incorporate it in any of these hearings?

Mr. DEXHEIMER. It is included in the bill, sir, and for that reason we have given you the information we have available.

Mr. HOSMER. Just one more question.

Are you talking about this whole document, or just San Juan-Chama?

Mr. DEXHEIMER. Just San Juan-Chama.

Mr. HOSMER. What about this whole document? Do you have any information on that?

Mr. DEXHEIMER. Which one do you have?

Mr. HOSMER. The one that Mr. Larson is asking be introduced in the record, dated January 4, 1954. It does not contain any statement as to whom it is from or any identifying features.

I am trying to find out the authority and background.

Mr. LARSON. It is an attachment to my statement which has been approved.

Mr. DEXHEIMER. This statement was prepared to give you all the information that we presently have available on all the projects which are included in the bill. It was for the purpose of giving you all the information which we presently have on all the projects that are included in the bill as differentiated from those projects which are included in the Secretary's report.

Mr. HOSMER. It was prepared in the regional offices and not in the Washington office; is that correct?

Mr. LARSON. All of these reports are prepared in the regional offices and reviewed in our Washington office.

Mr. REGAN. I would like to ask, Mr. Commissioner, was this report of the San Juan-Chama prepared in your Amarillo office?

Mr. DEXHEIMER. Yes.

Mr. REGAN. Region 5?

Mr. DEXHEIMER. Yes.

Mr. REGAN. Will the man in charge of the Amarillo office present his views at this hearing at a subsequent time? Is the man who is responsible for preparing this proposal going to present it?

Mr. DEXHEIMER. We didn't plan that he would, but if the committee wishes, we would be glad to have him here to do that.

Mr. REGAN. But he is in region 5, so Mr. Larson in charge of region 4 is going to present it in his stead; is that right?

Mr. DEXHEIMER. No, sir; we are just attaching it to Mr. Larson's overall reports on the upper Colorado project. We would be very happy to have someone from region 5 present the detailed information to the committee if they so desire.

Mr. REGAN. As one member of the committee, I so desire.

Mr. HOSMER. Mr. Chairman, may I inquire if we are going to go into all these projects and explain them in detail, the information that is in here?

Mr. HARRISON. I rather imagine so. They are part of the projects that come under the terms of the bill and it seems to me we would have to have some testimony regarding those projects, not just the statement that the whole thing should be approved without going into the individual projects.

I think the Department is planning to present testimony regarding at least the individual projects they have recommended. Twelve are for the inclusion in this overall picture and for that reason they are submitting the information for the committee.

Mr. HOSMER. This is not all the information that will be submitted?

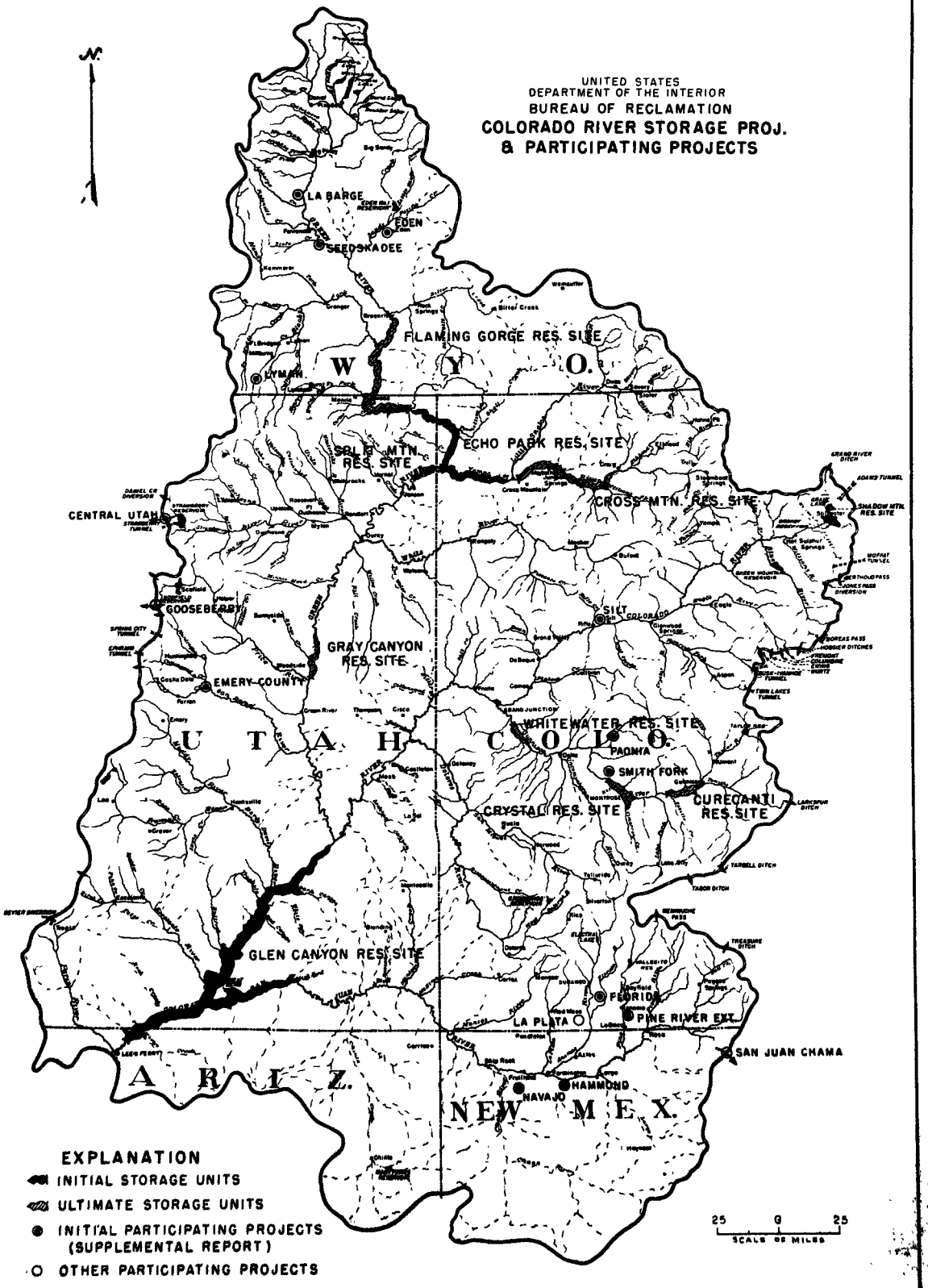
Mr. HARRISON. Mr. Hosmer, I could not tell you. I will have to wait until the Department puts on its testimony. I have no way of anticipating what they are going to put on, except that I say I think they will put on testimony covering the terms of the bill.

In my opinion that is customary.

Mr. HOSMER. Mr. Regan and I would appreciate hearing some more of the details.

Mr. HARRISON. If there is no objection to the introduction of this as part of the record, it will be so ordered.

Mr. ENGLE. May I suggest, Mr. Chairman, that rather than have the court reporter write all this, which means a repetition of copying it in the record, that it be made a part of the record to be included not in the transcript, but in the final printing of the record so that when the record is printed this information will go direct to the Printing



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Office. It will not require the court reporter to copy it all into the transcript and thereby run up the bill and result in unnecessary work.

Mr. HARRISON. If there is no objection to that, it will be adopted.

(The document referred to is as follows:)

STATEMENT ON CENTRAL PROJECT, UTAH

The potential central Utah project would provide for the multiple-purpose use in Utah of water tributary to the Colorado River. Under the general plan of development streams, draining the southern slope of the Uinta Mountains in the Uinta Basin in northeastern Utah would be intercepted and conveyed westerly by gravity flow through the Wasatch Mountains to the Bonneville Basin. The water would be collected by an aqueduct leading to a storage reservoir high in the Wasatch Mountains. From the reservoir the water would drop through a series of hydroelectric powerplants before being used for irrigation, municipal, and industrial purposes. Replacement water and water for additional development in the Uinta Basin would be provided by a major diversion from the Green River and by smaller developments on local streams.

The project is of such magnitude it has been planned in two parts—the initial phase, a unified portion that could be developed and operate independently, and the ultimate phase. The two phases combined make up the comprehensive plan. Sufficient investigations have been made of the comprehensive plan to show its physical feasibility. Detailed investigations have been made only on the initial phase.

This statement on the central Utah project, except as otherwise noted herein, is based on the physical plan of development presented in the Bureau of Reclamation report on central Utah project, Utah, dated February 1951—a supplement to the Colorado River storage project report, dated December 1950. It is possible that significant modifications in the project plan may be found desirable during the definite planning stage of the investigation of the project.

THE AREA AND ITS NEEDS

The project area includes land on both sides of the Great Basin Divide, the high mountain series consisting of the Wasatch Mountains and continuing ranges, that extends north and south across the center of the State. To the east of the divide, within the Colorado River Basin, are the Uinta Basin lands that would be served by the project. This area includes the communities of Vernal, Roosevelt, and Duchesne. To the west of the divide is the Bonneville Basin. The project would serve an area along the eastern border of this basin. This area, the most highly developed region in Utah, includes the communities of Salt Lake City, Provo, Heber, Spanish Fork, Payson, Nephi, Richfield, Delta, and Fillmore.

The need for water and electric energy in the Bonneville Basin is intensified by expanding industrial activities. The new Geneva steel plant near Provo, the largest fully integrated steel plant west of the Mississippi, and the Kennecott Copper Co.'s electrolytic refinery, recently constructed near Salt Lake City, are important industrial additions. Finished steel and copper are attracting satellite industries. Largely as a result of the industrial expansion, the population of the Bonneville Basin portion of the project area increased 29 percent from 1940 to 1950. The area's demand for food and for municipal, industrial, and miscellaneous water supplies has increased accordingly. The Basin contains vast areas of rich alluvial soil, but irrigation is generally required to mature crops. The flow of small local streams, practically the only source of water, falls far short of irrigation requirements. Importation of a substantial amount of water into the basin is essential to the basin's agricultural and industrial expansion but can be accomplished only through development of the central Utah project. Without the importation contemplated under the project, future municipal and industrial expansion in Salt Lake City and areas to the south will require a reduction in the use of water for irrigation. Also, without the importation of water and without an increased supply of electric energy, further development of the Bonneville Basin's rich resources of land, minerals, and chemicals will be slowed.

In contrast to the Bonneville Basin, the Uinta Basin has abundant water resources as compared with the land resources. Streams flowing south from the Uinta Mountains—the Duchesne River and its major tributaries, together with Ashley Creek and Brush Creek—produce more than ample water for

irrigation. Most of the stream runoff, however, is uncontrolled and as summer progresses the supply diminishes below the requirements of the land. The Moon Lake and Midview Reservoirs constructed by the Bureau of Reclamation to a combined capacity of 55,300 acre-feet, together with many small privately and Indian-owned reservoirs, provide valuable but insufficient regulation of water resources. With further regulation of water resources, agriculture, the principal enterprise, could continue to expand. Industrial development based on deposits of petroleum, other hydrocarbons, and phosphates, would be encouraged. Development of the petroleum industry is now getting under way. Several oil wells recently have been brought into commercial production.

THE COMPREHENSIVE PLAN

When fully developed the central Utah project would provide a full irrigation water supply for 200,000 acres of new land. It would also provide a supplemental supply for 239,900 acres now inadequately irrigated. It would provide 48,800 acre-feet of water to meet foreseeable demands for municipal, industrial, and other miscellaneous purposes, and it could provide additional water for these purposes as future requirements developed. Project powerplants tentatively planned would have an installed capacity of 249,000 kilowatts and would generate almost 1.2 billion kilowatt-hours of electric energy annually. Additional power potentialities exist and as investigations of the ultimate phase are continued the planned capacity of the powerplants may increase materially.

The flow of all important streams on the south slope of the Uinta Mountains as far east as Brush Creek would be intercepted by the potential Strawberry aqueduct and conveyed to the Strawberry Reservoir in the Wasatch Mountains. The flow of Carter Creek on the Uintas' northern slope would be brought to the southern slope for conveyance to the reservoir. The aqueduct, 110 miles long, would consist largely of tunnels through mountain ridges separating the parallel streams. Inflow to the tunnels would be regulated in small reservoirs on the mountain streams The western 36.8 miles of the aqueduct, extending from Rock Creek to the Strawberry Reservoir, would consist of two parallel bores. Power developments would be made on the various streams where practicable.

Strawberry Reservoir, a feature of the Strawberry Valley reclamation project, would be enlarged from its present capacity of 283,000 acre-feet to a capacity of 1,370,000 acre-feet by construction of Soldier Creek Dam on Strawberry River 9 miles below the existing dam. The enlarged reservoir would regulate (1) water delivered through the aqueduct, estimated to average 563,000 acre-feet annually; (2) additional water developed on Strawberry River between the existing and new dams, estimated to average 18,000 acre-feet annually; and (3) the present Strawberry Valley project supply, averaging about 69,000 acre-feet annually. Water in nearly uniform annual quantities would be released from the reservoir to the Bonneville Basin through 2 almost parallel tunnels, approximately 4 and 5 miles long, and then would be conveyed down the western slope of the Wasatch Mountains through Diamond Fork and Spanish Fork Canyons. In its descent from the reservoir to near the floor of the Bonneville Basin, a drop of about 2,600 feet, the water would pass through a series of hydroelectric powerplants with a combined capacity of 231,000 kilowatts, capable of producing 1.1 billion kilowatt-hours of energy annually. The water would pass first through the Old West and Fifth Water powerplants located near the outlets of the two tunnels. Water released from these plants would flow through the Sixth Water and Fifth Water aqueducts to a common surge pipe. The water would flow successively through the Hammock and Tanner powerplants to the Monks Hollow Reservoir. From Monks Hollow Reservoir the water would enter the Wasatch aqueduct. Eight miles down the aqueduct line, high on the wall of Spanish Fork Canyon, the water would be divided, part continuing in the aqueduct and extensions to the south and part being diverted to the north.

During the irrigation season the water continuing south in the Wasatch aqueduct would be distributed for irrigation and other purposes in the area from Salem to Levan. Part of the aqueduct water would be regulated in the Goosenest Reservoir and other reservoirs and distributed to lands that are above canals of the Strawberry Valley project in an area between Salem and York Ridge, a ridge south of Santaquin. At York Ridge, part of the water would be diverted into the potential Mona-Nephi Canal and used as far south as Levan. Some of the water would replace that now supplied for irrigation from Salt Creek near Nephi, thus permitting more of the spring water tributary to Salt

Creek to be used for municipal, industrial, and other miscellaneous purposes in the Nephi area. Return flows from irrigation in the Nephi area would be utilized on agricultural lands in the vicinity of Elberta. These flows would be regulated in the existing Mona Reservoir that would be enlarged under the project. During the nonirrigation season water continuing south in the Wasatch aqueduct beyond York Ridge would be conveyed to the 530,000 acre-foot Dyer Reservoir and stored for irrigation of lands near Holden and Fillmore. Some of the water from Dyer Reservoir would be used near Delta for irrigation of lands now supplied from the lower Sevier River. Thus more water of the Sevier River could be stored in existing upstream reservoirs and used for irrigation of lands along the upper reaches of the river, principally near Richfield.

Water diverted to the north from the Wasatch aqueduct, including the present Strawberry Valley project supply, would drop through the Castilla powerplant. It would then be used for supplemental irrigation and other purposes in the area from Santaquin to Springville now partially served by the Strawberry Valley project During the nonirrigation season releases from the Castilla plant would flow down Spanish Fork River to Utah Lake, relieving the obligation of Provo River to deliver water to the lake. So far as practicable throughout the year releases from the Castilla plant would be routed through existing powerplants of the Strawberry Valley project, thus providing a much needed firm water supply for operation of these plants.

Provo River water replaced in Utah Lake by water from the central Utah project would be stored in the potential 65,000 acre-foot Bates Reservoir on the Provo River and the potential 850 acre-foot Hobble Creek Reservoir on a tributary of Round Valley Creek. The operation of these reservoirs would be correlated with that of the Deer Creek Reservoir and other existing reservoirs on the Provo River system to the mutual advantage of present and potential water users. The central Utah project water from the Provo River would be used for irrigation, municipal, and industrial purposes in the Heber-Francis-Wallsburg areas and in the Provo-Salt Lake City region. A portion of this water would be conveyed to lands in the western part of the Jordan River Valley through the existing Provo Reservoir Canal and the potential West Valley Canal. Another portion would be conveyed by the Provo Reservoir Canal and used for irrigation and other purposes in the area from Provo to Lehi. The remainder would be utilized for municipal, industrial, and other miscellaneous purposes in areas between Lehi and Salt Lake City. This water would be conveyed from Provo River through the Salt Lake aqueduct, constructed by the Bureau of Reclamation as a part of the Provo River project. Central Utah project water conveyed in the aqueduct would be regulated to meet fluctuating demands in the potential 490 acre-foot Front Reservoir located one-half mile south of the mouth of Big Cottonwood Creek near Salt Lake City. As an addition to use of the Salt Lake aqueduct, a potential mine-drainage tunnel that would serve the important Park City-Alta mining district also could be utilized for the delivery of central Utah project water in the Provo River to the vicinity of Salt Lake City. Use of the tunnel, however, is not included in present plans of the Bureau of Reclamation. Existing irrigation distribution systems would be rehabilitated and extended in the Heber and Wallsburg areas.

Dams would be constructed where practicable to impound water for recreational and fish and wildlife purposes, thus providing partial compensation for damages to these purposes from the construction of some other project features. Included would be a dam forming Round Knoll Lake near Wallsburg, which would provide a constant water surface of 300 acres. Fish hatcheries would be constructed to provide fish for stocking streams as further compensation for damage resulting from the project.

A dike 6 7 miles long and 20 feet high would be constructed across the mouth of Provo Bay, an arm of Utah Lake. The bay would then be drained to reduce evaporation losses and to reclaim 9,340 acres of land for irrigation farming. An irrigation supply for the area would be pumped from Utah Lake and would consist of water saved from evaporation in the bay area and increased return flows reaching the lake from project lands Drainage water would be pumped from the bay area to Utah Lake. Plans are reported for a new State highway alinement across Provo Bay in the vicinity of the potential dike. Plans for the two structures could be correlated, resulting in a substantial saving in cost and other advantages.

The diking of Goshen Bay of Utah Lake, authorized as a part of the Provo River project but not yet undertaken, would become a part of the central Utah

project. The dike 22 feet high and 5.5 miles long would permit the south 26,000 acres of Utah Lake to be drained and would thereby reduce the average annual evaporation by 60,000 acre-feet. The water thus saved could be used for irrigation either in Cedar, Tooele, or West Jordan Valley.

A 7-mile section of the Jordon River channel between Utah Lake and Jordan Narrows would be enlarged. The channel improvement also was authorized as a part of the Provo River project. Improvement of the river channel from Jordan Narrows to Great Salt Lake is being investigated by the Corps of Engineers as a flood-control project

In order to replace water now used in the Uinta Basin that would be exported and to provide additional water for further development within this basin, water would be diverted from the Flaming Gorge Reservoir that would be constructed on the Green River as a feature of the Colorado River storage project. The water would be conveyed from the reservoir through the Flaming Gorge aqueduct, a structure 120 miles long, including an 18-mile tunnel through the Uinta Mountains. Under an alternative plan of development Green River water could be supplied to the Uinta Basin from Echo Park Reservoir, another potential feature of the Colorado River storage project. If the Echo Park Reservoir were used as the Uinta Basin source of supply, the Flaming Gorge aqueduct would be eliminated and the water would be distributed by an aqueduct generally parallel to, but 160 feet lower than, the Flaming Gorge aqueduct. Central Utah project water from the Echo Park Reservoir would be pumped an average lift of 170 feet.

Green River water would be supplemented in the Unita Basin by some water released from the Strawberry aqueduct and water developing below the Strawberry aqueduct. Supplies from the three sources would be coordinated for most efficient use and regulated in existing reservoirs, including the Moon Lake and Midview Reservoirs of the Moon Lake project, and several reservoirs that would be constructed under the project, including the Tyzack, Stanaker, Maeser, Halfway Hollow, Hancock, Altonah, Upalco, Starvation, and Hanna.

Project powerplants and transmission systems would be interconnected with the system proposed for transmission of electric energy produced by plants of the Colorado River storage project.

Water rights

Rights to flows of Uinta Basin streams have been acquired by both white settlers and Indians. These rights, evidenced by court decrees and by applications to appropriate water filed with the State engineer, cover all late-season waters carried by the streams. Nevertheless, surplus water beyond capacities of diversion works normally waste from almost all streams in the spring and early summer. Local interests, municipalities, and public agencies have filed applications to appropriate some surplus waters for local storage or exportation to the Bonneville Basin. The Bureau of Reclamation has filed applications to appropriate water for the project from the Green River and Uinta Basin streams.

The central Utah project would largely control the Uinta Basin's surplus waters. Much of the water would be exported, but that needed for further development in the Uinta Basin would be provided either directly or by exchange. Regulation of the water to furnish a full season supply would be advantageous to all present claimants and therefore no serious difficulty is expected in obtaining surplus waters for project purposes. Some water now used beneficially in the Uinta Basin could be exported in exchange for a regulated supply from the Green River without prejudice to existing water rights.

Annual depletions to the Colorado River at the sites of use resulting from the central Utah project are expected to average 189,400 acre-feet under the initial phase and 800,600 acre-feet under the comprehensive development. Depletions resulting from the comprehensive development would amount to approximately two-thirds of the water made available to Utah for future development under the terms of the upper Colorado River Basin compact. Sufficient water would be available in the Green River for the planned diversion to the Uinta Basin after completion of all potential upstream projects for use of water in Wyoming. The water exchanges involving Provo and Sevier Rivers and other lesser exchanges necessary to obtain potable water for domestic use could be made under the laws of Utah without impairment of existing rights. Present diversions from Strawberry River watershed would not be adversely affected.

Through its participation in the Provo River project the Metropolitan Water District of Salt Lake City has acquired water for future city growth. Although all of this water is not needed in the district immediately, an urgent requirement for water for municipal and irrigation use exists in areas outside of the district boundaries. Temporary use of the district's reserve water in adjoining

areas would lead only to intensified difficulties unless an additional source of water were assured for the future As the central Utah project would provide the additional source of water, its authorization would justify immediate leasing of the district's reserve water for use outside of the district

INITIAL PHASE OF PROJECT

In the initial phase of the project only Rock Creek and Uinta Basin streams west of Rock Creek would be diverted into the Bonneville Basin where development would be limited to areas between Salt Lake City and Nephi. Initial phase development in the Uinta Basin would include the Jensen, Vernal, and Upalco areas and lands along the Duchesne River.

The initial phase of the project would provide for the irrigation of 28,500 acres of new land and 132,000 acres now irrigated but in need of more water. Part of the water exported to the Bonneville Basin would be acquired by exchanges involving water for 42,600 acres of land in the Uinta Basin, more than half of which is owned by Indians or has been acquired from them. These exchanges may result in benefits to the Uinta Basin lands through improved water regulation Available data do not permit an evaluation of such benefits; consequently, they are not claimed in this report but they will be determined and evaluated in the preconstruction planning. The initial phase would also provide 48,800 acre-feet of water annually for municipal, industrial, and other miscellaneous uses. Initial phase powerplants with an installed capacity of 61,000 kilowatts would generate approximately 373 million kilowatt-hours of electric energy annually. Approximately 2.2 million kilowatt-hours of energy would be required by the project for irrigation and drainage pumping. Energy produced at central Utah project powerplants would be firmed by interconnections with plants of the Colorado River storage project.

Project works

Under the initial phase 1 of the 2 parallel aqueducts comprising the western 36.8 miles of the Strawberry aqueduct would be constructed. This aqueduct would intercept flows of Rock Creek, Hades Creek, Wolf Creek, West Fork of the Duchesne River, Currant Creek, Layout Creek, and Water Hollow. Reservoirs to regulate inflow to the aqueduct would be provided on Rock Creek (Upper Stillwater), West Fork of the Duchesne River (Vat) and Currant Creek (Currant Creek).

The Strawberry Reservoir would be enlarged through construction of the Soldier Creek Dam. The dam would be constructed in the initial phase to the full height required for the comprehensive development. One-stage construction to ultimate capacity would cost considerably less than initial construction and later enlargement. One-stage construction also would obviate interference with initial phase operation that otherwise would result while the dam was being enlarged.

The existing outlet tunnel from the Strawberry Reservoir would be enlarged. Below the tunnel outlet, in succession down the west slope of the Wasatch Mountains, would be constructed the Old West powerplant, Sixth Water aqueduct, Hammock powerplant, Tanner powerplant, Monks Hollow Dam, the Wasatch aqueduct as far as York Ridge near Santaquin, and the Castilla powerplant. The Mona-Nephi Canal would be constructed from York Ridge as far south as Salt Creek near Nephi. The Mona Reservoir would be enlarged, the Elberta Service Pipe would be constructed, and the existing Elberta Canal would be enlarged to distribute water from Mona Reservoir.

Use of Provo River water through exchange in the initial phase would require construction of Bates Dam on Provo River, Hobble Creek Dam on Little Hobble Creek, the West Valley Canal, and the Front Dam. Provo Bay would be diked and drained and the upper 7 miles of the Jordan River channel would be enlarged.

An exchange of water between the Bates Reservoir and numerous small storage reservoirs on the upper Provo River would be made to provide supplemental water to areas in the vicinity of Francis and Heber City. Water developing between Bates Reservoir and Hobble Creek Reservoir would be used for supplemental irrigation in the Wallsburg area in exchange for Strawberry Reservoir water delivered to Utah Lake. A dam would be constructed creating Round Knoll Lake for recreational and fish and wildlife purposes.

New project works to provide water for replacement and expanded irrigation and municipal use in the Uinta Basin would include Hanna Reservoir on the North Fork of Duchesne River, Starvation Reservoir on Strawberry River with a 6.8-mile feeder canal from the Duchesne River, the Upalco Reservoir offstream from Lakefork River, the Stanaker Reservoir with a 3.6-mile feeder canal from Ashley Creek, and the Tyzack Reservoir on Brush Creek.

Existing drains and irrigation laterals generally would be adequate for the project but some rehabilitation of drainage systems would be required in the Spanish Fork and Nephi areas, and new drains would be required in the Provo Bay, Lehi, Vernal, and Jensen areas. Construction of some new distribution laterals and rehabilitation of others would be required in nearly all major irrigation areas.

A pipeline would be required to convey water to communities in eastern Duchesne County. Necessary distribution facilities within the communities would be constructed and financed by local interests. The existing municipal distribution system in the Vernal area would be used to distribute the additional municipal water. Necessary extensions would be constructed by local interests. In the Bonneville Basin municipal water would be delivered at turnouts from principal project works. Additional facilities for treatment and distribution of the water would be provided by the water users.

Transmission lines for delivery of project power would be constructed to Salt Lake City on the north and to Manti on the south.

Facilities would be constructed for development of fish and wildlife, recreation, and forest resources in general as recommended in accompanying reports of the Fish and Wildlife, National Park, and Forest Services.

Construction schedule

Initial phase work would be constructed in steps extending over a period of about 16 years. Thus irrigation development would be undertaken at different times in 13 areas or blocks. First features constructed would include the portion of the Strawberry aqueduct from the West Fork of the Duchesne River to the Strawberry Reservoir. The initial program also would include construction of the Vat, Currant Creek, Bates, Hobble Creek, Round Knoll, Front, Upalco, and Stanaker Dams, enlargement of the Strawberry tunnel, construction of the Old West powerplant, and improvement of the Jordan River channel. Construction would next be undertaken on the Soldier Creek, Starvation, Upper Stillwater, and Hanna Dams, the Strawberry aqueduct from the West Fork of the Duchesne River to Rock Creek, initial portions of the Wasatch aqueduct, Starvation feeder canal, Sixth Water aqueduct, Hammock powerplant, and transmission lines. Last initial phase features to be constructed would be the Castilla and Tanner powerplants, Tanner diversion dam, Mona-Nephi Canal, Monks Hollow and Mona Dams, Goosenest Reservoir, Provo Bay development, and Elberta Service Pipe and Canal.

Effect on existing facilities

The operation of various existing facilities would require modification for correlation with the construction and operation of works planned for the central Utah project. Among the principal features in the Bonneville Basin affected by the initial phase would be the Strawberry Reservoir outlet tunnel, canals, and powerplants of the Strawberry Valley project; Deer Creek Reservoir, Provo Reservoir Canal, and Salt Lake aqueduct of the Provo River project; Utah Lake; and Mona Reservoir. Principal facilities in the Uinta Basin similarly affected would include Strawberry Reservoir of the Strawberry Valley project, Moon Lake and Midview Reservoirs and canals of the Moon Lake project, works of the Uinta Indian irrigation project, and various other structures on the Duchesne River, Ashley Creek, and Brush Creek systems. Public and private power facilities in both basins also would be affected. It is anticipated that agreements between present interests and potential project interests can be reached to mutual advantage concerning such matters as correlated operation of existing and potential facilities, construction of new facilities or modification of existing structures, and the acquisition of necessary rights-of-way or lands and interests in lands.

Project lands

Preliminary land classification surveys of the project lands indicate that they would be suitable for sustained crop production under irrigation farming. Detailed classification of most of the land areas in the project would be required during the definite planning stage of the investigation to confirm the suitability of the lands.

Revisions in initial phase plan

Since preparation of the 1951 report, the communities in eastern Duchesne County have constructed a municipal water pipeline and this feature would therefore be excluded from the project. As a result of eliminating the pipeline, about 2,300 acre-feet of Upalco Reservoir water is considered as a supplemental supply to 2,300 additional acres of land in the Upalco area. A refinement of the

water supply studies for lands in the Duchesne River area—Indian and white owned—shows that 4,070 acres of white lands formerly considered as receiving replacement water would receive supplemental water instead. Allowances for these revisions in plan are incorporated in the results of current estimates covered in the following paragraph.

Economic analysis

Results of current (1953) estimates by the Bureau of Reclamation on costs, repayment and benefit-cost ratio are summarized in the following tabulation:

Costs and preliminary allocations

Total construction cost (January 1953 prices, exclusive of interest during construction for any of the purposes)	$231,647,000
Nonreimbursable allocations:	
Recreation	2,830,000
Forest resource development	48,000
Flood control	3,113,000
Project investigations (Colorado River development fund)	603,000
Total nonreimbursable	6,594,000
Reimbursable allocations:	
Ultimate phase allocation	[1] 5,500,000
Initial phase allocation	219,553,000
Irrigation $127,354,000	
Municipal water 45,500,000	
Power 46,699,000	
Total reimbursable allocations	225,053,000
Total allocations	231,647,000
Annual operation, maintenance and replacement costs	[2] 768,990
Allocations:	
Irrigation	253,930
Municipal water	69,160
Power	445,900
Total allocations	768,990

[1] Cost of constructing Soldier Creek Dam to the ultimate height in the initial phase construction.

[2] Estimated at a price level of 180 (1939=100), for all except power facilities which were estimated at current prices Replacement costs estimated on a 50-year sinking fund basis with interest at 2½ percent.

Repayment of construction costs

[Thousands of dollars]

Purpose	Reimbursable allocation	Revenues [1]			
		Irrigation water users	Municipal water users	Initial phase power [2]	Required from net power revenues [3]
Ultimate phase	$5,500				$5,500
Irrigation	127,354	$15,191			112,163
Municipal water	45,500		$45,500		
Power	46,699			$46,699	
Total	225,053	15,191	45,500	46,699	117,663

[1] Irrigation and municipal payments toward construction cost in 50 years Initial phase power revenues paid toward construction cost extending over period from beginning of first power operation to 47 years after last power installation Municipal water and power allocations repaid with interest at 2½ percent on the unpaid balances with interest returns during the payout period amounting to $34,712,000 for municipal water and $33,819,000 for power excluding interest during construction

[2] Power revenues estimated at 6 mills a kilowatt-hour for firm energy, 3 5 mills for nonfirm and 3 mills for irrigation pumping energy.

[3] Required from net revenues from Colorado River storage project, including initial phase central Utah project power, following payout of power allocations under the general repayment plan of the Colorado River storage project.

Benefit-cost ratio

Average annual equivalent benefits	$9,590,400
Average annual equivalent costs	7,827,000
Ratio of benefits to costs	1.23 to 1

STATEMENT ON EMERY COUNTY PROJECT, UTAH

The potential Emery County project is planned primarily to improve the irrigation water supply and thus better the agricultural production of 24,080 acres of lands in Emery County in east central Utah near the towns of Huntington, Castle Dale, and Orangeville. The project is in the Green River Basin, a part of the upper Colorado River Basin.

The general type of farming now practiced in the area would be continued with project development. Agriculture would continue to center around the livestock industry with more than 90 percent of the irrigated area producing hay and grains. The increased production in livestock feed would permit increased production on the farm of beef, sheep, pork, and dairy products.

Principal construction features of the project would be Joes Valley Dam and Reservoir, with a total capacity of 57,000 acre-feet, to store water on Cottonwood Creek, the Swasey diversion dam on Cottonwood Creek, 10 miles downstream from Joes Valley, and the 17-mile Cottonwood Creek-Huntington Canal, with an initial capacity of 250 second-feet, heading at the Swasey diversion dam. Some canal laterals and drains would be constructed. Existing irrigation facilities in the area would be utilized as fully as practicable. Recreational facilities would be provided at the Joes Valley Reservoir.

The project would make available an average of 31,400 acre-feet of water annually for 24,080 acres of land in Emery County, including 20,450 acres now irrigated with only a partial supply and 3,630 acres not now irrigated. In addition, about 1,000 acre-feet of late-season water annually would be made available by exchange for transmountain diversion to lands in the Bonneville Basin now partially irrigated by the Ephraim and Spring City divisions of the existing Sanpete project. Recreational and scenic attractions at Joes Valley Reservoir site would be developed as planned by the National Park Service.

A preliminary land classification survey indicates that the project lands would be suitable for sustained production of crops under irrigation farming. A detailed classification would be necessary to confirm the suitability of the lands.

Water supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. Water rights for the project can be obtained under Utah State law.

A construction period of 3 to 5 years, including completion of definite plan investigations, would be required to complete construction of the project.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Emery County project, Utah, dated February 1951, a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) Bureau of Reclamation estimates for this project plan are summarized in the following tabulation:

SUMMARY, EMERY COUNTY PROJECT, UTAH

Location: East central Utah on the eastern slope of the Wasatch Plateau near the towns of Huntington, Castle Dale, and Orangeville, upper Colorado River Basin.

Irrigation water supply

	Acre-feet
Increase in annual direct-flow diversions	3,900
Annual storage supply	[1] 28,500
Total project supply	32,400
Annual stream depletion	15,500

[1] Includes an increase of 1,000 acre-feet annually in the water supply available for exportation to the Bonneville Basin for the Ephraim and Spring City divisions of the existing Sanpete project.

Irrigated acreage

	Acres
Supplemental irrigation service lands	20,450
New irrigation service lands	3,630
Total	[1] 24,080

[1] Exclusive of lands to receive water exported to Bonneville Basin.

Costs

Construction cost (exclusive of $17,500 nonreimbursable past expenditures for investigations from Colorado River development fund, and includes Forest Service proposal for road relocation)	$9,865,500
Annual operation, maintenance, and replacement costs	36,980

Allocations and repayment

Purpose	Cost allocation	Source of repayment		
		Irrigators (50 years)	Required from net power revenues of Colorado River storage project	Nonreimbursable
Construction costs				
Irrigation	$9,636,500	$3,715,000	$5,921,500	
Recreation	229,000			$229,000
Total	9,865,500	3,715,000	5,921,500	229,000
Operation, maintenance, and replacement costs:				
Irrigation	21,870	21,870		
Recreation	15,100			15,100
Total	36,980	21,870		15,110

NOTE.—Benefit-cost ratio 1.38 to 1.

STATEMENT ON EDEN PROJECT, WYOMING

When completed the Eden project in southwestern Wyoming will divert water from the Big and Little Sandy Creeks in the upper Colorado River Basin to irrigate 10,660 acres of arable lands not now irrigated and will replace or otherwise rehabilitate the major features of the irrigation system that heretofore was utilized to irrigate 9,540 acres.

Climatically adapted crops in the area such as alfalfa, pasture grasses, and small grains, will be produced on the project lands largely in conjunction with livestock operations centered around dairy cows and farm flocks of sheep and of chickens.

Construction of the Eden project was originally approved by the President on September 18, 1940, as a water conservation and utilization project under the act of August 11, 1939 (53 Stat. 1418). Work on the project was about 16 percent completed when stopped by order of the War Production Board in December 1942. Completion of the project was subsequently authorized by act of June 28, 1949 (Public Law 132, 81st Cong., 1st sess.). Construction of the project under the latter authorization is now well advanced with two major features of the project already completed and work currently underway on some of the other project features. The latter act provided for "such modification in the physical features as the Secretary of the Interior may find will result in greater engineering and economic feasibility: *Provided*, That of the construction costs of the irrigation features of the project not less than $1,500,000 for the project of 20,000 irrigable acres, or a proportionate part thereof based on the actual irrigable area as determined and announced by the Secretary of the Interior upon completion of the project, shall be reimbursed by the water users in not to exceed 60 years. * * * *Provided further*, That construction costs of the irrigation fea-

tures of the project which are not hereby made reimbursable by the water users shall be set aside in a special account against which net revenues derived from the sale of power generated at the hydroelectric plants of the Colorado River storage project in the upper basin shall be charged when such plants are constructed."

The current plan of the project is covered in a definite plan report prepared by the Bureau of Reclamation and dated May 1953. Construction features of the project include:

Big Sandy dam and dikes (now completed) on Big Sandy Creek to form Big Sandy Reservoir of 39,700 acre-feet total storage capacity.

Means Canal (now completed) to convey water from Big Sandy Reservoir to the west-side lateral and to the existing Eden Canal.

West-side lateral to serve lands on the west side of Big Sandy Creek.

Eden Creek enlargement and relocation below the terminus of the Means Canal to serve lands east of Big Sandy Creek.

Little Sandy Canal rehabilitation and extension to connect with the upper section of the Eden Canal.

Enlargement of existing lateral system served by Eden Canal to serve both presently irrigated and new lands under that canal.

Project drainage system.

Project construction costs based on January 1953 prices are currently estimated at $7,287,000 The project repayment was established by the project authorizing act of June 28, 1949, as $1,500,000 to be repaid over 60 years. This amount deducted from total project costs leaves $5,787,000 to be repaid from Colorado River storage project net power revenues under the general repayment plan of the latter project and in accordance with the Eden project authorizing act of 1949.

STATEMENT ON FLORIDA PROJECT, COLORADO

The potential Florida project is planned primarily to supply irrigation water to, and thus increase the agricultural production on, 18,950 acres of Florida Mesa and Florida River Valley lands in the upper Colorado River Basin in southwestern Colorado. The lands include 12,650 acres presently irrigated with only a partial supply and 6,300 acres presently not irrigated. Approximately 1,000 acres of the land, including 100 acres partially irrigated and 900 acres now unirrigated, are owned by Indians. In addition to irrigation values, the project would provide some enhancement in fish and wildlife values in the area and affect some decrease in flood damages along Florida River.

With project development, the irrigated lands would be utilized largely for the support of livestock enterprises as now practiced in the area Climatically adaptable crops, such as small grains, hay, pasture, and some pinto beans, potatoes, apples, vegetables, and berries, would be produced Analyses made indicate that a family-size farm would provide the farm family with a reasonable standard of living, provide employment for the available labor, and permit payment of operation, maintenance, and replacement costs of project facilities and some payment toward the construction costs of project facilities.

Preliminary land-classification surveys indicate that project lands would be suitable for sustained production of crops under irrigation farming. Detailed land classification would be required to confirm the suitability of all the lands. Water-supply studies based on records of streamflows as they have occurred in the past indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. Water rights for the project could be obtained under Colorado State law

Construction features of the project would include the Lemon Dam and Reservoir with a total capacity of 23,300 acre-feet to store water on Florida River, construction of a new diversion dam on Florida River at the head of the existing Florida farmers ditch, enlargement and extension of the existing Florida farmers ditch diverting from Florida River, and some distribution and drainage facilities. Water would be released from the reservoir as needed and conveyed in the natural river channel to heads of various downstream canals and ditches that would divert the flow for distribution to project lands.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Florida project, Colorado, dated January 1951, a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) Bureau of Reclamation estimates for this project plan are summarized in the following tabulation.

SUMMARY, FLORIDA PROJECT, COLORADO

Location: Southwestern Colorado on Florida Mesa and in Florida River Valley, about 9 miles southeast of Durango, upper Colorado River Basin.

Irrigation water supply

	Acre-feet
Annual increase in direct flow diversions	6,900
Annual storage supply	16,300
Total project supply	23,200
Annual stream depletion	12,900

Irrigated acreage

	Indian-owned (acres)	Non-Indian-owned (acres)	Total (acres)
Supplemental irrigation service land	100	12,550	12,650
New irrigation service land	900	5,400	6,300
Total	1,000	17,950	18,950

Costs

Construction costs (exclusive of $20,400 nonreimbursable past expenditures for investigations from Colorado River development fund)	$6,941,500
Annual project operation, maintenance, and replacement costs	12,600

Allocations and repayment

Purpose	Cost allocation	Source of repayment		
		Irrigators (50 years)	Required from net power revenues of Colorado River storage project	Nonreimbursable
Construction costs.				
Irrigation	$6,503,600	$1,711,500	$4,792,100	
Indian	(618,000)	[1](126,000)		
Non-Indian	(5,885,600)	(1,585,500)		
Fish and wildlife	208,700			$208,700
Flood control	229,200			229,200
Total	6,941,500	1,711,500	4,792,100	437,900
Annual operation, maintenance, and replacement costs				
Irrigation	12,100	12,100		
Indian	(1,100)	[1](1,100)		
Non-Indian	(11,000)	(11,000)		
Fish and wildlife	500			500
Total	12,600	12,100		500

[1] Subject to elimination or adjustment under an extension of the Leavitt Act of July 1, 1932 (47 Stat. 564) authorizing the Secretary of the Interior to adjust reimbursable debts of Indians.

NOTE.—Benefit-cost ratio, 1.4 to 1.

STATEMENTS ON GOOSEBERRY PROJECT, UTAH

The potential Gooseberry project would divert water from a headwater tributary in the Colorado River Basin to improve the irrigation water supply and thus the agricultural production of 16,400 acres of arable lands in the Bonneville Basin in Sanpete County, central Utah. The project would also enhance recreational values for the population in the general vicinity of the project. A small

net loss would probably result in fish and wildlife values. A net benefit to forest resource development would result from relocation of roads in connection with construction of project storage facilities.

The general type of farming now practiced in the area would be continued with project development. Agriculture would continue to center around the livestock industry with more than 95 percent of the irrigated area producing hay and small grains for livestock feed.

Under the project plan surplus flows of Gooseberry Creek would be regulated at the 17,200 acre-feet capacity reservoir that would be constructed at the Mammoth site on the creek and would then be conveyed in the potential 2.4-mile Mammoth tunnel through the Colorado-Bonneville Basin Divide to Cottonwood Creek. The water would be diverted from Cottonwood Creek into existing canals and the potential Gooseberry Highline Canal for conveyance to project lands. The water would be distributed to individual farm tracts by existing laterals that would be rehabilitated as necessary as a part of the project development. Usable return flow would be collected in natural channels that would be cleaned and improved as part of the project. Drains would be provided for land with a high water table and the San Pitch River Channel would be improved as necessary to provide an outlet for the drainage system. Boating, camping, and picnicking facilities would be provided at Mammoth Reservoir as recreational features of the project. As part of the reservoir construction, 3 miles of forest roads and a sheep corral would be relocated and 2 miles of connecting roads would be constructed.

Water-supply studies based on records of streamflows as they have occurred in the past indicate that with project development the irrigation supply for project lands would be increased by an average of 14,000 acre-feet annually including 11,700 acre-feet of direct diversion and an increase of 2,300 acre-feet of usable return flows. Water rights for the project can be obtained under Utah State law.

A preliminary land classification survey indicates that the project lands would be suitable for sustained production of crops under irrigation farming.

Results of current (1953) Bureau of Reclamation estimates for the physical plan of the project, as covered in the Gooseberry project report dated January 1953, are summarized in the following tabulation.

SUMMARY, GOOSEBERRY PROJECT, UTAH

Location: In Sanpete County in the central portion of Utah.

Plan of development: Transmountain diversion of surplus flows of Price River in Colorado River Basin to Cottonwood Creek in Bonneville Basin for irrigation use.

Irrigation water supply

	Acre-feet annually
Mammoth Reservoir releases	11,700
Usable return flow	2,300
Total new irrigation supply	14,000
Depletion of Colorado River flow	12,500

Irrigated acreage: Land that would relieve supplemental irrigation water, 16,400 acres.

Costs

Construction costs	[1] $5,760,500
Annual operation, maintenance, and replacement costs	13,560

[1] Exclusive of past expenditures for investigations from nonreimbursable Colorado River development fund and inclusive of $116,000 cost chargeable to the Gooseberry project, under terms of an existing contract to which the United States is a party, for benefits to the project resulting from construction of the now existing Scofield Reservoir on Price River downstream from the Mammoth Reservoir site.

Allocations and repayment

Purpose	Cost allocation	Source of payment revenue		
		Irrigators	Net power revenues Colorado River storage project	Nonreimbursable
Construction cost:				
Irrigation	$5,727,500	$2,375,000	$3,352,500	
Recreation	33,000			$33,000
Total	5,760,500	2,375,000	3,352,500	33,000
Operation, maintenance, and replacement costs:				
Irrigation	11,020	11,020		
Recreation	2,540			2,540
Total	13,560	11,020		2,540

NOTE.—Project benefit-cost ratio 1.2 to 1

STATEMENT ON HAMMOND PROJECT, NEW MEXICO

The potential Hammond project would divert waters of San Juan River to provide an irrigation supply for 3,670 acres of arable land now unirrigated. The lands lie along the south side of the river in a narrow 20-mile strip opposite the towns of Blanco, Bloomfield, and Farmington, in northwestern New Mexico.

Project works would include the Hammond diversion dam on San Juan River, a main gravity canal, a hydraulic turbine-driven pumping plant, the East Highline lateral, the West Highline lateral, minor distribution ditches, and a drainage system.

The principal crops that would be grown on the lands with project development would be alfalfa, apples, corn, beans, and barley. Most of the farms are of the fruit-crop and dairy-field crop types.

Preliminary land classification surveys indicate that the lands would be suitable for sustained crop production under irrigation farming. A detailed classification would be necessary to confirm the suitability of all the lands

Water-supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply would be available for the project with permissible shortages occurring in occasional drought years. A water right for the project can be obtained under New Mexico State law.

A period of about 2 or 3 years would be required to complete definite plan investigations and construction of project works except the drains. A few years operation of the project would be necessary to determine the extent of drainage actually required.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Hammond project, New Mexico dated November 1950, a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) estimates for this project plan are summarized in the following tabulation. Studies of the potential nearby Navaho project subsequent to 1950 indicate that it might be found desirable to materially modify the plan for serving the Hammond project lands during the definite plan investigations.

SUMMARY, HAMMOND PROJECT, NEW MEXICO

Location: Northwestern New Mexico along south side of Navaho River opposite towns of Blanco, Bloomfield, and Farmington, upper Colorado River Basin.

Irrigation water supply

	Acre-feet annually
Irrigation diversion requirement	18,400
Stream depletion	7,900

Irrigated area: Full irrigation service lands, 3,670 acres.

Costs and repayment

Project construction cost (exclusive of $7,700 past expenditures for investigations from nonreimbursable Colorado River development fund)	$2,302,000
Allocable to irrigation	2,302,000
Payable by water users in 50 years	370,000
Required from net power revenues of Colorado River storage project	1,932,000
Annual operation, maintenance, and replacement costs	16,100
Payable annually by water users	16,100

Benefit-cost ratio: 2.8 to 1.

STATEMENT ON LA BARGE PROJECT, WYOMING

The potential La Barge project would make a direct flow diversion from Green River, a principal tributary of the Colorado River, to provide for the irrigation of 7,970 acres of desert lands in Sublette and Lincoln Counties in southwestern Wyoming. Only about 300 acres of these lands receive any irrigation water at the present time. Their meager supply would likely be used on other lands outside the project area if the project was constructed. Water for domestic and stock-watering use on farms in the project area would be taken from project canals and from shallow wells that would be developed by the water users.

Project lands would generally be utilized for the support of livestock enterprises. Climatically adaptable crops, such as hay, small grain, pasture, and some garden crops would be produced. Analyses made indicate that an average farm of about 210 irrigated acres in the project area would provide the farm family with a reasonable standard of living, provide employment for the available family labor, and permit payment of operation, maintenance, and replacement costs and some payment toward construction costs of project facilities.

Detailed land-classification surveys show the project lands to be suitable for sustained production of crops under irrigation farming. Water-supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. A water right for the project can be obtained under Wyoming State law.

Construction features of the project would include a main diversion and distribution canal with an initial capacity of 175 second-feet and extending approximately 40 miles along the west side of Green River, a few short laterals, and a few short drains as required. Construction of the main canal and the laterals would require about 2 years. Drains would not be completed until a few years after application of water to the land so that the extent of works required could be determined.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the La Barge project, Wyoming dated January 1951, a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) estimates for this project plan are summarized in the following tabulation.

SUMMARY, LA BARGE PROJECT, WYOMING

Location: Southwestern Wyoming along west bank of Green River, about 50 miles northeast of Kemmerer, Wyo., upper Colorado River Basin

Irrigation water supply

	Acre-feet
Annual diversion requirement	24,300
Annual stream depletion	14,200

Irrigated area: New irrigation service lands, 7,970 acres.[1]

[1] Includes about 300 acres presently irrigated with meager water supply that would likely be used on other lands outside the project area if the project were constructed

Costs and repayment

Project construction cost (exclusive of $76,000 nonreimbursable past expenditures for investigations from the Colorado River development fund)	$1,673,300
Allocable to irrigation	1,673,300
Payable by water users in 50 years	495,000
Required from net power revenues of Colorado River storage project	1,178,300
Annual operation, maintenance, and replacement costs	14,700
Payable anually by water users	14,700

Benefit-cost ratio: 2.12 to 1.

STATEMENT ON LAPLATA PROJECT, COLORADO, NEW MEXICO

The potential LaPlata project would store and divert waters of the LaPlata River to improve the irrigation water supply, and thus the agricultural production of 9,800 acres of arable lands in southwestern Colorado and northwestern New Mexico now irrigated with an inadequate supply. Of the total area, 6,000 acres are in Colorado and 3,800 acres are in New Mexico. The project would also decrease flood damages along the lower stretch of LaPlata River. LaPlata River is a tributary of the San Juan River in the upper Colorado River Basin.

The general type of farming now practiced in the area would be continued with project development. Agriculture would continue to center around the livestock industry with most of the irrigated area producing livestock feeds.

Features of the project would include construction of a 12,000 acre-foot reservoir at the offstream Long Hollow site and a reservoir at the State Line site on LaPlata River with a normal capacity of 17,000 acre-feet, of which 12,000 acre-feet would be active for water conservation and 5,000 acre-feet would be dead storage, and a surcharge capacity of 15,000 acre-feet for flood control. A 400 second-foot feeder canal would be constructed to divert surplus LaPlata River flows to the Long Hollow Reservoir and a 70 second-foot outlet canal would deliver storage water from Long Hollow Reservoir to existing irrigation canals. Project water would be distributed to individual farm tracts by existing irrigation systems.

Water supply studies based on records of stream flows as they have occurred in the past indicate that the project would increase the irrigation supply at canal headgates by an average of 12,000 acre-feet annually. Water rights could be obtained under Colorado and New Mexico State laws. Under project operation the average annual increase in stream depletion would be about 5,800 acre-feet in Colorado and 3,200 acre-feet in New Mexico.

Preliminary land classification surveys indicate that the project lands would be suitable for sustained crop production under irrigation farming.

Results of preliminary estimates, made at 1953 construction prices, at a projected long term price level of 180 (1939=100) for operation, maintenance, and replacements costs, and at a price level of 215 (1910–14=100) for benefits and repayment, are summarized as follows:

Costs

Construction (exclusive of past expenditures for investigations from nonreimbursable Colorado River development fund)	$9,958,500
Annual operation, maintenance, and replacement costs	14,080

Cost allocations		*Operation, maintenance, and replacement costs*
Irrigation (reimbursable)	$9,184,700	$14,080
Flood control (nonreimbursable)	773,800	-------
Total allocations	9,958,500	14,080

Repayment of construction costs

Irrigation water users (50 years)	$1,245,000
Required from net power revenues of Colorado River storage project	7,939,700
Total repayment	9,184,700

Benefit-cost ratio

Average annual equivalent benefits	$260,000
Average annual equivalent costs	324,000
Ratio of benefits to costs	0.8 to 1

The foregoing plan for the potential LaPlata project could be undertaken as a first stage of development of the potential larger Animas-LaPlata project. The latter project would develop the Animas River waters as well as the LaPlata River waters for irrigation of the LaPlata project lands and a considerable additional acreage of supplemental and new lands in the same vicinity. Current reconnaissance investigations of the Animas-LaPlata project indicate that this project would be more economical under a plan which would not include the Long Hollow and State Line Reservoirs. Completion of the current investigations of the Animas-LaPlata project is necessary to determine which of the alternative possibilities offers the most economical means of development.

STATEMENT ON LYMAN PROJECT, WYOMING

The potential Lyman project is contemplated as a means of improving the late-season irrigation water supply and thus of bettering agricultural production on 40,600 acres of land near the town of Lyman in Bridger Valley, a part of the upper Colorado River Basin in southwestern Wyoming. The lands are now irrigated with only a partial supply.

Because of the semiarid climate in the area, irrigation is necessary for successful crop production. Only grasses for hay and pasture, alfalfa, and some small grains can be produced to any extent as the growth of most other crops is precluded by a short growing season and untimely summer frosts that characterize the high 6,500- to 7,000-foot elevations of the project lands. Additional late-season irrigation water is needed to increase yields of the forage and grain crops to bolster the all-important local livestock industry.

The Lyman project would provide late-season irrigation water through construction of a dam and reservoir with 43,000 acre-feet total capacity at the Bridger site on Willow Creek to store the spring flood flows of Blacks Fork and its tributary, West Fork of Smiths Fork. Surplus flows of these streams, now largely used for excessive irrigation in the spring runoff season, would be conveyed to the reservoir by two feeder canals, one diverting from each of the streams. The water would be retained in the reservoir until needed and then released to the Willow Creek channel. Enlargement of a few miles of this channel and construction of three canals to divert from this enlarged channel would provide the necessary facilities along with the existing irrigation systems in the area to effect the distribution of the water to project lands. The existing canal systems would be improved and extended as necessary. Drains would be provided where necessary to improve the removal of unavoidable waste and excess surface waters on the irrigated lands and to protect the lands from accumulations of harmful salts.

Preliminary land classification surveys indicate that project lands would be suitable for sustained irrigation farming although detailed surveys will be necessary to firmly establish their suitability. Some presently irrigated lands that may be found to be nonarable could be abandoned and their water supply transferred to readily accessible arable lands now idle.

Water supply studies, based on records and estimates of stream flows as they have occurred in the past, indicate that a total irrigation supply averaging 114,300 acre-feet annually within ideal requirements would be available to project lands under the plan of project operation. With project development, the lands would still be short by an average of 15,700 acre-feet, or 12 percent, of meeting the ideal irrigation requirement of 130,000 acre-feet annually. Without the project, the available irrigation supply to the lands within ideal demands averages 81,800 acre-feet or 37 percent short of a full supply. Thus, the project would increase the irrigation supply by an average of 32,500 acre-feet annually

and reduce the average irrigation shortages from 37 percent to 12 percent. A water right for the project can be obtained for the project as planned under Wyoming State law provided the necessary agreements and adjustments in water rights can be negotiated with holders of prior natural flow rights in the project area.

A period of 5 or 6 years would be required to complete definite plan investigations and construction of the project facilities excepting the drains. The drains would not be completed until a few years after operation of the project and the actual extent of drainage required could be determined.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Lyman project, Wyoming, dated October 1950, a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) Bureau of Reclamation estimates for this project plan are summarized in the following tabulation.

SUMMARY, LYMAN PROJECT, WYOMING

Location: Southwestern Wyoming on Blacks Fork, its tributaries and Willow Creek, in the vicinity of the town of Lyman, upper Colorado River Basin.

Irrigation water supply

	Acre-feet annually
Total ideal requirement at canal heads	130,000
Direct flow diversions	70,700
Bridger Reservoir releases	32,500
Useable return flows in project area	11,100
Total supplied under project operation	114,300
Total presently supplied without project	81,800
Increase due to project	32,500
Project stream depletion	0

(Additional water consumed on cropped lands would be offset by water saved through improved irrigation and drainage.)

Irrigated acreage: Lands to receive supplemental water, 40,600 acres (Some presently irrigated nonarable lands may be abandoned and their water supply transferred to now idle arable lands.)

Cost and repayment

Total construction cost (exclusive of $58,000 past expenditures for investigations from nonreimbursable Colorado River development fund)	$10,564,000
Allocable to irrigation	10,564,000
Repayable by water users in 50 years	2,255,000
Required from net power revenues of upper Colorado River storage project	8,309,000
Total annual increase in operation, maintenance, and replacement costs	45,900
Payable annually by water users	45,900

Benefit-cost ratio: 1.01 to 1.

Remarks: Project is dependent on more efficient irrigation than that now practiced in the area. Adjustment in water rights is required to permit storage of surplus spring flows now accruing to direct flow rights. Amendment to Wyoming water law is required to permit transfer of water from one land tract to another.

STATEMENT ON NAVAHO PROJECT, NEW MEXICO

The potential Navaho project (formerly called the Shiprock and South San Juan projects) would provide for the irrigation of about 151,000 acres of arable dry lands lying along the south side of San Juan River, a principal tributary of

Colorado River, near the towns of Bloomfield, Farmington, and Shiprock in northwestern New Mexico. Of the lands that would be irrigated 122,000 acres are located in the Navaho Indian Reservation and 29,000 acres are outside the reservation. All the lands within the reservation and some of the project lands outside the reservation are Indian owned. Remaining lands outside the reservation are publicly owned or privately owned by non-Indians.

The general plan of the project includes the Navaho Dam and Reservoir on San Juan River and a main highline canal to divert from the reservoir at a point near the dam and at an elevation well above the stream bed. This main highline canal would divert the water to a point about 28 miles downstream from Navaho Dam where the water would be dropped through a direct connected turbine pumping plant to a lower main canal that would extend westerly about 60 miles to serve the major portion of the project lands by gravity. The dropping water would energize the pump to lift a part of the water to serve the portion of the project lands inside and outside of the reservation that are too high to be served by the gravity diversion. A distribution system would extend beyond the pump lift to deliver the pumped water to the high lands. A system of drains would be provided as required to prevent seepage of project lands. A certain balance between the various canal elevations and the acreages to be served by gravity and by pumping is necessary in properly planning and designing the project.

Planning investigations of the Navaho project are being carried on jointly by the Bureau of Indian Affairs and region 4 of the Bureau of Reclamation. The project is an integral part of the Indian Affairs program to bring relief to the Navaho Indians from their very low family incomes and to make them self-sustaining.

The active storage capacity required for the Navaho project at Navaho Reservoir is dependent on the scale of development of the potential San Juan-Chama project. The latter project is a potential transmountain diversion to the Rio Grande Basin from the headwaters of San Juan River. This diversion project is being investigated by region 5 of the Bureau of Reclamation Coordination of the Navaho and San Juan-Chama project investigations are being made by the two regions of the Bureau of Reclamation and the Bureau of Indian Affairs in cooperation with the State of New Mexico.

Navaho project lands range from about 5,200 to 6,100 feet in elevation and have a semiarid to arid climate with an average frost-free season of about 150 to 160 days Annual precipitation averages less than 9 inches with about half occurring during the growing season, making irrigation necessary for successful crop production. With irrigation climatic conditions are favorable for growing most field crops, a variety of garden crops, and such fruits as apples, pears, peaches, cherries, and apricots. Most of the project acreage would be utilized for production of livestock feeds with smaller acreages being utilized for fruit and garden crops.

The 151,000-acre project would require an average annual irrigation diversion of about 630,000 acre-feet. Permissible shortages in meeting this requirement would occur in occasional drought years under project operation. The average annual stream depletion that would result from the development would be about 341,000 acre-feet.

Preliminary estimates to date indicate that the total construction cost of the 151,000-acre Navaho project would be about $232,650,000 exclusive of added storage replacement costs at Navaho Reservoir that would be required with upstream diversions to the San Juan-Chama project. Essentially all of the construction cost would be allocable to irrigation. Annual operation, maintenance, and replacement costs would approximate $563,000 and would be allocable to irrigation. Preliminary studies also indicate that the farm income would be sufficient for project water users, after meeting operation, maintenance and replacement costs and maintaining a reasonable standard of living to repay about 8 percent of the construction cost without interest in 50 years after delivery of water and following a suitable farm development period. This would leave about $213,210,000 of the construction cost to be met from net power revenues of the Colorado River storage project under the general repayment plan of that project. The payment capacity of the Indian owned land is estimated as being equal to that of the lands under non-Indian farming. The collection of construction costs which could be repaid from farm income would be deferred under the provision of the Leavitt Act of July 1, 1932 (47 Stat 564), authorizing the Secretary of the Interior to adjust reimbursable debts of Indians.

The estimates to date indicate a project benefit-cost ratio approximating 1.2 to 1.

A construction period of about 15 years would be required for efficiently completing definite plan investigations and construction of the project excepting the completion of drains. The desirable construction period, however, would be affected by the actual rate of land settlement as the construction progresses. A development period of 5 to 10 years would be desirable following delivery of water to the various land tracts before making assessments for construction costs.

STATEMENT ON PAONIA PROJECT, COLORADO

The potential Paonia project would divert water from the North Fork of the Gunnison River in the upper Colorado River Basin to improve the irrigation water supply, and thus the agricultural production, of 17,040 acres of land in west-central Colorado. Of these lands 14,830 acres are presently irrigated and 2,210 acres are arable but not now irrigated. Fish and wildlife values in the area would be enhanced and flood damages would be decreased.

The general type of farming now practiced in the area would be continued with project development but the additional irrigation supplies would make possible a more intensive crop production. Production of livestock foods and fruit, such as apples, peaches, and cherries, would continue to be the major crops grown.

Under the project plan, the Spring Creek Dam and Reservoir would be constructed at a site on Muddy Creek 1 mile above its junction with the North Fork River. The reservoir would have a capacity of 18,000 acre-feet, of which 11,000 acre-feet would be active and 7,000 acre-feet would be reserved for sediment retention and dead storage The existing Fire Mountain Canal diverting from the North Fork River 5 miles below the Spring Creek Dam would be enlarged and extended. The enlarged canal would be capable of diverting an increased amount of natural streamflow during the early irrigation season and in the late season its supply would be supplemented by water released from the reservoir. In this manner the irrigation water supply for lands under the Fire Mountain Canal would be improved and through its extension the canal would also serve lands on Rogers Mesa that heretofore have been irrigated from Leroux Creek, a tributary of the North Fork River. The Leroux Creek water thus released from Rogers Mesa would be diverted into the higher Overland Canal, which would be improved and enlarged for this purpose, and used to augment the present irrigation supply for lands on Redlands Mesa. Beginning at a point on the Fire Mountain Canal 9 miles below its head, the Minnesota siphon would be constructed to convey part of the water southward 12,000 feet across the North Fork River to the existing Minnesota Canal

Water supply studies based on records of stream flows as they have occurred in the past indicate that with project development the irrigation supply for project lands would be increased by 18,500 acre-feet annually The increase in stream depletion attributable to the development is estimated at an average of 9,000 acre-feet annually.

Land classification surveys indicate that the lands would be suitable for sustained crop production under irrigation farming. Some further detailed classification would be required to confirm the suitability of all the lands, particularly in the Leroux Creek and Minnesota areas.

The project was authorized by act of Congress on June 25, 1947. Enlargement and extension of the Fire Mountain Canal has been essentially completed under this authorization but modification of the authorization as described above is required to enable completion of the project. Reauthorization of the project, under the revised plan described above, was recommended in the Bureau of Reclamation report on the Paonia project, Colorado, dated February 1951, a supplement to the Colorado River storage project report dated December 1950.

Results of current (1953) Bureau of Reclamation estimates for the physical plan of the project as covered in the Paonia project report of February 1951 are summarized in the following tabulation:

SUMMARY, PAONIA PROJECT, COLORADO

Location: West-central Colorado on North Fork of Gunnison River (North Fork River) 50 miles southeast of Grand Junction, upper Colorado River Basin.

Irrigated area (acres)

	Receiving supplemental supply	New land
Fire Mountain division	8,110	810
Leroux Creek division	4,710	1,400
Minnesota division	2,010	
Total	14,830	2,210

Water supply

	Acre-feet
Average annual increase in usable irrigation water supply within ideal demands	18,500
Average annual increase in stream depletion	9,000

Costs

Project construction costs	[1] $6,936,500
Increase in annual operation, maintenance, and replacement costs attributable to project	11,100

[1] Exclusive of $67,500 past expenditures for investigations from the nonreimbursable Colorado River development fund and exclusive of $7,500 recreation facility costs.

Allocation and repayment

Purpose	Cost allocation	Source of payment revenues		
		Irrigators	Required from net power revenues of Colorado River storage project	Nonreimbursable
Construction costs:				
Irrigation	$6,791,600	[1] $2,414,000	$4,377,600	
Fish and wildlife	70,800			$70,800
Flood control	74,100			74,100
	6,936,500	2,414,000	4,377,600	144,900
Operation, maintenance, and replacement costs, Irrigation	11,100	11,100		

[1] Repayment in 68-year period as provided in 1947 act authorizing Paonia project.

Benefit-cost ratio. Ratio for overall project, 1.6 to 1

STATEMENT ON PINE RIVER PROJECT EXTENSION, COLORADO AND NEW MEXICO

The potential Pine River project extension would provide distribution canals to deliver water made available by the existing Pine River project to irrigate 15,150 acres of land now unirrigated in southwestern Colorado and northwestern New Mexico. Of this acreage 1,940 acres are within the boundaries of the existing Pine River Indian irrigation project.

The Pine River project, consisting of Vallecito Dam and Reservoir on Pine River, was authorized for construction in 1937 to provide storage water for 69,000 acres and was substantially completed and placed in operation by the Bureau of Reclamation in 1941. About half of the lands to be served were under canals and partially irrigated at the time of construction and now receive supplemental water from Vallecito Reservoir. The remaining lands had no distribution facilities at the time of construction. Facilities for these lands were not included as part of the original project as it was thought that the works required were relatively minor and could be undertaken by the water

users with private capital. The required works proved so costly, however, that they have not been privately constructed. As a result, canal systems for the lands that can be economically developed at the present time are planned for Federal construction as the Pine River project extension.

With development of the extension the irrigated lands would be utilized largely for the support of livestock enterprises as now practiced in the general locality. Major crops that would be produced on the extension lands are hay and small grains with some potatoes, pinto beans, and early maturing vegetables, and berries also grown.

The project extension would consist of the enlargement and extension of eight major canals and ditches diverting from Pine River, the construction of one new diversion dam on Pine River, and the construction of a number of small distribution laterals. Over half the extension lands would be served by enlargement and extension of the existing King consolidated canal and construction of a new diversion dam at the head of this canal. The other canals and ditches to be enlarged and extended include the Pine River canal and the Myers-Asher, Bennet and Myers, Bear Creek, and Pine River, Sullivan, Shroder extension, and Thompson Epperson ditches. A period of 3 to 4 years would be required to complete definite plan investigations and construction of the extension works.

Preliminary land classification surveys indicate the extension lands to be suitable for sustained crop production under irrigation farming. A detailed classification is necessary to confirm the suitability of all the lands. Water supply studies, based on records of stream flows as they have occurred in the past, indicate that an adequate water supply would be available for the development with permissible shortages on occasional drought years. A water right for the project can be obtained under Colorado and New Mexico State laws.

This statement is based on the physical plan of development presented in the report on Pine River project extension, Colorado and New Mexico, dated January 1951—a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) Bureau of Reclamation estimates for this development plan are summarized in the following tabulation.

SUMMARY, PINE RIVER PROJECT EXTENSION, COLORADO AND NEW MEXICO

Location: Southwestern Colorado and northwestern New Mexico on Pine River, about 20 miles east of Durango, Colo., upper Colorado River Basin.

Irrigation water supply

	Acre-feet
Average annual supply	45,450
Average annual stream depletion:	
Colorado	27,200
New Mexico	1,100
Total	28,300

Irrigated acreage

	Colorado	New Mexico	Total
New irrigation service lands:			
Indian [1]	1,940		1,940
Non-Indian	12,580	630	13,210
Total	14,520	630	15,150

[1] Includes some land in non-Indian ownership within boundaries of Pine River Indian irrigation project.

Costs

Construction cost (exclusive of $53,360 past expenditures for investigations from nonreimbursable Colorado River development fund)	$5,027,000
Annual operation, maintenance, and replacement costs	18,950

Allocations and repayment

Construction costs:	
Allocable to irrigation	$5,027,000
Assigned to Indians	644,000
Payable by Indians in 50 years or subject to adjustment under an extension of the Leavitt Act [1]	262,000
Assigned to non-Indians	4,383,000
Payable in 50 years by non-Indian water users	1,783,000
Required from net power revenues of Colorado River storage project	2,982,000
Annual operation, maintenance, and replacement costs:	
Allocable to irrigation	18,950
Assigned to Indians	2,400
Payable by Indians or subject to adjustment under an extension of the Leavitt Act [1]	2,400
Assigned to non-Indians	16,550
Payable by non-Indian water users	16,550
Benefit-cost ratio: 2.2 to 1.	

[1] Act of July 1, 1932 (47 Stat. 564), authorizing the Secretary of the Interior to adjust or eliminate reimbursable debts of Indians.

STATEMENT ON SAN JUAN-CHAMA PROJECT, COLORADO AND NEW MEXICO

The San Juan-Chama project would divert water from the headwaters of San Juan River, a principal tributary of the Colorado River, into the Rio Grande Basin for the purposes of providing supplemental water for existing irrigation projects and of providing water for municipal and industrial uses and for development of hydroelectric power. Although water for diversion would be collected from tributaries of the San Juan located in both Colorado and New Mexico all of the water would be used in New Mexico in the Rio Grande Basin. By exchange the project would also increase the use of water in New Mexico in the Canadian River Basin. The present plan provides for the diversion of 235,000 acre-feet of Colorado River Basin water annually out of the total amount allocated to New Mexico under the provisions of the upper Colorado River Basin compact.

With project development an adequate supply of excellent quality water would be available to satisfy the rapidly growing municipal and industrial requirements of the cities and towns in the middle Rio Grande Valley area. In addition water would be available to supplement the now deficient supply to over 200,000 acres of irrigated land in the area. Hydroelectric power would be developed to aid in supplying electrical energy for the development of the resources in the basin. The plants would be designed and operated primarily to meet peak loads and to permit efficient operation of an integrated fuel and hydropower system. In addition the project would provide an opportunity for further development of recreation, fish and wildlife facilities in the center of one of the more important tourist and recreational areas of the country.

Construction features of the project are described under the following three subparagraphs:

1. Collection and diversion element—Three reservoirs having a total capacity of 190,000 acre-feet located on the West Fork, East Fork, and Rio Blanco tributaries of the San Juan River. A feeder canal and conduit system to collect and transport the water to the head of Willow Creek in the Rio Grande Basin. The conduit system would be about 48 miles in length and would have a terminal capacity at the outlet of the tunnel through the Continental Divide of 1,000 cubic feet per second.

2. Regulation and power production element—Three reservoirs would be constructed on Willow Creek and the Rio Chama which, when integrated with the existing El Vado Reservoir and the authorized Chamita Reservoir, would provide facilities needed to regulate water releases for irrigation and municipal and industrial uses and for generation of hydroelectric power. Power development would comprise the installation of 145,000 kilowatts of plant capacity of which 95,000 would be utilized for peaking power and 50,000 for base power. The capacities of the 3 new reservoirs would be 228,000, 400,000, and 40,000 acre-feet. This capacity would be supplemented by the existing 198,000 acre-feet of capacity at El Vado and an additional 85,000 acre-feet planned to be provided in connection with construction of a multiple-purpose reservoir at a site

toward the lower end of the Rio Chama as part of the authorized middle Rio Grande project.

3. Water-use element.—Construction features for irrigation purposes would comprise regulatory reservoirs, rehabilitation of distribution systems, and some relocation and extension of canals and laterals on existing irrigation projects on Rio Grande tributaries. Water for these projects would be made available by operation under exchange agreements. The present plan does not include construction features for delivery of municipal and industrial water to the cities and towns beyond the reservoirs on the Rio Chama Such features could be added later as part of the project if the local interests desire Federal construction and financing.

Construction of project features would be accomplished over a period of about 15 years including the installation of all power units

This statement is based on the physical plan presented in Bureau of Reclamations interim report on the San Juan-Chama project, dated March 1952. The financial data and analysis of the projects were revised in December 1953 to conform to current policy and procedure. Project investigations to date are of reconnaissance degree of detail and the construction costs used, which are based on December 1951 prices, were prepared sufficiently conservative as to require no readjustment for the small change in construction prices since that date Results of the estimates along with other project data are summarized in the attached table.

SUMMARY, SAN JUAN-CHAMA PROJECT, NEW MEXICO

Location: Primarily in northern New Mexico involving project features in the San Juan River Basin in southern Colorado and northern New Mexico and in the Rio Grande, and Canadian River Basins in northern New Mexico.

Water supply: Diversion of 235,000 acre-feet of water annually from the San Juan Basin to the Rio Grande and Canadian River Basins for irrigation, municipal and industrial water and hydroelectric power. Average annual stream depletion in Colorado River—235,000 acre-feet.

Costs and repayment

Project construction cost	[1] $228,141,000
Allocations (including interest during construction on power and municipal water features):	
Power	75,855,000
Irrigation	99,308,000
Municipal and industrial water	59,402,000
Total allocations	234,565,000
Repayment:	
Power (42 years after completion of last unit)	75,855,000
Municipal and industrial water (50 years)	59,402,000
Irrigation:	
Water users (50 years)	32,335,000
Required from net power revenues after repayment of power allocation	66,973,000
Total repayment	234,565,000
Total annual operation, maintenance and replacement costs	1,272,000

Project benefit-cost ratio: 1.6 to 1.

[1] Exclusive of replacement storage costs required for the potential Navaho project in the San Juan River Basin and also exclusive of past expenditures for investigations from the nonreimbursable Colorado River development fund.

STATEMENT ON SEEDSKADEE PROJECT, WYOMING

The potential Seedskadee project would divert water from Green River, a principal tributary of the Colorado River, to provide for the irrigation of 60,720 acres of arable dry lands lying along both sides of the river in Lincoln and Sweetwater Counties in southwestern Wyoming. Of the total area 51,960 acres would be

included in family-sized farm units and 9,030 acres would be used for community pasture. Water for domestic and stock watering use in the project area would be obtained from project canals and from shallow wells that would be developed by the water users.

Fish and wildelife values in the area would probably suffer minor damage as a result of project development. Recreation values would not be materially affected.

With project development, the irrigated lands would be utilized primarily for the support of livestock enterprises, particularly dairying. Climatically adaptable crops, such as pasture, small grain, hay, and some garden crops would be produced. Analyses made indicate that an average farm of about 200 irrigated acres in the Seedskadee area would be required to provide the farm family with a reasonable standard of living, provide employment for the available family labor, and permit payment of operation, maintenance, and replacement costs of project facilities and some payment toward construction costs of project facilities.

Detailed land classification surveys show the project lands to be suitable for sustained production of crops under irrigation farming. Water supply studies based on records of streamflows as they have occurred in the past indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. A water right for the project can be obtained under Wyoming State law.

Principal construction features of the project would include a diversion dam on Green River, a system of main canals and laterals to convey water from the diversion dam and distribute it to project lands, two hydraulic driven pumps at drops in the distribution canals to lift water to some of the lands, and a few miles of artificial drains.

The Seedskadee diversion dam would consist of a low ogee overflow section 400 feet long, canal headworks, a sluiceway, and a dike 1,000 feet long. The Seedskadee diversion canal would extend along the west of Green River and would convey water from the river to the project lands. It would be 19 miles in length and would have an initial capacity of 1,350 second-feet. The diversion canal would terminate at a bifurcation structure at the headings of the two main canal distribution systems, one serving lands west of the river and the other serving lands east of the river. Main canals in the distribution system would total about 160 miles in length. A lateral system would be constructed to deliver water from the main canals to individual farm tracts.

A construction period of about 8 years, including the completion of definite plan investigations, would be required to complete all project facilities except the drains. Drains would not be completed until several years after application of water to the lands so that the actual extent of drainage works required could be determined.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Seedskadee project, Wyoming, dated November 1950, a supplement to the Colorado River storage project, dated December 1950. Results of current (1953) Bureau of Reclamation estimates for this project plan are summarized in the following tabulation. Studies of the upper Green River Basin made subsequent to 1950 indicate that significant modifications in the project plan may be found desirable during the definite planning stage of the investigation.

SUMMARY, SEEDSKADEE PROJECT, WYOMING

Location: Southwestern Wyoming along Green River, about 14 miles northwest of the town of Green River, Wyo., and 35 miles east of Kemmerer, Wyo.

Irrigation water supply

	Acre-feet
Annual irrigation net diversion requirement	225,800
Annual stream depletion	110,400

Irrigated area

	Acres
New irrigation service land in farm units	51,690
New service land in community pasture	9,030
Total new land	60,720
Supplemental service land	0

Costs and repayment

Project construction cost (exclusive of nonreimbursable past expenditures for investigations from Colorado River Development Fund)	$23,272,000
Allocable to irrigation	23,272,000
Repayable by water users in 50 years	4,785,000
Required from net power revenues of Colorado River storage project	18,487,000
Total annual operation, maintenance, and replacement costs	136,600
Payable annually by water users	136,600

Benefit-cost ratio: Ratio of average annual equivalent benefits to average annual equivalent costs, 1.46 to 1.

STATEMENT ON SILT PROJECT, COLORADO

The potential Silt project would provide for the full irrigation of 1,900 acres of new land and provide supplemental water to 5,400 acres of partially irrigated land, all in the vicinity of Rifle and Silt, communities in Garfield County of west central Colorado. The lands are situated in three compact blocks north of the Colorado River between Rifle and Elk Creeks, tributaries of the Colorado River. The project would also provide some enhancement in fish and wildlife values in the area.

The basic type of agriculture in the area would remain unchanged with project development because of climatic and soil conditions. With late season water provided by the project, however, the plantings of row crops would be increased somewhat as would the yield of livestock feeds. Alfalfa, small grains, sugar beets, and potatoes would continue to be the principal crops grown.

Principal construction features include the Rifle Gap Dam and Reservoir of 10,000 acre-feet total capacity on Rifle Creek, a small hydraulic turbine and direct-connected pump at the dam, reconstruction of one presently abandoned ditch, rehabilitation of the existing Grass Valley Canal and construction of some laterals and drains. Except for minor drainage work, about 3 years would be required for construction of project features, including the completion of definite plan investigations.

Preliminary land-classification surveys indicate that the lands would be suitable for sustained crop production under irrigation farming. Water-supply studies based on records of stream flows as they have occurred in the past indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. A water right for the project can be obtained under Colorado State law.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Silt project, Colorado, dated January 1951—a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) Bureau of Reclamation estimates for this project plan are summarized in the following tabulation:

SUMMARY, SILT PROJECT, COLORADO

Location: In upper Colorado River Basin in vicinity of towns of Rifle and Silt, Garfield County, west central Colorado.

Irrigation water supply

	Acre-feet
Increase in annual irrigation supply	10,100
Increase in stream depletion	5,800

Irrigated acreage

	New irrigation service land	Supplemental irrigation service land	Total
Harvey Mesa	290	4,760	5,050
Dry Elk Valley	690	640	1,330
Under Davie ditch	920		920
Total	1,900	5,400	7,300

Cost and repayment

Construction cost (exclusive of $15,000 past expenditures for investigations from nonreimbursable Colorado River development fund)	$3,356,000
Allocable to fish and wildlife (nonreimbursable)	73,600
Allocable to irrigation	3,282,400
Payable by water users in 50 years	1,020,000
Required from net power revenues of Colorado River Storage project	2,262,400
Annual increase in operation, maintenance, and replacement costs	8,400
Payable annually by water users	8,400

Benefit-cost ratio: 1.71 to 1.

STATEMENT ON SMITH FORK PROJECT, COLORADO

The potential Smith Fork project in west central Colorado would regulate surplus flows of Iron Creek and the Smith Fork of the Gunnison River, a tributary of the upper Colorado River, to increase the irrigation supply for 8,160 acres of land now partially irrigated and provide a new supply for 2,270 acres now unirrigated.

Although an improved irrigation supply would permit new lands to be cultivated and result in better crop yields on presently irrigated lands, the cropping program is largely controlled by climatic soil and topographic conditions. Most of the acreage would continue to be utilized for the production of livestock feeds with hay, small grains, and pasture predominating. Increased feed production in the area would result mostly in increased dairy cows with some increase also in beef cattle, hogs, and poultry.

Detailed land-classification surveys show the project lands to be suitable for sustained production of crops under irrigation farming. Water-supply studies, based on records of streamflows as they have occurred in the past, indicate that an adequate irrigation supply would be available for the project with permissible shortages in occasional drought years. A water right for the project can be obtained under Colorado State law.

Construction features of the project include a storage dam and reservoir with 14,000 acre-feet total capacity at the Crawford site on Iron Creek, the Smith Fork diversion dam, the 2.7-mile-long Smith Fork feeder canal of 100 second-feet, to divert from Smith Fork to Crawford Reservoir, the 6.6-mile Aspen Canal of 145 second-feet initial capacity to convey water from Crawford Reservoir to part of the project lands and feed existing ditches and four small lateral canals. Existing irrigation facilities in the area would be utilized as fully as practicable. A period of 3 to 4 years would be required to complete definite plan investigations and construct the project works.

This statement is based on the physical plan of project development presented in the Bureau of Reclamation report on the Smith Fork project, Colorado, a supplement to the Colorado River storage project report dated December 1950. Results of current (1953) Bureau of Reclamation estimates for this project plan are summarized in the following tabulation.

SUMMARY, SMITH FORK PROJECT, COLORADO

Location: West central Colorado along Smith Fork in the vicinity of Crawford, Colo., and 73 miles southeast of Grand Junction, Colo., upper Colorado River Basin.

Irrigation water supply

	Acre-feet
Annual increase in direct-flow diversions	4,450
Annual storage supply	11,200
Total project supply	13,650
Increase in annual stream depletion	7,500

Irrigated acreage

	Acres
New irrigation service land	2,270
Supplemental irrigation service land	8,160
Total	10,430

Costs and repayment

Construction costs (exclusive of $75,000 past expenditures for investigations from nonreimbursable Colorado River development fund and exclusive of recreation development costs)	$3,343,000
Allocable to irrigation	3,343,000
Repayable by water users in 50 years	1,045,000
Required from net power revenues of Colorado River storage project	2,298,000
Total annual operation, maintenance, and replacement costs	8,400
Payable annually by water users	8,400

Benefit-cost ratio: 1.27 to 1.

Mr. MILLER. I first want to say, Mr. Larson, I appreciate your broad, general statement about the upper Colorado River projects. Looking over the chart, summary table, the two additional units at Echo Park and Glen Canyon, they show their cost and generating capacity, and items that are necessary.

It shows there that there are no nonreimbursable funds in the two projects, Echo Park and Glen Canyon.

In other words, there is no sediment control or recreation or flood control that might be considered nonreimbursable.

Mr. LARSON. As I stated in my statment here, we did not attempt to evaluate the benefits from sediment control, flood control, or other uses like that.

Mr. MILLER. Then on the item under "Irrigation," I suppose the $48,043,000 under the Echo Park unit, it would be estimated that the $48,043,000 out of the sale of electric energy would go to help pay for irrigation cost under reclamation law.

Mr. LARSON. Yes, that is the allocation under irrigation—the $48,043,000 for Echo Park and $50,296,000 for Glen Canyon—and that would be paid off after the 44 years.

Mr. MILLER. And in the system of the nine dams and reservoirs that you mention on page 4 of your prepared statement. I suppose the order of importance and priority would be the Echo Park and the Glen Canyon units?

Mr. LARSON. The Echo Park and Glen Canyon are the only two units recommended in the Secretary's supplemental report for authorization at this time.

Mr. MILLER. And you feel that the introduction of power from these two units will be sufficient to amortize the cost and pay off the cost in, I believe the statement says, 44 years at 2½ percent interest?

Mr. LARSON. Yes, sir.

If you would like to see a chart, how that would work, we have a chart here to show exactly how that works out.

Mr. MILLER. Is that figure on a 6-mill-per-kilowatt-hour basis?

Mr. LARSON. Average of 6 mills per kilowatt-hour.

Mr. MILLER. After 44 years it would still be used to help pay irrigation costs?

Mr. LARSON. Yes, and those would be paid out very rapidly. Of the participating projects starting out for construction, the larger ones take anywhere from 12 to 15 years to build and they pay on to their 50th year. They would pay all they could within the irrigator's ability to pay. The power revenues on the 50th year would pay for any balance.

The municipal water users, if any, would pay the cost plus interest to go in the Treasury.

That is true of all 12 of the participating projects recommended by the Secretary.

Mr. MILLER. This estimated generating capacity is 1 million kilowatts from the two units, Echo Park and Glen Canyon?

Mr. LARSON. That is correct.

Mr. MILLER. Do you see sufficient outlet for the sale of the million kilowatt-hours in that immediate area?

Mr. LARSON. Yes, sir.

Mr. MILLER. It goes clear to the west coast?

Mr. LARSON. Our power market studies and those of the Federal Power Commission and others show that all of the power can be absorbed if we build on an orderly construction schedule.

Mr. MILLER. And you feel that there will be a sale—the power market studies show there will be a sale for a million kilowatt-hours when these dams are built?

Mr. LARSON. A million kilowatts?

Mr. MILLER. Yes, when the dams are completed?

Mr. LARSON. Yes.

Mr. MILLER. Do your studies show that in the construction of Echo Park and Glen Canyon there is sufficient water runoff to fill those reservoirs in a reasonable length of time so that they will be usable?

Mr. LARSON. Yes, sir; but because of the large capacity in Glen Canyon reserved for silt retention, it is important to fill Glen Canyon ahead of when it would ultimately be needed for regulatory storage for the upper basin States.

Mr. MILLER. Then you think that would help us to meet our commitments to the lower basin States and to Mexico by the construction of Glen Canyon Reservoir?

Mr. LARSON. Glen Canyon would be necessary for that purpose if the upper basin States are to use their 7½ million acre-feet.

Mr. MILLER. What is the position of the Echo Park site?

Mr. LARSON. That is next in capacity and next in importance to Glen Canyon.

Mr. MILLER. Would it help also to supply waters to the lower States and to Mexico?

Mr. LARSON. It is for exactly the same purpose.

Mr. MILLER. There is no land directly under this that will be irrigated. From your chart there is no new or supplemental water for irrigation purposes?

Mr. LARSON. No; these two reservoirs and the rest that will follow are necessary to provide the long-time holdover from wet cycles to dry cycles to permit diversion high up on the tributaries by the upper basin States, that capacity being set, by our investigations, at a total of 48 million acre-feet.

So it is just as necessary to have the reservoirs below as it would be if they were above the diversion.

Mr. MILLER. The number of new acres to be brought under the 12 participating projects named in your report shows 236,360 acres and 233,930 are supplemental acres.

Mr. LARSON. That is correct.

Mr. HARMISON. Mr. Engle.

Mr. ENGLE. Mr. Larson, looking at this table which Dr. Miller referred to your attention, do I understand that the Department is reporting on the 2 initial units plus the 13 participating units; is that the part that is covered in the Department recommendations?

What I am trying to straighten out in my mind is the difference between what the Department is recommending and what is in the bill.

As I understand, there is more in the bill than you people recommend at this time; is that right?

Mr. LARSON. Yes, Mr. Engle. I am confining my statement to the bills in this way, that I am reporting on the 2 storage units and the 12 participating projects recommended by the Secretary in his report and then we are showing what information we have on the additional units and participating projects that have been included in the bill by the States—upper basin States.

Mr. ENGLE. Directing your attention to the compilation "Summary table," which is attached to your statement, you are directing your testimony, then, to all of those projects which appear in that summary table down to and including what is called subtotal initial projects, and just above where the table says "Additional participating projects in the bill"; is that right? Do you follow me?

Mr. LARSON. No, that is not correct, Mr. Engle. If you will look at the top we have treated the Colorado storage project units up at the top by themselves.

First are the Echo Park and Glen Canyon units, recommended by the Secretary. If you look at the left side near the top you will see additional units in the bill.

The Secretary did not recommend those, but they are in the bill—Curecanti and Flaming Gorge. Then going on down, we have next the 12 participating projects shown by the Secretary in his supplemental report, and then down below the additional participating projects in the bill over and above what we recommend, plus Eden.

Mr. ENGLE. That is what I want to know. In other words, the additional units in the bill which are the two you have mentioned, Curecanti unit and Flaming Gorge unit, are not recommended by Interior, nor are Eden, Gooseberry, LaPlata, Navaho, South San

Juan, and San Juan-Chama. Those are not in the Secretary's recommendation, is that correct, although they are in the bill?

Mr. LARSON. That is right. He mentions them in there, but Eden, as I tried to explain a little while ago, was previously authorized.

It does make statements on these other projects.

Mr. ENGLE. If we were to vote today on the project the Secretary has recommended we would be required to take out of the bill the Curecanti unit, Flaming Gorge unit, and the five mentioned at the bottom of your table; is that right?

Mr. LARSON. Except Eden.

Mr. ENGLE. Well, it is already authorized; taking it out would not make any difference. The testimony now being presented by you and the other Interior witnesses is related to those projects which you have mentioned and not the ones that are in the bill, but not recommended by the Interior: is that right?

Mr. LARSON. Yes, but he has made statements concerning these other projects—he may have no objection or something like that, I don't recall all the statements, but you have the statements, I assume.

Mr. ENGLE. Just two other questions.

You may not be able to answer this one. As I read the statement made by Mr. Tudor, he states that the report of the Interior has not had the clearance of the executive office, referring to the budget, and he says:

> Accordingly, while we are not in a position at this time to make any recommendation for authorization of the project, we will in response to the request of the chairman of the Interior and Insular Affairs Committee, present our planning report.

Now, in the light of that statement, although you are not at the present time making any recommendation with regard to authorization, you do say, do you not, that these projects which you have recommended are economically feasible, is that right, as projects?

Mr. LARSON. These 12, yes, and some of the others for that matter. We have given you the best information we have and each one of those statements will state that, what the benefit-cost ratio is, on each one of them, both the 12 and the others.

Mr. ENGLE. Do you concur in the statement made by Mr. Tudor this morning that if we took Echo Park unit out of authorization that we would in effect take the cylinders out of the engine as far as economic feasibility of this Colorado Basin project is concerned.

Mr. LARSON. You would certainly badly damage the plan because Echo Park is the wheel horse in the upper basin, for the reason that the Split Mountain potential powerplant right below is simply another wheel onto Echo Park.

It has very little storage, 335,000 acre-feet, and whatever the release through Echo Park is, it is automatically through Split Mountain and almost automatically through Gray Canyon right on down below.

Echo Park also affects the feasibility of the Flaming Gorge on the Green River above Echo Park and on the Cross Mountain. It is larger and if it were used to a large extent for peaking, it would assist the other plants.

So if Echo Park goes out of the picture it does affect the feasibility of both Flaming Gorge and Cross Mountain.

Mr. ENGLE. Thank you very much.

Mr. HARRISON. Any further questions, Mr. Engle?

Mr. ENGLE. No.

Mr. HARRISON. Mr. D'Ewart.

Mr. D'EWART. Would you like to tell the committee why Gray Canyon was left out? I remember looking at that site. It looked like an excellent one for us on the committee outside of accessibility. Why was it left out?

Mr. LARSON. It is not left out. It was one of the team of nine, but it was not selected initially because we can't justify it initially without Echo Park.

With only 2 million acre-feet of storage and without regulation above, the cost of power generation would be more than steam.

Mr. D'EWART. What is the argument for leaving out Split Mountain?

Mr. LARSON. Split Mountain is retained in the group of nine until such time as the power is needed. It is left out now. We have taken the two best units.

The most feasible plan to set up is the two cheapest units first, so that all these other seven dams could be added on an incremental basis.

In other words, the bulk of the initial transmission system has to be paid for by Glen Canyon (four-fifths), and Echo Park (one-fifth), or we just don't have a plan which will produce power and deliver to load centers less than the alternative source—from steam.

Mr. D'EWART. I have one brief question as to rates. Your 6-mill rate includes the transmission facilities that are authorized in this bill?

Mr. LARSON. Yes. I can explain that if you like. We have taken the estimates of the nine dams and added a transmission grid system to the market centers on the basis of marketing all the power in the upper basin. We start on that basis. That would average about a 6-mill rate. That is regardless of whether the Government builds the whole transmission system, or whether it is built by private concerns. It all comes to the same place.

Mr. D'EWART. Do you happen to know what the cost of generating power in this area is from coal or oil or gas?

Mr. LARSON. Yes. There are several new steam plants near Salt Lake City, and, of course, in Denver, and we have taken the cost of producing power steam, built now at the time these were built, as more than six mills, possibly 7, but at least more than 6.

Mr. D'EWART. That is all I have.

Mr. REGAN. Mr. Larson, I would like to get back to page 11 of your statement.

In addition, among the attached statements are brief summaries of the LaPlata project, the San Juan-Chama project, and the balance of the Navajo project, namely the South San Juan division, all of which are contained in the bill, but on which substantiating information as to feasibility is not available at this time.

Then you come on down in the next paragraph and say "For which authorization is now being sought".

Now, are you now seeking authorization for those three projects in this bill, or should they be deleted from the bill?

Mr. LARSON. When I say authorization is being sought, I am, of course, referring to the bill. Personally I am not making any recommendations. I am simply reporting information on all the projects contained in the bill.

Mr. REGAN. I understand, but you say in your statement here that the feasibility has not been established and you are asking for authorization on that part that has been declared feasible.

Now, if we have 3 or 4 projects that are not feasible, why should they be included in the bill if you are not seeking authorization on them?

Mr. LARSON. Are you referring to the Gooseberry project?

Mr. REGAN. No, those to which you refer to here "as to feasibility is not available at this time."

You follow that for Gooseberry, also contained in the bill, you have a complete feasibility report.

Mr. LARSON. That is right.

Mr. REGAN. But you do not have on those three I have named.

Mr. LARSON. That is right.

Mr. REGAN. So, therefore, I ask you if they should be deleted from the bill that we are now considering for authorization?

Mr. LARSON. I don't think that is a question for me to answer.

Mr. HARRISON. Mr. Dexheimer, would you like to clarify that?

Mr. DEXHEIMER. I would like to say that the Department is now preparing a supplemental report on these bills in the light of very recent comments which we had from the various States. In that report, assuming that the Secretary approves what we are planning to do, it will say essentially this: that the States have asked that these be included and that we would have no objection if the Congress sees fit to so authorize them although our studies are not complete on them.

Mr. REGAN. Thank you, Mr. Dexheimer.

Mr. HARRISON. Is that all, Mr. Regan?

Mr. REGAN. Yes.

Mr. HARRISON. Senator Watkins is with us this afternoon. He has to leave shortly and he would like to ask some questions here. I want him to know he is welcome. We will be glad to have him participate in these hearings with us.

Senator WATKINS. Thank you, Mr. Chairman.

Mr. Larson, I note you say certain of these projects are not ready for authorization.

Mr. LARSON. I did not say that.

Senator WATKINS. That is what I understood you to say. I think you misspoke yourself.

Mr. LARSON. I did not mean it if I inferred that.

Senator WATKINS. When you say they are not ready, you mean they are not ready for immediate construction; isn't that the fact? I call your attention to Flaming George unit in Utah and Wyoming. What is the status of that one with respect to the rest of the project? What place does it have in the rest of the projects?

Mr. LARSON. It is 1 of the 9 dams as a team selected for completely regulating the river.

Senator WATKINS. It will be eventually necessary to regulate the water to deliver the water to the lower States and permit some to be used upstream?

Mr. LARSON. Yes, sir.

Senator WATKINS. Is that true of the Curecanti unit?

Mr. LARSON. Curecanti, or some other one.

Senator WATKINS. In other words, that is the amount of storage that is necessary to regulate the river?

Mr. LARSON. Yes. We had three on the Gunnison, Whitewater, Crystal, and the large Curecanti. Then the bill contained nothing on the Yampa.

Senator WATKINS. I would like you to explain if you will, irrespective of what is in the bill, because finally the House and the Senate can write into the bill what is necessary to make a project—we are not necessarily bound by what we introduce if the investigations and the facts later on show that there ought to be changes in the bill.

Now, as I understand it, what you are saying is that this will be a completely regulated river and it must be in the upper basin in order to deliver the water under the Colorado River compact of 1922, to the lower users and to Mexico, and at the same time to have some water in the amount that should come to the upper basin States.

Mr. LARSON. Yes, our estimate is the total of 48 million acre-feet required to regulate the river if the upper basin States fully utilize the water allotted to them under the 1922 compact and the upper basin compact.

Senator WATKINS. Tell us what projects will be needed eventually to make that complete regulation. I think the committee ought to know that and I certainly want to know. Through the courtesy of the chairman I am asking that question. Probably you can show it on the map if you have them all indicated. We can see what we have to do to regulate that river to accomplish the object.

Mr. SAYLOR. I hope you can get it. I tried this morning to get the answer and I could not.

Senator WATKINS. I think I understand what they are trying to get at.

Mr. LARSON. Starting at the top we have the Flaming Gorge Reservoir, with a capacity of 3,940,000 acre-feet.

The next one down is Echo Park at the junction of the Green and Yampa Rivers, with a capacity of 6,460,000 acre-feet.

Above Echo Park on the Yampa River is the Cross Mountain Reservoir of 5,200,000 acre-feet.

Going on down to Green, we have the Split Mountain with 335,000 acre-feet immediately downstream from Echo Park.

Further down the Green River, just above Green River, is the Gray Canyon Reservoir site with 2 million acre-feet.

Over on the Gunnison River, the high reservoir was the Curecanti of either two and a half million acre-feet which we selected in the first place, and the States later selected 940,000, and right below that, which is more or less a power dam, would be the Crystal Reservoir of 40,000 acre-feet.

Down near the mouth of the Gunnison River where it joins the Colorado near Grand Junction is the Whitewater site which has 880,000 acre-feet.

Then going on downstream at the end of the lower basin, we have the large Glen Canyon site with a capacity of 26 million acre-feet.

Making a total of 48,555,000 acre-feet.

Senator WATKINS. When you are talking about the 48 million acre-feet that is necessary to regulate the river, you are not now stating that all of that is necessary in the beginning or initial phase of construction?

Mr. LARSON. What is that?

Senator WATKINS. You are not claiming that all of that is necessary now, to begin construction now, of that number of reservoirs?

Mr. LARSON. No. In my statement I stated that theoretically the upper basin States could use 58 percent of its apportioned water without storage, but they would only get into difficulty. They could not fill the reservoirs and they ultimately could never use 42 percent of their water allotment.

Now, Mr. Chairman, I must correct my statement on the 48,550,000. That also included the Navajo Reservoir, which in our report of 1950 we had as 1 of the team of 10 dams.

Since that time, with the cooperation of New Mexico and working out the Navaho project with the Indians, and the San Juan-Chama, the Secretary is recommending in his report, which is agreeable to New Mexico, a transfer of the Navaho Reservoir out of the team of 10 dams. Now it is called a participating project for the benefit of the three that I mentioned, the San Juan-Chama, south San Juan division, and the Shiprock division of the Navaho project.

Senator WATKINS. What you are now recommending for authorization for the initial phase are two projects. Those are Echo Park and the Glen Canyon on the main stem of one of the large tributaries.

Mr. LARSON. Yes, those were the two in the Secretary's supplemental report.

Senator WATKINS. But if this program is worked out to take care of the waters of the river and to regulate it so that we can deliver to Mexico and to the lower basin States, the water they are entitled to under the compact of 1922, and still leave some for the upper States you must have all of these dams; is that right?

Mr. LARSON. That is correct. They may change the capacity of some like Curecanti. If the large Curecanti is not built, storage has to be found somewhere else.

Senator WATKINS. What you are planning is an overall development that will completely regulate the river and make it possible for the lower basin users to get their right and at the same time get as much as possible of the right given by the compact with the upper basin States.

Mr. LARSON. And at the same time provide for sediment deposition for 200 years.

Senator WATKINS. Your answer is largely yes to what I asked?

Mr. LARSON. Yes.

Senator WATKINS. I noticed you did not say yes, but you went off with a qualification.

Are there any other reasons why this overall program must be adopted before the full use of the regulation of the river upstream can be had?

I direct your attention to what I have in mind, which is the power to be developed. What part does that play in it?

Mr. LARSON. The power from these nine dams could certainly all be used in a comparatively short time. I think it is very fortunate to have a long-range plan that is feasible.

So whatever is authorized now will fit in with the ultimate picture and every step would be feasible as we go along.

Senator WATKINS. Would this program be feasible without the power revenue that would come from the building of all these dams?

Mr. LARSON. I know of no other way to finance the irrigation projects because they are all in excess of the water users ability to repay in a reasonable period of time which we have used in this plan as 50 years.

Senator WATKINS. In order to implement the 1922 compact, you certainly would have to have some way of financing the building of all these dams?

Mr. LARSON. That is correct.

Senator WATKINS. Is the fact that these reservoirs are made necessary by the terms of the treaty with Mexico keeping in mind the supply of the water as indicated in the records over the years?

Mr. LARSON. They are absolutely necessary if the upper basin States are to use their alloted water.

Senator WATKINS. Is there any other way they could get the water without the power project being built?

Mr. LARSON. They could go along for a while, as I stated in my statement there, and then they could divert no more, and meet the commitment under the 1922 compact which requires the upper basin States to deliver not less than 75 million acre-feet in any consecutive 10-year period. There may be some surplus that would have to be delivered.

Senator WATKINS. Now, has there been a period of time within the last 10 or 15 years when the flow in the river has been below what was anticipated at the time the 1922 compact was framed?

Mr. LARSON. The lowest cycle we have on record is the 10-year low cycle of 1931 to 1940, when the historical flow of the river was 10,151,000 acre-feet at Lee Ferry.

Senator WATKINS. For a 10-year period?

Mr. LARSON. Yes. And that shows the necessity for carrying water over long periods of time, 20, 25 years, or even maybe longer.

Senator WATKINS. This ought to be obvious, but I am going to ask the question anyway, because we do not always see the obvious, that a program which does not take into consideration the lowest water supply would not be worth anything at all; would it?

In other words, you could not build powerplants when you would not have any power, and have 1 year when you wouldn't have any water to deliver to plants?

Mr. LARSON. The low cycles are the determining factor in establishing the capacities of reservoirs.

Senator WATKINS. Referring to Echo Park Dam, how far above stream bed would it actually rise?

Mr. LARSON. What is it?

Senator WATKINS. How far above the stream bed will it actually rise?

Mr. LARSON. It is 690 feet above bed rock and 520 feet above stream bed.

Senator WATKINS. So it is important to know the difference that there is considerable space below stream bed down to bed rock.

Mr. HARRISON. Senator Bennett is also with us, but he says he does not want to ask any questions at this time.

Senator BENNETT. A Senator always changes his mind. While we have the map before us, and that long pointer, would you point out to the group where Browns Park and Lodore Canyon is? That came into the discussion this morning.

Mr. LARSON. If it is all right, Mr. Chairman, I will have Mr. Jacobson point that out, because he has gone through all the canyons.

Mr. JACOBSON. The section here [indicating] is the gateway to Lodore, and it is near the boundary of the monument. The capacity of the reservoir above that point lies largely in Browns Park.. This is the boundary of the monument at this point here [indicating].

Mr. HARRISON. Can you identify that sufficiently so it will be distinguishable on the record as printed?

Senator BENNETT. If the dam had been built in Lodore Canyon, would the body of the lake that backed up behind it have been in Dinosaur National Park or would it have been outside of it?

Mr. JACOBSON. Can I have the question again?

Senator BENNETT. I was asking if the dam had been built approximately, to use the general term, in Lodore Canyon, would the lake backed up behind it have been within the boundary of the Dinosaur Monument or outside of it?

Mr. JACOBSON. There were two sites involved in that particular withdrawal. One was about 3 miles below the boundary, and the other one about 6 miles. Both are inside the monument. The monument boundary is 23 river miles above Echo Park damsite, so it will extend possibly one fourth the way.

Senator BENNETT. So the dam would have been within the boundaries of the monument and part of the lake would have been within the monument?

Mr. JACOBSON. Yes.

Mr. ASPINALL. What would have happened to the rapids, Mr. Jacobson, if the Browns Park project had been built? What would have happened to the rapids?

Mr. JACOBSON. The liveliness of the rapids, of course, is due largely to the volume of the water that passes over them.

Mr. ASPINALL. At what time of the year?

Mr. JACOBSON. In the flood season of the year. During the low-flow season it is very difficult to maneuver between the rocks. A dam at that point, providing capacity above for power and river regulation would cause an equated river, and the rapids would not be what they are today.

Senator BENNETT. I would like to ask one more question on that same point. Can you give us any estimate of the approximate volume of water that would have been stored had that dam been built instead of the recommended Echo point? I realize that is a hypothetical question because the dam was not built and probably the studies were not made out to the end.

Mr. LARSON. The capacity is very, very much smaller. We can get that, but I do not recall it.

Mr. HARRISON. Is that all, Senator?

Senator BENNETT. Yes.

Mr. HARRISON. Mr. Saylor?

Mr. SAYLOR. Mr. Larson, the nine sites which have been specified by you in response to Senator Watkins are not all of the available sites in the Upper Colorado River Basin; are they?

Mr. LARSON. No, there are 2 or 3 more sizable sites.

Mr. SAYLOR. You are familiar, I believe, Mr. Larson, with House Document 419 of the 80th Congress, called The Colorado River?

Mr. LARSON. Yes.

Mr. SAYLOR. Your name appears in there quite frequently.

Mr. LARSON. I have not looked at it for a few years.

Mr. SAYLOR. Well, there is in this survey in House Document 419 a number of other sites in the upper basin that are specified, other than the ones that have been designated here on the map.

Mr. LARSON. Yes, there are others mentioned in there.

Mr. SAYLOR. Yes. You are still the director of region No. 4; is that correct?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. And as director of region No. 4, this area comes within your jurisdiction?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. Have you made the same kind of survey on the other available damsites that are referred to in House Document 419 that you have made so far on the nine which you have testified to here under the proposed plan now for the development of the upper Colorado River Basin?

Mr. LARSON. Some of them. We have drilled Dewey, for example, and went over it. We have a detailed topographic map and so on. We did not drill New Moab site because the reservoir would extend into the Arches National Monument.

Mr. SAYLOR. What others have you drilled or done work on besides those two?

Mr. LARSON. We have made some studies at Bluff but of course, we do not have much water there after the upstream projects are built; also the Desolation site. We studied the Dark Canyon site, but that is down in the Glen Canyon area, so that was eliminated for being within the Glen Canyon Reservoir site.

Mr. SAYLOR. So that in the upper Colorado River Basin there are sites wherein water could be stored for the purpose of enabling the upper basin States to use the water allocated to them in the compact of 1922, and in furtherance of their compact between the upper basin States dividing the water that has been allocated to them in 1948. Is that correct?

Mr. LARSON. There is, but not without material loss in evaporation and increase in cost of power generation.

Mr. SAYLOR. We will come to those points in a minute. The thing that I am trying to bring out is that you have not, by selecting these nine sites, wanted this committee or the general public to come to the conclusion that these are the only available sites in the upper Colorado River Basin wherein water can be stored?

Mr. LARSON. That is true. But we certainly mean to leave the impression that these are the best ones by far.

Mr. SAYLOR. That may be. That is a matter now of your opinion, that these are the best sites, is that correct?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. Now, none of these nine projects which you have designated as storage areas have any irrigation features connected with them directly, is that correct?

Mr. LARSON. Yes, some of them may have. At Whitewater, water can be diverted from there, and Curecanti and Flaming Gorge also. You can say directly or indirectly that the storage project provides regulation so that the water-use projects can divert higher up on the tributaries. To me they are all directly connected with irrigation. Although they do not divert out of all of them, they are directly connected with them just the same. Whether the reservoir is above the lands or below the lands, if you get water by replacement, it still serves the same purpose.

Mr. SAYLOR. There will be power generated at each one of these nine sites, is that correct?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. You, I think, signed the regional directors' report of December 1950, on the Colorado River storage project and participating projects?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. Do you have a copy of that available there?

Mr. HARRISON. Might I suggest at this time that if there are any other reports which you would like to have reference to, Mr. Saylor, that you give some information on them so that they may be sure to have them here?

Mr. SAYLOR. The only other reports that I wanted are the participating reports which were submitted to supplement this, and I think Mr. Larson is familiar with them all because he signed them.

They are the participating reports for the projects on the basin, which in 1950 were 11 in number.

Mr. LARSON. Yes. I have the 1950 report on the Colorado River storage project, and the supplemental project reports. We may not have them all, but we can have them tomorrow.

Mr. SAYLOR. Is it now true, Mr. Larson, that you, as the director of that area, look at this entire unit as one, that you look at the overall picture as one unit?

Mr. LARSON. Well, as a comprehensive plan.

Mr. SAYLOR. That is right. It is a comprehensive plan. So that when you said that there were wheels that participated in this thing, the wheels that you had specified will all have to turn eventually in each one of these nine projects?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. And if you moved your dams to other sites to gain additional storage, you would have additional wheels that would be a part of this whole overall program, would you not?

Mr. LARSON. Maybe. There might be places where it would cost more than steam and they would not be authorized.

Mr. SAYLOR. But the important thing that you are interested in, you have stated here, is that you want the upper Colorado River to be able to store its water and to use that water not just for the creation of power—that is not the principal reason for your recommending all of these dams—you are recommending them, are you not, so that the upper Colorado River will be able to deliver and fulfill its obligation to deliver water at Lee Ferry?

Mr. LARSON. No. The primary purpose is to develop agriculture, industry, and serve municipal populations, and at the same time meet delivery of water at Lee Ferry with the water to which the

lower basin is entitled; to use power as the vehicle to pay those costs that are over and above the ability of the irrigators to repay.

Mr. SAYLOR. Well, the irrigators have no duty in the upper basin to deliver water, do they?

Mr. LARSON. Not unless they should take what belongs to the lower basin or try to take it. It is the States' responsibility.

Mr. SAYLOR. The compact says that the upper basin had 7½ million acre-feet of water, is that not right?

Mr. LARSON. No. The compact said that the upper basin States can deplete the river, or words to that effect, up to 7½ million acre-feet annually, providing they do not cause the flow of water at Lee Ferry to be less than 75 million acre-feet in any consecutive 10 year period. That is what it says to me.

Mr. SAYLOR. Well, then, if we develop parts of the upper Colorado River, you can do it in some of the places you specified, and there may be other places that could be eliminated. One I have referred to in particular is Echo Park, Split Mountain. In other words, you have said, have you not, that there are other places in the upper Colorado River that you could store water? Is that not right?

Mr. LARSON. We have not found where we can replace that——

Mr. SAYLOR. Answer yes or no. Are there not other places in the upper Colorado River other than the nine that you have designated that you can store water in?

Mr. LARSON. Yes; like Dewey.

Mr. SAYLOR. There may be some features about them that are not as desirable. Is that not true?

Mr. LARSON. That is true.

Mr. SAYLOR. So that this theory that you have of being part of an integral plan, that plan is principally the brain child of yourself as director of region No. 4, is it not?

Mr. LARSON. No, sir; Echo Park was selected before I became regional director in 1943. It was drilled before that by another man in charge of planning.

However, I will admit that the longer I have gotten into it, the better it looks to me.

Mr. SAYLOR. I am delighted to find that the Bureau drilled as far back as 1943, because it seems there was nothing said in the President's order which withdrew this area in which Echo Park Reservoir site is located. If this was such an excellent site, and the Bureau knew so much about it, could you tell us if you know any reason why the President would not have included it in his withdrawal order?

Mr. LARSON. They did not know as much about it when the withdrawal was made, but soon after that, in 1939 or 1940 they drilled it. But our thinking after we got into the Colorado River has changed quite a bit when we realize the problems that we have making delivery at Lee Ferry, silt retention, and the fact that there are more projects, potentialities, than we have water, how valuable it is, and the toll of evaporation, and the lack of attractive large reservoir sites. We have learned a lot since 1938.

Mr. SAYLOR. In your report of 1950, you can tell me where in that report you have estimated the costs of building these nine reservoir sites?

Mr. LARSON. What is it you want, the cost estimates?

Mr. SAYLOR. Yes. I want to know where you have the cost estimates of the nine reservoir sites which have been testified to here this afternoon.

Mr. DAWSON. I refer the gentleman to the report here that is before you. I can give you the page number.

Mr. SAYLOR. I do not want your testimony, Mr. Dawson, I am only trying to find out from the man who drew it up, so that the record can clearly show where they are. I think they are just ahead of page 50.

Mr. LARSON. Page 7?

Mr. SAYLOR. I think on page 50 you will find the chart.

Mr. LARSON. On page 7 are the 10 dams, estimated construction cost, as a summary.

Mr. SAYLOR. Is that in the letter of transmittal?

Mr. LARSON. The regional director's letter. In our explanations here today, we have brought these costs up to the 1953 index, and made some changes, some other changes.

Mr. SAYLOR. Those 10 projects that appear on page 7 of the letter of transmittal, are the same 9 which you referred to in your testimony here this afternoon, and include Navaho, which you explained to Mr. Regan in his questioning as to why it was eliminated and now instead of being a storage project is a participating project?

Mr. LARSON. That is correct.

Mr. SAYLOR. I believe in addition you have the estimates of the total costs of these 10 projects which are a part of this report? Is that correct?

Mr. LARSON. That is the same table. It is just a duplication. In one case it is pulled up into the regional director's report. On page 49, there is a duplicate table.

Mr. SAYLOR. Now, following page 49, you have an itemized breakdown of these various projects, is that correct?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. Now, have you ever made a similar breakdown for the other dam sites which you have referred to here in your testimony?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. Such as Desolation?

Mr. LARSON. I don't know the details. The chief engineer worked up many estimates, such estimates on Dewey, and our own office has made up estimates on Desolation, and we have it also at New Moab.

Mr. HOSMER. I wonder if while he has that table there we can get the total 1950 costs on Glen Canyon and Echo Park?

Mr. SAYLOR. I am going to get to that. Now, would you make available for the members of this committee the other reports which you have made, the surveys you have made, for additional storage areas in the upper Colorado River Basin?

Mr. LARSON. We can produce that, but I do not think we have all of this with us from Salt Lake City.

Mr. SAYLOR. There is no need, sir, to have them here today or within the next week. It is just something that the committee would like to have. I know those of us who are interested in the upper Colorado River would like to see all of the studies that have been made.

Mr. ASPINALL. Do I understand that my colleague is asking for reports on some 253 reservoir sites?

Mr. SAYLOR. No, sir; I did not ask for that. I only asked for the information that was available upon studies that have already been made. If there are 2, 3, 4, 250 or 5,000, I do not care. I think we ought to have them.

Mr. ASPINALL. I thought you ought to know that there are approximately 253.

Mr. SAYLOR. I have not heard anything like 253 referred to this afternoon. But if there are 253, I am satisfied that Echo Park becomes much more easily replaceable by 253 than it is by 2, 3, or 5 that I heard tell about before.

(The information requested is as follows:)

DESCRIPTION OF MAJOR STORAGE AND POWER SITES IN UPPER COLORADO RIVER BASIN

Over the past half century a large number of storage and power sites in the upper Colorado River Basin have been investigated by private concerns, State organizations, and Federal agencies such as the Geological Survey and the Bureau of Reclamation. In each investigation the purposes to be served controlled the extent of study at each site. For the most part the primary objective was to provide storage of spring floods for direct application to lands during summer periods when the streamflow decreased below the rights of earlier appropriators.

Early in the Bureau of Reclamation's search for sites to store excess river runoff in years of high flow for subsequent release in compliance with article III (d) of the Colorado River compact it became apparent that development of smaller reservoirs for this purpose was more costly and extremely wasteful of water through evaporation. It was evident that long-time holder storage should be accomplished by storage in large reservoirs at higher elevations where evaporation rates were lower. It was also necessary in the consideration of potential sites to select developments which would serve purposes other than river regulation to assure feasibility and provide for maximum repayment since irrigators and other upper basin water users could not stand all of the costs of this long-time holdover storage in addition to the expensive facilities required for individual project service.

The following discussions of individual sites are separated by tributary basins and river profiles are attached to assist in following the narrative.

GREEN RIVER BASIN

Kendell Dam and Reservoir site is located at the headwaters of the Green River about 120 miles north and east of Green River, Wyo. The site is limited in economical storage to approximately 500,000 acre-feet. Because of its size and since its storage is closely tied in with irrigation developments downstream any use for long-time storage would be of little value. Site investigations have been made in connection with the Seedskadee and other small potential irrigation projects in that area.

Flaming Gorge Dam and Reservoir site: A number of dam sites have been investigated in the canyon section of the Green River from near the Wyoming-Utah State line to the Ashley Dam site 28 miles downstream. Several sites in the Flaming Gorge and Horseshoe Canyon section were drilled by the Bureau of Reclamation in 1907 and 1908 (21 holes) and by the Utah Power & Light Co. (31 holes), under a preliminary power permit issued by the Federal Power Commission in 1923. This company also cooperated with the Geological Survey during the period 1918–22 in making a plan and profile survey of the Green and Yampa Rivers from Greenriver, Utah, to Green River, Wyo., to be used for studies of potential hydroelectric developments

Studies in conjunction with central Utah project investigations led to the selection of the Ashley Dam site and plans for a reservoir with nearly 4 million acre-feet of capacity from which a gravity diversion could be made to the south slope of the Uinta Mountains. This reservoir would extend upstream nearly to Green River, Wyo., inundating such dam sites as Horseshoe Canyon and the original Flaming Gorge and utilize the same reservoir basin as the Red Canyon site.

Other sites in upper Green River Basin between Green River, Wyo., and the Kendall Dam site such as Big Basin, Fontenelle, and Riview are limited by terrain

or streamflow to capacities of considerably less than one-half million acre-feet and are therefore of value primarily for direct water-use project service.

Swallow Canyon Dam and Reservoir was suggested in USGS Water Supply Paper 618 by Ralf Wooley (1930) as an alternate to the Browns Park (Lodore) site since the geological exploration by the Bureau of Reclamation in 1907–9 (31 holes at 2 sites) indicated serious foundation difficulties and since the added storage possible with a high dam at Lodore would be of little value with regulation upstream by Flaming Gorge Reservoir. The Swallow Canyon development would be essentially a power drop with capacity only for reregulation.

Echo Park Dam and Reservoir: Mr. Wooley in his report points out the advantage of a storage and power development to regulate and use the combined flows of the Green and Yampa Rivers. Although he suggests a dam of 300 feet at the site, which was probably considered to be a very high dam at the time, later studies indicate that an economical dam over 500 feet high could be built at the site to furnish long-time holdover storage capacity. The reservoir formed by a 300-foot dam would have contained less than 1 million acre-feet and would have been of little value as a long-term holdover site. The investigations of this site are outlined in the Colorado River storage project report. Echo Park Reservoir would inundate both the Swallow Canyon and Lodore Dam sites.

Split Mountain Dam and Reservoir is essentially a second power drop below Echo Park Dam. Investigations are outlined in the Colorado River storage project report, and Mr. Wooley's report.

Juniper Dam and Reservoir was studied in considerable detail. Dam and reservoir topography was obtained and three holes were drilled in 1915. The reservoir capacity was limited to about 1½ million acre-feet by the town of Craig, Colo. The dam site and nearly all of the reservoir basin would be inundated by the Cross Mountain Reservoir.

Cross Mountain Dam and Reservoir has long been recognized as a good power development and was considered as a secondary power drop below Juniper. The reservoir capacity would be limited by the Juniper Dam to about 1 million acre-feet. Recent studies under the Colorado River storage project have indicated that the cost of a single dam at Cross Mountain to store 5,200,000 acre-feet is less than the cost of a combination of a small dam at Cross Mountain and a dam at Juniper to store about 2½ million acre-feet. The investigations of this site are outlined in the Colorado River storage project report.

Little Snake River Basin has inadequate runoff and lacks good sites for long-time storage.

Blue Mountain Dam and Reservoir has been given preliminary study as a power site. It is located in the canyon section of the Yampa River just downstream from the confluence of the Little Snake and Yampa Rivers. Storage at the site would be limited by the Cross Mountain powerplant to about 115,000 acre-feet. Because of its small size it would be of negligible value as a holdover storage reservoir.

Duchesne River Basin: The streamflow and storage sites in this basin are included under the central Utah projects for irrigation development. No significant contribution to long-time holdover storage can be developed.

White River Basin: The Buford site is the only significant storage site on the White River and is being considered for development in connection with irrigation in the White and Yampa River Basins. It is located upstream from Meeker, Colo., and is limited to about one-quarter million acre-feet It would make little contribution to long-time holdover storage

Desolation and Gray Canyon dam and reservoir sites offer the only large-capacity storage alternative in the Green River Basin. Development of the Desolation site would limit Gray Canyon storage to 490,000 acre-feet instead of the 2 million acre-feet presently planned. The Desolation Reservoir to replace Echo Park and the reduction in capacity at Gray Canyon would have a total capacity of 7,800,000 acre-feet and would extend upstream nearly to Jensen, Utah. The reservoir would have a maximum area of 113,000 acres and would result in added evaporation averaging 200,000 acre-feet annually. System power would be reduced by 242,000 kilowatts. Under present procedures for analysis development of this site would not be economically feasible. Status of investigations and a cost estimate are attached.

UPPER COLORADO RIVER BASIN

Depletions by existing and potential water-use projects in the headwaters area of the Colorado River and its tributaries upstream from the Roaring Fork River rule out any possibility of major long-term holdover storage. The location of

the main line of the Denver and Rio Grande Railroad in the canyon bottom further complicates any possibility for power development when the high cost of railroad relocation is considered. The Roaring Fork River Canyon is too precipitous to permit development of large capacity storage. Between the Roaring Fork confluence and Grand Junction, Colo., is the DeBeque dam and reservoir site identified in the Bureau of Reclamation reconnaissance report on the Cliffs-Divide project.

DeBeque dam and reservoir site development is complicated by the high cost of relocating about 30 miles of main line Denver & Rio Grande Western Railroad Co. railroad track. The dam site is located on the Colorado River about 20 miles northeast of Grand Junction, Colo Preliminary study indicates that about 2¼ million acre-feet of storage could be obtained, however, at a very high cost Economic feasibility will be dependent upon the use of site storage for future irrigation and industrial purposes as well as power production. The limited capacity of the site, its high streamflow, and its competitive uses makes any holdover storage contribution very minor.

Gunnison River Basin storage sites have been studied quite extensively. Of the many sites investigated all but the potential 2½ million acre-foot Curecanti Reservoir have only local regulatory values. The potential Whitewater Reservoir located near the confluence of the Gunnison with the Colorado River is also included as a Colorado River storage project unit but has only a limited value as a holdover storage site Date on these two sites are included in the Colorado River storage project report.

Dolores River Basin Limited streamflow, present in-basin irrigation, and present and potential water exports to the San Juan Basin for irrigation rule out any possibility for economical longtime holdover storage in this basin.

Dewey dam and reservoir site on the Colorado River 3 miles downstream from the Dolores River confluence is the best alternate for Echo Park since the New Moab site downstream would encroach upon the Arches National Monument. The reservoir capacity to replace storage at Echo Park would total 6,100,000 acre-feet. The maximum water surface area of 64,000 acres is 21,000 acres greater than at Echo Park, and the added reservoir evaporation loss would average 120,000 acre-feet annually. System power output would be reduced by 188,000 kilowatts. Status of investigations and a cost estimate are attached.

New Moab Dam and reservoir site is located 24 miles downstream from the Dewey Dam site and about 6 miles upstream from Moab, Utah. This site is more favorable than Dewey but would encroach into the Arches National Monument System storage would be replaced by a 6 million acre-foot reservoir. The maximum water surface area would be 55,000 acres and the added loss over that at Echo Park and Split Mountain would average about 100,000 acre-feet annually. System power output would be reduced by about 149,000 kilowatts. Status of investigations and a cost estimate are attached.

SAN JUAN RIVER BASIN

Large existing and potential water uses in this basin restrict the storable runoff. The only feasible site on the San Juan River which might develop a significant amount of holdover storage is the Chinle (Bluff) site.

Chinle Dam and Reservoir is located on the San Juan River about 12 miles downstream from Bluff, Utah, and 132 miles upstream from its confluence with the Colorado River. With development of the Navajo, San Juan-Chama and other smaller projects, the streamflow at this site would be reduced by nearly 40 percent. The principal advantage of storage at this site would be as a sediment trap upstream from Glen Canyon Reservoir. About one-third of the sediment now passing Lees Ferry originates upstream from Chinle Dam site. To replace Echo Park storage a 7 million acre-foot reservoir would be required. The maximum water surface area would be 70,000 acres and the added evaporation loss about 100,000 acre-feet if vegetal growth on the silt beds on the reservoir fringes could be controlled. However, the high cost of site development together with small streamflow and low power head combine to make this development infeasible under present procedures for project analysis.

Status of investigations and a cost estimate are attached.

Goosenecks and Slickhorn sites downstream from Chinle on the San Juan are limited storage sites of value only as secondary power drops if storage and sediment retention is provided at Chinle.

Navajo Dam and Reservoir is described in the Colorado River storage project report. The entire storage capacity possible at the site would be required for

direct water supply by the Navajo project and replacement storage required by the San Juan-Chama project.

COLORADO RIVER BELOW GREEN RIVER CONFLUENCE

Development of the Glen Canyon Dam and Reservoir as described in the Colorado River storage project report to a total capacity of 26 million acre-feet would back water upstream from the dam site (15 miles above Lees Ferry) 186 miles up the Colorado River and 71 miles up the San Juan River. This reservoir would inundate the Great Bend power site on the San Juan River and the Dark Canyon site on the Colorado River. The remaining possibility for storage and power in this reach of the river is at the Junction site.

Junction Dam and Reservoir site is located on the Colorado River just below the confluence of the Green River and at the head of Cataract Canyon. An attempt to drill the site in 1914 was not successful. Holes were put down in 4 places, 1 to a depth of 125 feet but bedrock was never reached. Subsequent planning was limited to consideration of a low rock fill structure to provide reregulation for power development by tunnels through Cataract Canyon. The reservoir would be limited in upstream extent by the town of Moab, Utah, to a total capacity of about one-half million acre-feet. This limited capacity would not contribute to long-time river regulation.

Status of investigations—new Moab unit

1. Engineering surveys.—Topographic surveys have been made of the new Moab (Nigger bill) Dam site and part of the reservoir by the Geological Survey and the Bureau of Reclamation and maps have been prepared at a scale of 1:24,000 with a contour interval of 20 feet up to elevation 4,400 feet.

2. Power surveys.—Preliminary power production and rate studies have been made for the new Moab unit.

3. Water supply studies.—Hydrologic data recorded near the Dewey site is applicable to the new Moab unit. Preliminary reservoir operation studies have been made to determine the value of storage at this site as an alternative to Echo Park. Studies of sediment inflow and evaporation at the site have been made.

4. Geology and exploration.—No geologic exploration work has been done at the new Moab site.

5. Economic studies.—Preliminary economic studies have been made for the new Moab unit.

6. Plans and estimates.—Preliminary designs and estimates have been prepared for various sizes of dams at the new Moab site Preliminary estimates of railroad location have been made.

Status of investigations—Dewey unit

1. Engineering surveys.—A preliminary dam site survey has been completed for the Dewey unit. Reservoir topographic survey maps have been prepared to elevation 4,300, at a scale of 1 inch = 2,640 feet and from elevation 4,300 to 4,430 at a scale of 1 inch = 1,000 feet.

2. Power surveys.—Preliminary power production, transmission, rate, and market studies have been made for the Dewey unit both as an independent unit and as an integrated part of the Colorado River storage project.

3. Water supply studies.—Hydrologic data have been recorded near the Dewey site and preliminary reservoir operation studies have been made to determine the value of storage at this site in the formulation of the plan of the Colorado River storage project and as an alternative storage site to Echo Park. Studies of sediment inflow and evaporation have been made.

4. Geology and exploration.—The Dewey Dam site was first drilled in 1918. Later during 1941, 1942, and 1943 preliminary type foundation and materials explorations were completed. The extent of these investigations is adequate for project report purposes.

5. Economic studies.—Preliminary economic studies have been made for the Dewey unit.

6. Plans and estimates.—Preliminary designs and estimates have been prepared for various sizes of dams at the Dewey site. Preliminary estimates of railroad relocation have been made.

Status of investigations—Desolation unit

1. Engineering surveys.—USGS river sheets have been prepared for the reach of the Green River which includes the Desolation Dam site and reservoir. No detailed dam-site topography has been prepared.

2. Power surveys.—Preliminary power production and rate studies have been made on the Desolation unit.

3. Water supply studies.—Hydrologic records have been computed and preliminary reservoir operation studies have been made to determine the value of storage at Desolation as an alternative to Echo Park. Studies of sediment inflow and evaporation have been made.

4. Geology and exploration.—No geology exploration work has been done at the Desolation site.

5. Economic studies.—Preliminary economic studies have been made for the Desolation unit.

6. Plans and estimates.—Preliminary designs and estimates have been prepared for various sizes of dams at the Desolation site.

Status of investigations—Chinle (Bluff) unit

1 Engineering surveys.—In 1914 the Bureau of Reclamation conducted limited field investigations at the Chinle site, including the preparation of a rough topographic map of the dam site at a scale of 1 inch=100 feet In 1921 the Geological Survey made a survey of the lower San Juan River from its mouth to the mouth of Chinle Creek, 133 miles upstream, and prepared topographic maps (3 sheets) at a scale of 1 inch= one-half mile, with contour intervals of 5 feet on the river and 20 feet on land. The upper end of this survey covered the Chinle site. In 1946 the Bureau of Reclamation completed an aerial survey of the San Juan River from its mouth to near the 4-corner intersection of the Utah, Colorado, New Mexico, and Arizona State lines to a scale of 1 inch= 1,000 feet.

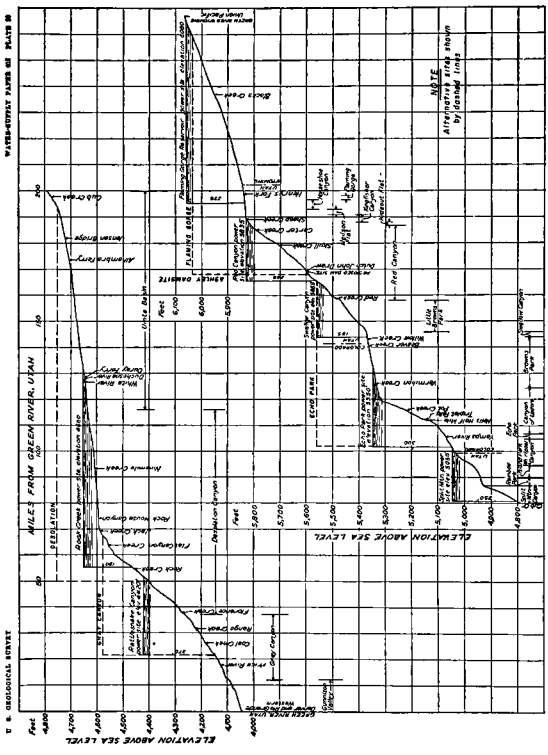
2. Power surveys.—Preliminary power production, transmission, rate, and market studies have been made for the Chinle unit both as an independent unit and as an integrated part of the Colorado River storage project.

3. Water supply studies.—Hydrologic data have been recorded at the Bluff site, and preliminary reservoir operation studies have been made to determine the value of storage at this site in meeting the Lee Ferry flow compact commitment. Studies of sediment inflow and evaporation have been made.

4. Geology and exploration.—No geologic exploration work has been done at the Chinle site.

5. Economic studies.—Preliminary economic analyses have been made for the Chinle unit during the formulation of the Colorado River storage project and later in searching for an alternative to replace Echo Park.

6. Plans and estimates.—Preliminary designs and estimates have been prepared for various sizes of concrete and earth dams at the Chinle site.


WATER-SUPPLY PAPER 465 PLATE 20
U. S. GEOLOGICAL SURVEY
ELEVATION ABOVE SEA LEVEL
MILES FROM GREEN RIVER, UTAH
ELEVATION
MILES FROM GREEN RIVER, UTAH
ELEVATION ABOVE SEA LEVEL
Feet
4,800
4,700
4,600
4,500
4,400
4,300
4,200
4,100
4,000
6,700
6,600
6,500
6,400
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170
160
150
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10
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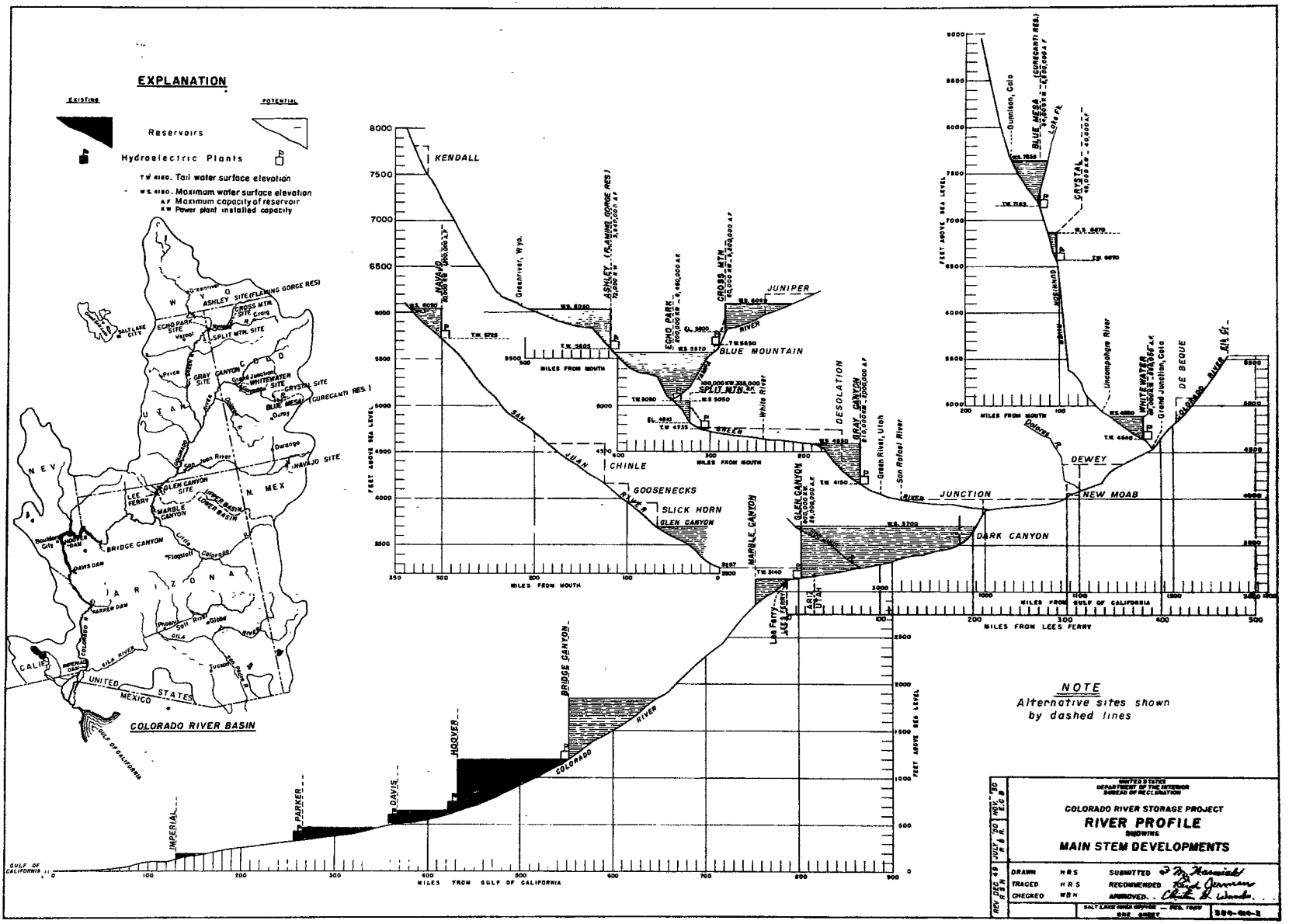
NOTE
Alignments first shown by dashed lines
Black Canyon
Gateway
Escalante Canyon
Dominguez Canyon
Big Dominguez Canyon
Little Dominguez Canyon
Cactus Park
Cedar Creek
Bull Canyon
Bull John Draw
Red Canyon
Hells Canyon
Kimball Creek
Silver Creek
Whitewater Creek
Mountain Creek
Roubideau Creek
Escalante Creek
Big Creek
Little Creek
Dry Creek
Pine Creek
Tabeguache Creek
Cottonwood Creek
Indian Creek
Coal Creek
Cactus Park
Gunnison River
Uncompahgre River
Colorado River
Green River
Gunnison Tunnel
Ashley Basin
Ashley Creek
Ashley Falls
Ashley Gulch
Ashley Tunnel
Ashley Valley
Ashley Valley Reservoir
Ashley Valley Reservoir Dam
Ashley Valley Reservoir Outlet Tunnel
Ashley Valley Reservoir Spillway
Ashley Valley Reservoir Spillway Tunnel
Ashley Valley Reservoir Spillway Tunnel Outlet
Ashley Valley Reservoir Spillway Tunnel Outlet Gate
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,800
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,700
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,600
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,500
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,400
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,300
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,200
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,100
Ashley Valley Reservoir Spillway Tunnel Outlet Gate Valve Chamber Access Road Bridge Abutment Pier Footing Foundation Rock Surface Elevation Above Sea Level Feet 4,000


EXPLANATION
EXISTING
POTENTIAL
Reservoirs
Hydroelectric Plants
T.W. 4160. Tail water surface elevation
W.S. 4160. Maximum water surface elevation
A.F. Maximum capacity of reservoir
K.W. Power plant installed capacity
COLORADO RIVER BASIN
UNITED STATES
MEXICO
GULF OF CALIFORNIA
KENDALL
NAVAJO
ASHLEY (FLAMING GORGE RES)
ECHO PARK
CROSS MTN
JUNIPER
BLUE MOUNTAIN
SPLIT MTN
CHINLE
GOOSENECKS
SLICK HORN
GLEN CANYON
MARBLE CANYON
DESOLATION
GRAY CANYON
JUNCTION
DARK CANYON
NEW MOAB
DEWEY
DE BEQUE
WHITEWATER
CRYSTAL
BLUE MESA
IMPERIAL
PARKER
DAVIS
HOOVER
BRIDGE CANYON
COLORADO RIVER
FEET ABOVE SEA LEVEL
MILES FROM MOUTH
MILES FROM LEES FERRY
MILES FROM GULF OF CALIFORNIA
NOTE
Alternative sites shown by dashed lines
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER STORAGE PROJECT
RIVER PROFILE
SHOWING
MAIN STEM DEVELOPMENTS
DRAWN HRS
TRACED HRS
CHECKED WBH
SUBMITTED
RECOMMENDED
APPROVED
REV DEC 49 R.S.H.
JULY '50 R.B.R.
NOV. '50 E.G.B.

OFFICIAL ESTIMATE

Project: Colorado River storage project alternative—Date, January 1954

NEW MOAB UNIT

Uniform cost classification	Description	Total estimate
01	RESERVOIRS AND DAMS	
01 01	New Moab Dam and Reservoir Location On Colorado River, 69 6 miles upstream from Green River confluence Reservoir storage 6,090,000 acre-feet Normal water storage elevation 4,330 feet Maximum water storage elevation 4,330 feet Type of dam Concrete, gravity Volume of dam 2,200,000 cubic yards Crest elevation 4,335 feet Crest width 40 feet Crest length 1,020 feet Present river elevation 3,958 feet Height of dam above stream 377 feet Height of dam above foundation 447 feet. Spillway capacity. 200,000 acre-feet Outlet capacity 6,200 second-feet Diversion capacity 90,600 second-feet Excavation, rock for dam 147,900 cubic yards Excavation, common for dam 195,600 cubic yards	$88, 000, 000
11	POWERPLANTS—HYDRO	
11 01	New Moab powerplant Installed capacity 186,000 acre-feet Number of units 3 Tailwater elevation 3,958 feet Mean operating head 310 feet Maximum static head 372 feet	26, 000, 000
13	Transmission system Transmission lines, switchyards, substations, etc	32, 000, 000
15	General property Town, utilities, and general service facilities	2, 000, 000
	Total, all classes	148, 000, 000

Source U. S Department of the Interior, Bureau of Reclamation

DEWEY UNIT

01	RESERVOIRS AND DAMS	
01 01	Dewey Dam and Reservoir Location On Colorado River, 94 miles upstream from Green River confluence Reservoir storage 6,100,000 acre-feet Normal water storage elevation 4,380 feet Maximum water storage elevation 4,380 feet Type of dam. Concrete, gravity. Volume of dam 1,516,000 cubic yards Crest elevation 4,390 feet Crest width 40 feet Crest length 2,026 feet Present river elevation 4,086 feet Height of dam above stream 304 feet Height of dam above foundation 368 feet. Spillway capacity 200,000 second-feet Outlet capacity 6,200 second-feet Diversion capacity 90,000 second-feet Excavation, rock for dam 235,000 cubic yards Excavation, common for dam 447,000 cubic yards.	$81, 600, 000
11.	POWERPLANTS—HYDRO	
11. 01	Dewey powerplant Installed capacity 149,000 kilowatts. Number of units 3 Tailwater elevation 4,086 feet. Mean operating head 273 feet Maximum static head 294 feet	21, 000, 000
13.	Transmission system Transmission lines, switchyards, substations, etc.	25, 800, 000
15.	General property Towns, utilities, and general service facilities	1, 100, 000
	Total, all classes	129, 500, 000

OFFICIAL ESTIMATE—Continued

Project: Colorado River storage project alternatwe—Date, January 1954—Con.

CHINLE UNIT (BLUFF)

Uniform cost classification	Description	Total estimate
01	RESERVOIRS AND DAMS	
01 01	Chinle Dam and Reservoir Location On San Juan River, 130 miles upstream from Colorado River confluence. Reservoir storage 6,920,000 acre-feet Normal water storage elevation 4,550 feet Maximum water storage elevation. 4,550 feet. Type of dam Concrete, gravity Volume of dam 1,500,000 cubic yards. Crest elevation 4,555 feet Crest width 40 feet. Crest length 1,250 feet Present river elevation 4,196 feet Height of dam above stream 359 feet Height of dam above foundation 470 feet Spillway capacity 230,000 second-feet. Outlet capacity 30,000 second-feet Diversion capacity 60,000 second-feet Excavation, rock for dam 131,200 cubic yards. Excavation, common for dam 293,300 cubic yards	$78, 700, 000
11.	POWERPLANTS—HYDRO	
11 01	Chinle powerplant Installed capacity 80,000 kilowatts Number of units 3 Tailwater elevation 4,196 feet Mean operating head 320 feet. Maximum static head 354 feet.	11, 200, 000
13.	Transmission system Transmission lines, switchyards, substations, etc	13, 800, 000
15.	General property. Towns, utilities, and general service facilities	1, 300, 000
	Total, all classes	105, 000, 000

DESOLATION UNIT

01	RESERVOIRS AND DAMS	
01 01	Desolation Dam and Reservoir Location On Green River 50 1 miles upstream from Green River, Utah. Reservoir storage 7,800,000 acre-feet Normal water storage elevation 4,758 feet Maximum water storage elevation 4,758 feet Type of dam Concrete, gravity Volume of dam 3,100,000 cubic yards. Crest elevation 4,763 feet. Crest width 40 feet Crest length 2,025 feet. Present River elevation· 4,400 feet Height of dam above river 363 feet Height of dam above foundation 478 feet. Spillway capacity 190,000 second-feet. Outlet capacity 10,000 second-feet. Diversion capacity 100,000 second-feet. Excavation, rock for dam 315,300 cubic yards. Excavation, common for dam 1,511,800 cubic yards.	$147, 300, 000
11.	POWERPLANTS—HYDRO	
11. 01	Desolation powerplant Installed capacity 163,000 kilowatts Number of units: 2 Tailwater elevation 4,400 feet. Mean operating head 325 feet Maximum static head: 357 feet	22, 800, 000

OFFICIAL ESTIMATE—Continued

Project: Colorado River storage project alternative—Date, January 1954—Con.

DESOLATION UNIT—Continued

Uniform cost classification	Description	Total estimate
11	POWERPLANTS—HYDRO—continued	
13	Transmission system Transmission lines, switchyards, substations, etc.	28,200,000
15	General property Towns, utilities, and general service facilities	2,700,000
	Total, all classes	201,000,000

Mr. SAYLOR. Now on your project breakdowns which appear between pages 49 and 50 of your preliminary report, would you turn to the breakdown of Glen Canyon Reservoir site? Will you give us for the record your estimates as of August 14, 1950, which, according to that sheet, shows the prices which you used in arriving at the cost of the Glen Canyon unit? Tell me what is the total cost of the Glen Canyon unit as of that time?

Mr. LARSON. The total cost of the Glen Canyon unit, with its appropriate share of the transmission system as listed, was $363,900,000, and it was prepared from detailed estimates prepared by the chief engineer in Denver. This is a summary of his studies.

Mr. SAYLOR. And the figures which you have used in your statement today show what as the estimated cost of the Glen Canyon unit today?

Mr. LARSON. I did not get your question, sir.

Mr. SAYLOR. According to the statement which you submitted in the record today, what is the estimated cost of the Glen Canyon unit?

Mr. LARSON. $421,270,000.

Mr. SAYLOR. And that was made up in the same manner in which your report was made in 1950, and just brought up to date?

Mr. LARSON. The costs were brought up to date, but the allocation to transmission system is different.

Mr. SAYLOR. What is the difference in the allocation of transmission?

Mr. LARSON. Well, we have been refining our studies and some of the procedures somewhat in our work so the allocations may be a little different. The transmission system is somewhat different, which affects the estimated cost. I would have to go into that to determine what that is. Out of the $421,270,000 cost in this table submitted with my statement today, $133,600,000 is for transmission, and you will note from the table following page 49 in the report, to which you referred, the transmission costs there are $108 million.

Mr. SAYLOR. Now, this Glen Canyon unit would produce power at approximate what per kilowatt-hour?

Mr. LARSON. I cannot give you that for Glen, because we were working the whole system into a rate of 6 mills to keep a fairly uniform average rate that the other units can come on incrementally as time goes on, and we would still have a uniform rate less than steam.

Mr. SAYLOR. In other words, you are not able to tell this committee, the Department is not able to tell this committee, whether or not Glen Canyon can produce power for 2 mills a kilowatt-hour or for 10 mills a kilowatt-hour?

Mr. LARSON. Yes; I can tell you that. It produces 800,000 kilowatts. That is approximately half of the output of the total, for about one-third of the cost.

The information contained in the Secretary's report shows the cost of power delivered to the market at Glen Canyon as 4.7 mills.

Mr. SAYLOR. Will all of the power produced in the Glen Canyon Reservoir site be marketed in the upper Colorado Basin?

Mr. LARSON. That I do not know. But it could be. The upper basin from our forecast shows that in 20 or 25 years it can use the total output from all 9 plants. Whether any will go down to California and Arizona in the meantime is not for me to say.

Mr. RHODES. Mr. Larson, for some purposes, Arizona is deemed to be an upper basin State. You make a point there that is rather interesting to me. The way I read this bill, the power is to be marketed in the upper basin States insofar as possible. If the power is marketed in the lower basin States or in other States, the contract would be of irrevocable nature so that the power may be recaptured in the event the power is needed in the upper basin States. Is that your understanding?

Mr. LARSON. I believe that is a paragraph in the bill that you referred to. It will come back or, if that is not practicable, there would be an adjustment of rates or something.

Mr. RHODES. As I read the bill, it provides that the contracts must state that the power may be recaptured if it is needed in the upper basin which sort of sets up a priority customer of the upper basin States. Is that your understanding of it?

Mr. LARSON. I think the bill purports to be that, but I think it speaks for itself. I would not want to interpret it.

Mr. RHODES. I would like to have you interpret it, because I am wondering if you think of Arizona in this particular instance as an upper basin State or a lower basin State? In other words, is the State of Arizona, which is partially in the upper basin, a preferred customer or is it not a preference customer insofar as this power is concerned?

Mr. LARSON. I think the way the bill is written it gives preference to the upper basin States. That is what it says to me.

Mr. RHODES. In your planning, now, you mentioned that there was $130 million in here for transmission from Glen Canyon. I presume you have a transmission grid for marketing the power from Glen Canyon. Might I ask you whether or not in planning that grid you have plans to transport any considerable amounts of power into the State of Arizona?

Mr. LARSON. I will have to swallow before I answer that, but I will do it. We have done it this way, Mr. Rhodes. We have figured on a transmission system in the upper basin to deliver kilowatt-hours to four States of the upper division, on this basis: If some power should go down, we will say, to Arizona, and if you do not deliver 800,000 kilowatts from Glen Canyon upstream, you immediately reduce the cost of your transmission, and by whatever that reduction was in our studies, it would be applied either in rates or lines to any power going down. That is the way we have assumed it.

In other words, we have assumed our studies on a complete transmission system in the four States of the upper division as a basis for arriving at a mill rate.

Mr. RHODES. Then I guess your answer to me as to whether you planned a transmission grid from Glen Canyon into the State of Arizona would be no?

Mr. LARSON. It is flexible. There is enough money in our estimates to go down there some distance. I do not know how far. It depends on how much power goes down.

Mr. RHODES. In your planning as to the marketability of this power, you stated that in 25 years all of the power can be marketed in the upper basin States. In that planning, do you have in mind marketing that power in the State of Arizona as well as the other upper basin States?

Mr. HARRISON. Will the gentleman yield there? Possibly on page 13 of the bill, where Arizona is definitely stated to be on in the upper Colorado Basin, I think that will cover that point as clearly as can be done.

Mr. RHODES. I agree with the chairman that it seems to so state, but I would like to have the Department's planning according to the testimony of this witness. I would like to have the Department's planning in the record. In other words, you are planning as to the places in which this marketing will take place in the next 25 years.

Mr. LARSON. Yes. Our planning was to base the rate on all the power being delivered to the upper basin so that if power went down below, to Arizona, the upper basin States or the lower basin, then the transmission system going from Glen upstream would be reduced by a certain amount of money, and whatever it was it could be applied below or an adjustment of rates made.

Mr. RHODES. As I interpret your testimony, then, you would say that only that part of Arizona which geographically lies within the upper basin would be considered as being within the upper basin?

Mr. LARSON. No, I did not say that. I said we have based our market studies on the other, and what goes down certainly is not for me to say—I mean the Bureau of Reclamation office.

Mr. RHODES. Of course, all I am trying to do is to get the basis on which you planned this project. I know you have made plans, and I know that you have considered certain basic fundamental data.

Mr. LARSON. Yes, we have. In my statement, we have assumed how much could go downstream without adversely affecting the transmission upstream. Well, certainly you cannot put less than half of Glen Canyon upstream to finance a transmission line. By the same token, you have to have quite a major demand downstream to finance a transmission line from Glen Canyon downstream.

Now, what will finally be done is not for region 4 or the Bureau to say, I do not think.

Mr. YORTY. Would the gentleman yield?

Mr. SAYLOR. I yielded for only one question.

Mr. YORTY. I wonder if my friend from Arizona will stipulate for power sale purposes that California also be considered as being in the upper basin?

Mr. SAYLOR. I thought at one point, Mr. Yorty, California might desire to see Arizona in all places.

Mr. RHODES. I am not sure that is where California would like Arizona to be at all.

Mr. YORTY. We do not like to be on both sides of all questions.

Mr. SAYLOR. In your original estimates in 1950 for the Glen Canyon unit, what did you figure power would sell for if the total cost of your project was $363,900,000?

Mr. LARSON. There again we had a pool rate. It is in the report here, I believe, as 5½ mills.

Mr. SAYLOR. In other words, you were going to sell Glen Canyon power at 5½ mills; is that correct?

Mr. LARSON. We were going to sell it all at 5½ regardless of which plant; that is a pool rate.

Mr. SAYLOR. In other words, the Department's thinking in this matter is that from Glen Canyon site to Flaming Gorge Reservoir Dam site, and all of the intermittent ones, regardless of what the costs were to produce power, you were going to sell it at a figure which would pay out overall; is that correct?

Mr. LARSON. Yes, except that each opportunity would be less than developing power at alternative sources. But where they are in a team like this, one dependent upon the other, one enhances the output of another, then we have used the one rate because, as we see it, unless the plants are tied together, almost as one plant, we do not have all firm power, and if we do not have practically all firm power, we do not have a plan.

Mr. SAYLOR. You do not mean to sit there and tell this committee that you expect to build all of these nine dams at one time; do you?

Mr. LARSON. No.

Mr. SAYLOR. All right, then. What you intend to do is to tell the committee that eventually you hope to be able to sell all the power at one figure?

Mr. LARSON. What I want to tell this committee is that this plan is based on selling it at an average rate of about 6 mills right at the beginning and Echo Park and Glen Canyon are so big in comparison to the rest that when the rest are added, whatever they are, the ones we have planned it will not change the setup.

Mr. SAYLOR. Mr. Larson, since 1950 to 1954, the cost of Glen Canyon has increased over $60 million. What effect has that had upon the figures of the Bureau as to what the costs are to produce power at Glen Canyon?

Mr. LARSON. All of our costs, since the 1950 report up to now, have been increased, I believe, about 12.8 percent, and we move the mill rate up from 5½ to an average of 6 mills.

Mr. SAYLOR. Could you tell this committee what it will cost today to produce power at Glen Canyon providing you can build Glen Canyon for $421,270,000?

Mr. LARSON. That is the cost I gave you at 4.7 mills.

Mr. SAYLOR. That was the figure you gave us at which you could produce power in 1949.

Mr. LARSON. No, that is the cost we are using in the statement here today.

Mr. SAYLOR. Then if 4.7 mills is what it will cost to produce that power today, what would it have cost in 1950, when you submitted your original report?

Mr. LARSON. 4.2. I am just recalling that from memory, but it is less than 4.7.

Mr. SAYLOR. Now, if Glen Canyon were authorized by this committee alone, and no other participating projects were authorized or

no other river storage projects were authorized, what would the Department's policy be with regard to selling that power? Would you still want to sell it at 6 mills or would you sell it at 4.7 mills?

Mr. LARSON. I cannot speak for the Department. My own opinion is that if you sold it for 4.7 mills your upper basin planning is gone. You have no plan. If you are going to build the other regulatory reservoirs, that is.

Mr. SAYLOR. How long would it take to pay out the Glen Canyon project if you would charge 4.7 mills?

Mr. LARSON. I think that is 50 years.

Mr. SAYLOR. 50 years?

Mr. LARSON. Based on 50 years.

Mr. SAYLOR. That 50 years is from the time construction is started, or is that an overall 50 years?

Mr. LARSON. That is 50 years, I believe, after the last unit is in operation. But all of our costs include interest during construction on these powerplants.

Mr. SAYLOR. If there were no other projects authorized, and only the Glen Canyon Reservoir site was authorized to be built, that is, at the end of 50 years where would the revenues from the power produced at Glen Cayon Reservoir site go?

Mr. LARSON. That all depends on the legislation under which it is authorized. I would not know.

Mr. SAYLOR. Suppose there is nothing said in the legislation. At the end of 50 years when the project is paid for, what happens to the money?

Mr. LARSON. I assume it would go into the Treasury of the United States.

Mr. SAYLOR. It goes into the Treasury of the United States, and the Treasury of the United States is represented not just by the upper basin States, but it is representative of all the 48 States and Territories and possessions; is that right?

Mr. LARSON. That is correct.

Mr. SAYLOR. So that hereafter, when any moneys are taken, after that project is paid for, it becomes necessary to look at things very factually and determine whether or not the money should be turned in to the Treasury or used for some other purpose; is that right?

Mr. LARSON. It depends on the benefits you expect to get if you use it for some other purpose, or which we think is greater than 1 to 1.

Mr. SAYLOR. Now, does the Department or the Bureau have any formula wherein they can tell this committee how much they think any one of the participating projects in the upper Colorado River Basin should be subsidized by power?

Mr. LARSON. All we can do is tell you, using the procedures that we do use in the Bureau, what the outcome is, and the benefit-cost ratio, how much is repayable by water users and how much by municipal users, if there are any, how much by power, if there are local powerplants on the participating projects, which there are in the case of 2 or 3, and what the balance is that the irrigators cannot pay that we have set aside to be repaid from power revenues. We can tell you what that is for each one of those 12 participating projects and for some of the others.

Mr. SAYLOR. In other words, we have not gotten into participating projects, but the same thing that you have said with regard to storage

projects is also true for participating projects? The Bureau has made plans for more than 12 participating projects?

Mr. LARSON. My statement said that the plan was based on whatever participating projects were authorized now. As the needs arise and the reports are available, the States would come in for more projects as time goes on, and we have estimated that would go on for at least the 75 years before the upper basin States eventually use the water to which they are entitled.

Mr. SAYLOR. Let me ask you, in making these plans for storage and participation in the upper basin, how much water did you figure was available in the upper basin?

Mr. LARSON. Our studies are based on 7½ million acre-feet.

Mr. SAYLOR. You, Mr. Larson, I am sure, are familiar with the report published by the Colorado Water Conservation Board in October of 1953?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. And that report was prepared by Mr. Hill of Leeds, Hill & Juett, is that correct?

Mr. LARSON. That is right.

Mr. SAYLOR. This report shows that there is not 7½ million acre-feet available for the upper Colorado River.

Mr. LARSON. It does not show that to us, or to me. Shall I give you the reason?

Mr. SAYLOR. Well, let me first ask you if that is not what the report says, that you are approximately 1,300,000 acre-feet short right now in the upper Colorado River Basin?

Mr. LARSON. The report was based on——

Mr. SAYLOR. Answer the question, sir. Is not that what that report says?

Mr. HARRISON. I think you can answer the question, but you always have the right to explain your answer.

Mr. LARSON. May I have the question again?

Mr. SAYLOR. Does not this report show that the upper Colorado River Basin is short 1,300,000 acre-feet per year?

Mr. LARSON. Yes, based on carrying water only over 20 years, an erroneous assumption. The mass curve was based on historical flow, instead of virgin flow, which does not present a true picture.

Mr. SAYLOR. In other words, it is your opinion that the Colorado Water Conservation Board did not get a very good report?

Mr. LARSON. No, that is a good report. Mr. Hill has assumed that the reservoir should fill every 20 years. We have assumed we can carry over water over a longer period than 20 years. The past records indicate that to us. The next few years will tell.

Mr. SAYLOR. How long can you carry water? You said you could carry it longer than 20 years. I want to know how long you can carry it.

Mr. LARSON. In an efficient reservoir, with not too high evaporation, you can carry water fully 30 years, and these reservoirs, Glen Canyon and Echo, will do it.

Mr. SAYLOR. Will you still have enough to produce all of this power that you say is available?

Mr. LARSON. Yes, I think our estimates of the power production are very conservative. I would not be surprised if the power is not greater than we figured.

Mr. SAYLOR. All right. Will you tell this committee the next reservoir up the river? That is the Whitewater Reservoir. Can you tell us what the cost of that reservoir was in 1949 or 1950?

Mr. LARSON. $40 million.

Mr. SAYLOR. Are you in a position to tell the committee what it would cost to build that reservoir today?

Mr. LARSON. Our cost brought up to date is $44,291,000.

Mr. SAYLOR. And the next reservoir is Crystal Reservoir site. Will you tell us the cost of that reservoir in 1950?

Mr. LARSON. $37,900,000.

Mr. SAYLOR. And the cost of it as of today?

Mr. LARSON. $40,952,000.

Mr. SAYLOR. And the next reservoir is Curecanti. Can you tell us the cost in 1950?

Mr. LARSON. $80,400,000.

Mr. SAYLOR. And the cost in 1954?

Mr. LARSON. The 2½ million acre-foot reservoir is $85,972,000.

Mr. SAYLOR. Now, if you build a high dam at Curecanti Reservoir site, what would it cost in 1950?

Mr. LARSON. 1950? I just gave you that. $80,400,000.

Mr. SAYLOR. And the figure that you gave us——

Mr. LARSON. We did not have a small Curecanti in 1950, only the large one.

Mr. SAYLOR. What would it cost to build that same dam in 1954?

Mr. LARSON. 1953? The small one or the large one? $85,972,000.

Mr. SAYLOR. The next reservoir site is Gray Canyon. Tell us what it would cost to build that in 1950.

Mr. LARSON. 1950 was $178,400,000.

Mr. SAYLOR. And the cost in 1954?

Mr. LARSON. $190,854,000.

Mr. SAYLOR. And the next reservoir is Split Mountain.

What was the cost of that project in 1950?

Mr. LARSON. 1950, $76,400,000.

Mr. SAYLOR. And the cost in 1954.

Mr. LARSON. $84,417,000.

Mr. SAYLOR. Now, the cost of Echo Park Reservoir site in 1950?

Mr. LARSON. $165,400,000.

Mr. SAYLOR. And the cost in 1954?

Mr. LARSON. $176,426,000.

Mr. SAYLOR. The next one is Flaming Gorge. What was the cost of that in 1950?

Mr. LARSON. $82,700,000.

Mr. SAYLOR. And the cost in 1954 of that same project?

Mr. LARSON. $82,942,000.

Mr. SAYLOR. I think the last one is the Cross Mountain Reservoir. What was the cost of that in 1950?

Mr. LARSON. $51 million in 1950.

Mr. SAYLOR. And in 1954?

Mr. LARSON. $50,225,000.

Mr. SAYLOR. Could you give the committee the total cost of those 9 reservoirs in 1950?

Mr. LARSON. $1,031,500,000 in 1950, for the 9.

Mr. SAYLOR. Can you give us the cost of those same 9 reservoirs in 1954, assuming that Curecanti is built as a high dam?

Mr. LARSON. I will have to correct the last figure. I was subtracting a little fast here. In 1950 it is $1,076,100,000. In 1953, it is $1,177,349,000.

Mr. SAYLOR. Assuming the change of plans from a high dam at Curecanti to a low dam at Curecanti, would you tell us the costs in 1954?

Mr. LARSON. Take $37 million off the 1953 figure. Of course, we do not have the 1950 figure.

One billion, one hundred forty million dollars in 1953.

Mr. SAYLOR. Of that $1,140 million, how much has the Bureau of Reclamation allocated to nonreimbursibles?

Mr. LARSON. Not a dollar; nothing yet. Some day they might on some of them, but they have not yet. Our plan has not evaluated any nonreimbursables to this date.

Mr. SAYLOR. In other words, I gather that the committee is to be forewarned that there is in the minds of at least certain people that some part of it should be classified as nonreimbursible?

Mr. LARSON. No, but I think we should recognize that there are fish and wildlife, recreation, benefits of a national nature, silt retention, and things like that, that may be evaluated in the future. What will be done then for nonreimbursables, I would not know. But we have not tried to evaluate them or ask for nonreimbursables in this plan to date.

Mr. SAYLOR. But is it not a matter of fact that committees of Congress have already recognized that certain of the items which you have just mentioned are already nonreimbursable, and should be so designated? Do you mean to tell me that the Bureau has absolutely nothing in its plans so far considering the fact that we have flood control, recreation, and wildlife, and they have not taken any money into consideration in writing it off?

Mr. LARSON. We have some nonreimbursables in the participating projects, but there is very little flood control on the main stem of the Colorado River. There are some, possibly, but it is not large compared with the total costs that we are talking about of a billion dollars or more. So we did not attempt to evaluate them for the dams which authorization is being asked for in the bills at this time.

Mr. SAYLOR. Now, of the nine projects that have been specified here as reservoir sites, what is the longest period after construction during which the sale of power at 6 mills will pay out that project?

Do this for me, Mr. Larson. Can you go right up the river as I did in asking you about the costs of the dams, and give us the payout period for each one of them?

Mr. LARSON. I can give you that now. The payout period for all the power allocations for the Echo Park and Glen Canyon, those 2 units would pay out in 44 years at an average rate of 6 mills, and if the others are added to the lines, they would pay out in 50 years after the last unit is on the line. The scheme is based on all of them paying out in 50 years, the first 2 in 44. It will be 50 years after the units come on the line.

Mr. SAYLOR. So that if Whitewater Reservoir were built in 1970, the first unit went into effect that year, 50 years later that project would be paid for?

Mr. LARSON. Yes.

Mr. SAYLOR. And the same for Crystal——

Mr. LARSON. Of course, if it was not started until then, there would be so much revenue in the pool I do not know how you would do it then.

Mr. SAYLOR. What was that?

Mr. LARSON. I said if it was not started for 70 years——

Mr. SAYLOR. No, I said that we were going to build that one and have it finished by 1970.

Mr. LARSON. 1970?

Mr. SAYLOR. Yes.

Mr. LARSON. I beg your pardon. I thought you said 70 years.

Mr. SAYLOR. No, my statement is that in 1970 we would complete Whitewater Reservoir and 50 years thereafter that project would be paid for.

Mr. LARSON. That is right.

Mr. SAYLOR. And the same is true for Crystal, Curecanti and the others?

Mr. LARSON. If nothing happens in the meantime, or prices change, it might change conditions some. But at our present day prices, it shows that with our estimated cost it would pay out in 50 years after the last unit is on the line, in blocks as they come on.

Mr. DAWSON. You are referring to Whitewater. He mentioned Curecanti along with it. Do you qualify that with the rate of either a high or low dam?

Mr. LARSON. Any of them that are found that can produce power at less than the alternative cost of steam. That is the way our plan is set up.

Mr. SAYLOR. Would the same thing be true for any other project which you built in Desolation Canyon, for example, one of the two hundred-odd sites referred to by Mr. Aspinall?

Mr. LARSON. Probably not, because if you assumed that if you build Desolation, you would not build Echo Park, then I do not think that would be feasible at all. It is just like Gray Canyon which would not be feasible without Echo Park.

Mr. SAYLOR. In other words, according to you, Gray Canyon would not be feasible if Echo Park were not built?

Mr. LARSON. I doubt that it will be.

Mr. SAYLOR. Will you tell us why?

Mr. LARSON. Because it needs major regulation upstream to take peaking loads that would be possible at Echo Park Reservoir. What Echo Park does is to make Split Mountain and Gray Canyon feasible.

Mr. SAYLOR. Well, suppose you built one at Flaming Gorge and one at Browns Park. Then what would be the effect?

Mr. LARSON. You would still have the Yampa River unregulated.

Mr. SAYLOR. Are there any other dam sites on the Yampa River?

Mr. LARSON. There are smaller ones, but nothing like Cross Mountain, for example.

Mr. SAYLOR. What are the projects that are available on the Yampa River?

Mr. LARSON. What is it?

Mr. SAYLOR. What are the available sites on the Yampa River?

Mr. LARSON. There was a Juniper site, but that is submerged by Cross Mountain. There are no other large sites.

Mr. SAYLOR. After the initial phase of establishing these nine power-producing projects on the river, how many participating projects does the Bureau have in mind?

Mr. LARSON. The initial phase that would come along with the Echo Park-Glen Canyon unit, there are 12, and then these additional ones asked for by the States. To us, additional——

Mr. SAYLOR. Those additional ones are Eden, Gooseberry, La Plata, Navaho, and San Juan-Chama.

Mr. LARSON. Yes. You can exclude Eden because it is already authorized and nearly built. The Shiprock division of the Navaho project, that is an Indian project, and not a Bureau of Reclamation project. That is for the Navaho and Hopi Indians.

Mr. SAYLOR. But it must be considered by the Bureau of Reclamation if they are going to develop the river, whether they build it or whether they do not?

Mr. LARSON. It comes into the scheme as a participating project from the Indian Bureau just like the other ones were investigated by the Bureau of Reclamation, two Interior agencies, with separate things to do. But the plan as I mentioned in my statement is one that would go along over a long period of years. Participating projects would come in as they are needed, and desired, and approved by Congress.

Mr. SAYLOR. I think you have shown in your original statement here that in the 12 participating projects which you have recommended, there would be 236,360 acres of new land brought into production, is that right?

Mr. LARSON. That is correct, for the first 12.

Mr. SAYLOR. And in additional participating projects, there would be 57,660 acres of new land?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. Making a total of new lands in these 17 projects of 294,020 acres; is that right?

Mr. LARSON. Yes, sir.

Mr. SAYLOR. Now, could you give a supplemental water supply for the sum of these projects?

Mr. LARSON. Yes, sir. The acreage is given for the supplemental supply lands.

Mr. SAYLOR. And the total amount of supplemental or acreage to receive a supplemental supply of water in the 12 participating projects is what?

Mr. LARSON. 233,930 acres.

Mr. SAYLOR. And what acreage is there that would receive a supplemental supply of water in the five additional participating projects asked for in the bill?

Mr. LARSON. 235,740 acres.

Mr. SAYLOR. Making a total acreage in the 12 participating projects and the projects authorized in the bill of what acreage to receive a supplemental supply of water?

Mr. LARSON. 469,670 acres.

Mr. SAYLOR. Can you tell the committee the total new lands receiving water and supplemental water?

Mr. LARSON. Well, under the 12 participating projects, and any additional participating projects, there are 294,020 acres of new land, and 469,670 acres of supplemental land. Is that what you asked for?

Mr. SAYLOR. Yes.

Mr. LARSON. Or a total in both categories of 763,690 acres.

Mr. SAYLOR. Now, in addition to these projects, Mr. Larson. can you tell the committee how many other projects are in the upper Colorado River Basin that might apply for and use water? If you do not have the answer, can you get it?

Mr. LARSON. As I explained in my statement, our 1946 report inventory of projects, included some 100 irrigation and power projects in the 4 States of the upper division, that is, the upper Colorado River Basin. That included projects outside of the natural basin entitled to use Colorado water. In other words, they were within the States of Utah, New Mexico, Colorado, and Wyoming. A lot of those, of course, will probably go out of the picture on detailed investigation. But it does seem reasonable from the studies made that there are more potentialities in the future than there is water to which the upper basin States are entitled. That may be 40 or 50 additional projects, depending upon the size.

Mr. HARRISON. Do you want any additional information on that?

Mr. SAYLOR. No, sir.

Mr. HARRISON. We have reached the time or adjournment. We will start again at 9:30 in the morning.

We will ask Mr. Larson to be present, and we will take up where we left off this afternoon.

(Thereupon, at 4:30 p. m., a recess was taken until Tuesday, January 19, 1954, at 9:30 a. m.)

COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

EIGHTY-THIRD CONGRESS

SECOND SESSION

ON

H. R. 4449, H. R. 4443, and H. R. 4463

TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

JANUARY 18, 19, 20, 21, 22, 23, 25, 26, 27, AND 28, 1954

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COLORADO RIVER STORAGE PROJECT

TUESDAY, JANUARY 26, 1954

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to recess, at 9:30 a. m. in the committee room, New House Office Building, Hon. William H. Harrison (chairman) presiding.

Mr. HARRISON. The committee will come to order.

The first witnesses this morning will be Mr. Northcutt Ely, special counsel for the Colorado River Board of California, and Mr. Raymond Matthew, chief engineer for the Colorado River Board of California.

Do you want to proceed first, Mr. Ely?

Mr. ELY. Mr. Matthew will proceed.

Mr. HARRISON. As you remember yesterday you asked for 45 minutes and that was the time allotted. It is not a question of trying to cut you down but that is the schedule we arranged, and we hope you can finish.

Mr. ELY. We will do our best.

Mr. HARRISON. You may proceed.

STATEMENT OF RAYMOND MATTHEW, CHIEF ENGINEER, COLORADO RIVER BOARD OF CALIFORNIA

Mr. MATTHEW. Mr. Chairman and gentlemen of the committee, my name is Raymond Matthew. I am chief engineer of the Colorado River Board of California, which is a State agency created by act of the legislature in 1937. The board is charged with the responsibility for protecting the interests of California in the waters of the Colorado River. It is composed of 6 members appointed by the Governor, each representing one of the public agencies having established rights to the use of water or power from the Colorado River.

PROPOSAL BEFORE THE COMMITTEE

The bill H. R. 4449 now pending before the committee seeks to authorize certain specified initial units of the so-called Colorado River storage project and certain specified participating projects with certain qualifications. It also contains provisions covering the operation, administration, and management of the project including a proposal that the storage project and participating projects shall be treated and accounted for as one project.

Mr. ENGLE. The proponents have the burden on this legislation. If you do not propose to do it with adequate time and adequate opportunity for these people to be heard, then naturally they will fail to meet the burden which is placed on them.

Mr. HARRISON. I suggest the gentleman from California make the motion that all of these witnesses be heard for the proponents first, and that later, when we can get to it, we take up the opponents some time in the future. If you will make that as a motion and the committee sustains you, you have that responsibility on your own shoulders, and it is agreeable to the chairman. Do you care to make the motion, Mr. Engle?

Mr. ENGLE. No.

Mr. HARRISON. You may proceed, Mr. Ely.

STATEMENT OF NORTHCUTT ELY, SPECIAL COUNSEL, THE COLORADO RIVER BOARD OF CALIFORNIA, WASHINGTON, D. C.

Mr. ELY. My name is Northcutt Ely. I am an attorney, with offices in the Tower Building, Washington 5, D. C., and appear here as special counsel to the Colorado River Board of California, a branch of the State government.

California, as a party to the Colorado River compact, is affected by this bill in the respects which I shall outline. California is also a party to the pending suit in the Supreme Court entitled *Arizona* v. *California, et al.*, No. 10 Original, October term, 1953, as are Nevada, Arizona, and the United States. I have the honor to represent California in that action, under the direction of Attorney General Brown of California. Certain of the issues in that suit are directly involved in the assumptions made by the Bureau of Reclamation in planning the project now before you. These will be identified during the course of my statement.

THE PENDING PROJECT

The legislation now before the committee, as modified by the explanations given here by the Interior Department, would accomplish four general objectives:

1. It would authorize in section 1, page 2, line 23, the construction of 15 reclamation projects. The aggregate consumptive use of these projects is said to be about 1,700,000 acre-feet, which added to about 2,500,000 acre-feet said to be required by projects already constructed or authorized, would represent a total of about 4,200,000 acre-feet. This total is well within the quantity of 7,500,000 acre-feet per annum, the use of which is apportioned to the upper basin by article III (a) of the Colorado River compact, to which I shall presently refer. Moreover, the engineering studies indicate that this total could be put permanently to use without the construction of any new holdover storage whatever, and that no holdover storage would be required for about 50 years, even if other projects were added.

2. The bill nevertheless authorizes, in section 1, page 2, line 12, the construction of four storage reservoirs (reduced to two, Glen Canyon and Echo Park, by the Department's testimony). The whole storage program amounts to over 48 million acre-feet. The purpose of au-

thorizing construction of these reservoirs now, instead of many years from now, is twofold:

(*a*) Electric energy would be generated and sold and the proceeds pooled to subsidize the construction of the power and reclamation projects previously referred to in section 1.

(*b*) If built now, the reservoirs could accumulate water with less interference with consumptive uses in both the lower and upper basins than if their construction were delayed until a later time when consumptive uses will be larger.

3. The bill authorizes, in section 5, page 8, the construction of other projects, unnamed, provided they meet certain criteria. These are not designated in the bill, but the Department has inventoried over 100 projects in various publications, particularly House Document 419, 80th Congress. It is not clear from section 5 whether these projects must be brought back to Congress for further authorization, or whether the Secretary is authorized by section 5 to build them; but in any event, when they are built, the new power projects and the new reclamation projects covered in section 5 will share in the subsidies afforded by the sale of power to be generated at Glen Canyon; and, in addition, and for the first time, a fourth function of the holdover storage at Glen Canyon and Echo Park will then come into existence. Thus:

4. When, as, and if the additional projects referred to in section 5 are built, it will be necessary to store water in Glen Canyon, or some equivalent storage capacity, not for use by these projects (Glen Canyon Reservoir is so far downstream that no water stored there can ever be used for irrigation or domestic purposes in the upper basin), but for quite a different reason: To enable these section 5 projects to increase the consumptive use in the upper basin above the 4,200,000 acre-feet required by existing projects plus the section 1 projects, without violating the provisions of article III (d) of the Colorado River compact, which stipulates that the States of the upper division (Colorado, Utah, New Mexico, Wyoming) will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years. In the driest decade so far, the flow at Lee Ferry was well over 100 million acre-feet, when the upper basin projects were using about 2 million acre-feet per year; and engineers tell us that the upper basin uses can rise to about 4,300,000 acre-feet, which is more than the total of existing uses plus the section 1 projects, before this 100 million total would shrink to 75 million.

Thus the ultimate purpose of Glen Canyon Reservoir, and other holdover storage, is to enable the upper basin to build the section 5 projects without violating article III (d) of the compact, and the immediate reason for constructing Glen Canyon Dam now instead of waiting until the section 5 projects are built is, first, to immediately subsidize the section 1 projects and, second, to fill Glen Canyon during a time when the filling is easier, presumably, than it will be later on.

As all of the foregoing involves the Colorado River compact, and as California is a party to that compact, California is directly concerned by the interpretations of the compact implicit in the bill, and in the interpretations of the compact which will control the administration of these reservoirs. This is readily apparent when it is realized that

the total storage capacity planned is over 48 million acre-feet, enough to intercept the whole flow of the river for several years, and that it is planned to hold over storage in these reservoirs for more than 20 years, or five Presidential administrations, in order to deliver to the lower basin under article III (d) in the year 2000 water that flows into the reservoir in 1980 for example. Some rather firm understandings as to the meaning of the compact are required, especially as the bill now make no provision for enforcement of the compact by any State against the United States, which will hold this water in its reservoirs and release it subject to the decision of a long succession of Secretaries of the Interior as to what the document means.

The meaning of the document is now in sharp controversy in the Supreme Court, in respects which affect the measure now before you. To these issues I now turn.

II. Interpretations of the Colorado River compact involved in the upper storage project legislation and the pending litigation:

1. THE MEANING OF "PER ANNUM" IN ARTICLE III

Article III (a): Does the apportionment of the use of 7,500,000 acre-feet per annum mean an average of that amount over a period of years, or a maximum in any one year?

The Reclamation Bureau, in submitting this upper basin storage project, makes the assumption that the apportionment means an average, so that the upper basin may use 9 million acre-feet or more of water in 1 year, and consider it as apportioned under article III (a) if it uses 6 million or less in some other year, to average 7,500,000 acre-feet.

California alleges in the pending lawsuit that the apportionment means a maximum, like speed limit on a highway, not an average. If the speed limit says 50 miles per hour, that doesn't mean an average of 50. We allege (Answer to Arizona, par. 8) that the words "per annum" in the compact mean "each year," and not an average of uses over a period of years, whether they are our uses or anyone else's. Arizona admits this, but says that the issue is not yet material in the lower basin (Reply, par. 8). The United States position is not clearly stated. The effect, if California is right, is not necessarily to deny the upper basin the right to use 9 million acre-feet, but to characterize the excess, 1,500,000 acre-feet, as unapportioned surplus, dedicated to Mexico under article III (c) of the compact or subject to competitive appropriation in the lower basin. The amount involved in this particular issue is very large, of the order of 1,250,000 acre-feet per year. That is, if the compact means what we think it means, the Reclamation Bureau is in error that much in its assumptions as to the quantity of water the upper basin can lawfully use of III (a) water each year, and by the same token that much more water must be let down to satisfy the Mexican Water Treaty and prior appropriations of surplus in the lower basin. The same problem arises in the lower basin, but there the Reclamation Bureau has assumed that the limitation imposed upon California's uses by the Boulder Canyon Project Act is a maximum, not an average; so also with its assumptions as to the deliveries under the Mexican Water Treaty and the amounts to be delivered under its water contracts with Arizona, California, and Nevada. Both assumptions cannot be correct.

2. THE METHOD OF MEASUREMENT OF CONSUMPTIVE USE

Article III (a): Does the apportionment of "beneficial consumptive use" mean the quantity in fact used, measured at the place of use, or does it mean the effect of that use measured in terms of stream depletion at some point hundreds of miles downstream, in this instance at Lee Ferry? This question of interpretation of the Colorado River compact and the Mexican Water Treaty is directly at issue in the present Supreme Court case. The quantity involved in this dispute, so far as the planning of the upper basin storage project is concerned, is 300,000 to 500,000 acre-feet, according to engineers' estimates. The Reclamation Bureau assumes that the measurement is to be in terms of downstream depletion in the case of the upper basin project and the central Arizona project, but in terms of diversion minus return flow, measured at the place of use, with respect to California. The Boulder Canyon Project Act so defines it, and the Mexican Water Treaty says (art. I (j)):

> "Consumptive use" means the use of water by evaporation, plant transportation or other manner whereby the water is consumed and does not return to its source of supply. In general it is measured by the amount of water diverted less the part thereof which returns to the stream.

That corresponds with California's allegation of the meaning of the term in *Arizona* v. *California* (Answer to Arizona, par. 8). Arizona denies that this definition applies to her uses, (Reply, par. 8) and the Reclamation Bureau, in the project before you, assumes that it does not apply to the upper basin, although in section 2, page 4, line 21, the projects to be built under the bill are recognized as being subject to the terms of the Mexican Water Treaty, as they of course are.

Another problem arises if the depletion theory prevails. One of its postulates is that when water is stored in a reservoir, the stream below is depleted, as of course it is, and therefore that the consumptive use of the stored water takes place then and there, in the year when the water is put in storage, not when it is taken out and used. On that premise, how is the 48 million acre-feet of holdover storage, that is, of stream depletion, to be charged? And, in future operation, how is the storage of more than 7,500,000 acre-feet in any one year to be charged? Is the same principle, whatever it may be, applicable to the lower basin reservoirs?

3. "RIGHTS WHICH MAY NOW EXIST"

Article III (a): Does the statement in article III (a) that the apportionment of the use of 7,500,000 acre-feet per annum "shall include all water necessary for the supply of any rights which may now exist" include two categories of uses in dispute in *Arizona* v. *California*: (1) The uses on the lower basin tributaries, particularly those of Arizona on the Gila River, which she says are not to be charged against the lower basin's apportionment of III (a) water, and (2) Indian uses in both basins? The significance of the Gila appears in connection with the upper basin's obligations under article III (c) and III (d) of the compact and that of the Indian uses in connection with article VII, and will be outlined when we reach those articles in numerical order.

4. THE MEXICAN BURDEN

Articles III (c) and III (d): Article III (c) provides that the Mexican burden, which is a minimum of $1,500,000 acre-feet per annum measured at the border, (more than that measured at Lee Ferry) shall be borne first out of surplus, over amounts specified in articles III (a) and III (b) and, if that is insufficient, then the burden of the deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency, in addition to that provided in article III (d).

Article III (d) provides that the States of the upper division, that is, Colorado, Utah, Wyoming, and New Mexico, will not cause the flow of the Colorado River at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years.

The interpretation of these two clauses is at issue in Arizona versus California and is involved in the present bill. The Reclamation Bureau apparently assumes in its presentation here that there will be available at Lee Ferry, after the section 5 projects are built, only about 75 million acre-feet every 10 years. Arizona says (Reply, pars. 8, 11) that all this 75 million is III (a) water, that is, that this figure is merely 10 times the quantity apportioned to the lower basin by article III (a) of the compact, and that all of the lower basin's III (a) uses can be made from the main stream. California (Answer, to Arizona pars. 8, 11) and Nevada (Petition, par. XIV) deny this, and say that Arizona's uses on the Gila, and the uses of Nevada and Utah on the Virgin River, are "rights which may now exist," in the language of article III (a), hence chargeable to (and protected by) article III (a). Arizona retorts that her uses on the Gila are covered by article III (b) of the compact, an article which says that, in addition to the apportionment in article III (a), the lower basin is given the right to increase its beneficial consumptive use by 1 million acre-feet per annum. If Arizona is sustained by the Court in this position, there is no water for Mexico in the 75 million acre-feet at Lee Ferry referred to in article III (d), and the upper basin, under article III (c), must, in addition, release water to supply one-half of any deficiency in meeting the Mexican burden.

When the Reclamation Bureau reported favorably on the central Arizona project, it was on the assumption that Arizona's interpretations were correct, without, however, endorsing them. If California and Nevada are correct, a portion of the 75 million acre-feet at Lee Ferry referred to in III (d), a portion equal to the total of the uses on the Gila, Virgin, and other tributaries under III (a), is excess or surplus water unapportioned by the compact, available in part for the service of the Mexican Water Treaty and in part for use in the lower basin. We view the 75 million as a minimum, unrelated to article III (a), and to be met whether or not there remains available to the upper basin, after meeting that obligation, water to sustain a maximum use of 7,500,000 acre-feet per annum of water apportioned by article III (a).

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5. RESERVOIR LOSSES

Nowhere in the compact is specific provision made for accounting for reservoir losses. Arizona says that they are all chargeable against the apportionments made by article III (a). Nevada says that they are all chargeable to surplus. California says that Basin versus Basin, they are to be charged with other uses to the basin in which they occur, in the order in which they accrue, whether to III (a), III (b), or other surplus, and that none are chargeable against present perfected rights existing in the lower basin before storage was provided. The upper basin compact (art. IV) charges them against apportionments under article III (a) of the Colorado River compact.

6. THE RIGHT TO DEMAND OR WITHHOLD WATER

Article III (e) of the Colorado River compact provides that the States of the upper division shall not withhold water, and the States of the lower division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural use. Glen Canyon Reservoir and certain other proposed upper basin main stream reservoirs will be so located, physically, that no water stored therein can ever be applied to domestic or agricultural uses in the upper basin. All of the water stored in such reservoirs will be required for domestic and agricultural uses in the lower basin and Mexico. If the 1953 Hill report to the State of Colorado is correct, the engineers say that if the Hoover Dam's reservoir, Lake Mead, is not filled on the day when the gates are closed at Glen Canyon, it may never fill again.

Who is to determine how rapidly storage in these upper basin reservoirs is to be built up, or, putting it another way, to what extent water which would otherwise flow into Lake Mead is to be intercepted and withheld? Who is to determine how rapidly and on what terms releases are to be made? Presumably, the Secretary of the Interior. Since the United States cannot be sued without its consent, manifestly some controls are necessary here if the States, both upper and lower, are not to abdicate the administration of their compact to the United States. Such controls are proposed in the final portion of this statement.

7. APPROPRIATION OF SURPLUS

Article III (f): Does the provision for a further apportionment, by unanimous consent after October 1, 1963, mean that no State may validly appropriate surplus until a new compact is made? California alleges, in the pending litigation, that any State, including the upper basin States, may appropriate surplus waters unapportioned by the compact, subject to their being divested but only by a new compact to which such a State is party, or by Court decree. That has been the position maintained by representatives of some, at least, of the upper basin States in previous hearings. Arizona and Nevada say that no State may acquire any right in surplus until a new compact is made. If they are sustained, then the upper basin can acquire no right in the waters it may use in any year in excess of 7,500,000 acre-feet.

8. IMPOUNDING OF WATER FOR POWER GENERATION

Article IV (b) of the Colorado River compact authorizes the impounding and use of water for generation of power, but stipulates that—

such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

As elsewhere noted, no water stored in Glen Canyon Dam and certain other mainstream reservoirs can ever be used, physically, for agricultural or domestic uses in the upper basin. Such water is the residue after the uses in the upper basin. It will be stored and used at such reservoirs to generate power to be sold to subsidize irrigation and power projects in the upper basin. The use of such reservoirs appears to be squarely controlled by article IV (b), and the right of the Reclamation Bureau to so manipulate them as to maintain power generation, if the waters stored therein are in fact needed for agricultural and domestic use in the lower basin, appears questionable. The sole function of Glen Canyon Reservoir is as part of a hydroelectric project, unless and until the section 5 projects are built, and for a period of 50 years or more even if they are built. Only thereafter does it assume any function under article III (d) of the compact.

9. INDIAN RIGHTS

Article VII of the Colorado River compact provides that nothing in the compact shall be construed as affecting the obligations of the United States to Indian tribes. The upper basin compact (art. VII) provides that use by the United States or its wards shall be charged as a use by the State in which the use is made. California, in the pending suit, takes the same position (Answer, par. 14). The United States denies this (Petition of Intervention, par. XXXVII), and says that—

the rights to the use of water of the Indians and Indian tribes are in no way subject to or affected by the Colorado River compact.

The Government's petition tabulates (appendix II) 1,747,250 acre-feet of "diversion" claims of Indians in the lower basin, of which 1,556,250 are in Arizona. Arizona says (Reply, par. 14), that—

the obligations of the United States to the Indians or Indian tribes are not material or relevant * * *

It is known that the Office of Indian Affairs construes article VII of the compact as meaning that (1) the Indian claims come ahead of the compact, are not chargeable to any State, and the compacting States simply divide the residue after the Indian claims; (2) Indian claims relate back to the date of establishment of the reservation, even though not put to use, and take priority over uses by non-Indians even though the uses by non-Indians may in fact long antedate the actual putting of water to use by the Indians. The Government's pleadings leave it free to make both these assertions. As to the first, Arizona has refused, so far, to disagree with the Indian Bureau's position. Naturally, if Arizona can hope for 1,500,000 acre-feet for Indian diversions, outside the compact, in addition to the 3,800,000

acre-feet she demands under the compact, there is a temptation to try to get it. Just where the water would come from is not very clear.

Arizona, at a meeting with the Attorney General of the United States on December 3, 1953, was invited to join the upper basin States, California and Nevada in a common statement of position that Indian uses are to be charged under the compact against the State in which they are situated, but she declined to do so. The existence of the Indian claims, and uncertainty as to their accounting, raises serious questions as to the water supply for the projects in both the upper and lower basins. Those questions will not be resolved until this suit is decided.

10. PRESENT PERFECTED RIGHTS

Article VIII provides that "present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact." In the present suit California alleges (answer to Arizona, par. 15) that "unimpaired" as used in this article means unimpaired as to both the quantity and the quality of the waters to which these perfected rights relate. As of the effective date of the compact, California's present perfected rights were not less than 4,950,000 acre-feet (answer to Arizona, par. 28). The report of the Reclamation Bureau contains no data on the effect of large transmountain diversions on the quality of water. Such a study should obviously be made. We know that when the compact was ratified, the Colorado commissioner's formal report stated that—

natural limitations upon the use of the waters within each of the upper States will always afford ample assurance against undue encroachment upon the flow at Lee's Ferry by any 1 of the 4 upper States. Colorado cannot divert 5 percent of its portion of the river flow to regions outside the river basin. (Hoover Dam Documents, H. Doc. 717, 80th Cong., p. A79.)

Elsewhere he testified that Colorado's transmountain diversions could not exceed 300,000 acre-feet per annum. By contrast, the Colorado transmountain diversion projects inventoried in the Reclamation Bureau's various reports aggregate 2 million acre-feet, or 52 percent of the water allocated to Colorado by the upper basin compact. There would be that much less water to absorb an increasing quantity of salts in passage to Lee Ferry. The effect on the lower basin is one which the lower-basin States are entitled to have studied and reported upon, to the end that their present perfected rights, in the language of article VIII, shall remain unimpaired.

III. The effects of the Colorado River controversies upon the upper basin developments:

California's basic position is that we are conforming to the Colorado River compact and that we must insist that the Reclamation Bureau and States of the upper division do so in the planning and administration of the upper basin storage project and participating projects. If the States differ as to the compact's meaning, the differences must be resolved. There are manifestly at least 10 serious questions of interpretation of the Colorado River compact which affect all the States involved in the present lawsuit and in the bill before the committee. There are others, affecting only the lower basin, which I have not enumerated.

As to some of these issues, the alinement of the various States' interests is quite different from the alinement on others. For example,

as to the question of whether the 75 million acre-feet at Lee Ferry, referred to in article III (d) of the Colorado River compact, is identical with the 7,500,000 acre-feet apportioned to the lower basin, the position of California is more advantageous to the upper basin than is Arizona's. So also, perhaps, with the Indian question.

In the pending suit, the Court may dispose of some or all of these issues. If so, the United States, as an intervening party, will presumably be bound by the decree. Or the Court may refuse to pass upon some or even all of them, as it has done three times in the past.

In any event, the administration of the great holdover storage reservoirs, and hence of the Colorado River compact, will be in the hands of the United States.

In view of the obviously important differences of interpretation of the Colorado River compact among the States of the Colorado River Basin, the question arises whether they are content to concede that the United States is to control, without recourse, the water held in these great reservoirs in the canyons midway between the users in the upper and lower basin, where it can be used by neither, and be sole arbiter of the conditions on which it shall be stored and released? If so, the compact is of doubtful protection to either group of States, because no State can sue the United States without its consent.

Manifestly, some controls are required to enable both the States of the upper division and the States of the lower division to obtain some protection in the administration of the holdover storage reservoirs. If the Secretary of the Interior should accumulate water in storage too rapidly, the whole lower basin water system would be in jeopardy. If he released it too freely, the upper basin would be adversely affected. Too much depends upon the interpretation the Secretary of the Interior gives to the Colorado River compact. The States are entitled to be consulted.

Mr. HARRISON. Mr. Ely, I would suggest, if it is agreeable, as our time is limited, that we will want you back before the committee again, which will give the committee members a chance to study these amendments, and when you come back we will discuss those amendments at that time.

Mr. ELY. That is agreeable. However, they are summarized in two pages. Perhaps I could do that and leave the text to be discussed later.

Mr. HARRISON. If they are part of the text, go ahead.

Mr. ELY. IV. Proposed amendments.

In the light of the foregoing, the following amendments to the bill are suggested (their full text is annexed. See p. 706):

1. At page 8, line 1—delete section 5. The unnamed, undescribed future participating projects can be individually authorized by Congress on their merits, after submission of reports to the affected States as required by the Flood Control Act of 1944.

2. At page 12, line 24, insert a new section to disclaim any intent to construe or interpret or amend the documents now before the Supreme Court.

3. At page 13, line 2—insert a new section to prohibit the exchange of Colorado River system water with States outside the Colorado River Basin. There is not enough to go around as it is, and not enough to enable the eastern slope of Colorado to compose its differences with Nebraska and Kansas.

4. At page 13, line 9—insert a new section to require a study and report on the effect of transmountain diversions in the upper basin on the quality of water at Lee Ferry.

5. At page 13, line 9—insert a new section to authorize State participation with the Secretary of the Interior in the programing of storage and release of water, and to authorize suit by any State against him if necessary to compel compliance with the Colorado River compact in the operation of the holdover storage reservoirs.

6. At page 13, line 9—insert a new section subjecting all uses under this Act to covenants, such as the upper basin States insisted be insisted be inserted in the bill authorizing the San Diego Aqueduct (Public, No. 171, 82d Cong.), to respect the Colorado River compact, the Boulder Canyon Project Act, the Mexican Water Treaty, and upper basin compact.

7. At page 13, line 9—insert a new section, again drawn directly from the upper basin amendments to the San Diego Aqueduct bill, subjecting the act and all works constructed thereunder to the Colorado River compact and the other documents comprising the Law of the River.

I close, as I began, by reaffirming the necessity under which California finds herself of insisting that the proposed project conform to the Colorado River compact, and as long as the meaning of that compact is in litigation, of urging this committee to include in the bill the safeguards we have suggested against any impairment of the position of the lower basin. Finally, we ask that in the operation of the holdover storage features of the project the States, upper as well as lower, have adequate assurance that their rights will not only be respected but be enforceable against the changing succession of Federal officials who will control those reservoirs, and, with them, the destiny of the Colorado River Basin.

(The amendments submitted by Mr. Ely follow:)

AMENDMENT No. 1

DELETION OF SECTION 5

Page 8, line 1. Strike all of section 5, and substitute:

"SEC. 5. The Congress reserves the right to add other participating projects to those listed in section 1, and to delete any now listed therein."

AMENDMENT No. 2

ASSURANCE AGAINST INTERPRETATIONS

Page 12, line 24. Substitute for section 11:

"SEC. 11. Nothing in this Act shall be so construed as to amend, construe, interpret, modify, or be in conflict with, any provision of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, or the Treaty with the United Mexican States."

AMENDMENT No. 3

TRANSMOUNTAIN DIVERSIONS

Page 13, line 2. Add a new section:

"SEC. —. (a) All of the waters of the Colorado River System exported from the natural basin of that system by means of works constructed hereunder, and extensions and enlargements of such works, to the drainage basin of any other river system, shall be consumptively used in States of the Colorado River Basin,

and will not be made available by exchange, substitution, or use of return flow, or otherwise, for consumptive use in any State not a party to the Colorado River Compact.

"(b) Nothing in this Act, by implication or otherwise, shall commit the United States to the further exportation of water from the Colorado River System."

AMENDMENT No. 4

STUDIES OF SALINITY

Page 13, line 9. Insert a new section:

"SEC. —. The Secretary of the Interior is directed to institute studies and to make a report to the Congress and to the States of the Colorado River Basin of the effect upon the quality of water available at Lee Ferry, of all transmountain diversions of water of the Colorado River System and of all other storage and reclamation projects, existing and proposed to be made in the Upper Colorado River Basin under full practicable development and use of water apportioned by the Colorado River Compact, including those proposed to be made under the authority of this Act."

AMENDMENT No. 5

STATE REPRESENTATIONS IN OPERATION OF RESERVOIRS

Page 13, line 9. Insert a new section:

"SEC. —. (a) Each State of the Colorado River Basin is authorized to appoint one representative to an Integrating Committee, to advise with the Secretary of the Interior in programing the storage and release of water from main stream reservoirs located in the Upper Basin, for use in the Lower Basin.

"(b) The Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Upper Basin for use in the Lower Basin, and, in the event of his failure to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States against him to enforce the provisions of this Section, and consent is given to the joinder of the United States as a party in such suit or suits."

AMENDMENT No. 6

COVENANTS

Page 13, line 9. Insert a new section:

"SEC. —. The United States and the States of Colorado, Wyoming, Utah, New Mexico, and Arizona, and their respective permittees, licensees, and contractees and all users and appropriators of water of the Colorado River System diverted or delivered through the works herein authorized and any enlargements or additions thereto shall observe and be subject to the Colorado River Compact, the Upper Colorado River Compact, the Boulder Canyon Project Act, and the Mexican Water Treaty (Treaty Series 994) in the diversion, delivery and use of water of the Colorado River System, and such condition and covenant shall attach as a matter of law whether or not set out or referred to in the instrument evidencing such permit, license, or contract and shall be deemed to be for the benefit of and be available to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming and the users of water therein or thereunder by way of suit, defense, or otherwise in any litigation respecting the waters of the Colorado River System: *Provided*, That the Congress does not, by the enactment of this Act, construe or interpret any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, or the Mexican Water Treaty, nor subject the United States to, nor approve nor disapprove, any interpretation of said compacts, statute or treaty, anything in this Act to the contrary notwithstanding."

AMENDMENT No. 7

SUBJECTION TO LAW OF THE RIVER

Page 13, line 9. Insert:
"SEC. —. This Act and all works constructed hereunder shall be subject to and controlled by the Colorado River Compact, proclaimed effective by the President June 25, 1929; the Boulder Canyon Project Act approved December 21, 1928; the Upper Colorado River Basin Compact, to which the Congress gave consent (Public 37, 81st Cong., approved April 6, 1949); and the Mexican Water Treaty (Treaty Series 994); and no right or claim of right to the use of the waters of the Colorado River System shall be aided or prejudiced hereby: *Provided*, That the Congress does not hereby interpret or construe said documents nor subject the United States to, nor approve nor disapprove, any interpretation or construction thereof."

Mr. HARRISON. Thank you very much, Mr. Ely, and we will contact you at the first opportunity, and we will have you back before the committee. If it is necessary for Mr. Matthew to come back, we will see he has sufficient notice. We regret that our time was limited this morning.

Mr. ELY. Thank you, Mr. Chairman. I appreciate the committee's courtesy.

Mr. HARRISON. The first witness for those who are in opposition to part or all of the legislation will be Gen. U. S. Grant 3d, of the American Planning and Civic Association.

I have been given five names, including Mr. Grant, Mr. Joe Penfold, Mr. Fred Packard, Mr. Dave Brower, Mr. Kenneth Morrison, in that order. Unless I receive a request, I will call them in the order I have read.

STATEMENT OF U. S. GRANT 3D, AMERICAN PLANNING AND CIVIC ASSOCIATION

Mr. GRANT. On behalf of the American Planning and Civic Association, of which I am president, I have the honor to appear before you in protest against the inclusion in the upper Colorado storage project of the Echo Park Dam, or any other dam inside of the Dinosaur National Monument, or in any other monument or national park in the region. In case you are not familiar with our association and its work, let me add that, starting with the Park and Outdoor Art Association in 1897 and its merger with the American League for Civic Improvement in 1904 to form the American Civic Association, by a succession of affiliations with others in the same field the association has for 57 years now been in the forefront of the fight for the conservation of our natural resources, the preservation of our marvels of scenic beauty, and for the protection of national parks and state parks against commercial and other encroachments that violate the primary purpose for which they were set apart. It is proud to claim having had an effective part in securing the establishment of the National Park Service.

It is therefore with a background of more than half a century's connection with the citizens' efforts to make our country a more attractive and agreeable place in which to work and live, and to save for future generations those natural areas and formations from which we have drawn improved health and inspiration, and with a sincere desire to provide for the sound economic development of

COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

EIGHTY-THIRD CONGRESS

SECOND SESSION

ON

S. 1555

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

JUNE 28, 29, 30, JULY 1, 2, AND 3, 1954

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COLORADO RIVER STORAGE PROJECT

FRIDAY, JULY 2, 1954

UNITED STATES SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON
INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to recess, at 9:30 a. m., in room 457, Senate Office Building, Senator Arthur V. Watkins, of Utah, presiding.

Present: Senators Arthur V. Watkins, Utah (presiding), Thomas H. Kuchel, California and Clinton P. Anderson, New Mexico.

Present also: Elmer K. Nelson, staff consultant engineer, and N. D. McSherry, assistant chief clerk.

Senator WATKINS. The subcommittee will be in session.

It has been suggested by our chairman, Senator Millikin, and concurred in by the present chairman, that we stand in silence for 1 minute out of respect to our late chairman, Hugh Butler.

(A minute of silence was observed in memory of the late chairman, Hon. Hugh Butler.)

Senator WATKINS. Under ordinary circumstances, the committee would recess out of respect to our late chairman, but I am quite certain from what I knew of Senator Butler during his lifetime, his devotion to duty, and his interest in getting the legislative program taken care of, that he would be one of the first to suggest that we do not recess, that we carry on with the work. The best respect we can show to him is to carry on the work of this committee as he wanted it carried on. I am sure he would not think it wise for us to take a recess at this time. So, under those circumstances, we will carry on with the hearing.

There may be some interruptions during the morning. The Senate goes in session at 10 o'clock, and it is possible that the members of this committee may be called to the Senate from time to time, but we will attempt to keep this hearing moving along so that we can give each of the witnesses who have been scheduled an opportunity to be heard. It is the hope of the acting chairman that we will be able to finish at least by tomorrow at noon.

We will call General Grant for further questions.

General, had you finished your statement in chief last night, or had we interrupted?

STATEMENT OF U. S. GRANT 3D, FOR THE AMERICAN PLANNING AND CIVIC ASSOCIATION—Continued

Mr. GRANT. There was about one paragraph more, sir.

Senator WATKINS. We will let you give that last paragraph before I ask you further questions.

board and a member of the Western Colorado Water Association which is a committee representing all of western Colorado.

The State of Colorado supplys practically three-fourths of the water that makes up the Colorado River. And by compact agreement Colorado has been allocated over one-half of the total volume of water from the Colorado River allocated to the four upper basin States. I know by experience that without storage reservoirs it matters not how much water is allocated to us by compacts and agreements, we cannot make future use of any part of the allocation as our streams are overdecreed on direct flow. In other words, we cannot even obtain the water we are allowed under present decrees without storage reservoirs as the minimum flows will not provide the necessary water.

If our thousands of acres of fertile soil are to be irrigated and if our vast deposits of oil shale, coal, and uranium are to be processed for the benefit of mankind, we must have storage reservoirs.

In S. 1555 there is one project which is the keystone to the development of water resources in western Colorado and that project is the Curecanti on the Gunnison River. It will store approximately a million acre-feet of water. The percentage of evaporation is less on this proposed reservoir than on any reservoir proposed in the upper Colorado River storage project. Curecanti is located high up on the Gunnison River nearest to the Continental Divide where the waters of the Colorado River originate. This then, means that as the water stored in Curecanti is diverted downstream from the dam, it can be used over and over again, providing the most good to the greatest number of people. Both the water and the power developed from Curecanti can be used to a good advantage in developing and processing of natural resources vital to the safety and success of the United States.

We in western Colorado do not believe the Bureau of Reclamation has investigated all of the possibilities and benefits attributed to the proposed Curecanti project. We know that there are many irrigation, recreation, and flood-control benefits that would be realized if the Curecanti Dam were built. We also feel certain that additional electric-power development can be obtained by utilization of an additional 295 feet of head in the 9-mile stretch between the Curecanti Dam site and the high-water line of the proposed Crystal Reservoir. The utilization of this additional power head and the benefits to irrigation, flood control, and recreation make Curecanti a very desirable project and one that will be economically feasible.

We in Delta County are fully familiar with the necessity of the Paonia participating unit of the upper Colorado River storage project. The project has been authorized in part at two different times in the past. Construction has been completed on the canal to carry water to the farms. The question most often asked locally is, "What water will the canal carry?" Without a reservoir to supply water for the canal, the canal is of no material benefit. We therefore request that favorable action be given the Paonia project now before your committee.

Although I have only set forth a few of the benefits that would result in the authorization and subsequent construction of the Curecanti and Paonia units of the upper Colorado River storage project, we in western Colorado are very anxious to see all of the units, in Senate bill S. 1555, authorized, and we hope the committee will act favorably on this bill as the benefits will accrue to everyone in our great Nation.

Very truly yours,

F. M. PETERSON, *Superintendent.*

Mr. PATTERSON. Thank you, sir.

Senator WATKINS. Thank you, gentlemen. I think we have had all the witnesses now except the witnesses from California. Are they here?

Mr. Ely, would you please come forward.

STATEMENT OF NORTHCUTT ELY, SPECIAL COUNSEL, THE COLORADO RIVER BOARD OF CALIFORNIA

Senator WATKINS. May I inquire how long you will take, Mr. Ely?

Mr. ELY. My statement will take perhaps three-quarters of an hour to present; short of questions, that is.

I am accompanied by Mr. Raymond Matthew, the chief engineer of the Colorado River board. His statement will take about the same time.

I also have a statement to present for Mr. Morris, who is unable to be here, and that will take less time.

Senator WATKINS. The reason I am inquiring is because I must consider, unfortunately, a personal matter affecting me. The session lasted until 12 o'clock last night, and I did not get home until 1 o'clock so I could retire. I have had a long day.

If it is going to take that length of time, I think in the interest of everybody we should recess until tomorrow. Did you want to read it?

Mr. ELY. I will prefer to read it.

Senator WATKINS. It looks like we will have to go until tomorrow. I have taken just about everything that I can take today.

Mr. ELY. Whatever suits you, Mr. Chairman.

Senator KUCHEL. Could we run an hour, Mr. Chairman, and perhaps hear Mr. Ely?

Senator WATKINS. Well, I will do that.

Mr. ELY. Whatever suits you, Senator.

Senator WATKINS. You may proceed, Mr. Ely.

Mr. ELY. Mr. Chairman, my name is Northcutt Ely. I am an attorney, with offices in the Tower Building, Washington, D. C., and appear here as special counsel to the Colorado River Board of California, a branch of the State government.

California, as a party to the Colorado River compact, is affected by this bill in the respects which I shall outline. California is also a party to the pending suit in the Supreme Court entitled "*Arizona* v. *California et al.*, No. 10 Original, October Term, 1953," as are Nevada, Arizona, and the United States.

I have the honor to represent California in that action as an assistant attorney general, under the direction of Attorney General Edmund G. Brown, of California. Certain of the issues in that suit are directly involved in the assumptions made by the Bureau of Reclamation in planning the project now before you. These will be identified during the course of my statement.

I. The pending project:

The legislation now before the committee, as modified by the explanations given by the Interior Department, would accomplish four general objectives:

First: It would authorize in section 1, page 2, line 19, the construction of 15 reclamation projects—reduced to 11 as recommended to this committee by Under Secretary Tudor. The aggregate consumptive use of these 11 irrigation projects is said to be about 400,000 acre-feet. The evaporation loss on the storage reservoirs, referred to below, is another 600,000 to 700,000 acre-feet. These quantities, added to about 2,500,000 acre-feet, said to be required by projects already constructed or authorized, would represent a total of about 3,500,000 acre-feet in the upper basin.

This total is well within the quantity of 7,500,000 acre-feet per annum, the use of which is apportioned to the upper basin by article III (a) of the Colorado River compact.

Moreover, the engineering studies indicate that this total could be put permanently to use without the construction of any new holdover

storage whatever, and that no holdover storage would be required for about 50 years, even if other projects were added.

Second: The bill nevertheless authorizes, in section 1, page 2, line 12, the construction of 5 storage reservoirs: Echo Park, Flaming Gorge, Glen Canyon, Navaho, and Curecanti—reduced to 3, Glen Canyon, Echo Park, and Curecanti, in Under Secretary Tudor's statement here. The ultimate storage program amounts to over 48 million acre-feet, and these 3 dams account for about 33 million. The purpose of authorizing construction of these reservoirs now, instead of many years from now, is twofold:

(*a*) Electric energy would be generated and sold and the proceeds pooled to pay out the cost of the storage dams, and thereafter, starting 44 years from completion of Glen Canyon, to subsidize the construction of the power and reclamation projections previously referred to in section 1.

(*b*) And the proponents of the measure say, if built now the reservoirs could accumulate water with less interference with consumptive uses in both the lower and upper basins than if their construction were delayed until a later time when consumptive uses will be larger.

Third: The bill authorizes, in section 5, page 8, line 1, the construction of other projects, unnamed, provided they meet certain criteria. These are not designated in the bill, but the Department has inventoried over 100 projects in various publications, particularly House Document 419, 80th Congress.

It is not clear from section 5 whether these projects must be brought back to Congress for further authorization, or whether the Secretary is authorized by section 5 to build them.

The House bill, H. R. 4449, in section 1, page 17, line 2, provides that the Secretary need not submit his reports on these projects to the affected States for comment.

In any event, when they are built, the new power projects and the new reclamation projects covered in section 5, commencing some 45 to 50 or more years in the future, will share in the subsidies afforded by the sale of power to be generated at Glen Canyon; and, in addition, and for the first time, a fourth function of the great holdover storage reservoirs will then come into existence. Thus:

Fourth: When, as, and if the additional projects referred to in section 5 are built, it will be necessary to store water in these reservoirs, not for use by these projects—Glen Canyon Reservoir, for example, is so far downstream that no water stored there can ever be used for irrigation or domestic purposes in the upper basin—but for quite a different reason: to enable these section 5 projects to increase the consumptive use in the upper basin above the 3,500,000 acre-feet required by existing projects plus the section 1 projects, without violating the provisions of article III (d) of the Colorado River compact.

That article of the compact stipulates that the States of the upper division—Colorado, Utah, New Mexico, Wyoming—will not cause the flow of the river at Lees Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years.

In the driest decade so far, the flow at Lees Ferry was well over 100 million acre-feet, during a time when the upper basin projects were using about 2 million acre-feet per year; and engineers tell us

that the upper basin uses can rise to about 4,300,000 acre-feet, which is more than the total of existing uses plus the uses of all the section 1 projects, plus all the projects that the Interior Department testimony has eliminated, before this 100 million total would shrink to 75 million.

Thus the ultimate purpose of Glen Canyon Reservoir, and the other holdover storage reservoirs, is to enable the section 5 projects to be built in the upper basin without violating article III (d) of the compact, and the immediate reason for constructing Glen Canyon Dam now instead of waiting until the section 5 projects are built is (according to proponents of the measure) first, to start paying out the cost of the big reservoirs, then to subsidize the section 1 projects and, second, to fill Glen Canyon and other reservoirs during a time when the filling is easier, presumably, than it will be later on.

The bill, and the testimony here, make clear that this measure is intended to commit Congress to a program for the full utilization of all the water which the upper basin claims under the Colorado River compact. Otherwise, the storage reservoirs are not needed for any water conservation purpose, and are strictly power dams.

As all of the foregoing involves the Colorado River compact, and as California is a party to that compact, California is directly concerned by the interpretations of the compact implicit in the Interior Department's reports which this bill would effectuate, and in the interpretations of the compact which will control the administration of these reservoirs.

This is apparent when it is realized that the total storage capacity planned is enough to intercept the whole flow of the river for several years, and that it is planned to hold over storage in these reservoirs, for more than 20 years, or 5 presidential administrations, in order, for example, to deliver water to the lower basin under article III (d) in the year A. D. 2000 which, in fact, flows into the reservoir in 1980.

During the 50 years that these reservoirs will serve no function except to generate power, they will evaporate some 30 million acre-feet of water.

Some rather firm understandings as to the meaning of the compact are required, especially as the bill now makes no provision for enforcement of the compact by any State against the United States, which will accumulate and hold this water in its reservoirs and release it subject to the decision of a long succession of Secretaries of the Interior as to what the document means.

The meaning of the document is now in controversy in the Supreme Court, in respects which affect the measure now before you. To these issues I now turn.

II. Interpretations of the Colorado River compact involved in the upper storage project legislation and the pending litigation:

1. The method of measurement of consumptive use:

Article III (a) of the Colorado River compact, in a single sentence, apportions from the Colorado River system in perpetuity to the upper basin and to the lower basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet per annum, which it states shall include all water necessary for the supply of any rights which may now exist.

Manifestly this one sentence must have the same meaning in both the basins to which it refers.

Senator ANDERSON. Do I understand by that that you mean the upper basin has just as much right to 7,500,000 acre-feet as the lower basin has?

Mr. ELY. To 7,500,000 acre-feet, yes, sir.

But there is sharp controversy over the meaning of the term "beneficial consumptive use." The question is whether it means the quantity in fact used, measured at the place of use, or whether it means the effect of that use measured in terms of stream depletion at some point hundreds of miles downstream, in this case Lees Ferry.

The same question arises under the Mexican water treaty's so-called escape clause. This question of interpretation of the Colorado River compact and the Mexican water treaty is directly at issue in the present Supreme Court case. The quantity involved in this dispute, so far as the planning of the upper basin storage project is concerned, is 300,000 to 500,000 acre-feet, according to engineers' estimates.

The Reclamation Bureau assumes that the measurement is to be in terms of downstream depletion in the case of the upper basin project and the central Arizona project, but in terms of diversion minus return flow, measured at the place of use, with respect to California. The Boulder Canyon Project Act defines it in the latter terms, and the Mexican water treaty says (article I (j)):

> "Consumptive use" means the use of water by evaporation, plant transpiration, or other manner whereby the water is consumed and does not return to its source of supply. In general it is measured by the amount of water diverted less the part thereof which returns to the stream.

That corresponds with California's allegation of the meaning of the term in *Arizona* v. *California* (answer to Arizona, par. 8). Arizona denies that this definition applies to her uses (reply, par. 8), and the Reclamation Bureau, in the project before you, assumes that it does not apply to the upper basin, although in section 2, page 4, line 21, the projects to be built under the bill are recognized as being subject to the terms of the Mexican Water Treaty.

Another problem arises if the depletion theory prevails. One of its postulates is that when water is stored in a reservoir the stream below is depleted, and therefore that the consumptive use takes place then and there, in the year when the water is put in storage, not when it is taken out and used.

On that premise, to what years is the 48 million acre-feet of hold-over storage, i. e., of stream depletion, to be charged? And in future operations, how is the storage of more than 7,500,000 acre-feet in any one year to be charged? Is the same principle, whatever it may be, applicable to the lower basin reservoirs?

Senator ANDERSON. How are they done now?

Mr. ELY. Our uses are charged on a per annum basis in the year in which the water is taken out and used, and not the year in which it is put in storage.

In further answer to your question of a moment ago, as to the right of each basin to the use of 7,500,000 acre-feet, Senator Anderson, I should have qualified it to say that I will come to the provisions of article III (d), which contains the 75-million-acre-foot provision, and will comment then, if I may, in answer to the questions you asked me earlier.

2. The meaning of "per annum" in article III.

Article III (a): Does the apportionment of the use of 7,500,000 acre-feet "per annum" mean an average of that amount over a period of years, or a maximum in any one year? Manifestly, as in the interpretation of "consumptive use," the compact must be given the same interpretation in both basins.

The Reclamation Bureau, in submitting this upper basin storage project, makes the assumption that the apportionment means an average over an extended period, apparently 35 years or more. The effect of this theory is that the upper basin may use, say, 9 million acre-feet or more of water in 1 year, and consider it as apportioned under article III (a), if it uses, say, 6 million or less in some other year, to average 7,500,000 acre-feet.

California alleges in the pending lawsuit that the apportionment means a maximum, like a speed limit on a highway, not an average. If the speed limit says 50 miles per hour, that doesn't mean an average of 50.

We allege (answer to Arizona, par. 8) that the words "per annum" in the compact mean "each year," and not an average of uses over a period of years, whether they are our uses or anyone else's.

Senator ANDERSON. Why didn't they set it that the lower basin would get 7,500,000 acre-feet each year and if the maximum fell below that, well and good? The effect of what you are saying is that California's 7,500,000 feet per year is fixed, and definite, but that 7,500,000 feet for the upper basin States is a maximum, and that deficiencies in dry years must be theirs and not the lower basin's.

Mr. ELY. What I am saying is that identically the same rule must apply to both basins.

Senator ANDERSON. Yes, but because there is a difference of guaranties, they don't apply to both basins if you carry them out. Isn't that right?

Mr. ELY. I will come to the guaranty in a moment.

I am talking about III (a), which, in our opinion, has no relation to the guaranty in III (d).

Senator ANDERSON. You think not?

Mr. ELY. I think not.

Senator ANDERSON. Quite obviously, it has to, if you are guaranteeing 7,500,000 to the lower basin States, and the others must deliver 75 million in 10 years, and they may never use more than the 7 million and a half in their big years and must make up the deficits in the small years, then the treatment is not the same and the guaranty does make some difference; doesn't it?

Mr. ELY. May I postpose comment on that until I come to article III (d)? I will try to answer you then.

Senator ANDERSON. Yes.

Arizona admits that "per annum" means "each year," not "average," but says that the issue is not yet material in the lower basin (reply, par. 8). The effect, if California is right, is that if the upper basin should use in a given year any quantity in excess of 7,500,000 acre-feet, it is using that excess out of unapportioned surplus, in competition with the appropriations of unapportioned excess or surplus waters which may have been made in the lower basin, and subject to the Mexican Treaty burden, which, under article III (c) of the compact, is to be first supplied out of surplus.

The amount involved in this particular issue is very large, of the order of 1,250,000 acre-feet per year. That is, if the compact means what we think it means, the Reclamation Bureau is in error that much in its assumptions as to the quantity of water which the upper basin can lawfully claim under article III (a), and, by the same token, that much more water must be let down to satisfy the Mexican Water Treaty and prior appropriations of surplus in the lower basin.

The same problem arises in the lower basin, but there the Reclamation Bureau has assumed that the limitation imposed upon California's uses by the Boulder Canyon Project Act is a maximum, not an average; so also with its assumptions as to the deliveries to be made under the Mexican Water Treaty and the amounts to be delivered under its water contracts with Arizona, California, and Nevada.

Both assumptions cannot be correct.

This problem of whether the apportionment under article III (a) is of an annual amount, or of an average available over a 20- to 35-year period, has no relation at all to the guaranty in article III (d) that the States of the upper division will not deplete the flow at Lees Ferry below 75 million in each 10 years. That problem is discussed below, in connection with the Mexican Treaty burden.

3. "Rights which may now exist"——

Senator WATKINS. Excuse me, sir. At this moment, Senator Anderson will take over, and we will conclude with the other witnesses tomorrow morning.

I regret having to leave.

Senator ANDERSON. You may proceed.

Mr. ELY. Article III (a): Does the statement in article III (a) that the apportionment of the use of 7,500,000 acre-feet per annum "shall include all water necessary for the supply of any rights which may now exist" include 2 categories of uses in dispute in *Arizona* v. *California:* (1) the uses on the lower basin tributaries, particularly those of Arizona on the Gila River, which she says are not to be charged against the lower basin's apportionment of III (a) water, and (2) Indian uses in both basins?

The significance of the Gila appears in connection with the upper basin's obligations under articles III (c) and III (d) of the compact, and that of the Indian uses in connection with article VII, and will be outlined when those articles are reached in numerical order.

4. The Mexican burden:

Articles III (c) and III (d): Article III (c) provides that the Mexican burden, which is a minimum of 1,500,000 acre-feet per annum measured at the border (and more than that, measured at Lees Ferry), shall be borne first out of surplus, over amounts specified in articles III (a) and III (b) and, if that is insufficient, that the burden of the deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver at Lees Ferry water to supply one-half of the deficiency, in addition to that provided in article III (d).

Article III (d) provides that the States of the upper division, that is, Colorado, Utah, Wyoming, and New Mexico, will not cause the flow of the Colorado River at Lees Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years.

The interpretation of these two clauses is at issue in *Arizona* v. *California* and is involved in the present bill. The Reclamation

Bureau apparently assumes in its presentation here that there will be available at Lees Ferry, after the section 5 projects are built, only about 75 million acre-feet every 10 years.

Arizona says (reply, pars. 8, 11) that all this 75 million is III (a) water, that is, that this figure is merely 10 times the quantity apportioned to the lower basin by article III (a) of the compact, and that all of the lower basin's III (a) uses can be made from the main stream.

California (answers to Arizona, pars. 8, 11) and Nevada (petition, par. XIV) deny this, and say that Arizona's uses on the Gila, and the uses of Nevada and Utah on the Virgin River, are "rights which may now exist," in the language of article III (a), hence chargeable to (and protected by) article III (a).

Arizona retorts that her uses on the Gila are covered by article III (b) of the compact, an article which says that, in addition to the apportionment in article III (a), the lower basin is given the right to increase its beneficial consumptive use by 1 million acre-feet per annum.

If Arizona is sustained by the court in this position, there is no water for Mexico in the 75 million acre-feet at Lees Ferry referred to in article III (d), and the upper basin, under article III (c), must, in addition, release water to supply one-half of any deficiency in meeting the Mexican burden.

When the Reclamation Bureau reported favorably on the central Arizona project, it was on the assumption that Arizona's interpretations were correct, without, however, indorsing them.

If California and Nevada are correct, a portion of the 75 million acre-feet at Lees Ferry referred to in III (d), equal to the total of the water supply available and used on the Gila, Virgin, and other tributaries under III (a), is excess or surplus water unapportioned by the compact, available in part for the service of the Mexican water treaty and in part for appropriation, contract and use in the lower basin.

We view the 75 million as a minimum of "wet water," unclassified and unrelated to article III (a), and to be met whether or not there remains available to the upper basin, after meeting that obligation, water to sustain a maximum use of 7,500,000 acre-feet per annum of water apportioned by article III (a).

Senator ANDERSON. Isn't that what I was saying a minute ago? That you view this as an obligation whether or not it means any water to the upper basin? If they had to cut off every irrigation project that has prior appropriation, you still think it has to be done to deliver to the lower basin, don't you?

Mr. ELY. The lower basin and Mexico; yes, sir.

Article III (d) takes precedence over III (a); yes, sir.

Senator ANDERSON. In other words, the rights of California to 75 million feet are superior to any of the allocation to the States of Colorado, New Mexico, and Utah?

Mr. ELY. No, sir.

A lot of the water apportioned by III (a) never passes Lees Ferry at all. It appears in the Gila River and other tributaries that enter below Lees Ferry.

Senator ANDERSON. How much is in the Gila?

Mr. ELY. By our reckoning, in excess of 2 million acre-feet, and on the Virgin River in Utah and Nevada, approximately 300,000, and

the Little Colorado, and other tributaries entering below Lees Ferry, perhaps another 300,000.

Senator ANDERSON. Out of the Little Colorado?

Mr. ELY. Yes, sir.

Senator ANDERSON. Have you seen the Little Colorado?

Mr. ELY. Yes.

Senator ANDERSON. How much was in it when you saw it? Was it absolutely dry?

Mr. ELY. It is a highly variable stream, obviously, but it is one of the resources of the lower basin, with whose use we are charged, Senator.

My point is that not all of the lower basin's 7½ million acre-feet per annum is found at Lees Ferry. That is Nevada's position, that is California's position. Arizona says to the contrary, that all of the lower basin's III (a) water is found at Lees Ferry.

If Arizona is right, the upper basin must deliver not only 75 million, but half of the Mexican deficiency. If we are right, the 75 million includes some water for Mexico.

Senator ANDERSON. In either event, the 75 million comes first before any water in the upper basin?

Mr. ELY. Yes, sir.

The upper division's guaranty under article III (d) comes ahead of the upper division's right under III (a) according to our view.

On the other hand, the Under Secretary of the Interior, in response to a question by a Senator in these hearings, appeared to agree that the compact means that if the upper basin lets down 75 million acre-feet in each 10-year period, it is entitled to keep and use what is left. This, in our view, illustrates the erroneous interpretations of the Colorado River compact built into the planning of the Colorado River storage project.

Senator ANDERSON. Are you raising that question to the Supreme Court? Will that question come squarely before the Supreme Court?

Mr. ELY. It will come before the Court, yes, sir. Not directed squarely to the position of the upper basin, as I have stated in answer to your question, but it is involved. The problem is what are the excess and surplus waters of the Colorado River system and what are the rights to appropriate them. That does involve the question of whether the waters above uses of 15 million of apportioned water are subject to appropriation.

Senator ANDERSON. This question of whether or not the compact means if the upper basin lets down 75 million acre-feet each 10-year period it fulfills its obligation is a very important question.

Mr. ELY. Very important, yes, sir.

Senator ANDERSON. Up to the next 75 million acre-feet, the upper Basin States surely do believe that it belongs to them, but no more is guaranteed because there is a provision for the distribution of surplus waters beyond that. But in recent years there certainly have been no surplus waters beyond that, and as far as we can tell from looking at charts now, there probably will never be.

Don't you think this is a very important thing to consider?

Mr. ELY. It is indeed, sir.

Senator ANDERSON. You don't think it will be settled by the current litigation?

Mr. ELY. We would like to have it settled. We hope it will be.

Senator ANDERSON. If California's position is right, then all of these other States that want water, might as well pack up and go home.

Mr. ELY. No, it develops to this, that in our view, to the degree that the upper basin or, for that matter, the lower basin, uses in any year water in excess of 7½ million acre-feet, it is using water which is not reserved by article III (a) as apportioned water, reserved against the law of appropriation, but is using excess or surplus waters to which it can claim a right only by appropriation.

And consequently if in any year the upper Basin States use more than 7½ million acre-feet, which is all that the compact reserved as against the law of competitive appropriation, it is competing for that water as against appropriations in the lower basin.

Senator ANDERSON. I hope you get it to the Supreme Court.

Mr. ELY. I hope you are right, Senator. We would like to get all of these questions disposed of.

Senator ANDERSON. I thought when we had the central Arizona hearing, it was a pretty general understanding that before the matter got to Court we would settle this question. I am shocked to know that we have not settled it, because that means we will not know where we are for another 20 years.

Mr. ELY. I agree with you. It may be that in order to settle all of the questions in the compact that the States—all of them—are necessary and indispensable parties.

Senator ANDERSON. The other way would be to pass the Colorado upper basin bill and let the State of California come in and tackle it. I think I like that better.

Mr. ELY. I think I differ with you as to the route to be followed. I may say after reading Judge Brietenstein's testimony I am rather convinced that the four upper basin States are necessary and indispensable parties to the present litigation and it is probably to the interest of the entire basin that the upper basin States be included and brought into this suit.

Senator ANDERSON. There is nothing about that in the central Arizona bill. I thought we should all be in the suit in the beginning, and I still think so, but that doesn't matter.

Mr. ELY. Litigation is not a happy method of settling any controversy, but, if it is needed, one lawsuit is better than a series.

5. Reservoir losses:

Nowhere in the compact is specific provision made for accounting for reservoir losses. Arizona says that they are all chargeable against the apportionments made under article III (a). Nevada says that they are all chargeable to surplus. California says that, basin versus basin, they are to be charged with other uses to the basin in which they occur, in the order in which they accrue, whether to III (a), III (b), or other surplus, and that none are chargeable against present perfected rights existing in the lower basin before storage was provided. The upper basin compact (art. IV) charges them against apportionments under article III (a) of the Colorado River compact.

6. The right to demand or withhold water:

Article III (e) of the Colorado River compact provides that the States of the upper division shall not withhold water, and the States of the lower division shall not require the delivery of water, which

cannot reasonably be applied to domestic and agricultural use. Glen Canyon Reservoir and certain other proposed upper basin mainstream reservoirs will be so located physically that no water stored therein can ever be applied to domestic or agricultural uses in the upper basin. All of the water stored in such reservoirs will be required for domestic and agricultural use in the lower basin and Mexico. The 1953 engineering report by Raymond A. Hill to the State of Colorado implies that, if Hoover Dam's reservoir, Lake Mead, is not filled on the day when the gates are closed at Glen Canyon, it may never fill again.

Who is to determine how rapidly storage in these upper basin reservoirs is to be built up, or, putting it another way, to what extent water which would otherwise flow into Lake Mead is to be intercepted and withheld? Who is to determine how rapidly and on what terms releases are to be made? Presumably the Secretary of the Interior. Since the United States cannot be sued without its consent, manifestly some controls are necessary here if the States, both upper and lower, are not to abdicate the administration of their compact to the United States.

Senator ANDERSON. Is this unusual?

What happened when the lower basin would appropriate it? Who decides when water would flow into Lake Mead? I presume it would be the Secretary of the Interior?

Mr. ELY. The inflow into Lake Mead at present is simply the natural flow of the stream.

Senator ANDERSON. Would not the natural flow still flow in the Grand Canyon, then?

Mr. ELY. Yes; at present, but that is the problem, Senator. It flows into Glen Canyon, and when the dam is built, would stop there.

Senator ANDERSON. Isn't it stopped in Lake Mead?

Mr. ELY. Lake Mead is in the lower basin.

Senator ANDERSON. Do you mean it is all right to have rules on stopping the water in the upper basin but no rules on stopping the water in the lower basins?

Mr. ELY. No; I am speaking of a potential conflict, through the Secretary's determination as to how much to let down from the upper basin to the lower, out of Glen Canyon. I would like to avoid those conflicts. If the Secretary of the Interior should decide, for example, that the compact means what some witnesses here have said it means, that if 75 million is let down, that is the end of the matter, and all else can be retained upstream——

Senator ANDERSON. What about that?

Mr. ELY. We would have a very difficult time getting into court to test that question. He is administering property of the United States, the dam, and I think it is likely that the United States would be a necessary party under the ruling in *Arizona* v. *California* (298 U. S.). Conversely, if the Secretary of the Interior decided that he didn't want to accumulate water as rapidly in Green Canyon as you would like to have him do, that the water ought to come down, I think the upper basin States would have great difficulty getting into court to test whether he was performing the compact or not, for the reason that the United States is a necessary party, and without the consent of Congress cannot be sued.

Senator KUCHEL. To that extent you disagree with the testimony of the Federal judge the other day?

Mr. ELY. Completely.

Senator ANDERSON. And with almost every lawyer who handled this.

Mr. ELY. No. The United States in *Arizona* v. *California* (298 U. S.) held that the United States was a necessary party in any suit in the lower basin involving Lake Mead.

Senator ANDERSON. Did they rule in that case with reference to the regulation of water where an officer was performing an administerial act, that he could not be brought into court without the consent of the United States Government?

Mr. ELY. It ruled that whatever was done was all subject to the rights of the United States.

Senator ANDERSON. This is a Cabinet officer, performing an administerial act, and it is your contention that nobody can question the performance without the consent of the United States?

Mr. ELY. I do not say it is an administerial act. If the Secretary of the Interior is managing Government property, that dam——

Senator ANDERSON. He is administering the compact between the States.

Mr. ELY. Yes; and if there is a conflict as to whether the compact requires him to let down 75 million or let down more, I would say that a suit to determine how the property of the United States should be administered is one that requires the presence of the United States in court.

Senator KUCHEL. In other words——

Mr. ELY. It is not a matter——

Senator ANDERSON. I think we differ completely as to whether the dam, the water in the dam, and everything connected with it would be the property of the United States. I would think the Secretary would be properly performing an administerial act. If I remember my own personal interest, I found one occasion at that time where a Cabinet officer can be brought into court.

Mr. ELY. The recent decisions with respect to the control of property of the United States, to my mind, confirm the intervals to be drawn from the decision in *Arizona* v. *California* (298 U. S.) that the United States would be a necessary party.

Senator KUCHEL. Let me make one more comment. If there were dispute on this point, and this constituted one of the questions for the committee to determine in its executive committee meetings on this bill, obviously, this would have to be cleared by an appropriate defense.

Mr. ELY. May I resume?

7. Appropriation of surplus:

Does the provision for a further apportionment, by unanimous consent after October 1, 1963, mean that no State may validly appropriate surplus until a new compact is made? California alleges, in the pending litigation, that any State, including the upper basin States, may appropriate surplus waters unapportioned by the compact, subject only to their being divested by a new compact to which such a State is party, or by court decree.

Senator ANDERSON. How about if they had not acquired them but put them to beneficial use?

Mr. ELY. The United States Supreme Court held in the Hinderliter case that a State may, by compact with another State, restrict the use of its own citizens even though they are valid under its laws.

To continue: That surplus waters are subject to appropriation has been the position maintained by representatives of some, at least, of the upper Basin States in previous hearings. Arizona and Nevada say that no State may acquire any right in surplus until a new compact is made. If they are sustained, then the upper basin can acquire no right in the waters it may use in any year in excess of 7,500,000 acre-feet. Actually, under the compact, the Boulder Canyon Project Act and the Mexican water treaty, all excess and surplus water of the Colorado River system has already been appropriated or obligated to uses in the lower basin and Mexico.

Senator ANDERSON. Does that mean that this provision for a further apportionment is void?

Mr. ELY. No; it is entirely permissive, Senator.

No State is required——

Senator ANDERSON. Would it require a unanimous consent among the States?

Mr. ELY. Yes, sir.

Senator ANDERSON. And since California wouldn't give it, it is a null provision?

Mr. ELY. It might be California or any other State. I can't imagine your State, for example, if you had appropriated and put to use certain waters, agreeing to give them up, any more than we would.

Senator ANDERSON. Certainly, when that provision was put in, it was understood that there would be another meeting, and if they figured out what would be done, the water would be divided again. You are not going to try to rewrite the history, are you?

Mr. ELY. No, quite the contrary. But the record is also clear that intervening appropriations would be valid although at the risk of a subsequent reapportionment.

Senator ANDERSON. If the subsequent reapportionment required the unanimous consent of California you know it could never be given in God's green earth.

Mr. ELY. And also if it is attempted to take from New Mexico water appropriated in New Mexico.

Senator ANDERSON. Does any State other than California contend that they all did not agree that in 1963 they would meet again to try to divide up the surplus?

Mr. ELY. What the ultimate position of the other States will be, I don't know. I have been asked at the witness table here at previous hearings whether I conceded the right of the upper basin States to appropriate surplus, and my answer was "Yes."

Senator ANDERSON. How could they appropriate surplus when they are not even starting to get any part of their 7,500,000. You would have to get up to that first, wouldn't you?

Mr. ELY. That is correct.

Senator ANDERSON. And, therefore, it is a foolish thing to talk about going beyond that.

Mr. ELY. My point is, Senator Anderson, that you are going beyond that, on the theory of the Reclamation Bureau's report underlying this bill, because if you use more than 7½ million in any 1 year,

you are using excess or surplus waters and establishing a right thereto by appropriation, not by apportionment.

Senator ANDERSON. Well, they would never put to actual use more than 7½ million. They certainly would have a right to store in order to deliver in their compact.

Mr. ELY. There you put your finger on one of the points which disturbs us. We contend that our right in the lower basin to claim apportioned water, water reserved against competitive appropriation, is a right to use up to 7½ million acre-feet in any 1 year, not an average of that quantity over a period of years. We can't claim in the lower basin 9 million of apportioned water in 1 year, because in some other year we used only 6 million. If we use only 6 million in 1 year, that is too bad. If we use 9 million in some other, then a million and a half of that is excess or surplus waters which we are using at our own risk, acquiring the right by appropriation.

Senator ANDERSON. Let me see if I get that straight.

Mr. ELY. We say the same rule applies exactly in the upper basin. If you use 9 million acre-feet in some year, you are using a million and a half of excess or surplus waters; you are not using 9½ million acre-feet of apportioned waters simply because in some other year you happened to use less than 7½ million.

Senator ANDERSON. Let's see if I can say it another way. If for 10 straight years the upper basin States deliver 7½ million acre-feet of water to you without fail every year, and in 1 of those years they use, say, 6 million acre-feet of water and the next year they use 6 million acre-feet of water but they have a very heavy runoff, and they store another 3 million acre-feet, you contend that that extra million and a half acre-feet, then, is a use of a surplus water to which they are not entitled.

Mr. ELY. No. There we fall apart on two differences, Senator Anderson. First, the 75-million-acre-feet guaranty at Lees Ferry in our mind has no relation whatever to article III (a) in either basin. It includes some III (a) water for the lower basin, it may include III (b) water, it includes water for Mexico, it may include some other surplus. It is so much wet water. It is a floor. It has nothing to do with the apportionment. The lower basin is charged in each of those years with the waters it uses on the Gila River, for example, and whether you measure the Gila at 1 million, 2 million, or some other figure, that is III (a) water, and so also are the old uses on the Virgin River. Consequently, the 75 million referred to in III (d) is just so much wet water, that includes a part of the Mexican burden.

That has nothing to do with how the upper basin uses are to be charged under article III (a). We say, as to article III (a): Charge the uses in the upper basin and in the lower basin exactly alike. Whatever rule you decide on for one applies to the other.

The rule already decided on for the lower basin, by statute, spelled out in the Boulder Canyon Project Act, is the aggregate annual consumptive use. If we use more than 7½ million in the lower basin, that excess is excess or surplus. We say that rule applies in the upper basin.

Senator ANDERSON. You recognize no difference between the two areas, one supplying water and the other receiving it, and if they supply you with 75 million they probably figure they are fulfilling their contract with you.

And if they store in periods of good runoff in order to make water available to you, you think that would be wrong?

Mr. ELY. That is not the problem. There is no relation between III (a) and III (d) in that sense. The water delivered to us under article III (d), the 75 million acre-feet, is not identical with the III (a) water. But the point you raise illustrates the gravity of the problem of interpretation that I am trying to put before you. I am, of course, arguing my side.

Senator ANDERSON. I think what you are trying to say is that no matter how badly the upper basin needs this water, there ought to be some way of interpreting compacts so they can't get it.

Mr. ELY. Not at all. We want to have the compact interpreted so you operate under exactly the same ground rules we do.

Senator ANDERSON. But you don't have the ground rules when you are upper State.

Mr. ELY. We think the interpretation of the compact should be the same in both basins.

Senator ANDERSON. You can turn the world upside down and start pouring a little water in our direction, and we will show you that it doesn't work very well.

Go ahead.

Mr. ELY. Thank you.

8. The impounding of water for power generation:

Article IV (b) of the Colorado River compact authorizes the impounding and use of water for generation of power, but stipulates that—

such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

As elsewhere noted, no water stored in Glen Canyon Dam and certain other main stream reservoirs can ever be used, physically, for agricultural or domestic purposes in the upper basin. Such water is the residue after the uses in the upper basin. It will be stored and used at such reservoirs to generate power to be sold to subsidize irrigation and power projects in the upper basin. The use of these reservoirs appears to be squarely controlled by articles IV (b) and III (e), previously referred to. The right of the Reclamation Bureau to so manipulate them as to maintain power generation, if the waters stored therein are in fact needed for agricultural and domestic use in the lower basin, is subject to challenge.

Senator ANDERSON. That is the first place I have agreed with you for a long time.

Mr. ELY. Thank you, sir.

The sole function of Glen Canyon Reservoir is as part of a hydroelectric project, unless and until the section 5 projects are built, and for a period of 50 years or more even if they are built. Only thereafter does it assume any function under article III (d) of the compact.

As elsewhere pointed out, during this 50-year period, when the sole function of the reservoir is to generate power, they will evaporate over 30 million acre-feet of water, at the cost of power generation and agricultural use in the lower basin. The notion that Glen Canyon is to be built to accommodate the lower basin, and that the lower basin should bear the evaporation losses there, is a little farfetched.

Senator ANDERSON. You say "as elsewhere pointed out, during this 50-year period when the sole function of the reservoir is to generate power." Can you imagine a stretch of 50 years when the sole function will be to generate power?

Mr. ELY. That appears to be the case, Senator, from a Reclamation Bureau study. They concede that for 25 years these dams would not be necessary for any conceivable development in the upper basin. They stop at that point. Our engineers say most likely the period is 50 years, even if all of the projects contemplated in both section 1 and section 5 were built. That is to say that without any regulation at all, the upper basin could deliver 75 million acre-feet every 10 years and retain something like 4,300,000 acre-feet for itself, without Glen Canyon or Echo at all.

Senator ANDERSON. And retain how much for itself?

Mr. ELY. Retain approximately 4,300,000. Beyond that point you need storage of the type contemplated here. The Reclamation Bureau's program of development apparently indicates it is about 25 to 50 years off before anyone would have to build Glen Canyon to perform the obligation of III (d).

Senator ANDERSON. But from the flow of the river, it doesn't look to be 50 years off, does it? That is, if you look at the flow for the last 15 or 20 years.

Mr. ELY. I am speaking of the hydrograph over the last thirty-odd years. If that were repeated again, you still could use 4,300,000 acre-feet, the engineers say, without holdover at all. That is more than existing uses plus all projects referred to in this bill. On these engineering questions, I am a layman and Mr. Matthew will follow me with the figures.

Senator ANDERSON. Along the line of Hoover Dam being useful for 200 years, would that be of any benefit to the lower basin?

Mr. ELY. I think unquestionably.

Senator ANDERSON. If it did prolong the life for Hoover Dam of 200 years, then would the opinions be different?

Mr. ELY. A benefit starting 200 years in the future, Senator, is a little hard to evaluate.

Senator ANDERSON. That is exactly the way I feel about your 50 years.

Mr. ELY. 9. Indian rights:

Article VII of the Colorado River compact provides that nothing in the compact shall be construed as affecting the obligations of the United States to Indian tribes. The upper basin compact provides that use by the United States or its wards shall be charged as a use by the State in which the use is made. California, in the pending suit, takes the same position. The United States denies this and says that—

the rights to use the water of the Indians and Indian tribes are in no way subject to or affected by the Colorado River compact.

The Government's petition tabulates 1,747,250 acre-feet of "diversion" claims of Indians in the lower basin of which 1,556,250 are in Arizona.

There are large Indian claims in the upper basin, but they have not been tabulated so far in this suit. Arizona says that—

the obligations of the United States to the Indians or Indian tribes are not material or relevant.

It is known that the Office of Indian Affairs construes article VII of the compact as meaning that (1) the Indian claims come ahead of the compact, are not chargeable to any State, and the compacting States simply divided the residue after the Indian claims; (2) Indian claims relate back to the date of establishment of the reservation, even though not put to use, and take priority over uses by non-Indians even though the uses by non-Indians may in fact long antedate the actual putting of water to use by the Indians.

The Government's pleadings leave it free to make both these assertions. As to the first, Arizona has refused, so far, to disagree with the Indian Bureau's position. Naturally, if Arizona can hope for 1,500,000 acre-feet for Indian diversions, outside the compact, in addition to the 3,800,000 acre-feet she demands under the compact, there is a temptation to try to get it. Just where the water would come from is not very clear. Arizona, at a meeting with the Attorney General of the United States on December 3, 1953, was invited to join the upper Basin States, California and Nevada, in a common statement of position that Indian uses are to be charged under the compact against the State in which they are situated, but declined to do so.

Senator ANDERSON. You would recognize that the State of New Mexico has agreed that the Navaho use, nearly all of our use, is properly chargeable against the State of New Mexico.

Mr. ELY. Yes; I think you are correct. Our uses of Indians in California, which are not large, are charged against our State and required to be so charged under the regulations of the Secretary of the Interior. The existence of the Indian claims, and uncertainty as to their accounting, raises serious questions as to the water supply for the projects in both the upper and lower basins. The United States, in this suit, also claims independent rights for the use of the Bureau of Land Management, the Forest Service, the Park Service, for fish and wildlife, et cetera, and denies that all of its rights are subject to the Colorado River compact. The magnitude of these additional claims is not stated. Those questions will not be resolved until this suit is decided.

10. Present perfected rights:

Article VIII provides that—

present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact.

In the present suit California alleges that "unimpaired" as used in this article means unimpaired as to both the quantity and the quality of the waters to which these perfected rights relate. California alleges that as of the effective date of the compact, her present perfected rights were not less than 4,950,000 acre-feet.

Senator ANDERSON. What was the figure in the so-called Self-Limitation Act?

Mr. ELY. 4,400,000 acre-feet of the waters apportioned by article III (a), plus not to exceed one-half of the excess of surplus waters unapportioned by the Colorado River compact.

The report of the Reclamation Bureau contains no data on the effect of large transmountain diversions coupled with other upper basin uses on the quality of water. Such a study should obviously be made. We know that when the compact was ratified, the Colorado Commissioner's formal report stated that—

natural limitations upon the use of the waters within each of the upper States will always afford ample assurance against undue encroachment upon the flow of Lees Ferry by any one of the four upper States. Colorado cannot divert 5 percent of its portion of the river flow to regions outside the river basin.

Elsewhere he testified that Colorado's transmountain diversions could not exceed 300,000 acre-feet per annum. By contrast, the Colorado transmountain diversion projects inventoried in the Reclamation Bureau's various reports aggregate 2 million acre-feet, or 52 percent of the water allocated to Colorado by the upper basin compact. There would be that much less water to absorb an increasing quantity of salts in passage to Lees Ferry. The effect on the lower basin is one which the lower basin States are entitled to have studied and reported upon, to the end that their present perfected rights, in the language of article VIII, shall remain unimpaired.

Senator ANDERSON. Did you feel that the discussion we had on that, in which we thought it would be interesting to have a study of this question of salinity on other projects was sufficiently broad compared to what you had in mind?

Mr. ELY. I don't think I heard all of that discussion.

Senator ANDERSON. It wasn't completely settled, but I think most of us agreed that it would be desirable to find out what the actual facts were.

Mr. ELY. The suggestion has been made that that study should go throughout the entire basin. I have no objection to that. We just want to know the facts.

III. CONCLUSION

California's basic position is that our State is conforming to the Colorado River compact, the Boulder Canyon Project Act, and the other enactments which comprise the law of the river, and we must insist that the Reclamation Bureau and the upper basin States do likewise in the planning and administration of the Colorado River storage project. The Colorado River storage project, as now planned, is based upon interpretations of the compact which, in our view, are wrong and constitute encroachments upon the compact for the benefit of the upper basin to the extent of about 1,500,000 acre-feet per year. The fact that the initial stages of this project will not use all the water claimed by the upper basin is not important. Thirty-three to forty-eight million acre-feet of storage is to be built now only on the premise that all the water claimed will be ultimately used, and the bill proclaims that it will be so used.

Because the legislation before you encroaches upon the Colorado River compact and upon California's water supply, the Colorado River Board of California has adopted the following resolution, which summarizes our position:

The Colorado River Board of California opposes the enactment of S. 1555 and H. R. 4449, 83d Congress, bills to authorize the Secretary of the Interior to construct, operate, and maintain initial units of the Colorado River storage project and participating projects, and for other purposes.

California favors the continuation of the development of the water resources of the Colorado River Basin on a sound economic basis, as the need for such development occurs. This State recognizes the right of the upper basin States to so utilize the waters apportioned to that basin by the Colorado River compact as approved by the Boulder Canyon Project Act, but subject to the terms and

conditions of those documents as the Supreme Court may construe them in the cas of *Arizona* v. *California*, now pending.

By the same token, California, in the protection of its investment of nearly $700 million in water-development projects which it has made in reliance upon the Colorado River compact and the Boulder Canyon Project Act, and the economy and population of more than 4 million people dependent upon these works, must resist legislation which would encroach upon the rights recognized in the lower basin States by those documents.

The proposed Colorado River storage project legislation adversely affects the lower basin States in much the same way as would the proposed central Arizona project legislation. Both are based upon interpretations of the Colorado River compact and the Boulder Canyon Project Act, with which California cannot agree and which are now at issue in the United States Supreme Court.

Each of them contemplates developments which would encroach upon the compact and project act, as interpreted at the time of enactment of those laws, to the extent of more than a million acre-feet per year. Both proposals are based upon unrealistic water-supply estimates. Each is in conflict with the presentation made to the Senate by the supporters of the Mexican Water Treaty. Each ignores the legal claims which are in conflict with it, and both ignore the damage which their construction would cause to the investments already made by their neighbors. Each of these proposals is dependent upon Federal subsidies for irrigation amounting to many times the value of the land when fully developed, and most of these subsidies are concealed. Both would commit the Congress to new feasibility standards and pay-out formulas with which this board and other California State agencies have officially expressed disapproval.

Senator ANDERSON. Do you think that is a valid objection to a project of this nature, where one State can get off by itself and say, "We don't approve of the basinwide pool, and, therefore, it is improper for the Federal Government to have that type of legislation"?

Mr. ELY. Aside from the right of any State to express its views, and I suppose we all have a right to do that, in this case our particular objection is that by the aid of these particular subsidies, the overdraft of the water is increased.

The Colorado River storage project would intercept the lower basin's water supply with giant reservoirs at Glen Canyon, Echo Park, and Curecanti, capable of storing several years' flow of the river. In the absence of statutory controls of the operation of such reservoirs designed to protect the output of firm power at Hoover Dam, upon which the United States and the power contractors relied, the use of such large storage could result in seriously curtailing the revenues at Hoover Dam and other dams on the lower river and upon which these lower projects depend for financing. It is against the best interest of both the power users in the lower basin and the Federal Treasury to so legislate.

Both Glen Canyon and Echo Park Reservoirs would be located downstream from any point of use by the proposed irrigation projects in the upper basin and their major purpose would be to provide revenues, commencing almost 50 years hence, to pay the capital cost without interest of the irrigation projects proposed for construction now. This postponement of nearly 50 years of the commencement of repayment of irrigation would result in a Federal subsidy amounting to over $2,500 per acre of irrigated land—an unwarranted and unjustified burden on the Nation's taxpayers.

California, as a major taxpaying State, is doubly affected, for the amount of the overdraft on the water supply of the Colorado River Basin is directly related to the amount of Federal subsidy to the irrigation projects creating the overdraft.

The bills delegate to the Secretary of the Interior power to resolve the feasibility of the participating irrigation projects. If reclamation

feasibility standards are to be changed, that should be done by Congress, in general legislation after the Hoover Commission has had an opportunity to report upon this very matter, heretofore committed to their study.

The proposed legislation includes some, and foreshadows others, large transmountain diversion projects in the upper basin using several million acre-feet of water annually, thereby impairing the quality as well as the quantity of the water available to the lower basin and to which the lower basin is entitled under the Colorado River compact.

For all these reasons, the Colorado River Board of California respectfully requests the representatives of this State in the Senate and House of Representatives of the United States to oppose the enactment of legislation to authorize construction of the Colorado River storage project and participating projects as proposed in these bills—S. 1555 and H. R. 4449—or similar legislation, and instructs its officers and staff to make the appropriate presentation of the views of this board to the congressional committees and executive agencies concerned with such legislation.

Mr. Chairman, may I ask permission to have printed as a part of my statement (1) the document which comprises the views of the State of California on the proposed Colorado River storage project which was submitted under the provisions of the Flood Control Act of 1944, and (2) a document which is a summary of the controversy in *Arizona* v. *California et al.*, comprising a portion of our pleadings in that case.

Senator ANDERSON. That will be made a part of the record.

Mr. ELY. And a number of resolutions by California cities and districts, and others, in opposition to this legislation.

Senator ANDERSON. They will be received.

(The documents referred to appear at the end of Mr. Ely's testimony.)

Senator ANDERSON. Senator Kuchel.

Senator KUCHEL. Mr. Chairman, the record so far in the Senate subcommittee apparently lacks some important information about what is involved in irrigation costs. May I, therefore, Mr. Chairman, request that this committee request the Bureau of Reclamation to file for inclusion into the record the following information:

(*a*) For each participating project included in the bill the average cost per acre, regardless of who pays the cost, for land which would be newly irrigated, for land to be supplied with supplemental water, for the total of the two kinds of lands——

Senator ANDERSON. Do you mean that? The first part is all right, where you say the total for the two kinds of lands per acre. I do not know how can you add new land and supplemental water on the same piece of land.

Senator KUCHEL. For land to be newly irrigated and lands to be supplied with supplemental water.

Senator ANDERSON. When you figure your per-acre cost, you can't figure the per-acre cost of new land and the per-acre cost of supplemental water on land that is not new and say that both go to the same acre, because they cannot be new and supplemental at the same time.

Mr. ELY. I think it would be useful to have the statistics on each type.

Senator ANDERSON. I don't object to that. He said the total of the per-acre cost of new and supplemental water, and they cannot be new and supplemental on the same piece of ground.

Mr. ELY. I think if that were shown for each class it would be the statistics required.

Senator KUCHEL. May that request be made, Mr. Chairman?

Senator ANDERSON. Yes; for each. I am not trying to be critical; I am just saying that it is impossible the other way.

Senator KUCHEL. Mr. Chairman, I would on that point like, with your assistance, to acquaint the representatives of the Bureau of Reclamation with just what is desired.

Senator ANDERSON. Let it be understood that Senator Kuchel will discuss it with Mr. Larson; and if it is possible to furnish the figures he has requested, even though I think they would be difficult to furnish, they will be furnished.

(The following was subsequently received for the record:)

Estimated cost allocated to irrigation projected on an average acre basis for project total, supplemental, and new lands

Participating project	Project area (acres)		Total	Irrigation allocation total
	New	Supplemental		
Central Utah	28,540	131,840	160,380	$127,354,000
Emery County	3,630	20,450	24,080	9,636,500
Florida	6,300	12,650	18,950	6,503,600
Hammond	3,670		3,670	2,302,000
LaBarge	7,970		7,970	1,673,300
Lyman		40,600	40,600	10,564,000
Navaho [1]	151,000		151,000	232,650,000
Paonia	2,210	14,830	17,040	6,791,600
Pine River extension	15,150		15,150	5,027,000
Seedskadee	60,720		60,720	23,272,000
Silt	1,900	5,400	7,300	3,282,400
Smith Fork	2,270	8,160	10,430	3,343,000

Participating project	Average project cost per acre	Average new land cost per acre	Average supplemental land cost per acre
Central Utah	$794	$1,874	$560
Emery County	400	1,115	273
Florida	343	671	180
Hammond	627	627	[3]
LaBarge	210	210	[3]
Lyman	260	[2]	260
Navaho [1]	1,540	1,540	[3]
Paonia	398	1,229	275
Pine River extension	332	332	[3]
Seedskadee	383	383	[3]
Silt	450	950	272
Smith Fork	321	854	174

[1] Navaho not included in the Department's recommendation in report on the bill.
[2] All new land.
[3] All supplemental land.

Senator KUCHEL. Now, Mr. Chairman, just 1 or 2 questions.

Can you inform the committee, Mr. Ely, of the status of the lawsuit in the Supreme Court? When might a decision be anticipated?

Mr. ELY. The status of the case is this: Arizona filed a bill of complaint against California and the water using agencies in California. She did not join the United States and did not join any other State as defendants. The State of California answered. The United States intervened. The State of Nevada was allowed permission by the court to intervene and is now a party. Arizona has not answered Nevada. Nevada has not answered the United States. A master has been appointed by the court and the case refrred to the master. The procedure from now on is in the hands of the master.

How the master will set the case up or how long it will take him to try it and render his report and thereafter for argument to be heard upon it, and an opinion of the court to be handed down is a matter of conjecture.

One of the problems involved, I may say, is as to just what parties are necessary to the determination of this controversy. The State of Nevada has raised the point that Utah and New Mexico are indispensable parties, as being in part within the lower basin. We think Nevada is right about that. From Judge Breitenstein's testimony I draw the conclusion that all four States may very well be indispensable parties. His views and ours as to the interpretation of this document are obviously poles apart. It may consequently be necessary to implead all four of them.

Senator KUCHEL. You are just in the preliminary stages so it would be futile, even, to try to estimate when a decision would be reached?

Mr. ELY. That is correct, sir.

Senator ANDERSON. I think, Mr. Ely, that in the central Arizona hearing, unless my memory is playing me a trick, I was one of those that kept insisting that all of the States had to come in. I desire that.

Mr. ELY. I think that is correct, Senator Anderson.

Senator ANDERSON. I certainly subscribe to that point of view. We might as well all get into court anyway.

Mr. ELY. We do not want a protracted lawsuit and then end up with a decree that we find does not settle the questions, and that sometime in the distant future there is to be another lawsuit involving the upper basin. Let's get it all settled at one time.

Senator KUCHEL. Basically is it the position of the attorney general of California and the Colorado River Board of California that this legislation would violate the rights of California under the Colorado River compact?

Mr. ELY. That is the opinon and view of the Colorado River Board of California and of the State as expressed through the department of public works, which is delegated by the Governor as the responsible agency to render the State's reports under the procedure of the Flood Control Act of 1944.

Attorney General Brown has direction of the lawsuit; and so far as possible, the legislation and the lawsuit have been kept in separate compartments. We have not desired to have the problems of the legislation affect the lawsuit or vice versa, any more than we can help. They converge here in my testimony, as I represent the State's department of justice in our supreme court and represent another branch of the State, the Colorado River Board, with respect to this legislation.

Senator KUCHEL. And it is also the position of the State government that there is no present avenue by which the people of our State could bring into court and have a judicial decision rendered on the alleged violations of the Colorado River project?

Mr. ELY. If this bill should be enacted, without provision for some way to get into court to test the questions I have mentioned, our view is that without an act of Congress granting the consent to join the United States, it is highly doubtful whether any of the seven States could get the matter before the court as to the proper operation of these giant reservoirs.

Senator ANDERSON. I noticed in the House hearings you submitted some amendments.

Mr. ELY. We did, Senator Anderson. I am not submitting them here because of the fact that the bill seems to have taken a considerably different course. It is a little difficult to see just what final form it will have. I don't think any useful service would be performed by my submitting amendments at this stage.

Senator ANDERSON. In the House hearings, you expressed your disapproval of transmountain diversions. When the Colorado-Big Thompson project was constructed, did California object to that in any way?

Mr. ELY. No.

Senator ANDERSON. Has California objected to any of the other transmountain diversions until the State of New Mexico wanted to have a little tiny one?

Mr. ELY. No, Senator. We have, with growing concern, watched the mounting list of transmountain diversions.

Senator ANDERSON. As long as you had a big State like Colorado doing it, you never raised a voice; did you?

Mr. ELY. That is not it. I think that we have taken on the big powerful State of Colorado in connection with the Fryingpan-Arkansas project. It was the first time in which we have seriously raised this question of the effect of transmountain diversions.

Senator ANDERSON. I went through the Fryingpan hearings in the Senate. Did you testify?

Mr. ELY. Yes, sir. I am not sure you were there that day, Senator.

Senator ANDERSON. I may have missed that day. Therefore, you are strongly opposed to the transmountain diversion in Colorado as you are to the one in New Mexico?

Mr. ELY. Yes. There is no distinction between one of the upper States and the others, Senator. We have been reluctant to object to any upper-basin State projects until we felt that this bill presented us with the necessity, whether we like it or not, of raising the issues I have now raised. I would like this opportunity to place in the record a memorandum that summarizes the bills for development in the upper basin and the lower basin that have gone through in the last several years with California's acquiescence. It is frequently said by uninformed people that California's position is to oppose development through the basin; that is not true.

Senator ANDERSON. I say that you pick out your opponents that only have two Congressmen and not very strong representation. We feel kind of sorry that you picked out on us.

Mr. ELY. If we were looking for easy opponents, I think the State of New Mexico would be the last that we would pick, so long as it is represented in the Senate with the representation it has, to say nothing of its representation in the House. I would go a long way to avoid a row with you, Senator.

Senator ANDERSON. I recognize it is a very difficult thing for a State to watch a trend and finally some day speak about it.

Mr. ELY. That is our feeling; yes.

Senator ANDERSON. Revert for us a minute to the House bill, because it will have to be before us some time, either as a document we will consider on the floor or as a matter that might go to conference.

Mr. ELY. Might I interrupt to ask if this could go into the record; this memorandum?

Senator ANDERSON. Yes. That could go into the record at this point.

(The data referred to follow:)

MEMORANDUM—CALIFORNIA AND UPPER BASIN PROJECTS

An idea has been implanted in the minds of some Members of Congress from the States in the upper basin of the Colorado River to the general effect that California has consistently obstructed or opposed the approval of reclamation projects in the upper basin.

California has not only failed to oppose upper basin development; it has in repeated instances supported such development. That fact can be demonstrated.

I. Boulder Project Adjustment Act (54 Stat. 744): In the year 1940 the Boulder Project Adjustment Act was adopted by Congress with the active support of California, and its delegation in both Houses. That act provides that for 15 years there shall be paid out for investigation and construction of projects located exclusively in the upper basin States (Colorado, New Mexico, Utah, and Wyoming) the sum of $500,000 per year, a total of $7,500,000. Further, for the next 35 years a like sum each year shall be equitably distributed for the same purposes among the 7 States of the Colorado River Basin. From this it will follow that at least another $8 or $9 million will fall to the share of the upper basin States. This money is being derived and will be derived from the rates paid for power produced at Hoover Dam. More than 90 percent of the money is being taken from the pockets of the household and commercial power users in California.

These provisions of the act were not only agreed to by California but vigorously supported in Congress by the California delegation. They confer a special benefit upon the upper basin States, which have these funds available in addition to their fair share of the funds appropriated to the Bureau of Reclamation in general for general investigation of projects throughout the West.

II. Furthermore, in each of the following named projects, the California representatives on the congressional committees voted for the projects and either supported and voted for them on the floor or permitted them to be adopted without objection by unanimous consent. In no case did California oppose any of these projects. The record so shows.

1. Provo (Deer Creek) project, Utah (62 Stat. 92).
2. Mancos project, Colorado (61 Stat. 176). (In this instance, the Colorado River Board of California affirmatively supported reauthorization of the project before congressional committees and with the California delegation.)
3. Paonia project, Colorado (61 Stat. 181). (In this instance California took the same affirmative position as in the case of the Mancos project.)
4. Eden project, Wyoming (Public Law 132, 81st Cong.).
5. Weber Basin project, Utah (Public Law 273, 81st Cong.).
6. Fort Sumner project, New Mexico (Public Law 192, 81st Cong.).
7. Vermejo project, New Mexico (H. R. 3788, 81st Cong.).
8. Big Thompson project, Colorado (H. R. 5134, 81st Cong.).

III. Upper Basin Compact Act (Public Law 37, 81st Cong.): California officially joined with representatives of other States in commending the efforts of the upper basin States to come to an agreement upon an upper basin compact and repeatedly expressed the hope that they would be able to harmonize their views and make such a compact. When the compact had been made and ratified by the legislatures of the upper basin States, it came here for the consent of the Congress. The bill sets up certain criteria for the measurement and administration of the waters of the upper basin States which are distinctly different from those which are applicable to all seven Colorado Basin States under the original Colorado River compact of 1922. In the hearings which were held on the upper basin compact bill before the House Committee on Public Lands representatives of California appeared and testified on one point only. They stated that California had no interest whatever in how the upper basin States proposed to handle their affairs among themselves, but they asked that it be made crystal clear that the action of Congress should not be taken so as to interpret or vary the terms of the original Colorado River Basin compact. It developed then that the official representatives of the upper basin States disclaimed having any such idea, and language was agreed upon between California and the upper basin States which appeared in the House committee report, and properly preserves all questions of interpretation of the Colorado River com-

pact. This being settled, California approved the passage of the bill and it was passed on the Consent Calendar in both Houses.

Certainly no fair-minded person would consider that there was anything in the nature of obstruction or opposition on the part of California in these proceedings. The suggestion made by California was promptly and frankly accepted and agreed to by the upper basin States as being in proper order. The bill was not delayed nor was it jeopardized nor lost.

Senator ANDERSON. Can you show us where in the House bill as it was reported, the bill authorizes anything except the projects and units that are specifically listed?

Mr. ELY. Section 2 of the House bill, H. R. 4449, corresponds in general to section 5 of the Senate bill. It appears at page 17 of the House bill.

Senator ANDERSON. No; I am saying as reported.

Mr. ELY. This is as reported, sir.

Do you have it before you?

Senator ANDERSON. Yes; I do have it.

Mr. ELY. It reads:

In order to achieve such comprehensive development as will assure the consumptive use in the State of the upper Colorado River Basin of waters of the Colorado River system, the use of which is apportioned to the upper Colorado River Basin by the Colorado River compact, and to each State thereof, by the upper Colorado River Basin compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects, authorized in this act, and of new participating projects as additional information becomes available and additional needs are indicated.

Thereafter, follow two criteria. There is also in the bill a provision——

Senator ANDERSON. Yes; but that does not authorize it.

Mr. ELY. It is a declaration of intent.

Senator ANDERSON. That is right. I can say that at some future time I intend to pay a certain amount of money to my bank, but unless I come forward with the money, the bank is never going to mark my note paid.

Mr. ELY. My point is there is no need for spending several hundred million dollars for Glen Canyon and Echo Park unless the section 2 projects are going to be built. The section 1 projects require only a half million feet of consumptive use and no storage.

Senator ANDERSON. We do want to get a point in there that we can use if we need to, to build additional projects. May I say, Mr. Ely, I don't know what is in the minds of anybody else, but as far as I am concerned, I do not desire to see the State of California deprived of one drop of water to which it is properly entitled, and I think if we had the cooperation instead of difficulties, I am not referring to the difficulties, it is in the testimony, it would be possible to construct the projects in the upper Colorado River Basin and provide sufficient storage so that when the river was well managed we would have all the water necessary to take care of the lower basin and all of the projects that the upper basin thus far, at least, can envision.

We would do it on the basis of us all being friends together, instead of on a basis where it will develop into a row between the upper and lower basins. I think it can be done. I have been trying during the days of this hearing, to assure other parts of the basins that my State does not have any designs on anybody, on the water of anybody, including either Arizona, California, or Nevada, and I think it might

be possible so to pass this bill and so to word it that those fears ought to be to some degree dissipated.

I do have some pretty strong convictions on what the Colorado compact means. I think anybody that was around at the time it was written can remember some of the history pretty clearly. I can't realize that was thirty-some-odd years ago. Maybe it was. I still like to think it was a short time ago.

I remember the enthusiasm with which Mr. Hoover and others announced the signing of that document.

Mr. ELY. Senator Anderson, I appreciate what you say, and I certainly accept at full value your assurance that you don't want to take water that belongs to California, and we don't want to take water that belongs to you, either. But unhappily we have a disagreement as to what the rights are. If I may make two additional comments——

Senator ANDERSON. Could I say, still with a smile on my face, that we believe in our State, that you don't want to take it away from us, but you certainly would enjoy delaying our getting it.

Mr. ELY. No, I would rather see you get it. I would like to see the meaning of the compact determined and have you, as well as us, get exactly the water we are entitled to. I might make these two comments, and I know it is late:

One is that the House bill on page 17, line 2, contains language that section 1 (c) of the Flood Control Act of 1944 shall not be applicable to such supplemental reports.

In other words, the Secretary does not have to submit to the affected States, including California, the reports on the proposed section 2 projects.

Senator ANDERSON. That is correct. And all that I can say is that so far as the Senate bill is concerned, as to the projects in New Mexico, he does have to submit them to the affected States and he does have to submit them back to the Congress.

Mr. ELY. The other comment I would like to make is that in closing, I think a great deal of the difficulties that we face are due to the Mexican Water Treaty. We said so in 1944. California and Nevada opposed that treaty. As a matter of fact, the water users throughout the Colorado Basin overwhelmingly opposed it, that is, the actual irrigation districts. It was unhappily supported by the State governments of five of the States at that time, in response to a plea of the State Department that they do so, recognizing the Mexican Water Treaty as a war-time agreement, and many considerations supposing to influence it.

To our mind it was the same unhappy breed as a number of wartime agreements: Yalta, on a small scale.

The results of the treaty are absolutely disastrous. They guarantee to Mexico twice what that country has ever used in the state of nature and as you pointed out, Senator, a guaranty on the Colorado River is a very difficult burden to undertake.

How we are going to solve that, I don't know.

Senator ANDERSON. I don't suppose there is any way to solve it. I have said that I think it is one of thhe most serious mistakes that has ever been made. I think it is the one thing that seems to make difficult the solution of the problems of the Colorado River. At one time, in discussing the Polish Corridor, I said that it wasn't very wide but so long as it was there it was wide enough to bar forever the peace in Europe. And the Mexican treaty, while not very big, is big enough

almost to destroy the hope for peace on the Colorado River as long as it is there. I think it would be well, even at this late date, to try to buy back some of the water bargained away. I think we would have to buy it back, but I would be happy to buy it back. It is worth millions and millions of dollars to us in buying back peace.

Mr. ELY. The treaty is a whole lot worse in operation than it is on its face. It guarantees a million and a half acre-feet and requires us to meet Mexico's nominations of the rate in cubic feet per second at which water shall reach the border, up to 3,500 second-feet. Actually, our Government has found it impossible to gage the releases from Hoover and Davis so as to even approximate the 3,500 second-foot figure. The water reaching the Mexican border, even at times when storage in Lake Mead is being drawn down, when it should not be drawn down, has far exceeded it. There has never been a time when the Mexicans have not received more water than the treaty entitled them to.

What will happen if Lake Mead continues to be drawn down, I cannot tell. I think that is a serious problem that deserves the attention of Congress.

Senator ANDERSON. I think that is one which the upper and lower division might well reach an agreement on.

Thank you.

We will recess now until 9 o'clock tomorrow morning.

Mr. ELY. Before I leave the stand, Senator Anderson, may I express my deep appreciation for the courtesy which I have received at the hands of yourself and the committee. While we may not agree, you have been most attentive and considerate of what I have had to say, and I appreciate it.

(The exhibits accompanying Mr. Ely's testimony are as follows:)

EXHIBIT A

IN THE SUPREME COURT OF THE UNITED STATES

October term, 1953

No. 10 Original

State of Arizona, Complainant, v. *State of California, Palo Verde Irrigation District, Imperial Irrigation District, Coachella Valley County Water District, Metropolitan Water District of Southern California, City of Los Angeles, Calif., City of San Diego, Calif., and County of San Diego, Calif., Defendants*

United States of America, Intervener

SUMMARY OF THE CONTROVERSY (EXHIBIT A)

(As appended to answer of California defendants to petition of intervention tion on behalf of the United States)

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EXHIBIT A

SUMMARY OF THE CONTROVERSY

The pleadings filed by Arizona, Nevada, the United States and California, to date, disclose complex questions of fact and law, many of which are interrelated. The summary of principal questions presented below is divided into four parts: (I) the quantities of water in controversy; (II) the ultimate issues, from the standpoint of the respective prayers; (III) a tabulation of factual issues; and (IV) the issues of interpretation of the basic documents involved. Under this division, certain questions reappear and to this extent reflect the interlocking nature of the problem.

I. THE QUANTITIES OF WATER IN CONTROVERSY

The United States seeks to quiet title to rights to the use of water, consumptive and otherwise, "as against the parties to this cause," for federal purposes, in unstated amounts.

Arizona seeks to quiet title to the beneficial consumptive use of 3,800,000 acre-feet per annum of the waters of the Colorado River System (measured by "man-made depletion of the virgin flow of the main stream") and to enjoin California's right to permanently use any water in excess of approximately 3,800,000 acre-feet per annum (measured by "diversions less returns to the river"), that being the effect of (1) reducing 4,400,000 acre-feet of III (a) water by reservoir losses, and (2) denying California any permanent right to use excess or surplus waters.

California asserts a right to the beneficial consumptive use in California of 5,362,000 acre-feet per annum of the waters of the Colorado River System (measured by "diversions less returns to the river") under contracts with the United States, comprising 4,400,000 acre-feet of the waters apportioned by Article III (a) of the Colorado River Compact and 962,000 acre-feet per annum of the excess or surplus waters unapportioned by the Compact, including in such excess or surplus the "increase of use" permitted to the Lower Basin by Article III (b) of the Compact.

Nevada seeks to quiet title to 539,100 acre-feet per annum (measured in part by both methods) of the beneficial consumptive uses apportioned by Article III (a) of the Colorado River Compact, and to not less than a total of 900,000 acre-feet from all classes of water.

As the States differ in their definition of "beneficial consumptive use," their claims require restatement in terms of a common denominator in order to evaluate their effects. Thus:

The quantity to which Arizona seeks to quiet title, 3,800,000 acre-feet per annum, measured by the method she urges, "depletion of the virgin flow of the main stream occasioned by the activities of man," is equivalent to more than 5,000,000 acre-feet measured by consumption at the site of use, or "diversions less returns to the river," the standard established by the Boulder Canyon Project Act and asserted by California. The difference is due primarily to the fact that under Arizona's interpretation, the Compact deals with the virgin flow in the main stream only and that the use of water "salvaged by man" is not charged as a beneficial consumptive use, whereas under California's interpretation the Compact deals with the waters of the entire river system and such salvage is so charged.

Conversely, the aggregate of the California contracts, 5,362,000 acre-feet per annum, measured by "diversions less returns to the river," is equivalent to only about 4,500,000 acre-feet measured by "man-made depletion" (without charge for salvaged water). If Arizona's prayer should be granted, California's rights would be reduced to about 3,800,000 acre-feet per annum, measured by "diversion less returns to the river," or to about 3,000,000 acre-feet measured in terms of "depletion of the virgin flow of the main stream."

The impact of Nevada's claims on those of the other states is not readily evaluted.

II. ULTIMATE ISSUES

The ultimate issues, in the sense of the results sought by each party, may be grouped as follows:

The United States

Does the United States have rights, "as against the parties to this cause, to the use of water in the Colorado River and its tributaries" in the following categories?

(1) for consumptive use of all projects in the Lower Basin, which it asserts independently of any rights claimed by the States in which such projects are located;

(2) to fulfill its obligations arising from international treaties and conventions; but this involves, with respect to the burden of the Mexican Water Treaty, the obligations as between the States of the Upper Division and the States of the Lower Division under Articles III (c) and III (d) of the Colorado River Compact, and involves also the effect of the so-called "escape clause" of Article 10 of that Treaty, which allows reduction in the guaranteed deliveries to Mexico, in the event of extraordinary drought, in the same proportion as consumptive uses in the United States are reduced, "consumptive uses" being defined in Article I of the Treaty;

(3) to fulfill all its contracts for the delivery of water and electric power, *i. e.*, with or in Arizona, California, and Nevada; but it alleges that the water available is not sufficient to satisfy all these obligations;

(4) to fulfill the Government's obligations to Indians and Indian Tribes; but this involves not only the questions of the magnitude and priorities of these claims but the questions of whether or not they are chargeable under the Colorado River Compact to the Basin and State in which such uses are made, what the obligation of the Upper Division States may be to release water for use by Indians in the Lower Basin, and what rights the United States may have to withhold water in reservoirs in the Upper Basin for use by Indians in both Basins;

(5) to protect its interests in fish and wildlife, flood control and navigation; but such rights as it may have for these purposes may require the impounding and release of water from reservoirs in both Basins, and not merely reservoirs bordering or within Arizona and California, and again involves the question of accounting under the Compact; and

(6) for use of the National Park Service, Bureau of Land Management, and Forest Service; but if the United States has claims "as against the parties to this cause" for these functions, such claims apply to all the waters of the Colorado River System in both Basins.

The adjudication of these claims of the United States requires consideration and resolutions of: questions of fact, referred to later; the power of the United States to impound and dispose of water independently of rights derived from the States; the extent of its obligations under treaties and contracts; the impact and effect of its treaties upon rights of domestic water users; how its claims to the use of water shall be measured; the location, magnitude and priorities of In-

dian claims, and claims for other alleged federal purposes; the extent to which its rights and obligations are controlled by the Colorado River Compact; and the extent to which its claims may be exercised *in futuro* in derogation of intervening rights and uses.

Arizona

Is Arizona entitled to a decree:

(1) Quieting title to 2,800,000 acre-feet per annum of the beneficial consumptive uses apportioned to the Lower Basin by Article III (a) of the Colorado River Compact, substantially all to be taken from the main stream, and measured in terms of man-made depletion of the virgin flow of the main stream?

(2) Quieting title to all of the 1,000,000 acre-feet per annum by which the Lower Basin is permitted to "increase its use" by Article III (b) of the Colorado River Compact (notwithstanding the decision of this Court in *Arizona* v. *California et al.*, 292 U. S. 341 (1934)), to the exclusion of the other States of the Lower Basin, all to be taken from the waters flowing in the Gila River, and to be measured in terms of man-made depletion of the virgin flow of the main stream?

(3) Reducing California's right to the uses apportioned by Article III (a) of the Colorado River Compact to approximately 3,800,000 acre-feet per annum, in consequence of reservoir losses?

(4) Enjoining California's right to receive and permanently use under its government contracts 962,000 acre-feet per annum, or any part thereof, in excess of 4,400,000 acre-feet per annum?

The determination of Arizona's claims involves: the questions of fact, later referred to; the standing of Arizona to seek a declaratory decree quieting title to a "block" of water for projects not yet constructed or authorized (about 1,600,000 acre-feet per annum of the 2,800,000 claimed from the main stream); the source of title to Arizona's claims to 2,800,000 acre-feet of III (a) water and 1,000,000 acre-feet of III (b) water; the status of the uses on the Gila; the measurement of uses thereof and of the main stream; whether Arizona's status is that of a party to the Colorado River Compact or that of a third party beneficiary of the Statutory Compact between the United States and California, and if so, whether Arizona is bound by the interpretations placed thereon by the principal parties thereto in its formulation and administration; and the validity and effect of Arizona's water delivery contract with the United States.

Most of the questions posed by Arizona's claims revolve around the issue of whether the Gila River shall be treated as a part of the Colorado River System for all purposes, or shall receive special treatment in respect of (1) the identification of uses thereon with the waters referred to in Article III (b); (2) the corollary exemption of "rights which may now exist" on the Gila from any charge under Article III (a); and (3) the devaluation of the charge for beneficial consumptive uses from the quantity which is in fact consumed on the Gila (alleged by California to be about 2,000,000 acre-feet per annum) to the lesser quantity represented by the resulting depletion in the virgin flow of the main stream (alleged by Arizona to be about 1,000,000 acre-feet per annum).

California

Are the contracts between the United States and the defendant public agencies of California for the storage and delivery of water valid and enforceable? Inasmuch as these contracts are, in terms, for permanent service but subject to the Colorado River Compact, the Boulder Canyon Project Act and the California Limitation Act, the issue is whether these enactments, considered together as a Statutory Compact established by reciprocal legislation, authorize and permit the Secretary of the Interior to presently contract for the storage and delivery for permanent beneficial consumptive use in California, of 4,400,000 acre-feet per annum of the waters apportioned by Article III (a) of the Colorado River Compact plus one-half of the excess or surplus waters unapportioned by the Compact, including in such excess or surplus the "increase of use" permitted to the Lower Basin by Article III (b) of the Compact. The aggregate of these contracted quantities, subject to physical availability of the amounts of excess or surplus waters, which vary from year to year, is 5,362,000 acre-feet per annum.

The determination of California's claims involves: the questions of fact, later referred to; the extent to which rights have vested in both the United States and California under the Statutory Compact; whether Arizona is estopped by her previous conduct from asserting her present position; whether the limitation is net of reservoir losses; how California's uses shall be measured; whether California is chargeable with the use of salvaged water; the effect of California's

appropriations, in their relation to the expressions "rights which may now exist" and "present perfected rights" in the Compact and Project Act; the definition of the Project Act term, "excess or surplus waters unapportioned by" the Colorado River Compact; the availability of such waters for permanent service; the intent of Congress with respect to the waters referred to in Article III (b); and the relation between California's contracts and the later agreements which the Secretary of the Interior has entered into with others.

Nevada

Is Nevada entitled to a decree:

(1) Quieting title to 539,100 acre-feet per annum of the beneficial consumptive uses apportioned to the Lower Basin by Article III (a) of the Colorado River Compact?

(2) Reserving for a future agreement the disposition of the use of the 1,000,000 acre-feet referred to in Article III (b) of the Colorado River Compact, and preserving to Nevada an equitable share thereof?

(3) Assuring Nevada the ultimate beneficial consumptive use of not less than 900,000 acre-feet per annum, from all classes of water?

The determination of Nevada's claims requires the consideration and resolution of: the questions of fact later referred to; the questions of interpretation previously mentioned; the question of whether Nevada's share of III (a) waters has been determined or limited to 300,000 acre-feet per annum; whether, as to stored waters, Nevada may claim any quantity in excess of her contracts with the United States; and the source of title to her claims to 539,100 acre-feet per annum of III (a) water and not less than 900,000 acre-feet per annum from all sources.

Interests of other States

There remains the question whether the claims of the United States, Arizona, California, and Nevada can be effectively determined without concurrently determining the rights and obligations of Utah and New Mexico with respect to the waters of the Lower Basin, and the rights and obligations of those states and Colorado and Wyoming with respect to other waters of the Colorado River System, to the extent that they are affected by the issues in controversy here.

In more detail, these "ultimate issues" depend upon the resolution of the following questions of fact and of the interpretation of the Colorado River Compact, the Boulder Canyon Project Act, the Statutory Compact between the United States and California, and the Mexican Water Treaty.

III. FACTUAL ISSUES

There are substantial issues of fact, raised by the pleadings to date. These include, but are not limited to, determination of:

(1) the investments and obligations undertaken by the parties in the construction of works and in the performance of their contracts with the United States, and the investments and obligations undertaken by the United States in reliance upon such contracts;

(2) the location, magnitude and priorities of the water rights necessary to enable the United States to perform its obligations to Indians and Indian tribes pursuant to Article VII of the Compact;

(3) the requirements of the United States for (a) flood control, (b) navigation, (c) fish and wildlife, and (d) the other claims which it makes;

(4) the quantities of water physically available for beneficial consumptive use in the Lower Basin, assuming full use by the Upper Basin of its Compact apportionment, full regulation of the supply available to the Lower Basin, and full performance of the Mexican Water Treaty;

(5) the uses, present and potential, on the main stream and on each tributary, determined as of the place of use, as California contends is the proper method, and the effect of those uses in terms of manmade depletion of the virgin flow of the main stream as Arizona contends is the proper method;

(6) the quantities of water "salvaged" by the activities of man, on the main stream and on the tributaries;

(7) reservoir losses, present and potential, gross and net;

(8) appropriative rights, priorities, and uses thereunder, on the main stream and tributaries;

(9) the extent and place of use of "rights which may now exist" and which, under Article III (a) of the Compact, are to be charged as uses of water appor-

tioned by Article III (a), and of "rights which may now exist" in California, within the meaning of Section 4 (a) of the Project Act; and

(10) the extent and place of use of "present perfected rights" protected by Article VIII of the Compact and directed by the Boulder Canyon Project Act to be satisfied in the operation and management of the Project.

IV. THE ISSUES OF INTERPRETATION OF THE COLORADO RIVER COMPACT, THE BOULDER CANYON PROJECT ACT, THE STATUTORY COMPACT, AND THE MEXICAN WATER TREATY

Questions relating primarily to Article III (a) of the Colorado River Compact include the following: Whether the Colorado River Compact deals only with the main stream or treats with Colorado River System waters wherever they may be found; whether the uses apportioned by Article III (a) to the Lower Basin are to be taken only from "water present in the main stream and flowing at Lee Ferry," as Arizona contends, or from the tributaries as well, as California and Nevada contend; whether the 7,500,000 acre-feet referred to in Article III (a) is related to the 75,000,000 acre-feet referred to in Article III (d), as Arizona contends, or whether the latter figure includes excess or surplus waters unapportioned by the Compact, as California contends; by what process Arizona claims to have acquired an apportionment of 2,800,000 acre-feet of III (a) water, to be taken from the main stream; whether the apportionment of 7,500,000 acre-feet "per annum" is a statement of a maximum, or of an average, and, if the latter, over what period of years; the definition and measurement of "beneficial consumptive use"; the accounting for water added to and withdrawn from storage on the main stream and tributaries; whether the use of water salvaged by man on the main stream and tributaries is to be charged under the Compact; the definition of "rights which may now exist," which are to be included in charges to water apportioned by Article III (a) and their magnitude on the main stream and tributaries; the date to which this last expression refers; whether, in the absence of a compact among the Lower Basin States, the division of water among them is to be affected by appropriative rights, *i. e.*, "rights which may now exist"; whether Indian rights, and other federal claims to consumptive use, are included within that expression and are to be charged under the Compact; whether reservoir losses are chargeable as beneficial consumptive uses, and if so, their classification under the Compact and their relation to other uses.

Questions relating primarily to Article III (b) of the Colorado River Compact include the following: The questions relating to the definition of "beneficial consumptive use" and "per annum" previously stated in connection with Article III (a); whether the "increase of use" permitted to the Lower Basin by Article III (b) is an apportionment in perpetuity as in Article III (a), as Arizona contends, or a license to acquire rights by appropriation and contracts under the Project Act in excess or surplus waters unapportioned by the Compact, as California contends; whether this right to increased use is identified solely with the water found flowing in the Gila River, as Arizona contends, or is identified with the first 1,000,000 acre-feet of increased use (above 7,500,000) per annum throughout the Lower Basin, as California and Nevada contend; whether this right is available to all five States of the Lower Basin, or to Arizona alone, as she contends (notwithstanding the decision of this court in Arizona v. California *et al.*, 292 U. S. 341 (1934)); the status of uses in New Mexico on the Gila; the status of uses on other tributaries; and to what degree reservoir losses are chargeable to this increase of use. Reference to the relation of the Mexican Treaty burden to the uses under Article III (b) appears below in connection with Article III (c).

Questions relating primarily to Article III (c) of the Colorado River Compact include the following: Whether the waters to be supplied Mexico are "apportioned" thereby (this bears upon the determination of the meaning of the expression "excess or surplus waters unapportioned by" the Colorado River Compact, appearing in the Boulder Canyon Project Act, *infra*); whether, if the quantities in excess of those specified in Articles III (a) and III (b) are insufficient to supply the deliveries to Mexico, the burden, with respect to the Lower Basin, falls first upon the uses referred to in Article III (b), as California contends, or upon those referred to in Article III (a), as Arizona contends; and the relation of the "escape clause" in Article 10 of the Treaty, which permits reduction in deliveries to Mexico in case of extraordinary drought in proportion to the reduction in consumptive uses in the United States. The relation of

Article III (c) to Articles III (d) and III (a), with respect to the obligations of the Upper Division States, is referred to below in connection with Article III (d).

Questions relating primarily to Article III (d) of the Colorado River Compact include the following: As a corollary to one of the questions stated with reference to Article III (a), whether the 75,000,000 acre-feet referred to in Article III (d) is related to the 7,500,000 acre-feet apportioned by Article III (a) to the Lower Basin, or whether the 75,000,000 acre-feet include excess or surplus waters available for delivery to Mexico or use in the Lower Basin; the resulting effect on the obligation of the States of the Upper Division stated in Article III (c) to furnish additional water to meet the deficiency if surplus above the quantities specified in Articles III (a) and III (b) is insufficient to supply Mexico; and whether the Lower Basin is entitled to demand release of this 75,000,000 acre-feet notwithstanding the consequent inability of the Upper Basin to make beneficial consumptive use of 7,500,000 acre-feet per annum.

Questions relating primarily to Article III (e) of the Colorado River Compact include the following: Whether, if excess or surplus waters are appropriated (or contracted for) in the Lower Basin, their release from storage in the Upper Basin may be required; whether, if Indians uses are not subject to the Colorado River Compact, the United States may require release of water from reservoirs in the Upper Basin to satisfy them, in addition to the water which the States of the Upper Division are required to release in performance of Articles III (c) and III (d) of the Compact; so also with respect to the other federal claims asserted by the United States "as against the parties to this cause," for use of water in the Lower Basin.

Questions relating primarily to Articles III (f) and III (g) of the Colorado River Compact include the following: Whether the provisions in these articles with reference to a compact to be made after October 1, 1963, are permissive or mandatory; whether, in the light of the Statutory Compact, these provisions preclude the acquisition of rights in excess or surplus waters by appropriation and by contract with the United States in the interim, subject only to further apportionment as between Basins by such a future compact; and whether, in the event of competing interstate claims to such excess or surplus waters, in the absence of a compact apportioning them, priority of appropriation, including contracts with the United States, controls.

Questions relating to Article VII of the Colorado River Compact include the following: Whether uses by Indians are subject to the Colorado River Compact; whether Indian uses are chargeable under the Compact to the Basin and the State in which they are situate; if not, whether they are prior and superior to the apportionments made by the Compact, or are in competition with appropriations of others which are subject to the Compact; the location, magnitude, and asserted priority of Indian claims; their effect upon the quantities available to non-Indian users under Articles III (a), III (b), etc.; their effect on the distribution of the Mexican Treaty burden; and their effect on the obligations of the States of the Upper Division under Articles III (c) and III (d).

Questions relating primarily to Article VIII of the Colorado River Compact include the following: The date to which the expression "present perfected rights" relates, *i. e.*, 1922, 1929, or some other date; the definition of said term; whether such definition is to be determined under the law of the State under which the right arose; whether the assurance against impairment extends to quality as well as quantity; the extent of these rights in each State; their relation to the expression "rights which may now exist," as used in Article III (a) of the Compact and Section 4 (a) of the Project Act; and the impact of reservoir losses when present "perfected rights" attach to, and are satisfied from stored waters, pursuant to the direction in Article VIII.

Questions relating primarily to the Boulder Canyon Project Act and the resulting Statutory Compact between the United States and California include the following: Whether the alternative consent given in the Project Act to a Seven-State or Six-State Compact became final on June 25, 1929, in establishing the latter; whether Arizona could, or did, effectively ratify a Seven-State Compact thereafter; if so, whether the Statutory Compact authorized by the Project Act as a corollary to a Six-State Compact remains in effect; if it does, whether Arizona can claim the benefits of both; whether the Statutory Compact authorized contracts to be made with the California defendants for the permanent service (in addition to 4,400,000 acre-feet of III (a) waters) of one-half of the excess or surplus waters unapportioned by the Compact for use in California; whether it included therein the waters referred to in Article III (b), or precluded California from use of such waters; whether the "excess or surplus," of which

California may use one-half, is to be reckoned before or after deduction of the quantity required to be delivered to Mexico; the effect on California's right to "excess or surplus" of a future compact apportioning such waters; whether the limitation "for use in California" is net of reservoir losses, or is subject to further reduction in consequence of such losses; whether the definition of consumptive uses applicable to California is applicable to Arizona, and vice versa; whether California is free to make use of salvaged waters without charge under the Compact or the Limitation Act; the effect of California's appropriations; the meaning and effect of the reference to "rights which may now exist" in Section 4 (a) of the Project Act; the extent of California's "present perfected rights" as referred to in Section 6 of the Project Act; whether by the Project Act, or otherwise, the shares of Nevada or Arizona in the waters of the Colorado River System have been determined; and the construction and effect of the water delivery contracts held by those States.

GOODWIN J. KNIGHT, GOVERNOR, STATE OF CALIFORNIA

DEPARTMENT OF PUBLIC WORKS,
OFFICE OF THE DIRECTOR,
Sacramento, February 15, 1954.

Hon. DOUGLAS MCKAY,
Secretary of the Interior, Department of the Interior,
Washington, D. C.

DEAR SIR: Your proposed supplemental report on the Colorado River storage project and participating projects, transmitted to the President on December 10, 1953, was received in this office on December 28, 1953, with letter of transmittal from the Acting Commissioner of Reclamation to Governor Goodwin J. Knight, and forwarded to the division of water resources of this department for study and review.

On February 2, 1954, a request was sent to you for additional detailed substantiating information in order to permit a thorough analysis and appraisal of the proposed developments.

Since it appears that the proposed developments are now under active consideration by the executive departments and the Congress, looking toward an early decision, it is understood that comments of all interested States are desired without delay. Accordingly, a report has been prepared by the division of water resources in collaboration with the Colorado River Board of California, setting forth the general views of the State of California; subject, however, to such modifications as are deemed necessary when and if detailed substantiating information has been received and the proposals have been given further consideration. This report has been received and is transmitted herewith.

I concur in the comments submitted and request that they be considered as expressing the views of the State of California on your proposed report. It is further respectfully requested that the report, dated February 15, 1954, on this subject, be transmitted to the President of the United States and to the Congress along with the other material that may be so transmitted.

Very truly yours,

FRANK B. DURKEE, *Director of Public Works.*

STATEMENT OF THE STATE OF CALIFORNIA ON PROPOSED SUPPLEMENTAL REPORT OF THE SECRETARY OF THE INTERIOR ON COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, DATED DECEMBER 10, 1953

INTRODUCTION

Reference is made to letter of December 15, 1953, by Acting Commissioner of Reclamation H. F. McPhail to Gov. Goodwin J. Knight, of California, transmitting copies of a supplemental report of the Secretary of the Interior, dated December 10, 1953, on the Colorado River storage project and participating projects, and inviting comments. The project was originally reported upon by the Bureau of Reclamation in Project Planning Report No. 4–8a.81–1 dated December 1950. That report is incorporated, with modifications, in the Secretary's supplemental report.

The 1950 report presented a plan of development of the upper Colorado River Basin comprising 10 major dams and reservoirs with hydroelectric plants on the Colorado River and principal tributaries above Lee Ferry, and an indefinite

number of water-using projects designated "participating propects." That report recommended approval of the overall plan and initial authorization and construction of 5 units of the storage project and 10 new participating projects, and inclusion as participating projects of 2 irrigation developments already authorized and under construction.

The supplemental report of December 1953 recommends approval of the overall plan, initial authorization and construction of the Glen Canyon and Echo Park units of the storage project, authorization for immediate construction of the same 10 new participating projects, inclusion of the same 2 previously authorized projects as participating projects and authorization of the Shiprock division of the Navaho project, including Navaho Dam and Reservoir, with actual construction of the Navaho project to be referred until a report thereon has been approved by the Congress.

Cost estimates for the storage units and the participating projects in the Secretary's supplemental report are revised upward as compared to the estimates in the 1950 report. There also appears to be some revision in the assumptions as to power output and revenues and allocation of costs of the storage project, although no explanation is given.

A proposed repayment program is recommended which would involve postponement of repayment of the irrigation costs beyond the ability of the water users to repay until after the power investment in the storage units is repaid with interest. It is estimated in the financial operation study attached to the report that it would take 56 years to pay off the power investment with interest.

This proposal differs from the repayment program proposed in the 1950 report, under which it was planned to divert and use the interest charged on power investment to repay the portion of the irrigation costs beyond the ability of the water users to repay.

PREVIOUS VIEWS AND RECOMMENDATIONS

Under date of June 14, 1951, the State of California submitted to former Secretary of the Interior Oscar L. Chapman its views and recommendations on the original project planning report dated December 1950. From those views and recommendations the following is quoted:

"Therefore, the State of California favors congressional authorization of the specific projects set forth in the proposed report of the Secretary of the Interior or as may be modified, and their construction with Federal funds consistent with national welfare if (*a*) such projects qualify under criteria, policies, and procedures of the Congress, and (*b*) the diversion and utilization of the waters of the Colorado River system by and through these projects will not impair the rights of the State of California or any of its agencies to the waters of that system as defined and set forth in the Colorado River compact and related laws and documents."

It was further stated that the phrase "criteria, policies, and procedures of the Congress" was intended to refer to "uniform criteria, policies, and procedures to be established by the Congress."

COMMENTS ON SUPPLEMENTAL REPORT

California agencies have rights established by prior appropriation and by contract with the Secretary of the Interior under the authority of the Boulder Canyon Project Act, providing for the use in California of 5,362,000 acre-feet annually of water from the Colorado River system. It is the duty of the State to protect and preserve those rights of its citizens. California is, therefore, rightfully concerned in proposals for the further development of the water resources of the Colorado River Basin wherever such developments may be. For this reason it is necessary for the State to analyze thoroughly any proposals for further development and take whatever steps appear required to insure that such developments would not impair the rights of California and its agencies in and to the waters of the Colorado River system.

The Colorado River storage project and participating projects as proposed in the report under review would obviously have substantial effect upon the available water supply and the operation of facilities in the lower basin and California. Furthermore, the plan of financial operation of the project as proposed by the Department of the Interior departs materially from existing reclamation law and is not in accordance with sound standards and policies.

The comments herein are directed, first, to the effects of the proposed project on California's rights to Colorado River water and, secondly, to basic questions of criteria, policies, and procedures involved in the proposals. These have been prepared by the division of water resources in collaboration with the Colorado River Board of California.

Because of the lack of supporting detail in the supplemental report under review, the comments are necessarily based largely on the substantiating material presented in the original 1950 report and the accompanying special reports on individual participating projects.

Effects on California's rights to Colorado River water

The engineering studies presented in the original 1950 report and the related special reports on participating projects and the supplemental report of the Secretary of the Interior are vague and uncertain with respect to the effects of proposed upper basin developments on the water supply available to the lower basin, the rights of California thereto, and the operation of facilities in the lower basin. The plans for construction and operation of the proposed developments, insofar as revealed in these reports, give no proper or adequate consideration to the interests of the lower basin States. Furthermore, the studies involve or imply what California considers to be erroneous interpretations of the Colorado River compact.

The erroneous interpretations of the compact include: (1) that article III (a) apportions to the upper basin a water use of 7,500,000 acre-feet a year in terms of depletion of the virgin flow at Lee Ferry instead of a beneficial consumptive use of 7,500,000 acre-feet a year at places of use; (2) that the upper basin would be entitled to the consumptive use of an average annual amount of 7,500,000 acre-feet instead of a maximum of 7,500,000 acre-feet in any one year. Because of these erroneous interpretations, the report is invalid as regards the showing of how soon and how much holdover storage will be needed and as regards the ultimate quantity and pattern of residual flow into the lower basin at Lee Ferry.

There are at least 10 serious questions of interpretation of the compact which would be involved in and affect the proposed storage project and related reclamation developments. (See statement of Northcutt Ely on behalf of Colorado River Board of California at hearings on H. R. 4449 before Subcommittee on Irrigation and Reclamation of Committee on Interior and Insular Affairs of House of Representatives, January 26, 1954.) All of these questions are at issue in the pending case of *Arizona* v. *California, et al.;* United States Supreme Court, October term, 1953, No. 10 original.

California's basic position is that this State is conforming to the Colorado River compact and must insist that the Bureau of Reclamation and the States of the upper basin do so in the planning and administration of the Colorado River storage project and participating projects.

As to annual variation in consumptive use requirements, there appears to be no justification for the assumption in the report that under full development, with a regulated water supply and with practically all the irrigated land receiving a full supply each year, the water requirement and use would be highest in wet years and lowest in dry years. This assumption cannot be reconciled with the results of the latest scientific investigations of the subject, and therefore is a probable source of further error in the findings in the reports on the storage project and participating projects.

It is evident that the building, filling and operation of the proposed main-stream reservoirs, with an ultimate total capacity of about 48 million acre-feet, would have substantial effect upon lower basin facilities and operations. Even the filling of the two reservoirs, Glen Canyon and Echo Park, now proposed for initial authorization with combined capacity of 32 million acre-feet, would have a material effect and would present serious problems.

Who is to have the final decision and control as to the operation of these holdover reservoirs, including storage and release of water? Article III (e) of the Colorado River compact provides that the States of the upper division shall not withhold water and the States of the lower division shall not require the delivery of water which cannot reasonably be applied to domestic and agricultural use. Glen Canyon Reservoir and certain other proposed upper basin main-stream reservoirs will be so located physically that no water stored therein can ever be applied to domestic or agricultural uses in the upper basin. All of the water stored in such reservoirs will be required for domestic and agricultural use in the lower basin and Mexico. Furthermore, consideration

must be given to the Government's obligations to maintain the contracted firm power output at Hoover Dam.

No discussion of such problems, including the inevitable reduction in power output at lower basin plants and its economic effect from a national standpoint, is presented in the reports. Insofar as the original basic report or the 1953 supplement indicate, there is no evidence that the effects on operation of lower basin storage and power facilities have been given due consideration in planning the schedules of constructing, filling, and operating the proposed upper basin storage and power facilities.

Of equal concern to the problems of quantity and fluctuation of flow into the lower basin at Lee Ferry is the problem of quality of water. This problem concerns water users throughout the basin, but especially those in the lower basin States. Increased consumptive use of the waters of the Colorado River and its tributaries in the upper basin, particularly the relatively pure water of the headwater streams, will result in higher concentrations of mineral salts in the residual flow downstream.

The provisions in the Colorado River compact of water for the lower basin would be largely nullified if the supply were unsuited in quality for all beneficial purposes. Furthermore, article VIII of the compact provides: "Present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact." Certainly, this means unimpaired in quality as well as quantity.

The reports are completely lacking of information that would provide answers to the questions concerning quality of water. It is California's position that before development proceeds on any additional large scale consumptive use projects in the upper basin, the entire problem of quality of water should be fully explored; that determination should be made as to the effects of increased upper basin uses up to full development, upon the quality of the flow at Lee Ferry; and that authorization of such additional projects, particularly transmountain diversion projects, in the upper basin should be deferred until satisfactory evidence is presented that such projects, in combination with existing projects and other projects contemplated under full development, would not have harmful effects on the quality of water remaining for use in the lower basin.

It is evident from the foregoing that there are a number of unknowns remaining to be determined as to water supply and use in the upper basin, and as to the amount of water that would be expected to be available to the lower basin passing Lee Ferry under conditions of ultimate development in the upper basin with full practicable utilization of the water supply apportioned to the upper basin under the Colorado River compact. This points up the need for a comprehensive system of gaging and sampling stations to measure both quantity and quality of water throughout the basin in order to determine the water supply available and the actual use of water. It is considered essential that more adequate measurements and records of water supply and use be obtained which will permit reliable studies to be made of the operation of existing and proposed developments in the upper basin and of the resulting available water supply, both as to quantity and quality, passing Lee Ferry for the lower basin.

Criteria, policies, and procedures

The laws governing Federal reclamation development are embodied in the original Reclamation Project Act of 1902 and the Reclamation Project Act of 1939, as amended. Therein are set forth the criteria, policies, and procedures of general application which may be collectively designated as existing reclamation law. For the purposes of this review, only certain features of the law will be referred to.

Existing reclamation law provides that the reimbursable construction costs of irrigation reclamation projects shall be repaid within a period of 40 years, without interest, in 40 equal annual installments. In the case of a project for irrigation of new lands, it permits a development period not to exceed 10 years, during which no repayment may be required.

Where a project includes facilities for municipal water supplies, the law provides that the reimbursable cost chargeable thereto shall be repaid in 40 years, with interest if deemed proper by the Secretary of the Interior.

Where a reclamation project includes hydroelectric power features, the law provides for reimbursable cost to be repaid with interest within a period of 40 to 50 years.

Present law permits nonreimbursable allocations of reclamation project costs for flood control, navigation, and fish and wildlife in the case of projects which include features to perform these purposes.

The repayment program recommended by the Secretary in the supplemental report constitutes a material departure from established criteria, policies, and procedures of general application in existing reclamation law.

It appears to be similar to that authorized by the Congress specifically for the Collbran project, Colorado (Public Law 445, 82d Cong., approved July 3, 1952). The special repayment provisions in that act are set forth as exceptions to existing reclamation law. It was stated at recent hearings before the House Interior and Insular Affairs Committee that at the time the committee passed upon the Collbran project bill, approval of the repayment formula therein was specifically for that project alone and was not to be considered as establishing a precedent for other reclamation projects.

The proposed repayment program, if adopted, would involve the postponement of the repayment of the costs allocated to irrigation on the storage units and on a major portion of the irrigation costs of the participating projects, for a period of about 50 years. These irrigation costs for which repayment would be deferred would comprise, according to the report, a minimum of about $268 million, plus an unknown amount for the Navaho project.

Studies of the original reports on the participating projects indicate that about 85 percent of the irrigation costs would be repaid without interest by power revenues. Considering the time value of money, the postponement for about 50 years of repayment of a large part of the construction cost of the proposed development would obviously require a subsidy from the Federal Treasury that would have to be paid out of Federal taxes. The interest charges on the funds borrowed by the Federal Government to defray the irrigation costs of the project would never be repaid from project revenues and would have to be paid out of taxes even if the capital investments were eventually repaid.

It is recognized that the provision, under existing law, of interest-free money for irrigation reclamation projects involves a substantial subsidy from the Federal Treasury which must be borne out of taxes, comprising the cost of interest on funds advanced, which in a period of 40 years would aggregate an amount almost equal to the original capital investment even though the principal be fully repaid in equal annual installments during the 40-year period.

It would appear that the Secretary's proposal in the report under review, for repayment would in effect extend the development period, during which no repayment would be made on a major portion of the investment, to about 50 years for both new land and old lands receiving a supplemental water supply. Such a postponement in repayment obviously would greatly multiply the amount of the Federal subsidy involved.

Owing to the lack of detailed information on the revised costs, no exact figure for the amount of the subsidy that would be involved in the proposed repayment program can be given. However, it could be readily calculated if detailed information on costs were available. In any case, the accumulated debt or total subsidy would amount to several times the original investment. Whether this would be in the national interest is for the Executive and the Congress to determine. However, it is believed that a report should be made as to the true cost of the Federal subsidy involved under the proposed repayment program, so that the Executive and the Congress will be fully informed before making a decision with respect thereto.

Under the proposed program and method of financing, it appears that justification of the initially proposed participating irrigation projects and future decisions to build additional participating irrigation projects would depend not so much upon the merits of the individual projects as upon the availability of revenues, 50 or more years in the future, from power projects generally unrelated thereto physically. None of the participating projects recommended for initial construction would be in themselves financially sound according to information in the basic storage project report and the reports of 1950 and 1951 on the individual participating projects.

On the average the water users would be able to pay only about 15 percent of the irrigation investment on the 12 participating projects. The balance of the cost would have to be subsidized—the capital investment by power revenue and the interest charges in even greater amount for an indefinite period by the Federal Treasury through taxes.

To the extent that high power rates could and would be maintained for the next 75 to 100 years or more to subsidize additional participating irrigation projects, authorization of the overall plan of upper basin development as proposed in the report, with such program and procedure would constitute an advance appropriation of funds for the construction of future projects of unknown engineering and financial feasibility.

The Colorado River storage project appears to be basically a hydroelectric power project. The only showing of economic justification in the report is based solely on power revenues. Considered in this light, the financial feasibility of the storage project appears open to question for several reasons. Repayment of the reimbursable construction costs within the periods and at the power rates proposed would depend entirely upon: (1) Allocation of a large portion of the construction cost to irrigation on an interest-free basis; (2) postponement of the starting of repayment of the irrigation allocation for about 50 years; and (3) subsidization of the more costly units with surplus power revenues earned by the less costly units.

No clear and adequate justification is shown in support of the allocation of a large part of the cost of the storage project to irrigation. Justification for the allocation to irrigation of several hundred million dollars (over $98 million for the initial 2 units) depends upon the future authorization of projects for consumptive use of water in the upper basin. Only minor use could be made of the regulatory reservoirs of the storage project directly for water-consuming projects. Future irrigation projects as a rule would require individual storage facilities.

The one reason given for the proposed allocation to irrigation on the storage project is that the storage units would provide holdover capacity so that the upper basin can proceed with the development and use of water without violating the Colorado River compact. Information in the basic report shows that at the present and anticipated future rate of upper basin development, Glen Canyon alone would suffice for this purpose for 40 to 50 years hence. Furthermore, it appears that the additional consumptive use estimated for the participating reclamation projects proposed for initial authorization in the Secretary's report could be made even without Glen Canyon Reservoir.

However, the early construction of Glen Canyon Reservoir would be justified from other considerations and advantages. Based upon the cost analyses in the report, the Glen Canyon Reservoir and power development could be constructed and operated on a sound financial basis and, therefore, merits authorization at this time.

Analyses indicate that the cost of power from most of the other proposed units of the storage project, considered individually and on the basis of either the total cost or the power allocations alone, would be greater than the proposed selling price, and that, in fact, power revenues from the Glen Canyon unit would have to subsidize most, if not all, of the other storage units in addition to subsidizing participating irrigation projects. It appears questionable, therefore, whether certain of the storage units would be justified or needed, from the standpoint of either the holdover storage requirements or the value of the power produced.

The original 1950 report indicates an intent to market the power output of the upper-basin storage and power units in the upper-basin States, with little regard to potential market and needs for electric power in the lower-basin States. This question of power disposal is referred to in the supplemental report as a matter of policy to be determined.

There appears to be some question in the report as to the ability of the power market in the upper-basin States to absorb all of the power output, even of the initial two storage and power units, for a number of years in the future. Glen Canyon power could be readily disposed of in the lower basin, where there is a great need for additional power. It is believed that the question of policy on disposal of power, particularly from Glen Canyon, merits the special consideration of the Executive and the Congress.

CONCLUDING COMMENTS

1. California agencies have established rights in and to the waters of the Colorado River system under the Colorado River compact and related documents. The State of California has the duty of protecting and preserving those rights. Obviously, construction and operation of the proposed Colorado River storage project and participating projects would have substantial effect upon the quantity and quality of the available water supply and the operation of facilities in the lower basin and in California. The State is concerned that such developments shall not impair the established rights of California and its agencies in and to Colorado River water.

2. There are at least 10 major questions of interpretation of the compact which would be involved in and affect the proposed storage project and related reclamation developments. With respect to several of these questions the report under review is based upon what California believes are erroneous inter-

pretations of the compact. All of the questions are at issue in the pending case of *Arizona* v. *California et al.*, in the United States Supreme Court. California's basic position is that this State is conforming to the Colorado River compact and must insist that the Bureau of Reclamation and the States of the upper basin do so in the planning and administration of the Colorado River storage project and participating projects.

3. Revised analyses should be made and reported upon, based upon proper interpretation of the Colorado River compact, as to the need for holdover storage and as to the probable effects of its construction, filling, and operation upon the quantity and pattern of flow into the lower basin at Lee Ferry and upon the operation of lower-basin facilities.

4. Before development proceeds on any additional large-scale consumptive-use projects in the upper basin, a determination should be made as to the effects of increased upper-basin uses up to full development, upon the quality of the flow at Lee Ferry; and authorization of such additional projects, particularly transmountain diversion projects, in the upper basin should be deferred until satisfactory evidence is presented that such projects, in combination with existing projects and other projects contemplated under full development, would not have harmful effects on the quality of water remaining for use in the lower basin.

5. The plans for construction and operation of the upper-basin storage project and related reclamation projects, insofar as revealed in the original 1950 report and the Secretary's supplemental report under review, give no proper or adequate consideration to the effect of the proposals on the lower-basin developments and evidence little, if any, regard to the interests of the lower basin. Moreover, the engineering studies are vague and uncertain with respect to the effect of proposed upper-basin developments on the lower basin and additional studies are essential with respect thereto. The State of California desires full information as to what the effect of the proposed plan will be on existing and future developments below Lee Ferry and particularly on the quality and quantity of water available for use in California.

6. There are many problems that should and must be carefully studied and solved before authorizing or proceeding with any overall plan of development in the upper basin. In the meantime, some additional development could proceed if found justified for authorization by the Congress. However, it is the position of the State of California that the interests of the lower basin, and of California in particular, must be fully protected with proper safeguards in connection with any legislation for authorizing of additional development in the upper basin to the end that the construction and operation of the proposed projects shall fully conform with the Colorado River compact and related laws and documents.

7. The plan of financial operation of the project recommended by the Secretary departs materially from existing reclamation law and is not in accord with sound standards and policies. The proposed postponement for about 50 years of the repayment of a large part of the cost would result in a substantial increase in the national debt, constituting a subsidy to irrigation on the part of the Nation's taxpayers far beyond the subsidy contemplated under existing law. The magnitude of such subsidy should be clearly stated and explained in the report.

8. None of the participating reclamation projects recommended for initial authorization would be in themselves financially feasible. The water users could repay only small proportions of the reimbursable construction costs. The balance of the cost would have to be subsidized—the capital investment by power revenue and the interest charges in even greater amount for an indefinite period by the Federal Treasury through taxes.

9. No clear and adequate justification is shown in support of the allocation of a large part of the storage-project cost to irrigation on an interest-free basis. Only minor use could be made of the regulatory reservoirs of the storage project directly for water-consuming projects. The report indicates that the proposed allocation to irrigation on the storage project is based upon the need of holdover capacity to permit the upper basin to develop and use the water without violating the compact. However, it appears from the report that the additional consumptive use estimated for the reclamation projects proposed for initial authorization could be made without holdover storage, and that at the anticipated rate of development Glen Canyon Reservoir alone would suffice for this purpose for 40 to 50 years hence. Therefore, the justification for immediate construction of initial units of the storage project would be based upon other considerations and purposes to be served.

10. The early construction of Glen Canyon Reservoir would be justified from the standpoint of other immediate advantages. Based upon the cost analyses in the report, the Glen Canyon Reservoir and power development could be constructed and operated on a sound financial basis and therefore merits authorization at this time.

11. Glen Canyon power could be readily disposed of in the lower basin where there is a great need for additional power. The question of policy regarding its disposal merits the special consideration of the Executive and the Congress.

12. The cost of power for most of the proposed major storage and power units, other than Glen Canyon, would be greater than the proposed selling price for power, and interunit subsidies would be required principally from Glen Canyon power revenues to support the other units. It appears questionable, therefore, whether certain of the storage units would be justified or needed, from the standpoint of either the holdover storage requirements or the value of the power produced.

13. The proposal recommended by the Secretary for the Colorado River storage project and participating projects raises basic questions as to the proper criteria to determine the financial feasibility and economic justification of new reclamation developments, and particularly the criteria, policies, and procedures for repayment, and the amount of Federal subsidy that is justified. These basic questions are a matter of national policy which must and should be decided by the Executive and the Congress.

14. The State of California, in analyzing its own projects and in reviewing proposed Federal reclamation projects in California, has consistently stood for sound financial and economic standards upon which proposed developments should be evaluated and qualified for approval and authorization. It is the view of the State of California that all water-development projects, including the proposed projects under review herein, should qualify under sound criteria of feasibility and repayment as a matter of national policy in the best public interest.

Submitted by:

A. D. EDMONSTON,
State Engineer.

Approval recommended.

RAYMOND MATTHEW,
Chief Engineer, Colorado River Board of California.

Approved.

FRED W. SIMPSON,
Chairman, Colorado River Board of California.

SACRAMENTO, CALIF., *February 15, 1954.*

EXHIBIT C

(Accompanying testimony of Northcutt Ely)

Resolutions opposing S. 1555 and H. R. 4449, the Colorado River storage project bills in the 83d Congress, have been adopted by the following:

Colorado River Board of California
Imperial Irrigation District
Metropolitan Water District of Southern California
Los Angeles City Council
Central Labor Council of Los Angeles
Department of Water and Power of the City of Los Angeles
San Diego County Water Authority
San Diego City Council
Imperial County Board of Supervisors
Imperial County Farm Bureau
Holtville, Calif., Chamber of Commerce
Calexico, Calif., Chamber of Commerce
Calexico City Council
Coachella Valley County Water District
Rainbow Municipal Water District, San Diego County, Calif.
California State Chamber of Commerce, southern California council
Brawley, Calif., Chamber of Commerce
Brawley City Council
Calipatria, Calif., Chamber of Commerce

Westmorland, Calif., City Council
Council of the City of Burbank
Board of Supervisors of Orange County
Board of Directors of the City of Pasadena.

RESOLUTION OF COLORADO RIVER BOARD OF CALIFORNIA OPPOSING PENDING LEGISLATION AUTHORIZING COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

The Colorado River Board of California opposes the enactment of S. 1555 and H. R. 4449, 83d Congress, bills to authorize the Secretary of the Interior to construct, operate, and maintain initial units of the Colorado River storage project and participating projects, and for other purposes.

California favors the continuation of the development of the water resources of the Colorado River Basin on a sound economic basis, as the need for such development occurs. This State recognizes the right of the upper-basin States to so utilize the waters apportioned to that basin by the Colorado River compact as approved by the Boulder Canyon Project Act, but subject to the terms and conditions of those documents as the Supreme Court may construe them in the case of *Arizona* v. *California* now pending.

By the same token, California, in the protection of its investment of nearly $700 million in water-development projects which it has made in reliance upon the Colorado River compact and the Boulder Canyon Project Act, and the economy and population of more than 4 million people dependent upon these works, must resist legislation which would encroach upon the rights recognized in the lower basin States by those documents.

The proposed Colorado River storage project legislation adversely affects the lower basin States in much the same way as would the proposed central Arizona project legislation. Both are based upon interpretations of the Colorado River Compact and the Boulder Canyon Project Act with which California cannot agree and which are now at issue in the United States Supreme Court. Each of them contemplates developments which would encroach upon the compact and project act, as interpreted at the time of enactment of those laws, to the extent of more than a million acre-feet per year. Both proposals are based upon unrealistic water supply estimates. Each is in conflict with the presentation made to the Senate by the supporters of the Mexican Water Treaty. Each ignores the legal claims which are in conflict with it, and both ignore the damage which their construction would cause to the investments already made by their neighbors. Each of these proposals is dependent upon Federal subsidies for irrigation amounting to many times the value of the land when fully developed, and most of these subsidies are concealed. Both would commit the Congress to new feasibility standards and payout formulas with which this board and other California State agencies have officially expressed disapproval.

The Colorado River storage project would intercept the lower basin's water supply with giant reservoirs at Glen Canyon, Echo Park, and Curecanti, capable of storing several years' flow of the river. In the absence of statutory controls of the operation of such reservoirs designed to protect the output of firm power at Hoover Dam, upon which the United States and the power contractors relied, the use of such large storage could result in seriously curtailing the revenues at Hoover Dam and other dams on the lower river and upon which these lower projects depend for financing. It is against the best interest of both the power users in the lower basin and the Federal Treasury to so legislate.

Both Glen Canyon and Echo Park Reservoirs would be located downstream from any point of use by the proposed irrigation projects in the upper basin, and their major purpose would be to provide revenues, commencing almost 50 years hence, to pay the capital cost without interest of the irrigation projects proposed for construction now. This postponement for nearly 50 years of the commencement of repayment of irrigation would result in a Federal subsidy amounting to over $2,500 per acre of irrigated land—an unwarranted and unjustified burden on the Nation's taxpayers.

California, as a major taxpaying State, is doubly affected, for the amount of the overdraft on the water supply of the Colorado River Basin is directly related to the amount of Federal subsidy to the irrigation projects creating the overdraft.

The bills delegate to the Secretary of the Interior power to resolve the feasibility of the participating irrigation projects. If reclamation feasibility standards are to be changed, that should be done by Congress, in general legislation.

after the Hoover Commission has had an opportunity to report upon this very matter, heretofore committed to their study.

The proposed legislation includes some, and foreshadows other, large transmountain diversion projects in the upper basin using several million acre-feet of water annually, thereby impairing the quality as well as the quantity of the water available to the lower basin, and to which the lower basin is entitled under the Colorado River compact.

For all these reasons, the Colorado River Board of California respectfully requests the Representatives of this State in the Senate and House of Representatives of the United States to oppose the enactment of legislation to authorize construction of the Colorado River storage project and participating projects as proposed in these bills, S. 1555 and H. R. 4449, or similar legislation, and instructs its officers and staff to make the appropriate presentation of the views of this board to the congressional committees and executive agencies concerned with such legislation.

STATE OF CALIFORNIA,
County of Los Angeles, ss:

I, Harold F. Pellegrin, executive secretary of the Colorado River Board, do hereby certify that the foregoing is a true copy of a resolution unanimously adopted by said board at a regular meeting thereof, duly convened and held at its office in Los Angeles on the 2d day of June 1954, at which a quorum of said board was present and acting throughout.

Dated this 2d day of June 1954.

HAROLD F. PELLEGRIN,
Executive Secretary.

RESOLUTION OF IMPERIAL IRRIGATION DISTRICT, APPROVING TWO RESOLUTIONS OF COLORADO RIVER BOARD OF CALIFORNIA, AND EXPRESSING CONFIDENCE IN SAID BOARD AND ITS REPRESENTATIVES AND ADVISERS

RESOLUTION NO. 137–54

Whereas there has been called to the attention of the directors of Imperial Irrigation District, an irrigation district organized and existing under the laws of California, and serving in excess of one-half million acres of land in Imperial County, Calif., two certain resolutions of Colorado River Board of California, passed and adopted on June 2, 1954, which resolutions oppose S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas Imperial Irrigation District is a member agency and represented upon said Colorado River Board, and said Colorado River Board is an agency created by the legislature of the State of California to protect the interests of the State of California in and to the use and uses of waters of the Colorado River system: and

Whereas said two resolutions opposing Senate bills 964 and 1555 and House of Representative bills 236 and 4449, 83d Congress, which bills would authorize that certain project in California designated as the Frying Pan-Arkansas project, and would authorize a Colorado River storage project and participating project, all as more particularly outlined in said bills; and

Whereas the State of California and the Colorado River Board, representing the water users in California of the waters of the Colorado River system, have a vital interest in the waters of the Colorado River system; and

Whereas it is the honest belief of the board of directors of Imperial Irrigation District that said two resolutions of June 2, 1954, of the Colorado River Board opposing said pending legislation for the reasons and to the extent in said resolutions indicated are not only justified but are essential to the protection of the interests of the State of California and California's use of the waters of the Colorado River system; and

Whereas the board of directors is fully familiar with the organization and activities of said Colorado River Board, and has full confidence in this district's representation upon said Colorado River Board and in the advisers and representatives of this district, cooperating with and advising said Colorado River Board;

Now, therefore, on motion of Director Watton and seconded by Director McFarland, be it hereby resolved as follows:

1. That this board of directors does hereby go on record as expressing its confidence in the sincerity and purpose and activities of said Colorado River Board of California.

2. That this board expressed its confidence in the sincerity and purpose and activities of its representatives and advisers on and to said Colorado River Board of California.

3. That this board expresses its approval of said two resolutions which are hereto attached as passed by said Colorado River Board, and does hereby authorize and direct the secretary of this board to give full distribution to this resolution, including the mailing of copies of said resolutions to all Members of Congress in the State of California.

Passed and adopted June 8, 1954, by unanimous vote of this body.

IMPERIAL IRRIGATION DISTRICT,
By EVAN T. HEWES, *President.*
[SEAL] By MAHLON I. MATHIS, *Secretary.*

IMPERIAL IRRIGATION DISTRICT,
Office of the Secretary, ss:

This is to certify that the foregoing is a full, true, and correct copy of resolution No. 137–54 passed by the board of directors of Imperial Irrigation District at its regular session on the 8th day of June 1954.

In witness whereof, I have hereunto set my hand and affixed my seal of said district this 8th day of June 1954.

[SEAL] MAHLON I. MATHIS, *Secretary.*

BOARD OF DIRECTORS, THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

RESOLUTION 4433

Whereas the Metropolitan Water District of Southern California is one of the principal contractors, under the Boulder Canyon Project Act, for the storage and delivery of water from Lake Mead and for the delivery of electrical energy from the Hoover powerplant, and has a vital interest in the water available to the lower basin of the Colorado River under the Colorado River Compact, both as to quality and quantity, and also has a vital interest in the continued production of electrical energy from the Hoover powerplant in accord with estimates upon which the United States and California agencies relied in financing the project; and

Whereas there are pending in the Congress of the United States certain bills, to wit, S. 1555, H. R. 4449, S. 964, and H. R. 236, which, if enacted, would authorize large storage reservoirs and irrigation works in the upper basin of the Colorado River; and

Whereas the estimates of water available for the projects so sought to be authorized are based on erroneous interpretations of the Colorado River compact—these erroneous interpretations are adverse to the interests of millions of people in southern California whose lives and economy have been established upon the assurance that they would retain their share of Colorado River water; these erroneous interpretations are now under attack in the Supreme Court of the United States; and

Whereas said bills do not contain adequate provisions safeguarding the quality of water in the lower basin and do not contain adequate controls of the operation of the vast storage reservoirs proposed needed to protect the energy output from the Hoover power project; and

Whereas the Colorado River Board of California has adopted resolutions opposing the said bills and stating the reasons for its opposition: Now, therefore, be it

Resolved, That the enactment of said bills is against the interests of the Metropolitan Water District and other California agencies, and should be opposed; be it further

Resolved, That the Metropolitan Water District respectfully requests the representatives of the State of California in the Congress of the United States to oppose the enactment of the said bills or similar legislation, and further requests the municipalities and other agencies constituting the area of the Metropolitan Water District to join in requesing and urging such opposition.

I hereby certify, that the foregoing is a full, true, and correct copy of a resolution adopted by the board of directors of the Metropolitan Water District of Southern California, at its meeting held June 9, 1954.

A. L. GRAM,
Executive Secretary,
The Metropolitan Water District of Southern California.

CITY OF LOS ANGELES

RESOLUTION

Whereas the city of Los Angeles and the more than 2 million persons who now reside here are dependent upon the Colorado River for vitally important quantities of water and power for civic needs, as well as for residential and industrial uses; and

Whereas the share of Colorado River water and power for which this city has contracted and which it must continue to have to sustain its economy is threatened under the provisions of bills S. 1555 and H. R. 4449 now pending in Congress, which bills would authorize the initial units of the Colorado River storage project and participating projects: Now, therefore, be it

Resolved, That the Los Angeles City Council, acting for the welfare of the city and its residents, expresses its strong opposition to bills S. 1555 and H. R. 4449 and urges the Senators and Representatives in Congress from the State of California to oppose the enactment of that legislation; be it further

Resolved, That a copy of this resolution be sent to Vice President Richard M. Nixon, Senators William F. Knowland, and Thomas H. Kuchel, all Members of Congress from the State of California, and all members of the Rules Committee of the House of Representatives.

HAROLD A. HENRY,
CHARLES NAVARRO.

JUNE 23, 1954.

RESOLUTION

Whereas the Central Labor Council has consistently opposed legislation injurious to the welfare of the citizens of this city and the Nation; and

Whereas the Colorado River storage project bill (H. R. 4449), now pending before the Congress, would inflict on all American taxpayers an unjustifiable new burden; and

Whereas the economy of this city, the State of California, and the Nation would be seriously impaired by this costly and unnecessary project: Now, therefore, be it

Resolved, That the Central Labor Council vigorously oppose passage of H. R. 4449 by the Congress.

Adopted in regular session of the Los Angeles Central Labor Council, June 21, 1954.

[SEAL] W. J. BASSETT, *Secretary.*

RESOLUTION No. 1003

Whereas the Department of Water and Power of the City of Los Angeles has the obligation to provide for the water and power needs of the present population of this city, now numbering more than 2 million persons, and for the additional population that will have to be served as the city continues to grow; and

Whereas the Colorado River is depended upon as the sole source of water supply available now to meet that daily increasing need, all other sources of supply available to Los Angeles already being used to their limits; and

Whereas the Colorado River, through the Hoover Dam powerplant, is the largest single source of power supply for the city of Los Angeles and, in addition, generates hydroelectric power for other cities and utilities of this State, including the Metropolitan Water District, as well as for the States of Arizona and Nevada; and

Whereas the long-planned use by California of its fair share of the natural resources of the Colorado River is jeopardized by bills S. 1555 and H. R. 4449

now pending in Congress, which bills would "authorize the Secretary of the Interior to construct, operate, and maintain initial units of the Colorado River storage project and participating projects, and for other purposes"; and

Whereas premature and hasty action on those bills, while the Hoover Commission is still conducting its comprehensive studies on a national water resources policy program, would make drastic and piecemeal changes in reclamation law and would deprive the Congress of the benefit of a "yardstick" to measure the true economic costs and values of the proposed projects; and

Whereas California is vitally concerned with the proper management of the Colorado River so that all of the States entitled to share in its resources, under the terms of the "law of the river," may do so with greatest possible benefits to the respective States and to the United States: Now, therefore, be it

Resolved, That bills S. 1555 and H. R. 4449 in their present form be opposed because further engineering, legal, and economic studies, including the findings of the Hoover Commission, are essential for the guidance of all interests, local and national, that have the responsibility of making sound decisions respecting the future development of the resources of the Colorado River.

I hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the Board of Water and Power Commissioners of the City of Los Angeles at its meeting held June 15, 1954.

JOSEPH L. WILLIAMS, *Secretary.*

A RESOLUTION OF MEMBERS OF THE BOARD OF DIRECTORS OF THE SAN DIEGO COUNTY WATER AUTHORITY OPPOSING COLORADO RIVER STORAGE PROJECT AND FRYINGPAN-ARKANSAS PROJECT, AND ENDORSING ACTION OF COLORADO RIVER BOARD OF CALIFORNIA IN RESPECT THERETO

RESOLUTION NO. 318

The San Diego County Water Authority is the distributor of Colorado River water to the city and county of San Diego, Calif. Its citizens and taxpayers have obligated themselves for the payment of many millions of dollars the full cost of the works constructed for that purpose. The economy of the area and the water supply of its inhabitants depend upon the continued availability of water from the Colorado River in the quantity and of the quality to which California is entitled under the Colorado River compact and the Boulder Canyon Project Act.

The citizens of San Diego County, and, in fact, all of California, pay a very large proportion of taxes collected by the Federal Government, and consequently have a serious concern that Federal funds be not expended on projects of questionable economic feasibility or which must be financed by heavily subsidized formulas—with the result that California taxpayers are financing both their own projects and those for other areas that may result in diminishing the quantity and quality of the water upon which large sections of the State must depend.

The Colorado River Board of California opposes the enactment of the acts authorizing the Colorado River storage project (S. 1555 and H. R. 4449, 83d Cong.) and the Fryingpan-Arkansas project (S. 964 and H. R. 236, 83d Cong.) for the reasons that the projects would adversely affect the quantity and quality of the water to which this State is entitled, and could not be constructed without unwarranted Federal subsidies and financed upon a formula lacking economic feasibility.

The San Diego County Water Authority endorses and approves the position taken by the Colorado River Board, and joins in respectfully urging the representatives of this State in the Senate and House of Representatives to stand united in opposition to the enactment of legislation authorizing these projects—and to exert every effort to protect the people of this State from improper invasion of their water rights and unfair tax burdens to finance unsound projects.

STATE OF CALIFORNIA,
County of San Diego, ss:

I, Dorothy D. Miller, executive secretary of the San Diego County Water Authority, hereby certify that the foregoing is a true copy of a resolution approved by a majority of the members of the board of directors of said San Diego County Water Authority this 9th day of June 1954.

Executive Secretary of the Board of Directors, San Diego County Water Authority.

RESOLUTION No. 118512

Whereas the city of San Diego is a member of the San Diego County Water Authority and as such is a distributor of water to the city of San Diego, Calif. Its citizens and taxpayers have obligated themselves for the payment of many millions of dollars as the full cost of the works constructed for that purpose. The economy of the area and the water supply of its inhabitants depend upon the continued availability of water from the Colorado River in the quantity and of the quality to which California is entitled under the Colorado River compact and the Boulder Canyon Project Act.

Whereas the citizens of San Diego and, in fact, all of California, pay a very large proportion of taxes collected by the Federal Government, and consequently have a serious concern that Federal funds be not expended on projects of questionable economic feasibility or which must be financed by heavily subsidized formulas—with the result that California taxpayers are financing both their own projects and those for other areas that may result in diminishing the quantity and quality of the water upon which large sections of the State must depend.

Whereas the Colorado River Board of California opposes the enactment of the acts authorizing the Colorado River storage project (S. 1555 and H. R. 4449, 83d Cong.) and the Fryingpan-Arkansas project (S. 964 and H. R. 236, 83d Cong.) for the reasons that the projects would adversely affect the quantity and quality of the water to which this State is entitled, and could not be constructed without unwarranted Federal subsidies and financed upon a formula lacking economic feasibility: Now, therefore, be it

Resolved by the Council of the City of San Diego, as follows:

That the city of San Diego endorses and approves the position taken by the Colorado River Board, and joins in respectfully urging the representatives of this State in the Senate and House of Representatives to stand united in opposition to the enactment of legislation authorizing these projects—and to exert every effort to protect the people of this State from improper invasion of their water rights and unfair tax burdens to finance unsound projects.

Adopted June 10, 1954.

Presented ———.

Approved as to form by ———.

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE TO COLORADO RIVER STORAGE POJECTS

Whereas two resolutions have been called to the attention of the Board of Supervisors of the County of Imperial, State of California, copies of which are hereto attached and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555, and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River Board was authorized and created and provided for by the Legislature of the State of California as an agency to protect the interests of the State of California in and to the waters of the Colorado River system; and

Whereas as evidenced by the said two resolutions of June 2, 1954, of the Colorado River Board, said board opposes said pending legislation for the reasons and to the extent as in said resolution indicated, and this body feels that said Colorado River Board is justified in its position: Now, therefore, on motion of Supervisor Snyder, seconded by Supervisor Cavanah, there is hereby

Resolved as follows, on the affirmative rollcall vote of Supervisors Cavanah, Boley, Fifield, and Snyder, Supervisor Osborne being absent, 1. That we do

hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River Board, and authorize the county clerk to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 21st day of June 1954, by the unanimous action of this body.

BOARD OF SUPERVISORS OF THE COUNTY OF IMPERIAL,
STATE OF CALIFORNIA,
By THOMAS J. BOLEY, *Chairman.*
By HARRY M. FREE, *County Clerk.*

The foregoing is a correct copy of a resolution adopted by the board of supervisors, Imperial County, Calif., on June 21, 1954.

Dated June 22, 1954.

HARRY M. FREE,
Clerk of Said Board of Supervisors.
By E. W. DEMONEY, *Deputy.*

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the Imperial County Farm Bureau, copies of which are hereto attached and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555 and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River board was authorized and created and provided for by the Legislature of the State of California as an agency to protect the interests of the State of California in and to the waters of the Colorado River system; and

Whereas as evidenced by the said two resolutions of June 2, 1954, of the Colorado River board, said board opposes said pending legislation for the reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River board is justified in its position: Now, therefore,

On motion of Baxter Loveland, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River board, and authorize the secretary to mail copies of said resolution to all California Members of Congress.

Passed and adopted June 1954, by the unanimous action of this body.

IMPERIAL COUNTY FARM BUREAU,
By D. M. MIDDLETON, *President.*
By VERA PARKER, *Acting Secretary.*

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE TO COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the chamber of commerce of the city of Holtville, county of Imperial, State of California, copies of which are hereto attached and which have been passed by the Colorado River

Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555 and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that a certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River Board was authorized and created and provided for by the Legislature of the State of California as an agency to protect the interests of the State of California in and to the waters of the Colorado River system; and

Whereas, as evidenced by the said two resolutions of June 2, 1954, of the Colorado River Board, said board opposes said pending legislation for the reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River Board is justified in its position: Now, therefore,

On motion of Arthur Lockie, seconded by C. L. Martin, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River Board, and authorize the secretary of this body to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 21st day of June 1954, by the unanimous action of this body.

CHAMBER OF COMMERCE OF THE CITY OF HOLTVILLE,
COUNTY OF IMPERIAL, STATE OF CALIFORNIA,
PAULE J. NICK, *Secretary.*

I, Paule J. Nick, secretary of the Holtville Chamber of Commerce, do hereby certify that the foregoing resolution was unanimously passed and adopted by the board of directors of the Holtville Chamber of Commerce, at a regular meeting thereof, held the 21st day of June 1954, at which a quorum of said board was present and acting throughout.

Dated June 21, 1954.

PAULE J. NICK, *Secretary.*

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE TO COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the chamber of commerce of the city of Calexico, county of Imperial, State of California, copies of which are hereto attached and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555, and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River Board was authorized and created and provided for by the Legislature of the State of California as an agency to protect the interests of the State of California in and to the waters of the Colorado River system; and

Whereas, as evidenced by the said two resolutions of June 2, 1954, of the Colorado River Board, said board opposes said pending legislation for the

reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River Board is justified in its position: Now, therefore,

On motion of Earl Cavanah, seconded by Dexter Wright, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River Board, and authorize the secretary of this body to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 17th day of June 1954, by the unanimous action of this body.

CHAMBER OF COMMERCE OF THE CITY OF CALEXICO, COUNTY OF IMPERIAL, STATE OF CALIFORNIA,

[SEAL]

By HUGH E JAMISON, *President.*

By DAN KLEIN, *Secretary.*

RESOLUTION NO. 1251, CITY OF CALEXICO, CALIF.

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the city council of the city of Calexico, county of Imperial, State of California, copies of which are hereto attached and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress, and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River System, and

Whereas said two resolutions oppose Senate bills 964 and 1555 and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills, and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River board was authorized and created and provided for by the Legislature of the State of California as an agency to protest the interests of the State of California in and to the waters of the Colorado River system, and

Whereas as evidenced by the said two resolutions of June 2, 1954, of the Colorado River board, said board opposes said pending legislation for the reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River board is justified in its position;

Now, therefore, on motion of Carrillo, seconded by Barnes, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River board, and authorize the city clerk to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 15th day of June 1954, by the unanimous action of this body.

CITY COUNCIL OF THE CITY OF CALIFORNIA, COUNTY OF IMPERIAL, STATE OF CALIFORNIA,

By WM J. OSBORN, *Mayor.*

By RICHARD S. EMERSON, *City Clerk.*

49500—54——41

STATE OF CALIFORNIA,
County of Imperial, ss:

I, Richard S. Emerson, city clerk of the city of Calexico do hereby certify that the above and foregoing Resolution No. 1251 was duly passed and adopted by the city council of the city of Calexico in regular session on the 15th day of June 1954 by the following vote to wit:

Ayes: Osborn, Reed, Barnes, Carillo.
Noes: None.
Absent: Jackson.
[SEAL]

RICHARD S. EMERSON,
City Clerk, City of Calexico.

RESOLUTION NO. 54–29 OF THE BOARD OF DIRECTORS OF COACHELLA VALLEY COUNTY WATER DISTRICT

Be it resolved by the board of directors of the Coachella Valley County Water District, as a public agency of the State of California and a user of Colorado River water, in regular meeting assembled this 8th day of June 1954, That those two certain resolutions adopted by the Colorado River Board of the State of California on the 2d day of June 1954, entitled "Resolution of Colorado River Board of California Opposing Pending Legislation Authorizing Colorado River Storage Project and Participating Projects" and "Resolution of Colorado River Board of California Opposing Pending Legislation Authorizing Fryingpan-Arkansas Project in Colorado" be and the same are hereby approved and concurred in by this district with the same force and effect as if set out verbatim herein: Be it further

Resolved, That the secretary of this district be and she is hereby instructed to immediately forward to each Member of the United States Congress representing the State of California a certified copy of this resolution, together with a copy of each of the two resolutions of the Colorado River Board of the State of California, as hereinabove mentioned, attached hereto.

STATE OF CALIFORNIA,
County of Riverside, ss:

I, Barbara K. Schmid, secretary of the Coachella Valley County Water District, hereby certify that the foregoing is a true copy of a resolution unanimously adopted by the board of directors of said district at a regular meeting of said board of directors held on the 8th day of June 1954.

Dated this 10th day of June 1954.
[SEAL]

BARBARA K. SCHMID,
Secretary, Coachella Valley County Water District.

RESOLUTION OF THE RAINBOW MUNICIPAL WATER DISTRICT OPPOSING THE COLORADO RIVER STORAGE PROJECT AND FRYINGPAN-ARKANSAS PROJECT, AND ENDORSING THE ACTION OF THE COLORADO RIVER BOARD OF CALIFORNIA IN RESPECT THERETO

RESOLUTION NO. 8

Whereas the Rainbow Municipal Water District is a distributor of Colorado River water to the residents, citizens, and taxpayers located within the corporate area of the Rainbow Municipal Water District, and its citizens and taxpayers have obligated themselves for the payment of large sums of money used and to be used to defray the cost of works constructed for that purpose; and

Whereas the economy of its area and the water supply of its inhabitants depend upon the continued availability of water from the Colorado River in a quantity and of a quality to which California is entitled under the Colorado River compact and the Boulder Canyon Project Act; and

Whereas the citizens of the Rainbow Municipal Water District pay taxes collected by the Federal Government, and consequently have a serious concern that Federal funds be not expended on projects of questionable economic feasibility or which must be financed by heavily subsidized formulas with the result that its taxpayers are financing both their own projects and those of other areas, that may result in diminishing the quantity and quality of the water upon which this district and large sections of the county of San Diego and the State of California must depend; and

Whereas the Colorado River Board of California opposes the enactment of the acts authorizing the Colorado River storage project (S. 1555 and H. R. 4449, 83d Cong.) and the Fryingpan-Arkansas project (S. 964 and H. R. 236, 83d Cong.) for the reasons that the projects would adversely affect the quantity and quality of the water to which the State of California is entitled, and could not be constructed without unwarranted Federal subsidies and financed upon a formula lacking economic feasibility: Now, therefore, it is

Resolved, That the Rainbow Municipal Water District endorses and approves the position taken by the Colorado River Board of California, and joins in respectfully urging the representatives of this State in the Senate and House of Representatives to stand united in opposition to the enactment of legislation authorizing these projects, and to exert every effort to protect the people of this district, of the county of San Diego and of the State of California from improper invasion of their water rights and unfair tax burdens to finance unsound projects.

STATE OF CALIFORNIA,
County of San Diego, Rainbow Municipal Water District, ss:

I, Ben G. Martin, secretary of the Rainbow Municipal Water District, hereby certify that the foregoing is a true and correct copy of a resolution duly and regularly passed by unanimous vote of all of the directors of said district at a meeting held on the 11th day of June 1954.

BEN G. MARTIN,
Secretary of the Board of Directors and of the Rainbow Municipal Water District.

CALIFORNIA STATE CHAMBER OF COMMERCE,
Los Angeles, Calif., June 1954.

RECOMMENDATIONS OF THE SOUTHERN CALIFORNIA COUNCIL SEMIANNUAL MEETING AT LOS ANGELES, MAY 26, 1954

Twenty subjects of current concern to business were considered by seven committees of the Southern California Council meeting at the Statler Hotel, Los Angeles, on May 26, 1954. Following are recommendations of the council adopted at the general luncheon session, which are referred to the appropriate statewide committees and to the board of directors for approval and final implementation by the State chamber organization.

Background data respecting any of these recommendations or other items on the program sent to council members may be obtained by contacting the southern California regional office.

The agricultural committee, Donald A. Stevning, chairman, considered problems in the marketing of agricultural products and discussion of possible entry into the United States from northern Mexico of the Mexican fruitfly resulted in the following recommendation:

That the appropriate committees of Congress be fully advised of this situation with the request that funds be made aavilable to carry on the work of the United States Department of Agriculture in attempting to prevent entry of this pest into California; and, further, that the United States Government urge the Government of Mexico to instigate adequate control measures against this pest in Mexico.

The natural resources committee, Frederick W. Simpson, chairman, heard comment on offshore oil development and the current thinking on best use of State tidelands funds. Regarding the threat to southern California's Colorado River water supply contained in two legislative bills now before Congress calling for almost complete development of the upper Colorado River Basin in Wyoming, Utah, and Colorado, and the proposed creation of a new State water department, the committee made the following recommendations:

That the State chamber of commerce support the position of the Colorado River Board of California and oppose the present upper Colorado River Basin projects as provided in H. R. 4449 and S. 1555 and the so-called Arkansas-Fryingpan project in H. R. 236 and S. 964.

That the State chamber of commerce support legislation in the next session of the legislature to create a new and independent State water department.

The highway committee, Frank G. Forward, chairman, was informed of State freeway location policies and studied assembly constitutional amendment 32, which proposes use of highway-tax funds for parking facilities, and problems

in connection with proposed bus turnouts on freeways, resulting in the following recommendations:

That the Southern California Council recommends that the California State Chamber of Commerce oppose assembly constitutional amendment No. 32, which will appear as a ballot proposition at the November 1954 general election.

That the Southern California Council recommends that the California State Chamber of Commerce set up a special study committee within the statewide highway committee for the purpose of studying all aspects of the proposal that bus turnouts be provided upon metropolitan freeways.

The tax committee, Clarence A. Rogers, vice chairman, regarded the State budget for 1954–55, separation of taxation from liquor administration (S. C. A. 4), and State finance of public-school construction (S. C. A. 3), adopting the following recommendations:

That the Southern Council approve senate constitutional amendment No. 4, which would establish a department of alcoholic-beverage control and an appeal board.

That the Southern Council approve the senate constitutional amendment No. 3 which will authorize the issuance of $100 million by the State for grants and loans to school districts for school construction.

The travel and recreation committee, H. H. (Bob) Roberts, chairman, received reports on the 1953–54 southern California winter-sports season, some proposals for development of beaches and parks with State tidelands funds, southern California's current roadside-cleanup and roadside-rests programs, and developed the following recommendations:

That the Southern California Council urge the State chamber to continue to give top priority to the roadside cleanup campaign.

That the Southern California Council urge the State chamber to take steps to get house action on bills now before the House Committee on Agriculture to provide funds for sanitation and improved recreation facilities in national forests.

The industrial and industrial insurance committees (in joint session), Edward Mills, chairman of latter group, presiding, reviewed pension plans and collective bargaining, legislative studies on unemployment insurance, and the future of workmen's compensation insurance, and discussed trends in Federal and State labor-management legislation. No recommendations were made.

An industrial survey workshop, George N. Hawley presiding, was held to provide chamber of commerce managers and local industrial development interests with practical aids and answers on the best procedures and methods to employ in compiling community industrial surveys.

ATTENDANCE AT SOUTHERN CALIFORNIA COUNCIL MEETING, STATLER HOTEL, LOS ANGELES, MAY 26, 1954

IMPERIAL COUNTY

Bill Duflock
Leonard McClintock

INYO COUNTY

Bertha Horine

ORANGE COUNTY

Herb Alleman
A. A. Beard
J. A. Bradley
J. H. Bray
P. H. Budd
Robert L. Clark
Ted Craig
Eric E. Eastman
Selim H. Franklin
Clint Flynn
William Gallienne
Mrs. G. R. Gough
George Kellogg

ORANGE COUNTY—con.

H. F. Kenny
Allen S. Koch
Stephen F. Michalec
H. G. Osborne
Walter Schmid
Ross A. Shafer
Donald S. Smiley
Willard Smith
H. Sprenger
Harry Welch
C. L. Young

RIVERSIDE COUNTY

L. M. Backstrand
D. R. Crane
Stuart A. Cundiff
Sam Dictor
Nelson S. Dilworth
R. R. Drake
Dennis P. Flanagan
George C. Gerwing

RIVERSIDE COUNTY—con.

G. R. Gough
A. C. Keith
Donald Stevning
Tyler Suess
Walter E. Vaughn, Jr.
R. H. Westbrook
A. Chesnaye Woodill

SAN BERNARDINO COUNTY

Donald DeMent
John H. Fairweather
J. Clay Garrison
Max H. Green
William F. Hauser
Horace P. Hinckley
C. V. Kane
George McCarthy
Frank H. Mogle
Frank E. Mosher
Mrs. Pearl Pettis
J. J. Prendergast

ATTENDANCE AT SOUTHERN CALIFORNIA COUNCIL MEETING, STATLER HOTEL, LOS ANGELES, MAY 26, 1954—Continued

SAN BERNARDINO COUNTY—continued

George W. Savage
George R. Seals
H. P. Shawlee
Maj. L. A. Silvernail
E. Q. Sullivan
John W. Swoap
Floyd A. Taylor
D. M. Tucker
A. W. Walker
Robert L. Walker
R. V. Ward

SAN DIEGO COUNTY

John F. Borchers
Frank G. Forward
Robert Hays
J. F. Jorgensen
R. M. Levy
J. H. Mack
Albert E. Matlack
Bob Rundell
M. J. Shelton
Ray E. Schafer
Frederick C. Sherman
Fred Simpson
E. E. Wallace
Gilbert S. Wright

SANTA BARBARA COUNTY

C. Leo Preisker
Clarence A. Rogers
Stanley T. Tomlinson
O. V. Wilson

VENTURA COUNTY

Clifford F. Ahlers
Al Albinger
Thomas L. Bailey
Edwin C. Bixby
John S. Broome
Mrs. Ina E. Clifton
Joseph F. Daly
A. C. Hardison
Robert W. Lefever
Lloyd E. McCampbell
L. S. Peterman
James F. Shiells
Alma K. Stark
William H. Tolbert

OUT OF DISTRICT

R. W. Bruce
Stanley Burke
Thomas W. Caldecott
Frank P. Gomez
E. S. Gregory
C. N. Gustafson
Carter Harrison

OUT OF DISTRICT—con.

Carl Lloyd
William J. Losh
A. F. Mather
S. E. Wood
C. W. Weinberger
Victor H. Owen, Jr.
E. J. L. Peterson

LOS ANGELES COUNTY

R. F. Ahern
Howard P. Allen
J. C. Allen
Frederic L. Alexander
W. E. Alworth
George O. Alloway
A. W. Althouse
William Andrews
E. R. Arner
H. G. Arnold
Jim Armstrong
Wesley S. Bagby
Harrison R. Baker
L. D. "Joe" Bale
Hugh Barnes
Stuart M. Bate
Edwin Bates
Frank D. Battistini
R. H. Beaton
Ed Beaty
E. E. Benedict
E. Maxwell Benton
Sidney H. Bierly
C. D. Bishop
Harry F. Blaney
Thomas W. Blazey
Russell S. Bock
Max Bookman
R. E. Boyden
George E. Boysen
John R. Brainard, Jr.
Calvin E. Bream
William Breiby
Milton Breivogel
Harold U. Brown
I. E. Brown
Mrs. Nedra Brown
Ralph Buffon
G. S. Bulkley
Lewis Burke
T. S. Burnett
Norman E. Burns
Carl Bush
John D. Bushnell
Curtis C. Byrne
John C. C. Byrne
Leo Carrillo
Homer F. Caswell
Jim R. Chaffee
Bernard E. Chamberlain
Robert L. Chambers
Chuck Chandler
Larry Chandler

LOS ANGELES COUNTY—con.

Felix Chappellet
A. L. Chavannes
Dale V. Clanton
Harry Cheshire
Ralph O. Chick
N. L. Clarine
D. E. Cole
Guthrie Collins
M. E. Collins
J. William Connor
Elmer Cook
Lawrence T. Cooper
F. W. Converse
C. W. Coughlin
William F. Cowan
Charles J. Cox
Glenn A. Crawford
William B. Crowell
Art Curry
A. N. Curtiss
Roger H. Davis
M. M. Davore
Mrs. Stanley D. Decker
Arthur H. Deibert
Louis F. DeMartini, Jr.
Anthony J. DiStasi
James A. Doherty
Homer L. Duffy
Ralph C. Durke
E. E. East
William J. Edelhauser
L. E. Edwards
Mrs. Liston M. Edwards
W. E. Elieson
Matt English
Garabed Ezmirlian
W. L. Fahey
Paul S. Farr
H. G. Feraud
L. W. Ferguson
Ralph V. Fitting
Ben S. French, Jr.
V. F. Frizzell
L. E. Fuller
Lamar W. Gardner
R. V. Garrod
Douglas G. Gittins
Wesley J. Gordon
Theodore Grant
Robert Greenwald
H. V. Griffitts
John D. Hackstaff
Frank B. Hagan
Mrs. Jean W. Haley
Mrs. Waldo E. Handy
Phil Townsend Hanna
George B. Hanson
Allen D. Harper
Mrs. John H. Harris
Paul Harvey
Earl A. Hawkes
George N. Hawley
Edwin C. Heath

ATTENDANCE AT SOUTHERN CALIFORNIA COUNCIL MEETING, STATLER HOTEL, LOS ANGELES, MAY 26, 1954—Continued

LOS ANGELES COUNTY—con.

Mrs. Robert G. Hees
F. R. Herrmann
Miss Jo Anne Hewitt
Charles J. Higson
H. F. Holley
L. W. Hood
R. S. Horne
E. Horsfall
F. J. Hortig
C. H. Howard
James S. Howie
H. R. Hudsen
L. A. Irvin
W. M. Jacobs
Hayden F. Jones
Robert L. Jordan
Waldo Johns
W. H. Johnson
Ken Kendrick
Howard Kennedy
Sam R. Kennedy
Boyd Kern
M. William Killars
Alfred H. King
S. E. Kingsley
Raymond W. Kinne
Don J. Kinsey
LeRoy G. Kline
George Klimmer
Mrs. George Klimmer
L. E. Knox
Charles L. Kopp
O. John Krause
Dr. J. R. Lacayo
C. L. LaForce
Stanley M. Lanham
Frank Lanterman
Lloyd Lanterman
Howard F. LeBaron
Charles T. Leeds
C. R. Leslie
Harold K. Levering
A. M. Levy
C. C. Lincoln
W. R. Lindersmith
Ernest L. Leon
Leonard Longacre
Thomas L. Lowe
Mrs. J. M. Luney
F. C. Lynch
LeRoy E. Lyon, Sr.
R. F. MacNally
Joe Manning
Merth E. Martenson
George E. Martin
Fels Matheny

LOS ANGELES COUNTY—con.

C. Chris Matthews
Jack Matthews
Raymond Matthew
J. C. E. McClure
Robert McClure
Harold McGlynn
A. D. McLennan
John A. McNeil
DeWitt Meredith
Ruth E. Meilandt
Earl O. Miller
Howard A. Miller
Jack Miller
Edward Mills
Robert L. Minckler
R. A. Moody
C. B. Moore
R. E. Moon
Howard V. More
Tom T. Morris
Beatrice Mozanoff
Karl R. Naumann
Lynn Newcomb
Luther A. Nichols
William Howard Nicholas
T. S. Norton
R. A. Olmsted
Elmer Olsen
Emery E. Olson
L. W. Olson
Robert F. O'Neill
LeRoy D. Owen
Don Packer
G. R. Pahlman
Charles H. Palmer
Kyle Palmer
W. J. Palmer
John G. Payson
Everett B. Peck
H. H. Peters
W. F. Peterson
Everett A. Philipp
O. V. Pope
W. R. Powell
C. L. Prow
William A. Pixley
Walter L. Reynolds
H. C. Rice
J. E. Richardson
Lyman P. Robertson
H. H. Roberts
Stewart J. Rogers
L. D. Romig
R. W. Rood
Leigh Russell
W. D. Shaw

LOS ANGELES COUNTY—con.

James G. Shea
David G. Shearer
George H. Shellenberger
M. B. Silberberg
John A. Simpson
John E. Skelton
Charles K. Slack
Francis M. Small
Earl A. Smith
Clarence L. Smith
William French Smith
F. W. Spencer
Marvin J. Stacy
Charles R. Stapleton
Dave Starr
John B. Steinweden
Kenneth C. Stever
Ron Stever
Bryant Stirdivant
M. Stockwell
Erich F. Stuewe
D. F. Swartling
E. Wood Tebbe
Edward T. Telford
W. C. Tesche
Calvin T. Thomas
John M. Thompson
Thomas W. Tily
George W. Trefts
N. Bradford Trenham
George N. Tucker
Thomas F. Tugwell
R. C. Trygstad
Max Eddy Utt
James E. Umfrid
T. L. Van Law
Clark F. Waite
F. C. Walker
Paul D. Walker
Jack Wallace
A. G. Walsworth
Paul K. Webster
Earl M. Welty
S. F. Whaley
David L. Williams
J. S. Willmarth, Jr.
Melvin D. Wilson
Hugo H. Winter
Floyd Wohlwend
L. H. Wohlwend
Homer H. Woodling
D. W. Woods
Harold W. Wright
Mildred Younger
Richard H. Zeller

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE TO COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the Chamber of Commerce of the City of Brawley, County of Imperial, State of California, copies of which are hereto attached and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555 and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River Board was authorized and created and provided for by the Legislature of the State of California as an agency to protect the interests of the State of California in and to the waters of the Colorado River system; and

Whereas as evidenced by the said two resolutions of June 2, 1954, of the Colorado River Board, said board opposes said pending legislation for the reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River Board is justified in its position: Now, therefore,

On motion of William Dillard, seconded by Gene Bryant, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River Board, and authorize the secretary of this body to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 10th day of June 1954 by the unanimous action of this body.

CHAMBER OF COMMERCE OF THE CITY OF BRAWLEY, COUNTY OF IMPERIAL, STATE OF CALIFORNIA,
By D. E. WEBB, *President*,
By D. WAYNE ROBERTSON, *Secretary*.

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the City Council of the city of Brawley, county of Imperial, State of California, copies of which are hereto attached and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555 and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River Board was authorized and created and provided for by the Legislature of the State of California as an agency to

protect the interests of the State of California in and to the waters of the Colorado River system; and

Whereas as evidenced by the said two resolutions of June 2, 1954, of the Colorado River Board, said Board opposes said pending legislation for the reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River Board is justified in its position: Now, therefore,

On motion of W. L. Powell, seconded by Joe Rodriquez, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River Board, and authorize the city clerk to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 21st day of June 1954, by the unanimous action of this body.

CITY COUNCIL OF THE CITY OF BRAWLEY, COUNTY OF IMPERIAL, STATE OF CALIFORNIA,
By PAT WILLIAMS, *Mayor.*
[SEAL] By CHARLES A. WARREN, *City Clerk.*

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-KANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE TO COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the chamber of commerce of the city of Calipatria, county of Imperial, State of California, copies of which are hereto attached and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. .449, 83d Congress; and

Whereas this body is familiar with the organization, functions and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555 and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated at the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River Board was authorized and created and provided for by the Legislature of the State of California as an agency to protest the interests of the State of California in and to the waters of the Colorado River System; and

Whereas as evidenced by the said two resolutions of June 2, 1954, of the Colorado River Board, said board opposes said pending legislation for the reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River Board is justified in its position.

Now, therefore, on motion of William H. Sorenson, seconded by Harry Momita, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River Board, and authorize the secretary of this body to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 16th day of June 1954, by the unanimous action of this body.

CHAMBER OF COMMERCE OF THE CITY OF CALIPATRIA, COUNTY OF IMPERIAL, STATE OF CALIFORNIA.
By GORDON B. BARRINGTON, *President.*
By R. M. CHAPMAN, *Secretary.*

RESOLUTION APPROVING THE COLORADO RIVER BOARD OF CALIFORNIA AND ITS POSITION OPPOSING PENDING LEGISLATION AUTHORIZING THE FRYINGPAN-ARKANSAS PROJECT IN COLORADO AND ITS RESOLUTION OPPOSING PENDING LEGISLATION RELATIVE COLORADO RIVER STORAGE PROJECTS

Whereas two resolutions have been called to the attention of the City Council of the City of Westmorland, County of Imperial, State of California, copies of which are hereto attached, and which have been passed by the Colorado River Board of California on June 2, 1954, opposing S. 964 and H. R. 236, and S. 1555 and H. R. 4449, 83d Congress; and

Whereas this body is familiar with the organization, functions, and activities of the Colorado River Board of California and its representation of California in connection with matters relating to the Colorado River system; and

Whereas said two resolutions oppose Senate bills 964 and 1555 and House of Representatives bills 236 and 4449, 83d Congress, which bills would authorize that certain project in Colorado designated as the Fryingpan-Arkansas project and would authorize a Colorado River storage project and participating projects, more particularly set forth in said bills; and

Whereas the State of California has a vital interest in the waters of the Colorado River system and said Colorado River Board was authorized and created and provided for by the Legislature of the State of California as an agency to protect the interests of the State of California in and to the waters of the Colorado River system; and

Whereas, as evidenced by the said two resolutions of June 2, 1954, of the Colorado River Board, said board opposes said pending legislation for the reasons and to the extent as in said resolutions indicated, and this body feels that said Colorado River Board is justified in its position: Now, therefore, on motion of Councilman Stuart, seconded by Councilman Martin, there is hereby resolved as follows:

1. That we do hereby express our confidence in the Colorado River Board of California as representing the interests of California as to the Colorado River system and the waters thereof.

2. We do hereby expressly approve said two resolutions which are hereto attached as the action of said Colorado River Board and authorize the city clerk to mail copies of said resolution to all California Members of Congress.

Passed and adopted this 14th day of June 1954 by the unanimous action of this body.

[SEAL]

CITY COUNCIL OF THE CITY OF WESTMORLAND,
COUNTY OF IMPERIAL, STATE OF CALIFORNIA,
By BEULA A. RUSSELL, *Mayor.*
By ELIZABETH HUFFINER, *City Clerk.*

RESOLUTION No. 9780, OPPOSING SENATE BILL 1555; HOUSE BILL 4449; S. 964 AND H. R. 236 OR SIMILAR LEGISLATION PENDING IN THE CONGRESS OF THE UNITED STATES

Whereas the city of Burbank is vitally dependent upon a water supply obtained from the Colorado River; and

Whereas the Colorado River storage project as proposed in S. 1555 and H. R. 4449 and the Fryingpan-Arkansas project as proposed in S. 964 and H. R. 236, now pending in the Congress of the United States of America, would jeopardize the water rights and the water supply of the city of Burbank, Calif.; and

Whereas the aforementioned projects would inflict on the taxpayers of the city of Burbank and on the entire Nation an unjustifiable burden: Therefore be it

Resolved, That the enactment of these project bills is against the interest of the city of Burbank and should be opposed; and be it further

Resolved, That the city council of the city of Burbank, Calif., respectfully request the representatives of the State of California in the Congress of the United States to oppose the enactment of the above-mentioned bills or any similar legislation and that copies of this resolution be forwarded by the city clerk forthwith to the Hon. William F. Knowland and Hon. Thomas H. Kuchel, United

States Senators, and to all the California Representatives in the Congress of the United States.

Passed and adopted this 25th day of June 1954.

CARL M. KING,
President of the Council of the City of Burbank.

Attest:

NAOMI G. PUTNAM,
City Clerk.

STATE OF CALIFORNIA,
County of Los Angeles, City of Burbank, ss:

I, Naomi G. Putnam, city clerk of the city of Burbank, do hereby certify that the foregoing resolution was duly and regularly passed and adopted by the council of the city of Burbank at its regular adjourned meeting held on the 25th day of June 1954 by the following votes:

Ayes: Councilmen Bank, Blais, Hilton, and King.

Noes: None.

Absent: Councilman Jolley.

NAOMI G. PUTNAM,
City Clerk.

RESOLUTION OF THE BOARD OF SUPERVISORS OF ORANGE COUNTY, CALIF., JUNE 15, 1954

On motion of supervisor Featherly, duly seconded and carried, the following resolution was adopted:

Whereas the county of Orange in the State of California is vitally dependent on a water supply obtained from the Colorado River;

Whereas the Colorado River storage project bill (H. R. 4449), now pending in the Congress, would jeopardize the water rights and the water supply of the county of Orange;

Whereas the Colorado River storage project would inflict on the taxpayers of this county and the Nation an unjustifiable burden: Therefore be it

Resolved by the Board of Supervisors of Orange County, That the enactment of the Colorado River storage project bill is against the interests of the county of Orange and should be opposed; be it further

Resolved, That the county of Orange respectfully requests the representatives of the State of California in the Congress of the United States to oppose the enactment of this bill or any similar legislation.

Ayes: Supervisors C. M. Featherly, Willard Smith, Ralph J. McFadden, Heinz Kaiser, and Willis H. Warner.

Noes: None.

Absent: None.

STATE OF CALIFORNIA,
County of Orange, ss:

I, B. J. Smith, county clerk and ex-officio clerk of the Board of Supervisors of Orange County, Calif., hereby certify that the above and foregoing resolution was duly and regularly adopted by the said board at a regular meeting thereof held on the 15th day of June 1954 and passed by a unanimous vote of said board.

In witness whereof, I have hereunto set my hand and seal this 15th day of June 1954.

B. J. SMITH,
County Clerk and ex-officio Clerk of the Board of Supervisors of Orange County, Calif.

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE CITY OF PASADENA OPPOSING FEDERAL LEGISLATION AUTHORIZING COLORADO RIVER STORAGE PROJECTS

Whereas the city of Pasadena is dependent on a water supply obtained from the Colorado River; and

Whereas the Colorado River storage project as proposed in S. 1555 and H. R. 4449 and the Fryingpan-Arkansas project as proposed in S. 964 and H. R. 236, now pending in the Congress, would jeopardize the water rights and the water supply of the city of Pasadena; and

Whereas the projects aforesaid would inflict on the taxpayers of this city and the Nation an unjustifiable burden: Therefore be it

Resolved, That the enactment of these project bills is against the interest of the city of Pasadena and should be opposed: be it further

Resolved, That the city of Pasadena respectfully requests the representatives of the State of California in the Congress of the United States to oppose the enactment of the bills aforesaid or any similar legislation.

EXHIBIT D

RESOLUTIONS OF THE AMERICAN PUBLIC POWER ASSOCIATION, MAY 1954, OPPOSING THE USE OF THE COLLBRAN FORMULA AND EXCESSIVE SUBSIDIES TO IRRIGATION

RESOLUTION NO. 8.—INTEREST COMPONENT—COLLBRAN FORMULA

Whereas the American Public Power Association, composed of the principal locally owned public power systems of the United States, has a direct concern in the standard of financial operations established for Federal power projects, as any public discredit resulting from uneconomic Federal power policies reflects in a degree upon the locally owned public power systems; and

Whereas the American Public Power Association disapproves the Federal power practice of diverting from the Federal Treasury the interest component of revenues derived from the power investment portion of Bureau of Reclamation projects, and using the interest so collected for retirement of capital amounts invested in irrgation projects instead of for paying interest on the resulting national debt; and

Whereas the Collbran formula proposed by the Bureau of Reclamation indirectly effects the same result, by postponing the commencement of repayment of the irrigation investment until the power investment is first retired, and is equally unsound; and

Whereas in the aggregate the sums involved in diversion of the interest component and Collbran formula would require the replacement through added taxes of many billions of dollars for the numerous reclamation projects now proposed, and

Whereas this association has been on record since 1946 as not opposing a reasonable subsidy to irrigation from power revenues, but insists as a matter of principle and sound economics, that any irrigation subsidy believed to be in the public interest should be clearly set forth and be specifically recognized and approved as such in authorization of the project by the Congress; and

Whereas as stated in this association's statement of power policy, total capital costs paid from power revenues shall not exceed the amount for which a comparable supply of power could have been developed had irrigation not been one of the purposes of the project: Now, therefore, be it

Resolved, That the American Public Power Association condemns these practices and recommends that they not be employed in future Reclamation Bureau projects. This recommendation is made in the best interests of the American taxpayer, of the public power industry, and of the public it serves. Adoption of such a reform would avoid a concealed subsidy, the benefits of which go to only a limited number of persons at the expense of the Federal Treasury.

RESOLUTION NO. 8 (A)—EXCESSIVE SUBSIDIES TO RECLAMATION

Be it resolved, The American Public Power Association is opposed to the increasing burden which is being placed upon the power users in order to subsidize irrigation projects. In some projects recently proposed by the Bureau of Reclamation the irrigators are required to pay less than 15 percent of the costs allocated to irrigation, and the power users are required to pay more than 85 percent thereof plus all the costs allocated to power. In other cases the subsidy to be exacted from the power users would amount to the equivalent of nearly $100,000 for each 160-acre farm. This practice is not in the public interest.

This association's declaration of "Federal power policy" states that when irrigation is one of the joint purposes of a project, power revenues may be used to pay that portion of the capital costs properly chargeable to irrigation which is beyond the ability of the irrigators to pay, but that the total capital

costs to be paid from power revenues shall never exceed the amount for which a comparable supply of power could have been developed had irrigation not been one of the purposes of the project. This formula concedes fair and adequate subsidies to irrigation from the power users. If a reclamation project is sufficiently meritorious to justify greater subsidies, they should be fully disclosed, and paid from the general treasury.

(Copied from Public Power, vol. 12, No. 6, dated June, 1954.)

CITY OF SAN JACINTO

RESOLUTION NO. 448—A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SAN JACINTO, RESPECTING SENATE BILL 1555 AND H. R. 4449 IN RESPECT TO STORAGE WATER PROJECTS IN THE COLORADO RIVER BASIN

Whereas the city of San Jacinto is vitally dependent on a water supply obtained from the Colorado River;

Whereas the Colorado River storage project as proposed in S. 1555 and H. R. 4449 and the Fryingpan-Arkansas project as proposed in S. 964 and H. R. 236, now pending in the Congress, would jeopardize the water rights and the water supply of the city of San Jacinto;

Whereas the aforementioned projects would inflict on the taxpayers of this city and the Nation an unjustifiable burden: Therefore be it

Resolved, That the enactment of these project bills is against the interest of the city of San Jacinto and should be opposed; and be it further

Resolved, That the city of San Jacinto respectfully requests the representatives of the State of California in the Congress of the United States to oppose the enactment of the above-mentoned bills or any similar legislation.

Moved, passed, and adopted at a special meeting of the City Council of the City of San Jacinto, a California municipality, duly called and held on June 30, 1954.

Dated June 30, 1954.

W. M. KOLB,
Mayor, City of San Jacinto.

Attest:

MARGARET D. BELTZNER,
City Clerk, City of San Jacinto.

RESOLUTION NO. 54-91—EXPRESSING OPPOSITION TO H. R. 4449

Whereas the city of Santa Ana, Calif., is vitally dependent on a water supply obtained from the Colorado River;

Whereas the Colorado River storage project bill (H. R. 4449), now pending in the Congress, would jeopardize the water rights and the water supply of the city of Santa Ana;

Whereas the Colorado River storage project would inflict on the taxpayers of this city and the Nation an unjustifiable burden: Therefore be it

Resolved by the City Council of the City of Santa Ana, That the enactment of the Colorado River storage project bill is against the interests of of the city of Santa Ana and the county of Orange and should be opposed; be it further

Resolved, That the city of Santa Ana respectfully requests the representatives of the State of California in the Congress of the United States to oppose the enactment of this bill or any similar legislation.

Passed and adopted by the City Council of the City of Santa Ana at its regular meeting held on the 21st day of June 1954.

COURTNEY R. CHANDLER, *Mayor.*

Attest:
[SEAL]

ERMA KEELER,
Clerk of the Council.

RESOLUTION NO. 2595

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF TORRANCE OPPOSING S. 1555 AND H. R. 4449 AND THE FRYINGPAN-ARKANSAS PROJECT AS PROPOSED IN S. 964 AND H. R. 236, NOW PENDING IN THE CONGRESS

The City Council of the City of Torrance does resolve as follows:

Whereas the city of Torrance is vitally dependent on a water supply obtained from the Colorado River; and

Whereas the Colorado River storage project as proposed in S. 1555 and H. R. 4449 and the Fryingpan-Arkansas project as proposed in S. 964 and H. R. 236, now pending in the Congress, would jeopardize the water rights and the water supply of the city of Torrance; and

Whereas the aforementioned projects would inflict on the taxpayers of this city and the Nation an unjustifiable burden: Now, therefore, be it

Resolved by the City Council of the City of Torrance, That the enactment of these project bills is against the interest of the city of Torrance and should be opposed; be it further

Resolved, That the City Council of the City of Torrance respectfully requests the representatives of the State of California in the Congress of the United States to oppose the enactment of the above-mentioned bills or any similar legislation.

Introduced, approved, and adopted this 29th day of June 1954.

NICKOLAS O. DRALE,
Mayor of the City of Torrance.

Attest:

A. H. BARTLETT,
City Clerk of the City of Torrance.

RESOLUTION No. 541—A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF HEMET, RESPECTING SENATE BILL 1555 AND H. R. 4449 IN RESPECT TO STORAGE WATER PROJECTS IN THE COLORADO RIVER BASIN

Whereas the city of Hemet is vitally dependent on a water supply obtained from the Colorado River;

Whereas the Colorado River storage project as proposed in S. 1555 and H. R. 4449 and the Fryingpan-Arkansas project as proposed in S. 964 and H. R. 236, now pending in the Congress, would jeopardize the water rights and the water supply of the city of Hemet;

Whereas the aforementioned projects would inflict on the taxpayers of this city and the Nation an unjustifiable burden: Therefore be it

Resolved, That the enactment of these project bills is against the interest of the city of Hemet and should be opposed; be it further

Resolved, That the city of Hemet respectfully requests the representatives of the State of California in the Congress of the United States to oppose the enactment of the above-mentioned bills or any similar legislation.

Moved, passed, and adopted at a special meeting of the City Council of the City of Hemet, a California municipality, duly called and held on July 2, 1954.

Dated July 2, 1954.

JAMES S. SIMPSON,
Mayor, City of Hemet.

Attest:
[SEAL]

MARY E. HENLEY,
City Clerk, City of Hemet.

A RESOLUTION OF THE COUNCIL OF THE CITY OF GLENDALE OPPOSING PENDING LEGISLATION AUTHORIZING COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS

Whereas the city of Glendale is vitally dependent on a water supply obtained from the Colorado River; and

Whereas the Colorado River storage project as proposed in S. 1555 and H. R. 4449 and the Fryingpan-Arkansas project as proposed in S. 964 and H. R. 236, now pending in the Congress, would jeopardize the water rights and the water supply of the city of Glendale; and

Whereas the aforementioned projects would inflict on the taxpayers of this city and the Nation an unjustifiable burden: Now, therefore, be it

Resolved by the Council of the City of Glendale, That the enactment of these project bills is against the interest of the city of Glendale and should be opposed, and that the Council of the City of Glendale respectfully request the representatives of the State of California in the Congress of the United States to oppose the enactment of the above mentioned bills or any similar legislation; and be it further

Resolved, That the city clerk be and is hereby instructed to transmit copies of this resolution to the Senators and Representatives of the State of California in the Congress of the United States.

I, G. E. Chapman, city clerk of the city of Glendale, do hereby certify that the foregoing is a true and correct copy of resolution adopted by the Council of the City of Glendale, Calif., on the 24th day of June 1954.

[SEAL]

G. E. CHAPMAN,
City Clerk of the City of Glendale.

THE RAILROAD BROTHERHOODS
JOINT LEGISLATURE COUNCIL OF CALIFORNIA,
Los Angeles, Calif., June 21, 1954.

MY DEAR MR. CONGRESSMAN: The Railroad Brotherhoods Joint Legislative Council of California, after due consideration of the effects of the enactment of the Colorado River storage bill (H. R. 4449), feel that the enactment of this legislation would not be in the public interest, and I am therefore directed to advise you of the position of our membership as outlined in the following resolution setting forth our position on this matter:

Whereas the Railroad Brotherhoods Joint Legislative Council is vitally interested in any legislation affecting the welfare of the citizens of this country; and

Whereas the Colorado River storage project bill (H. R. 4449), now pending before the Congress, would impose upon all American taxpayers an enormous additional burden; and

Whereas the economy of the Nation would be seriously impaired by construction of this expensive and unjustifiable project: Now, therefore, be it

Resolved, That the Railroad Brotherhoods Joint Legislative Council vigorously opposes passage of H. R. 4449 by the Congress;

And we further urge that you do all possible to prevent this legislation from being enacted.

Adopted June 21, 1954, by the legislative representatives of the several organizations of the Railroad Brotherhoods Joint Legislative Council of California, upon behalf of the organizations and the membership thereof.

LEROY H. MORGAN,
Chairman, Railroad Brotherhoods Joint Legislative Council of California.

(Whereupon, at 6:35 p. m., the committee was recessed, to reconvene at 9 a. m. the following day, Saturday, July 3, 1954.)

JRP Historical Consulting LLC

Scott A. Miltenberger, Ph.D., Principal Historian and Heather K. Norby, Senior Historian
Memorandum to Jay Johnson, General Counsel, Central Arizona Water Conservation District
RE: Upper Basin Compact and CRSP Historical Questions
(February 25, 2026)

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COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

EIGHTY-THIRD CONGRESS

SECOND SESSION

ON

S. 1555

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

JUNE 28, 29, 30, JULY 1, 2, AND 3, 1954

Printed for the use of the Committee on Interior and Insular Affairs

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COLORADO RIVER STORAGE PROJECT

WEDNESDAY, JUNE 30, 1954

UNITED STATES SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON
INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to recess, at 10 a. m., in room 457, Senate Office Building, Washington, D. C., Senator Arthur V. Watkins, Utah, presiding.

Present: Senators Arthur V. Watkins, Utah, and Clinton P. Anderson, New Mexico.

Present also: Senator Thomas H. Kuchel, California; Elmer K. Nelson, staff consulting engineer; and N. D. McSherry, assistant chief clerk.

Senator WATKINS. The committee will come to order.

The first witness this morning will be the Honorable Ivan C. Crawford, director, Colorado Water Conservation Board.

STATEMENT OF IVAN C. CRAWFORD, DIRECTOR, COLORADO WATER CONSERVATION BOARD

Mr. CRAWFORD. Mr. Chairman and members of the committee, my name is Ivan C. Crawford. I am the director of the Colorado Water Conservation Board, an official State agency. On behalf of the board, I appear here in support of the bill authorizing the upper Colorado storage projects and participating projects generally but particularly in support of the five participating projects located in the State of Colorado.

Four of these projects—Paonia, Smith Fork, Florida, and Silt—have a common characteristic: They are primarily projects which seek to bring a supplemental supply of water ot land already under irrigation and, in addition, each one brings in some new land, smaller in area than the portion securing supplemental water. The Pine River extension project, the exception in this respect, brings new land under irrigation; however, the project is, as the name implies, an extension of a project already in existence.

I should like to present the salient characteristics of these projects. They have all been investigated and reported on by the Bureau of Reclamation. In each case the benefit-cost ratio has been found to be greater than 1; in each case it has been found that it will be necessary for the proposed upper Colorado River storage account to furnish a considerable portion of the funds required to bring the projects into existence.

The Paonia project: Studies were initiated on this project by the Bureau in 1936. It was authorized for construction on March 18, 1939,

Upon the condition that the legal availability of a reasonable quantity of water for the Denver-Blue River diversion be established, either by litigation or some other arrangement, and the condition that such project be otherwise feasible, the board approves the Denver-Blue River project for inclusion as a participating project in the authorization of the Colorado River storage project or for such other Federal legislative or administrative action as may be requested by Denver.

12. The board recommends that Denver and the representatives of the west slope in Colorado make every effort to arrive at a harmonious solution of the unfortunate transmountain diversion controversy which for years has created dissention in Colorado. The board pledges that it and its staff will be ready to assist in the amicable settlement of this prolonged conflict.

13. The director of the board and the Colorado member of the Upper Colorado River Commission are directed to do all things necessary and proper to effectuate this resolution.

14. Copies of this resolution shall be forthwith transmitted to the Governor of Colorado and to the members of the Colorado congressional delegation.

Senator WATKINS. Any questions, Senator Anderson?

Senator ANDERSON. No questions.

Senator WATKINS. I have no questions. Thank you very much for your statement.

Judge Breitenstein will you come forward please?

STATEMENT OF JEAN S. BREITENSTEIN, DENVER, COLO.

Mr. BREITENSTEIN. My name is Jean S. Breitenstein and my address is 2501 Albion Street, Denver.

At the outset, Mr. Chairman, I have one thing which embarrasses me. The young lady who mimeographed my statement put my new title at the head of it. There should be no implication at all that I am testifying here in any official capacity. I am here as a private citizen, on my own time and my own expense.

I might say that after I was confirmed for the office which I now hold, the question arose as to my testifying in support of this legislation. I submitted to the chief judge for the Court of Appeals of the Tenth Circuit the question as to whether or not I should take my oath of office or defer until I appeared before your committee. I secured from him a letter, signed by the Judicial Council of the Court of Appeals of the Tenth Circuit, in which they unanimously say that I should take the oath of office and there would be no impropriety in my appearing here and testifying.

I have a photostatic copy of that letter which I would like to submit for your files so there will be no question raised.

Senator WATKINS. That will be received.

(The letter referred to follows:)

UNITED STATES COURT OF APPEALS, TENTH CIRCUIT,
Denver 1, Colo., June 2, 1954.

JEAN S. BREITENSTEIN, *Denver, Colo.*

DEAR MR. BREITENSTEIN: The Circuit Council of the United States Court of Appeals, Tenth Circuit, composed of the five circuit judges of the circuit, has given consideration to the inquiry in your letter of June 1, 1954, addressed to me as chief judge of the circuit. You asked the circuit council to advise you of its opinion with respect to the propriety of your testifying before the Subcommittee on Irrigation and Reclamation of the Senate Interior and Insular Affairs Committee, relative to a bill now pending for the authorization of the Colorado River storage project, after having qualified as United States district judge for the District of Colorado.

We understand that for many years you have been attorney for the Colorado Water Conservation Board and for the Colorado member of the Upper Colorado River Commission; that you have resigned as attorney for such board and member; that because of your long connection, as attorney for such board and member, with Colorado River Basin problems, you have acquired a knowledge of pertinent matters of fact and law especially qualifying you to give valuable testimony to such subcommittee—testimony with respect to matters peculiarly within your knowledge and not obtainable from any other witness.

We further understand if you do appear before such subcommittee and testify, you will receive no compensation of any kind therefor and will personally pay expenses of travel and maintenance incurred in connection therewith.

We understand no matter of disqualification is involved, because you will be disqualified to sit in matters involving the Colorado River Basin, with respect to which you have acted as counsel in the past.

The council has carefully considered your inquiry and, in the light of what we regard as pertinent facts, it is our considered judgment that you should immediately qualify as United States district judge for the District of Colorado; that you should testify, when requested, before the Subcommittee of the Senate Interior and Insular Affairs Committee, and that there will be no impropriety in your so testifying after you have qualified as United States district judge for the District of Colorado.

Respectfully,

SAM G. BRATTON,
Circuit Judge.
WALTER A. HUXMAN,
Circuit Judge.
ALFRED P. MURRAH,
Circuit Judge.
JOHN C. PICKETT,
Circuit Judge.
ORIE L. PHILLIPS,
Chief Judge.

Senator WATKINS. I might say your reputation in the field of water development is so well known that I think the committee might have considered subpenaing you if you had not voluntarily appeared. We want to get the benefit of what you know about this upper Colorado River Storage and just because you were put on the bench, do not think you can deprive the committee of having your valuable information on this legislation.

I am sure you have not been in a judicial term long enough to feel that it would be anything which would disqualify you in making your statement.

Mr. BREITENSTEIN. That is right, Mr. Chairman, and I might say just to get into the record the experience I have had, I worked on Colorado River matters with some continuity since 1927.

For many years I was the attorney for the Colorado Water Conservation Board and also I have been the Colorado member of the Upper Colorado River Commission.

Before I go into the prepared statement that I have, I would request that the statements which I gave before the House committee in hearings on H. R. 4449, be made part of the record here. I think I will not read them so there will be no duplication, but if they could be put into the record as they appear at pages 308 to 313, I believe it might be helpful.

Senator WATKINS. Mr. Breitenstein, in view of the fact that the information referred to is already available is the House Hearings. I think it advisable to make the information part of this committee's files rather than to duplicate it here.

Mr. BREITENSTEIN. In the prepared statement that I have, the matter covered by subdivision 2 has been gone into by other witnesses and it would be repetition for me to mention that. Accordingly, I would like to begin on page 3, subdivision 111, that is, that the project is within the spirit and intent of the reclamation laws.

As the project is planned, the principal holdover reservoirs will not store and release water for downstream consumptive uses in the upper basin. Their function rather will be to regulate the streamflows and to generate power. However, the stream regulation, which is so provided, will make possible consumptive use projects for agricultural and municipal purposes which could not exist without the stream regulation provided by the holdover reservoirs.

Senator WATKINS. You have in mind, of course, the use of that water by exchange?

Mr. BREITENSTEIN. That is correct, sir.

The engineers have estimated that under historical streamflow records the available firm water supply for the upper basin is only about 4,200,000 acre-feet annually. The compact apportions to the upper basin beneficial consumptive use of 7,500,000 acre-feet annually. The difference between the 2 figures, or 3,300,000 acre-feet, represents the quantity of water which will become available for consumptive use in the upper basin by the stream regulation provided by the large reservoirs. The application of this additional 3,300,000 acre-feet of water annually to beneficial consumptive use is beyond doubt a reclamation project.

The generation and sale of hydroelectric power from the units of the storage project is clearly within the Reclamation Act. The April 16, 1906, amendment (34 Stat. 116) to the Reclamation Act of 1902 (32 Stat. 388) shows that Congress contemplated and authorized the development of the power features of reclamation projects. Other amendatory or supplementary legislation shows that throughout the years Congress has authorized, and appropriated funds for the construction of, hydroelectric projects. There are outstanding examples such as Hoover Dam, Parker Dam, and Davis Dam in the lower basin. Section 9 (c) of the Reclamation Project Act of 1939 makes specific reference to the sale or lease of power.

The Colorado River storage project is within the traditional concept of a reclamation project. The primary difference between it and the reclamation project of the past is its size.

In supporting the Colorado River project the upper basin States believe that they are carrying into effect the principle of the regional water development.

Senator WATKINS. May I go back for a moment, Judge?

You said the primary difference between this and other projects in the past was one of size. It is because of the large size that the development has not taken place in the past.

Mr. BREITENSTEIN. That is absolutely correct, Senator, yes. I agree with that.

Senator WATKINS. In other words, if we had gone along piecemeal and gotten an authorization for each project year by year, it would appear to be not as large a project as it now appears.

Mr. BREITENSTEIN. If we had been as fortunate as other areas and developed these small projects in the past, this would not be the size that it is.

Senator WATKINS. And it is the first time, is it not, within your memory, that we have proposed a comprehensive program for a river system?

Mr. BREITENSTEIN. That is correct. This is a comprehensive program for the upper basin.

Senator WATKINS. It shows the development and complete utilization of the water, not only for consumptive uses but also for power and any other uses to which water can be put.

Mr. BREITENSTEIN. Yes, and it is a use which affects four States. Four States have joined in supporting this project.

Senator WATKINS. When I divide it into four, it is not so large, either, is it?

Mr. BREITENSTEIN. That is correct.

Senator WATKINS. I am asking these questions for the benefit of the other Members of the Senate who may not understand that the way we in the West do.

Mr. BREITENSTEIN. Mr. Chairman, next in my statement I have analyzed the two pertinent compacts, the 1922 compact and the 1948 compact. Those have been discussed by others, and if the material appears in the record, I think it would not be necessary to read it at this time.

Senator WATKINS. We will have it all appear in the large type.

Mr. BREITENSTEIN. Thank you.

On page 8, I refer to pending litigation in the lower basin. In August 1952 Arizona brought suit against California and certain public entities of the State concerned with the use of Colorado River water. Later the United States intervened. Nevada has filed a motion for leave to intervene and such motion has been granted. This case, *Arizona* v. *California* (No. 10 original, 1953 term, Supreme Court of the United States of America), involves controversies of long standing as to the rights of the lower basin States to the use of Colorado River water. The States of Colorado, New Mexico, Utah, and Wyoming are not parties to, or involved in, this lawsuit.

In its complaint Arizona presented three basic issues, viz:

1. How is beneficial consumptive use measured?

2. Is water covered by article III (b) of the 1922 compact apportioned water or unapportioned water?

3. How are reservoir losses from lower basin main stream reservoirs to be charged?

In their answers and other pleading the defendants have asserted a multitude of issues which appear to be immaterial and irrelevant with perhaps two exceptions, which are:

1. Is Arizona a party to and bound by the 1922 compact?

2. If Arizona is a party to the 1922 compact, does it have any rights under, or may it receive any benefits by reason of, the so-called California Self-Limitation Act (act of March 4, 1929; ch. 16, 48th sess.; Statutes and Amendments to the Codes, 1929, pp. 38–39)?

The defendants in this case have requested the Court to appoint a special master to conduct hearings on the controverted issues and to make a report to the Court with recommendations. Arizona opposed this and requested if a special master was appointed, he be limited to the five issues which I have enumerated. However, the Court appointed a master under a general reference. It is not clear at this time whether the master will restrict or limit the hearings in the first

instance. Should he follow such a course, that is, restricting his first consideration to the issues mentioned, then it is possible that the case may be effectively posted within a year or two. On the other hand, it is possible since the reference to the master is general, that it will be necessary to hear evidence on controverted facts and the determination of the case may be indefinitely prolonged.

The pendency of the *Arizona* v. *California* case has no effect whatsoever upon the authorization of the Colorado River storage project. All parties to that case assert and rely upon the 1922 compact, the Boulder Canyon Project Act, the Mexican Water Treaty, and the other laws and instruments which constitute the recognized and admitted law of the river. Similarly, the authorization of the Colorado River storage project is predicated upon the validity and integrity of the law of the river. While it is true that in the lower basin there has been a prolonged controversy over the application and construction of certain specific terms and provisions, these controversies do not affect the upper States or the availability of water for the Colorado River storage project.

Any insinuation that the authorization of the Colorado River storage project should be delayed until the *Arizona* v. *California* case is decided is an attempt to defeat upper basin development. There is no legitimate reason for any delay in this project because of the lower basin controversy.

Senator WATKINS. May I ask this question, Judge: Is it not true that there is no responsible decision the Court could make under the issues raised in this case which would make it impossible for the upper basin States to use a large percentage of the waters which are given to them under the 1922 compact?

Mr. BREITENSTEIN. That is correct, Mr. Chairman, and I go into that a little later in the statement.

Senator WATKINS. Then I will not ask you any further questions on that.

Mr. BREITENSTEIN. I would like to interpolate here that if the development in the lower basin had been deferred until there was a settlement of all the controversies down there, you would never have had the Hoover Dam, the All American Canal, Parker Dam, or the Davis Dam or any other of the great developments which they have down there, because while Congress was authorizing and appropriating funds for those projects, there were in existence these controversies which have now come to a head in the present lawsuit. While those projects were under construction, there were three United States Supreme Court lawsuits between Arizona and California. So if their development had to wait until all the controversies were settled, they would not have the projects which they now have.

Senator WATKINS. Of course one of the fundamentals for this project is the water supply. If there is available water supply regardless of the suits and issues involved, there should be no reason for delay.

Mr. BREITENSTEIN. That is correct.

Senator WATKINS. I note reference among the resolution just read to some controversies in Colorado. I am sure the Colorado people would not want this held up until all the controversies in that State have been settled.

Mr. BREITENSTEIN. That is correct.

Senator WATKINS. We do not happen to have any in Utah now, but we do not know when they might break loose.

Mr. BREITENSTEIN. You are fortunate.

Senator WATKINS. I think as we go through these projects, the people are usually able to adjust themselves, and ultimately the controversies will be settled, probably not to the complete satisfaction of everybody, but to the satisfaction of the majority, at least.

Mr. BREITENSTEIN. Yes.

In the next portion of my statement, Senator, I discuss certain legal points which have been raised. In doing this, I am not raising strawmen and knocking them down. Each one of these points has been asserted by people who have testified, either in the House hearings on this project or in hearings on the Fryingpan-Arkansas project. I thought the record should contain at least my answer to these points. The first point, one raised by a Senator earlier this week, is the meaning of per annum in article III of the 1922 compact. It has been urged that the apportionment of the 7,500,000 acre feet of water per annum as made by article III (a) of the 1922 compact means a maximum in any one year and not an average over any period of years. This is a theoretical issue which may some day have to be decided.

Most obviously if the 7½ million is a maximum, the average will be less than that unless there is complete stream regulation. At the moment the assertion of the issue does not even raise a material hypothetical question. The same witness who has raised this point quotes engineering reports as stating that the aggregate consumptive use of the reclamation projects included within the Colorado River storage project is about 1,700,000 acre-feet a year. When this is added to the 2,500,000 acre-feet required by projects already constructed, there will be 4,200,000 acre-feet of water put to consumptive use in the upper basin. See statement of Northcut Ely, hearings on H. R. 4449, H. R. 4443, and H. R. 4463 before the Subcommittee on Irrigation and Reclamation of the House Committee on Interior and Insular Affairs, 83d Congress, 2d session, page 697.

Hence, the upper basin will have to increase its use by 3,300,000 acre-feet before it approaches the figure which is said to be the maximum. The point, if it is worth consideration at all, becomes important only when some other project is up for authorization. It does not and cannot affect the Colorado River storage project.

THE MEASUREMENT OF CONSUMPTIVE USE

The 1922 compact does not define the method of measurement of consumptive use. For a number of years there have been controversies over this point. California has always contended that the measurement is by the "diversions-less-return method." The four upper division States and Arizona have contended that the measurement is in terms of "manmade depletion of main stream virgin flow." In its tendered petition in intervention in the *Arizona* v. *California* case Nevada has asserted a modification of the mainstream depletion theory.

The upper basin States in the 1948 compact adopted the main stream depletion method unless the administrative agency created by that compact should, by unanimous action, adopt some other method. Hence, so far as the area in which the Colorado River storage project

is located is concerned, the method of measurement is settled. There can be no doubt as to the right of the upper basin States to agree upon a method of measurement which is binding upon them. In this connection it should be pointed out that the California theory of measurement in terms of diversion-less-returns is thoroughly impractical in the upper basin because in that area, instead of there being a very few large diversions such as exist in California, there are literally thousands of diversions. It is utterly unreasonable and impractical to provide automatic measuring devices for all these diversions. Even if the diversions could be measured, no engineer has yet come forward with any reasonable method of determining return flows.

In the statement of Mr. Ely above referred to (House Hearings on H. R. 4449, p. 700) it is asserted that the quantity of water involved in this dispute over the method of measuring "so far as the planning of the upper basin storage project is concerned, is 300,000 to 500,000 acre-feet, according to engineers' estimates." As has previously been pointed out in discussing Mr. Ely's statement, the estimated total consumptive use of water in the upper basin which will result after this project is in operation will amount to about 4,200,000 acre-feet of water annually. If, because of the adoption of a different method of measurement, an additional 500,000 acre-feet must be added to this, the total is still well within the allocation made to the upper basin by the 1922 compact. Hence, the issue is entirely immaterial so far as this project is concerned.

E. RIGHTS WHICH MAY NOW EXIST

The assertion is made that the apportionment made by article III (a) "shall include all water necessary for the supply of any rights which may now exist." The pertinency of this assertion is obscure. The States involved in the Colorado River project recognize fully that the apportionment included rights then existing. This point may possibly have some application in the lower basin controversy, but has no application so far as the Colorado River storage project is concerned.

It should be clearly understood that the 1948 compact gives full recognition to the validity of the 1922 compact. Further in requesting the authorization of the Colorado River storage project the affected States have taken the unequivocal position that the authorization, construction, and operation of the project must be in conformity with the law of the river.

THE MEXICAN BURDEN

Article III (c) of the 1922 compact provides that any right to water recognized in Mexico shall be satisfied first out of surplus over the amounts specified in article III (a) and III (b) and if that is insufficient, then the deficiency shall be borne equally by the two basins and the upper division States are required to deliver at Lees Ferry water to supply one-half of the deficiency. The 1944 Mexican Water Treaty, Treaty Series 944, obligates the United States to deliver to Mexico 1,500,000 acre-feet annually subject to diminution under certain conditions. The adequacy of the water supply to satisfy this

obligation out of surplus has been the subject of prolonged contention for a number of years. At the moment the argument is entirely theoretical because some 8 or 9 million acre-feet of water annually is being discharged by the Colorado River into the Gulf of California. Report of Senate Committee on Foreign Relations, Executive Report No. 2, 79th Congress, 1st session, page 4.

It is conceivable that under conditions of ultimate development there may be an issue as to the responsibilities of the two basins in regard to the satisfaction of the Mexican right. Under existing conditions the issue is entirely hypothetical. As has been mentioned before, the consumptive use of water in the upper division States after the Colorado River storage project is in operation will amount to about 4,200,000 acre-feet. Hence, there is an adequate cushion to supply any potential obligation of the upper division States.

The obligation to deliver water to Mexico may at some future time become pertinent but it has no materiality so far as the authorization of the Colorado River storage project is concerned.

RESERVOIR LOSSES

The 1922 compact makes no provision for the charging of reservoir losses. The method to be applied is one of the issues in the pending *Arizona* v. *California* case.

So far as the upper basin is concerned, the 1948 compact sets up in its article V a definite procedure for the charging of these reservoir losses. The Colorado River storage project is an upper basin project. The upper basin States have agreed upon how they will charge reservoir losses. They have no concern whatsoever with the unfortunate lower basin controversy on this point. It has no materiality to them or the project which they desire.

Senator ANDERSON. Does it have anything to do with the amount of water the upper basin States can deliver at Lees Ferry?

Mr. BREITENSTEIN. Not in my opinion, Senator. They are obligated under III (d) to deliver 75 million every 10-year period.

Senator ANDERSON. If the evaporation losses were to be charged against that, however, it would make some difference.

Mr. BREITENSTEIN. That is true, Senator. There are people who feel that because the Glen Canyon Reservoir is of tremendous benefit to the lower basin, that the lower basin should share some of the reservoir losses of Glen Canyon. However, I apprehend that it would take voluntary agreement by the lower basin in order to bring that about.

The next is the right to demand or withhold water, article III (e), of the 1922 compact provides that the States of the upper division shall not withhold water and the States of the lower division shall not require the delivery of water which cannot reasonably be applied to the domestic and agricultural uses. This must be considered in connection with article II (h) which defines "domestic use" as including the use of water for certain purposes but specifically excluding the generation of electrical power and with article IV (b) which provides that water may be impounded and used for power generation but such impoundment and use shall be subservient to the use of water for agricultural and domestic purposes which are declared to be dominant.

Under these provisions of the compact water may be withheld by the upper basin and stored in the reservoirs contemplated by the Colorado River storage project so long as the water so stored is not required for domestic and agricultural uses in the lower basin. The mere fact that water so stored can be used for the generation of hydroelectric power in the lower basin does not impose any obligation upon the upper basin to deliver it for that purpose.

Indeed, one significant reason for the authorization and construction of this project at this time is that the immediate construction of the main stream holdover reservoirs will permit them to accumulate water with less interference with uses in both the lower and upper basins than if their construction is delayed until a later date.

In the lower basin the United States has constructed immense dams and powerplants. The United States is interested in securing the production of power and its resulting share of power revenues. By running this water not only through the lower basin plants but also the upper basin generators contemplated by this project, more power will be produced to add to the wealth of our Nation. It is to be presumed that the United States, the upper basin States, and the Upper Colorado River Commission will comply with the compact and will so operate the reservoirs as to attain the greatest possible benefit within the terms of the 1922 compact.

APPROPRIATION OF SURPLUS

Another question which has been raised is whether or not article III (f) of the 1922 compact intends that no State may validly appropriate surplus water until a new compact is made for the allocation of surplus. The pertinency of this point is beclouded. Except for California, there has been general agreement among the Colorado River Basin States that no firm right to any surplus waters may be obtained until there is an allocation after October 1, 1963. The position of California has been that a right to use a portion of such surplus may be obtained subject to possible divestment after October 1, 1963. It has never been explained how the validity or invalidity of either position has any bearing upon the authorization of the Colorado River storage project.

IMPOUNDMENT OF WATER FOR POWER GENERATION

As has heretofore been mentioned, article IV (b) of the 1922 compact makes the impoundment and use of water for power generation subservient to agricultural and domestic uses. This is recognized by the upper basin States who do not deny that the project is squarely controlled by the 1922 compact. This provision, however, does not affect the feasibility of the Colorado River storage project. Water needed for agricultural and domestic purposes in the lower basin must be passed downstream to the full extent of the apportionment made to the lower basin by article III (a) of the compact and in accordance with the delivery obligation contained in article III (d) of the compact.

Public officials are presumed to do their duties. Sovereigns, such as the United States, and quasi-sovereigns, such as the States, are presumed to comply with the law. It is not reasonable to object to the

Colorado River storage project upon the ground that in the future the persons in official control of the reservoirs will violate the law of the river.

INDIAN RIGHTS

The 1922 compact provides in its article VII that nothing therein shall be construed as affecting the obligations of the United States to Indian tribes. Article VII of the upper basin compact of 1948 requires that uses of water by the United States and its wards shall be charged as a use by the State in which the use is made.

It is true that in the pending suit of *Arizona* v. *California* there is an issue as to the method of charging Indian uses of water. This does not concern the upper basin. The omission in the 1922 compact of any provision for the charging of uses of water by the United States or its wards has been supplied so far as the upper basin is concerned, by the 1948 compact.

A California spokesman in the House hearings on this project has stated that the Bureau of Indian Affairs has construed the compact as meaning that the Indian claims in effect are prior and constitute the first demand upon the water supply. If such a theory should be upheld, then every right to the use of water of the Colorado River and its tributaries is of doubtful validity. It is inconceivable that the United States as the guardian of the Indians will ever assert that the rights of the Indians come ahead of the use of water on the great reclamation projects which the United States has constructed on the Colorado River such as Hoover Dam, the All-American Canal, the Salt River project, the Gila project, the Colorado-Big Thompson project, and many others.

Senator ANDERSON. Did the California spokesman give his authority for that statement?

Mr. BREITENSTEIN. He did not. However, I may say from conferences which I have had with representatives of the Bureau of Indian Affairs, that is the position which they have taken in statements to me.

Senator ANDERSON. They have construed the Winter's case pretty liberally with respect to that?

Mr. BREITENSTEIN. Yes; they rely on the Winter's case, Senator.

And adjudication of the Indian rights in the Colorado River Basin would require a consideration of every right to the use of the waters of the Colorado River and its tributaries in each of the seven basin States. Such procedure would cost millions of dollars and require years of time. It should be mentioned in passing that there are Indian reservoirs on many other streams. There is nothing unique about the Colorado River. If the Indians have a prior right to the use of the water of all of our streams, then indeed the Nation is in a most grievous condition.

In this regard it should be pointed out that the upper basin States have always had a deep concern over the welfare of the Indians. The apportionment to New Mexico, as made in the 1948 compact, was substantially increased because of a recognition of the Indian rights. The upper basin States desire to have the lot of the Indians improved by the construction of water use projects which are reasonably adapted to serve the Indian needs. In connection with the investigation of the

Colorado River storage project much consideration has been given to the Shiprock project in New Mexico. It is to be hoped that these studies will soon be completed and a project report submitted to the Congress so that the Indians may benefit therefrom. It should be understood that the upper basin States wish to help the Indians. At the same time they protest against any delay in the authorization of the Colorado River storage project by reason of the assertion of fantastic, unrealistic, and groundless claims of Indian rights.

PRESENT PERFECTED RIGHTS

California has asserted that the word "unimpaired" as used in article VIII of the 1922 compact means unimpaired as to both quantity and quality. California then suggests that the upper basin development will cause the quality of water delivered at Lee Ferry to deteriorate and, hence, constitute a violation of the compact. This is a denial of the validity of the apportionment made by article III (a) of the 1922 compact, because, if the California theory is correct, any impairment in quality would render the use of the water apportioned to the upper basin impossible. Such was never the intent of those who drafted the 1922 compact. Nowhere in that compact is any reference made to quality of water.

The statements of California witnesses are based upon no engineering studies supporting the theory that the quality of water will be impaired by upstream development. The assertions are based upon speculation and conjecture and constitute but another example of the extreme positions asserted to prevent and embarrass an upper basin development.

It is an elementary principle of the construction of statutes, treaties, and compacts that a document must be taken and considered as a whole. When the Colorado River compact of 1922 is so taken and considered, the conclusion will be inevitably reached that article III (a) is effective as to the apportionment of water and may not be destroyed by the legalistic and unwarranted insertion in article VIII of the compact after the word "unimpaired" the phrase "either in quantity or in quality."

California spokesmen, in discussing this subject, make reference to proposed transmountain diversions of water in the upper basin. Here again the 1922 compact is explicit. The definitions of the basins as stated in article II (f) and article III (g) clearly contemplate the transmountain diversion of water because they include within those basins all parts of the mentioned States without the drainage area which "are now, or shall hereafter be, beneficially served by waters diverted from the system."

It is, of course, well known that the California uses in the Imperial Valley, the Los Angeles area, and the San Diego area are all transmountain diversions.

It is respectfully submitted that the upper basin States have the right to make use of their apportioned share of the water at any place within such States, provided only that the Lee Ferry delivery obligations are maintained.

Suggested amendments:

PRELIMINARY AMENDMENTS

In the hearings before the House Committee on the Colorado River storage project bill, Mr. Ely, attorney for California, suggested certain amendments. These will be grouped for discussion.

PROPOSED AMENDMENTS PERTAINING TO THE LAW OF THE RIVER

The upper basin States recognize that the Colorado River project must be authorized, constructed, operated, and maintained in accordance with the law of the river. Further, any uses of water under any units of the project must conform to the law of the river. It is desirable to have this made clear in the bill but undue and unnecessary repetition should be avoided.

In this same regard the upper basin States recognize that there is the pending lawsuit involving uses of the Colorado River water in the lower basin. It is not the intent of the upper basin States, in urging the authorization of the Colorado River storage project, to influence the course of that litigation.

If amendments are thought necessary on these points, then the language employed in section 7 (a), (b), and (d) of the May 6, 1954, committee print on S. 964 to authorize the Fryingpan-Arkansas project is acceptable and adequate.

TRANSMOUNTAIN DIVERSIONS

Amendment No. 3 offered by Mr. Ely relates to transmountain diversion—see hearings on H. R. 4449, supra, pages 706, 707. This amendment requires that all Colorado River system water exported out of the natural basin of that system must be consumptively used in a Colorado River Basin State. In support of this proposal Mr. Ely merely stated that there is not enough water to enable the eastern slope of Colorado to compose its differences with Nebraska and Kansas.

Colorado has already composed its differences with both Nebraska and Kansas. On the North Platte River there is a Supreme Court decree (325 U. S. 589, 665). On the South Platte there is an interstate compact with Nebraska (44 Stat. 195). On the Republican there is a compact with Nebraska and Kansas (57 Stat. 86). On the Arkansas there is a compact with Kansas (81st Cong., 1st sess., ch. 155, Public Law 82. Hence, there is no reason for Colorado to have any desire whatsoever to pass any Colorado River water out of its borders. Indeed, the need for water in Colorado is so serious that it is inconceivable that Colorado would voluntarily permit any of its apportioned water exported from the Colorado River Basin to be used anywhere except in Colorado.

Be that as it may, the position taken by Mr. Ely does not accord with the Colorado River compact and does not accord with the uses of Colorado River water made in California. There is nothing in the Colorado River compact of 1922 which requires that water taken out of the natural basin must be consumptively used in a Colorado River Basin State. From a practical standpoint it would be impossible to give an assurance that Colorado River water would not pass out of the borders of a Colorado River Basin State. This results from the fact that Colorado River water is commingled with natural basin water and cannot be identified after such commingling.

Under the existing court decree and interstate compacts, Colorado is under no obligation to pass any imported water to any downstream State—for example, North Platte decree, article XII (c), 325 United States 671; South Platte compact, article IV, Arkansas River compact, article III B and article IV A.

If the theory for which Mr. Ely contends is the law, then the State of California is required to use consumptively all the water diverted from the Colorado River system for use in the Los Angeles and San Diego areas, because if it is not so used but discharged into the Pacific Ocean, there will be a compact violation. This situation in and of itself shows the fallacy of the contention.

If it is determined that some protective amendment should cover this point, then section 7 (c) of the committee print of S. 964, above referred to, is satisfactory.

SALINITY

Mr. Ely's amendment No. 4 relates to studies of salinity. The question of quality of water has heretofore been discussed. If the Congress wishes to authorize the Secretary of the Interior to make salinity studies, the upper States have no objections. But there is no reason whatsoever for an amendment to a bill for the authorization of the Colorado River storage project requiring salinity investigations. If this is to be done at all, it should be done under a general authorization applying to all western streams; and, so far as the Colorado River is concerned, it should apply to the upper basin as well as the lower basin.

The next subject is: Operation of reservoirs.

Senator ANDERSON. Where is most of the water being diverted from now?

Mr. BREITENSTEIN. The lower basin.

Senator ANDERSON. If this is to apply, surely we ought to go back and start testing that first.

Mr. BREITENSTEIN. I should think so, yes.

Senator ANDERSON. The point of the greatest use is the point of the greatest benefit to the greatest number of people. The Republic of Mexico might object to the use of this water by the State of California, for example.

Mr. BREITENSTEIN. That is right, sir.

The next refers to operation of reservoirs.

Amendment No. 5 proposed by Mr. Ely authorizes the creation of an "integrating committee" to advise with the Secretary of the Interior on the storage in, and release of water from, main stream upper basin reservoirs. The first obvious thought is that if such an integrating committee is to be created, then it should have control over not only the upper basin reservoirs, but also the lower basin reservoirs.

As has heretofore been pointed out, the officers of the United States and the States are presumed to do their duty. If in the performance of any ministerial act they violate the law of the river, they may be held to account in a proper legal manner.

It may be eventually desirable to have some such committee as has been suggested, but when and if that time arises, its responsibility should encompass both basins and not just the upper basin. Moreover, if it is to be created, it should be brought into existence by a statute designed for that purpose and not an amendment to a bill

for the authorization of an upper basin storage project. In other words, if you have a committee of that kind at all, it should be a general committee applying to every project on the entire stream, and not a selected group of projects.

Senator ANDERSON. Why not have that on the Columbia River as well?

Mr. BREITENSTEIN. If it is desirable at all, you might have a committee on the Columbia, Missouri, Sacramento, and so on, over the western part of the United States.

Senator WATKINS. As you have suggested, the time may arrive when we may have to have some water masters on the river.

Mr. BREITENSTEIN. That may eventually be necessary.

Senator WATKINS. It may be done by creation of a committee or by naming a water commission, but that has nothing to do with this bill at the present time.

Mr. BREITENSTEIN. No, sir; not in my opinion.

The next topic relates to waiver of immunity to suit.

Mr. Ely also suggests in his proposed amendment No. 5 that the United States give consent to suit in the event of the failure of the Secretary of the Interior to comply with the law of the river. This request assumes improperly that the Secreary of the Interior will not comply.

If the United States is to grant any general waiver of immunity to suit in matters affecting the Colorado River Basin, it should be done by a statute especially intended for that purpose. It should not be done in legislation to authorize the Colorado River storage project.

I would like to add, if you do it at all, it should be by such general legislation that it will apply to both basins.

Senator KUCHEL. Would you mind developing the reasons a little bit, Judge?

Mr. BREITENSTEIN. Because, Senator, if you do that, it should be of general application. We have here a project for the upper basin of the river. In the first place, I think any consent by the Congress to suit should be in a bill by itself, so that particular consideration may be given to that one point.

Second, I say that if you are going to waive immunity to suit, consent to suit, then it should be as to matters affecting the entire stream, and not just the upper basin.

It is conceivable, Senator, that we in the upper basin might want to sue you folks in the lower basin. Why should you have a preference over us here?

Senator KUCHEL. My only point is, assuming an amendment were drafted in keeping with the suggestion that you just made, could it not legally and in parliamentary fashion be attached to this vehicle?

Mr. BREITENSTEIN. It could, if it was thought necessary. I think you will have better consideration of that point if it is in specific legislation.

As you no doubt remember, several years ago there were prolonged hearings, both on the Senate and the House side, on proposed legislation granting immunity to suit in Colorado River matters. None of those bills ever passed, but there were hearings which went on for weeks on that one specific point.

Senator ANDERSON. Judge, when we were struggling with the central Arizona bill, which authorized dams down below the Grand

Canyon, Bridge Canyon, and others, a great deal of attention was given to the question of the right of the Government to be sued in this Colorado River matter. It seems to me—and I am sure you remember a lot better than I—it seems to me the State of California proposed at that time, as a compromise, that the central Arizona project be passed, but that before it was to be operative or effective there had to be this suit entered into and tried in the courts of the country. It was a general provision for that.

Mr. BREITENSTEIN. That is correct, yes.

The next material that I have here, beginning at the bottom of page 28, refers specifically to Colorado.

Senator WATKINS. May I ask you about another matter for a moment. I notice in the waiver of immunity to sue, that if it is as general as you have stated it there, the right to sue the Secretary of the Interior to compel the enforcement of the law of the river might be a very effective way to stop this project. One can say the Secretary is violating the law of the river in doing this or that, and a suit could be brought and an injunction sought. That would end progress on the river until that suit was disposed of.

Mr. BREITENSTEIN. That is right. There is another point I would like to make there. I am not trying to express any judicial opinions here, but in my opinion, if the Secretary of the Interior or any of those under him, in constructing or operating this project, violated the law of the river, I think that they could be stopped, and the question of waiver of immunity by the United States would be immaterial to that suit.

Senator KUCHEL. You think they could be what, Judge? I did not hear you.

Mr. BREITENSTEIN. Could be restrained from violating the law of the river.

Senator KUCHEL. By judicial process?

Mr. BREITENSTEIN. Yes.

Senator KUCHEL. In the absence of an immunity provision in the statute?

Mr. BREITENSTEIN. Yes; because when they violate the law of the river, they would not have about them the cloak of protection which the United States has. When an officer violates a ministerial duty, he can be called to task for that, Senator, and there is no question of suit against the State.

Senator KUCHEL. Your point would be, then, that you would urge there is no necessity for an immunity provision to be added to this bill to compel the Secretary of the Interior to comply with the law of the river, because you would urge that that right would be available even in the absence of an immunity provision.

Mr. BREITENSTEIN. That is my opinion, sir, because of the nature of this project and the nature of the responsibilities, duties, and obligations of the Secretary of the Interior in regard to it. You do not have the same situation here that you had in the lower basin. That related to the right to the use of the water, the availability of water. That is a different situation, in my opinion, than would arise in the operation of this project.

Senator WATKINS. As a matter of fact, frequent suits are filed against Federal officials here in the District of Columbia to compel them to do their duty.

Mr. BREITENSTEIN. That is correct.

Senator KUCHEL. So, in a word, your objection to this specific proposal of Mr. Ely's is that it would be surplusage?

Mr. BREITENSTEIN. In my opinion, it would, yes. If the Secretary violates the law of the river, I apprehend that your State or mine or any other could sue him and compel him to comply with the law of the river.

Senator KUCHEL. The only thing that occurred to me, if the position you take is correct and it would be merely surplusage to add it, then I can see no violent objection to it if it would not otherwise impair the legislation.

Senator ANDERSON. If it would not otherwise impair the legislation, yes, but that is the very point.

Senator KUCHEL. The judge has not suggested that it would otherwise impair the legislation, Senator. I do not think he has.

Mr. BREITENSTEIN. The difficulty, Senator, is that it is an encouragement to litigation. We in the upper basin do not like litigation. Colorado has had more unfortunate experiences with water litigation than any other State. I have participated in some.

For example, the Arkansas River was in Federal court litigation from 1901 until 1943; the Laramie River from 1913 to 1940; the North Platte from 1934 to 1945. We in the upper basin try and settle our problems—and we have had a lot of them—without going to court, because of the length of time and the troubles you get into. It is better to do it across the table than it is in court, in my humble judgment.

I would like now, if I may, to pass to the top of page 31. The other material in there will be covered by other witnesses from Colorado. So, if I may, I will turn to the top of page 31.

The subject there is: Curtailment of USE.

Article IV of the 1948 compact provides for the curtailment of use to satisfy the delivery obligation imposed by article III (d) of the 1922 compact. The State of Colorado is bound by this provision and it is to be presumed that it will comply therewith. However, there appears to be some misunderstanding as to the application of this provision and the provisions of article III (a) of the 1948 compact. In his testimony before the House committee on H. R. 4449, Mr. Raymond Matthew stated, at page 691, that the upper basin States should be required to set up priorities for existing and potential projects such as has been done in California. While he has not enlarged upon this, his idea evidently is that this must be done in order to fix responsibility in the event any curtailment of use ever becomes necessary. So far as Colorado is concerned, the answer is that Colorado now has, and at least ever since the adoption of its constitution has had, the priority system whereby each and every decreed water use is given a priority number and in times of curtailment the uses are shut down in the inverse order of their priority.

Certain of the testimony presented in the House hearings is based upon the theory that the percentage apportionment of use made to Colorado by the 1948 compact applies not to the Colorado River system as a whole in Colorado, but as to each tributary. The idea is that Colorado can use but 51.75 percent of the water of each tributary. There is nothing in the 1948 compact which even hints at such a principle. The allocation to Colorado is 51.75 percent of—

the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by the upper basin under the Colorado River compact.

This is a general and not a specific apportionment. There is nothing in the Colorado River compact of 1922 which in any way limits the amount of water that Colorado and its water users may take and divert from any tributary. The apportionment is a percentage of all available water. In the upper basin compact of 1948, certain conditions are placed on Colorado so far as the use of water from the San Juan and Yampa River is concerned. These conditions are in no way related to the apportionment percentage of Colorado.

That concludes my statement, and I am grateful for your giving me the opportunity to appear here.

Senator WATKINS. Do you have any questions?

Senator ANDERSON. I think we should be grateful to you, Judge, for coming here and giving us the benefit of your long experience in this matter.

Mr. BREITENSTEIN. Thank you.

Senator WATKINS. Senator Kuchel?

Senator KUCHEL. Judge, I am a new Member of the Senate. I come from California. The representatives of the State of California have been apprehensive that there might be in the legislation something which would effectively violate the 1922 Colorado River compact, and to that extent would interfere with the legal rights of California under that compact.

I would like, if I may, by a few questions to inquire and get a little background so far as your thinking is concerned, as a lawyer and as a distinguished judge.

I was most interested in your statement. First of all, on page 20 where you discuss Indian rights, and then over on page 21 you suggested that a California spokesman in the House hearings on the project stated that the Office of Indian Affairs has construed the compact—that is, the 1922 compact—as meaning that the Indian claims in effect are prior and constitute the first demand upon the water supply.

Senator Anderson asked a question or two at that point relative to the authority with which the California spokesman made that statement.

Did I understand you, Judge, to say that the statement is based on the Office of Indian Affairs taking that very position?

Mr. BREITENSTEIN. That is correct, sir. I may say that California attorneys have just as vigorously opposed that theory as have those representing the upper basin States.

Senator KUCHEL. I see. So we have the situation where one of the agencies of the Department of the Interior has in effect ruled that Indian claims constitute a first—I was almost going to use the word "paramount"—a first right with respect to the waters of the river.

Mr. BREITENSTEIN. They have made that claim; yes, sir.

Senator KUCHEL. Has that ruling been acceded to by the Secretary of the Interior? Has it been applied by the Department of the Interior?

Mr. BREITENSTEIN. That is a controversial subject, Senator. So far as I know, the present Secretary of the Interior has never agreed to it, nor has the Department of Justice.

Senator KUCHEL. Meanwhile, however, it still is the basis on which the Office of Indian Affairs has conducted its business?

Mr. BREITENSTEIN. It has repeatedly made that assertion. There is no doubt of that.

Senator KUCHEL. If that decision in favor of Indian claims priority were to continue, would that have any effect upon the bill before us if it were adopted and enacted into law?

Mr. BREITENSTEIN. It might have a very grievous effect, sir, but if it is so adopted, it would not only affect the Colorado River—it would affect the Sacramento River, Columbia River, Snake River, Yellowstone River—all the western streams where there were any Indians at all.

Senator KUCHEL. So would it not be proper for this committee to hear from a representative of the Department with respect to a ruling of one of its offices, and have the matter clearly brought before the committee, either indicating that the Department would continue to abide by that decision on the part of its Office of Indian Affairs, or that it now repudiates it and changes it?

Mr. BREITENSTEIN. That is a matter of policy for the committee, Senator.

Senator KUCHEL. At least it would be your statement that the present construction of the compact which the Office of Indian Affairs has made would have a marked and, I think you said, grievous effect on the legislation?

Mr. BREITENSTEIN. It would also affect the operation of the Hoover Dam, the Metropolitan Aqueduct, the All-American Canal, and all of them.

Senator ANDERSON. There are as many Indians along the Colorado River as there are in the State of California.

Mr. BREITENSTEIN. Yes, there are Indians in every Colorado River Basin State except Wyoming. Wyoming does not have any. All the rest of us do.

Senator WATKINS. As a matter of fact, we are not having any arguments with the Indians respecting this project. They are in favor of it just as we non-Indians are.

Mr. BREITENSTEIN. That is correct, sir. And may I point out, as I did before Senator Kuchel came in, that in the upper basin compact, we took care of all that. We have specific provisions in the upper basin compact that all uses of water by the United States or its wards are chargeable to the State in which they occur. As I said then, the other States increased the allotment to New Mexico in order to take care of the Shiprock project.

Senator ANDERSON. And did not the people participating in that conference steadily represent the desire to have a large supply of water devoted to the Navaho Indians?

Mr. BREITENSTEIN. May I say, Senator, they did that very vigorously.

Senator WATKINS. As a matter of fact, the United States has already adopted a policy, in authorizing projects downstream, of not letting any so-called Indian rights affect, in any way, the policy of building these projects.

Mr. BREITENSTEIN. That is correct. You have the reservations below Hoover Dam on the Colorado River.

Senator KUCHEL. Then we have a case here of the right hand not knowing what the left hand is doing, because—and I am trying only to develop the facts here—if the Office of Indian Affairs ruled one way and the Government of the United States on occasion ruled otherwise, then we have diametrically opposite decisions by the Federal Government with respect to prior rights of Indians on waters.

Mr. BREITENSTEIN. That is correct, sir, and that is involved in the pending Rio Grande lawsuit between Texas and New Mexico.

Senator KUCHEL. It does point up one of the problems that ought to be solved, at least administratively and perhaps subsequently judicially.

Mr. BREITENSTEIN. I don't disagree with that at all, sir. I do want to emphasize that the upper basin States have shown a concern over the Indians. It is our desire to help the Indians.

Senator KUCHEL. I think I quote correctly one of the able witnesses who testified yesterday or the day before, when I say that in the law of water, and particularly when there are exchanges of water, the exchanges must constitute an exchange of water not alone alike in quantity, but also in quality.

If that is true, I would like to refer to your testimony on page 23, where you say that the statements of California witnesses are based upon no engineering theory that the quality of the water will be impaired by upstream development.

Mr. BREITENSTEIN. Yes.

Senator KUCHEL. Would it be correct, Judge, for me to state your position to be that, while there is a responsibility of delivering on any exchanges water of equal quantity and quality, it is your position that the people from California have not successfully urged that there would be a lack of quality in any exchange?

Mr. BREITENSTEIN. That is partly it; and, Senator, I should say first, with all due regard to George Clyde—and I have the utmost respect for him—I heard him make that statement yesterday, and I frankly disagree with the part on quality of water. In Colorado on the eastern plains there are exchanges of water every year—it is a practice of long standing—where I am sure there is different quality in the exchange. But it is usable water. The ultimate question is whether or not the water is usable.

Senator KUCHEL. And by usable, you mean from the chemical standpoint, capable of being used for the various consumptive purposes that the compact would require?

Mr. BREITENSTEIN. For the purpose intended; yes.

On the other matter that you raised, Senator——

Senator KUCHEL. May I pursue that a moment.

Mr. BREITENSTEIN. Surely.

Senator KUCHEL. With respect to usability, can you state to the committee who would determine the quality of exchanged water under this legislation?

Mr. BREITENSTEIN. Sir, I don't think that under the legislation here there would be any necessity of determining the quality of water, because it seems to me that, if anything, the quality—I am speaking as a layman, please understand me—will be improved. So far as exchanges in Colorado are concerned—they have been going on on the

eastern plains for years—I have never yet heard the question of quality of water raised.

I might say, Senator, that when you get into quality of water, the quality of water on such streams as the Pecos, the Rio Grande, the Arkansas, and part of the south Platte, is much less than that of the Colorado. Yet that water is being used and has been used for years for irrigation and municipal purposes.

Senator KUCHEL. I suppose the question of the quality of water or usability of water is a matter of judgment.

Mr. BREITENSTEIN. It is to a great extent.

Senator KUCHEL. There was some testimony in the House of Representatives in the hearing on the bill which would indicate that under this legislation the quality of water would be affected. I suppose if that testimony were correct, the question of proper quality or usability again would be a question of judgment. Reasonable people might disagree.

Mr. BREITENSTEIN. That is correct.

Senator KUCHEL. Again I ask, suppose under this legislation, and in good faith, the contention were made that the quality of water delivered at Lee's Ferry after the present legislation were adopted into law was not usable. Who would sit in judgment as between the different opinions?

Mr. BREITENSTEIN. Senator, if that should come about, I apprehend that the final decision would be by the Supreme Court of the United States on the basis of the conflicting claims of the parties.

Senator KUCHEL. How would the Supreme Court of the United States have jurisdiction to decide that question?

Mr. BREITENSTEIN. I apprehend that some lower basin State or States would sue the upper basin State or States and claim that there was a violation of the compact because the water delivered at Lee's Ferry is inferior in quality.

Senator KUCHEL. Would the Supreme Court gain jurisdiction of that merely by the filing of the suit in the Supreme Court by one State against another?

Mr. BREITENSTEIN. Yes. The Court has original jurisdiction of such suits.

Senator KUCHEL. Would the Department of the Interior have the responsibility of determining whether or not the quality of the exchange water was the same?

Mr. BREITENSTEIN. Frankly, Senator, I doubt whether or not the Secretary of the Interior would. There is nothing in the 1922 compact which relates to the quality of water. If there is a violation of that compact, the violation, in my judgment, would occur by a State because of our existing system of apportionment and allocation of water in the West. If it would be contended by a State that another State, or States is violating the law in any way, the United States Supreme Court would have jurisdiction to determine that issue.

Senator KUCHEL. Is it your testimony, then, that the bill in its present wording does not clothe the Secretary of the Interior with the responsibility of administering the projects provided for in this bill as to the determination of quality and quantity of water?

Mr. BREITENSTEIN. As to quantity, I think the bill does give him that power, because it gives him the power to operate these reservoirs.

Senator KUCHEL. As to quality?

Mr. BREITENSTEIN. Quantity.

Senator KUCHEL. But not as to quality?

Mr. BREITENSTEIN. No, sir.

Senator KUCHEL. So if there ever were a question, as respects the delivery below Lee's Ferry, as to the quality of the water, it would be your statement that under the bill those who contended they were aggrieved would have to look to the specific State——

Mr. BREITENSTEIN. State or States; yes.

Senator KUCHEL. Or States to satisfy their grievance?

Mr. BREITENSTEIN. Yes, Senator, because the rights would be those alleged to exist under the 1922 compact. That compact has been signed by the States. I apprehend if that situation ever developed one State would say that another State has violated the compact. That is the way it would arise. And the Court would take, I assume, original jurisdiction of the case.

Senator KUCHEL. And no action by the Congress would be necessary to approve the jurisdiction?

Mr. BREITENSTEIN. Not in my opinion, sir.

Senator WATKINS. Would it be proper for Congress to take away the right of any State to sue another State?

Mr. BREITENSTEIN. I think it has been held that Congress cannot do that, Senator.

Senator WATKINS. That is right.

Senator KUCHEL. On page 24, in discussing the recommendations which Mr. Ely made to the House committee, you describe his amendments under numeral 2, "Proposed amendments pertaining to the law of the river," and you find yourself in agreement with the first suggestion he made.

Mr. BREITENSTEIN. Oh, yes. We say here, Senator, that this project must be authorized, constructed, and operated under the law of the river. We are relying on that just as much as the lower basin is.

Senator, in that regard, I do not know whether you have seen it or not, but there have been suggested amendments to the bill to authorize the Fryingpan-Arkansas project, that is, S. 964.

Senator KUCHEL. I was going to ask you, do you have that language?

Mr. BREITENSTEIN. Yes, I have it here.

Senator KUCHEL. Could it be made a part of the record, Mr. Chairman? That would be in connection with the Judge's recommendations.

Senator WATKINS. We will receive it as a part of your testimony. Will you identify it?

Mr. BREITENSTEIN. I have it copied on a piece of paper here. These are taken from the committee print on S. 964.

Senator WATKINS. If you will make a notation that you offered it as a part of your testimony.

Senator KUCHEL. On S. 964.

Senator ANDERSON. Could we not ask Mr. Nelson to put into the record at this point the suggested amendments to the Fryingpan-Arkansas bill, and we will have them all in the record at this point.

Senator WATKINS. Since he has it already, let us do it this way.

Mr. BREITENSTEIN. These cover the points Mr. Ely was testifying to and, so far as I am concerned, I have no objection to them. They

do not go into the waiver of immunity to suit, but they do go into the law of the river and matters like that.

If the committee saw fit to put similar provisions in this bill, so far as Colorado is concerned I am sure it would have no objection.

(The document referred to follows:)

SEC. 7. (a) The use of water diverted from the Colorado River to the Arkansas River Basin through works constructed under authority of this Act, shall be subject to and controlled by the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, and the Mexican Water Treaty (Treaty Series 994), as hereinbefore provided, and shall be included within and shall in no way increase the total quantity of water to the use of which the State of Colorado is entitled and limited under said compacts, statute, and treaty, and every contract entered into under this Act for the storage, use, and delivery of such water shall so recite.

(b) All works constructed under authority of this Act, and all officers, employees, permittees, licensees, and contractors of the United States and of the State of Colorado acting pursuant thereto, and all users and appropriators of water of the Colorado River system diverted or delivered through the works constructed under authority of this Act and any enlargements or additions thereto shall observe and be subject to said compacts, statute, and treaty, as hereinbefore provided, in the diversion, delivery, and use of water of the Colorado system, and such condition and covenant shall attach as a matter of law whether or not set out or referred to in the instrument evidencing such permit, license, or contract and shall be deemed to be for the benefit of and be available to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming and the users of water therein or thereunder by way of suit, defense, or otherwise in any litigation respecting the waters of the Colorado River System.

(c) None of the waters of the Colorado River System shall be exported from the natural basis of that system by means of works constructed under authority of this Act, or extensions and enlargements of such works, to the Arkansas River Basin for consumptive use outside of the State of Colorado, and no such waters shall be made available for consumptive use in any State not a party to the Colorado River Compact by exchange or substitution or, as far as the same is controllable through the operation of works herein or hereafter authorized, by use of return flow.

(d) No right or claim of right to the use of the waters of the Colorado River System shall be aided or prejudiced by this Act, and the Congress does not, by its enactment, construe or interpret any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, or the Mexican Water Treaty or subject the United States to, or approve or disapprove any interpretation of said compacts, statute, or treaty, anything in this Act to the contrary, notwithstanding.

Senator ANDERSON. The Fryingpan-Arkansas project is a diversion of water from one water slope to another, is it not?

Mr. BREITENSTEIN. Yes, sir, it is a transmountain diversion of water from a tributary of the Colorado River to the headwaters of the Arkansas River, in Colorado.

Senator ANDERSON. With the greatest use being domestic in this case.

Mr. BREITENSTEIN. That is correct, yes, sir.

Senator ANDERSON. The provision of a water supply for a great city like Colorado Springs, and so forth——

Mr. BREITENSTEIN. Pueblo, and other cities.

Senator ANDERSON. Is regarded as a very proper use of that water if the State of Colorado wants to do it that way.

Mr. BREITENSTEIN. That is right.

Senator KUCHEL. In your testimony on page 27 with respect to salinity and the recommendation made about salinity, you state you have no objection to Congress authorizing the Secretary of the In-

terior to make salinity studies, but that if it were done at all, it should be under a general authorization applying to all western streams.

Mr. BREITENSTEIN. Yes.

Senator KUCHEL. Since here we deal with a contractual arrangement by which a number of States have entered into an agreement on the waters of the Colorado River, what would your objection be if an amendment were suggested requiring studies of salinity merely as a part of this project?

Mr. BREITENSTEIN. Senator, I personally would have no objection to that if the authorization was general all the way up and down the stream from the headwaters clear down to the Gulf of California. However, if there is to be such a salinity investigation, it should be under general legislation applying to all the western streams.

Senator WATKINS. As a matter of fact, Judge, the Geological Survey is now authorized to make that study.

Mr. BREITENSTEIN. It makes some studies, Senator. I think those might well be broadened to include streams in areas which are not now included.

Senator WATKINS. I understood from one of the previous witnesses that such a study was being made out in Colorado.

Mr. BREITENSTEIN. I understand that salinity studies have been made on the Colorado by the USGS for some time. I don't know how long they have been made.

Senator KUCHEL. My only point is that if the question of professional studies on the salinity of the water in this river were deemed to be important, it seems to me it would be easier to discuss the possibility of amending this legislation with respect to studies of salinity on the water covered by this bill rather than by urging in a separate piece of legislation that that study be extended to waters in all rivers.

Mr. BREITENSTEIN. That may be true, Senator, but certainly as a minimum it should include the entire length of the Colorado River system. You will recall the testimony of Mr. Clyde yesterday, that during the period before the regulation of the stream by Boulder Dam, the quality of water at Yuma, Ariz., at times of low flow was much worse than it is now with regulation.

Senator ANDERSON. It is your testimony that this means a concentration of solids of about seventy-eight one hundredths ton per acre-foot, and might rise as high as eighty-eight one hundredths of a ton. I have never had any expert advise that I should not put water on my land that had eighty-eight one hundredths of a ton in it. As a matter of fact, we have not had any water now for 10 or 12 days.

The Pecos River is dry. Rivers are dry that have never been dry before. We would like to get water that went as far as permissive drainage, which is two full tons per acre-foot.

I do think if we are going to have some studies, I would like to know what eighty-eight one hundredths does to your soil if it is, as Mr. Clyde pointed out, regularly flowing on and not just flushing it out at one time and then leaving it very dry at another. It seems to me in the hearings on the central Arizona project, the discussion with reference to the Gila River pretty clearly brought out the difference between a well-regulated river and one that is dry and then has flood periods.

Mr. BREITENSTEIN. That was gone into quite thoroughly in those hearings, as I recall.

Senator KUCHEL. Senator Anderson, may I ask if you would like to know what effect that amount of salinity or liquid solids, as you suggest, would have on your land, would you like to know sufficiently to consider an amendment in this legislation to provide the technical and professional facilities?

Senator ANDERSON. We have had many discussions of the Winters case. As a layman, I have many times asked my legal friends if one of them sometime would sit down and tell me in pretty simple language what the implications of the Winters case are and what was decided by the Winters case, so that I might know more about it than the Bureau of Indian Affairs seems to know, I will put it that way. But at least I would like to know in general what the Winters case means as applied to all rivers in the United States, and not just to the Colorado.

By the same token, I would like to know what salinity means and what these solids mean across the country, not only as far as the upper Colorado River is concerned, but what the lower basin is doing to the poor Republic of Mexico, which stands by and has no defense because it may be getting some awful water. I do not think it is. I think water is pretty good if you can have it for irrigation even if it has salinity up to ninety-nine one-hundredths of a ton per acre-foot.

Senator KUCHEL. Senator, are you suggesting that the Republic of Mexico has made any representations that its receipt of Colorado River water is not of the quality——

Senator WATKINS. Gentlemen——

Senator ANDERSON. No. It is delighted to get hold of some water.

Senator WATKINS. We are not going to settle any arguments affecting Mexio here. I would like to suggest that since one of the United States agencies which is studying water problems is already making that investigation, and apparently has authority to do it or it would not be doing it, that any amendment of that kind here would be absolutely unnecessary. If a problem arises the United States Geodetic Survey can take care of it. It would be better for them to do it, anyway, than to have the Bureau of Reclamation making the study. The Bureau of Reclamation is too much mixed up in it. It would be better to have an independent agency making that study.

I cannot see any reason or necessity for such an amendment in this legislation. I do not believe it wise for one department to attempt to do what some other department is equipped to do and has already begun.

Senator KUCHEL. Mr. Chairman, with all due respect to the chairman—and the chairman may be completely right—I think the fact remains that in the testimony yesterday or the day before, it was indicated that there is hardly any professional conclusions in this field, and that therefore it is impossible for a technically qualified witness to bring to this committee any professional or expert testimony on that very question.

Senator WATKINS. As of now. But they are making the study. It was started recently, as I understood the statement of one of the witnesses. They are going on with that.

Senator KUCHEL. Just one final question. Perhaps I should not ask you this, Judge. This is one which is of legal nature. I would like to ask whether, in your judgment, questions of the usability of

water ought to be pretty well determined before any legislation providing for the exchange of water is enacted?

Mr. BREITENSTEIN. No, I dont think so, Senator. If you waited for that to be determined, you would postpone all development.

May I point out this: In the lower basin they didn't wait to have those questions determined. When they put in the Metropolitan aqueduct or when they put in the All-American Canal or when they developed the Salt River project or the Gila project, they did all those things with these questions undetermined, and they did all of them while there were controversies in the lower basin as to the rights of the lower basin States.

We want to get it developed. We want to comply with the compact. We intend to comply with the compact. We recognize the lower basin has rights under that compact which we respect.

Senator WATKINS. But if we violate their rights, they always have their remedy.

Mr. BREITENSTEIN. That is correct, sir.

Senator WATKINS. We cannot anticipate breaches.

Mr. BREITENSTEIN. No. The presumption is that officials will comply with the law.

Senator WATKINS. Thank you, Judge.

Mr. BREITENSTEIN. Thank you, Mr. Chairman.

Senator WATKINS. Sam Ahkeah, chairman of the Tribal Council of the Navaho Indians is our next witness.

STATEMENT OF SAM AHKEAH, CHAIRMAN, NAVAHO TRIBAL COUNCIL, ACCOMPANIED BY NORMAN M. LITTELL, GENERAL COUNSEL, NAVAHO TRIBE

Senator WATKINS. We are glad to have you with us, Mr. Ahkeah. Do you desire to have your attorney sit by you during your testimony?

Mr. AHKEAH. Yes, sir.

Senator WATKINS. He may come forward.

Will you state your name for the record?

Mr. LITTELL. Norman M. Littell, 1826 Jefferson Place NW., Washington. I am general counsel of the Navaho Tribe.

Mr. AHKEAH. Mr. Chairman and gentlemen of the committee, I am Sam Ahkeah, chairman of the Navaho Tribal Council, now living in Window Rock, Ariz., and my home is at Shiprock, N. Mex., on the San Juan River. I make this statement on behalf of about 75,000 Navahos who live on some of the most arid lands in the North American Continent, embracing the Navaho Reservation having within its boundaries about 24,000 square miles or roughly 16 million acres of land.

The San Juan River flows along our northern boundary. In fact, until the United States acquired this territory from Mexico by the Treaty of Guadalupe Hidalgo, we owned land on both sides of the river. When the white settlers and military expeditions came to New Mexico in the 1840's and 1850's, they found our ancestors growing wheat, corn, beans, and other crops. They had well-developed peach orchards, and on one occasion carried blankets of peaches to a friendly military expedition.

We knew what the use of water would do to our land and in a primitive way used it. Kit Carson tells how our fields, crops, and

COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

EIGHTY-FOURTH CONGRESS

FIRST SESSION

ON

S. 500

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

FEBRUARY 28, MARCH 1, 2, 3, 4, AND 5, 1955

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COLORADO RIVER STORAGE PROJECT

FRIDAY, MARCH 4, 1955

UNITED STATES SENATE,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met at 10 a. m., pursuant to recess, in the committee room, 224 Senate Office Building, Senator Clinton P. Anderson (New Mexico), presiding.

Present: Senators Clinton P. Anderson (New Mexico); Joseph C. O'Mahoney (Wyoming); Alan Bible (Nevada); Eugene D. Millikin (Colorado); Arthur V. Watkins (Utah).

Also present: Senator Thomas H. Kuchel (California); Gordon Allott (Colorado).

Present also: Stewart French, staff director and chief counsel; Goodrich W. Lineweaver, staff member for reclamation; William K. Coburn, staff member for public lands; James Gamble, staff member for Indian affairs; Richard L. Callaghan, chief clerk; N. D. McSherry, assistant chief clerk; and Elmer Bennett, office of legislative counsel, Department of the Interior.

Senator ANDERSON. Mr. Griffith, please. You may proceed, sir.

Senator KUCHEL. Mr. Chairman, I take great pleasure in introducing Hon. Ben P. Griffith, a distinguished citizen of the city of Los Angeles, and presently the president of the board of water and power commissioners of the city.

STATEMENT OF BEN P. GRIFFITH, PRESIDENT OF THE BOARD OF WATER AND POWER COMMISSIONERS OF THE CITY OF LOS ANGELES, CALIF.

Mr. GRIFFITH. My name is Ben P. Griffith, and I am president of the Board of Water and Power Commissioners of the City of Los Angeles. This board consists of five members, appointed by the mayor, with the consent of the city council and is charged with the administration of the water and power department. This department constitutes the largest municipally owned utility in this country. The board members themselves receive no salary, except for a fee of $25 per meeting. Under the charter of the city of Los Angeles, they are clothed with broad powers which make them nearly autonomous, and remove these vital utilities as nearly as possible from political pressures. It is not, and has not been for nearly 30 years supported by taxes but by revenues derived from the rate payers which number some 800,000. As a result, the department has been able to plan for a prudent period ahead of its current needs, and to finance and construct its distribution and storage

STATEMENT OF NORTHCUTT ELY, SPECIAL COUNSEL, THE COLORADO RIVER BOARD OF CALIFORNIA

Mr. ELY. Mr. Chairman, my name is Northcutt Ely. I am an attorney, with offices in the Tower Building, Washington 5, D. C., and appear here as special counsel to the Colorado River Board of California, a branch of the State government.

California, as a party to the Colorado River compact, and with heavy investments made under the Boulder Canyon Project Act, is seriously affected by this bill in the respects which I shall outline. California is also a party to the pending suit in the Supreme Court entitled *Arizona* v. *California et al.*, No. 10 Original, October term, 1953, as are Nevada, Arizona and the United States. I have the honor to represent California in that action as an assistant attorney general of my State, under the direction of Attorney General Edmund G. Brown of California.

The Bureau of Reclamation and the upper basin States, in planning the project now before you, have made interpretations of the compact and the project act which we challenge in the pending Supreme Court action, and which have necessitated our motion to implead these States in that suit. The Supreme Court, on February 28, 1955, referred that motion to the special master, Hon. George I. Haight, whom it had previously appointed, with instructions "to hear the parties and report with all convenient speed his opinion and recommendation as to whether the motion should be granted."

I shall discuss the pending project, our own projects which are affected, the conflicting interpretations of the compact and project act upon which the existing lower basin projects and the proposed upper basin projects are respectively based, and the effect upon our very large investments if the pending upper basin project were built and operated in the manner proposed.

I. THE PENDING PROJECT

The Colorado River storage project is variously described in bills now before Congress, but all of them have the four following objectives:

(1) Authorization of the construction of 11 to 30-odd reclamation projects. The aggregate consumptive use of these projects, including the evaporation loss, is said to range from about 1 million to about 2 million acre-feet. These quantities, when added to about 2,500,000 acre-feet, said to be required by projects already constructed or authorized, would represent a total use of say 3,500,000 to 4,500,000 acre-feet in the upper basin. The larger of these figures is still within the quantity of 7,500,000 acre-feet per annum, the use of which is apportioned to the upper basin by article III (a) of the Colorado River compact. Moreover, the engineering studies indicate that this total could be put permanently to use without the construction of any new holdover storage whatever, and that no holdover storage would be required for nearly a half century, even if other projects were added.

(2) Nevertheless, these bills authorize the immediate construction of 2 to 6 storage reservoirs: Echo Park, Flaming Gorge, Glen Canyon, Cross Mountain, Navaho, and Curecanti. The ultimate storage program amounts to over 48 million acre-feet. These storage dams are

far downstream from the irrigation projects. They would not store water to be used on these projects. They would, instead, store the water which is not used on the irrigation projects in the upper basin, but which is destined for use in the lower basin and in Mexico. It is proposed that this lower basin water, so intercepted, be used to generate electric energy, the power sold, and the proceeds used to pay out the cost of the storage dams, and thereafter, starting 44 years from completion of Glen Canyon, to pay for the reclamation projects named in section 1 of the bill. The irrigation projects thus subsidized are called participating projects, and the subsidy is over 85 percent of their construction cost. The power would be sold to 10 privately owned utilities at a rate in excess of 6 mills per kilowatt-hour, in contrast with Hoover Dam, where 91 percent of the firm energy is sold to public agencies at a switchboard cost of about 2 mills per kilowatt-hour.

Senator ANDERSON. Are the figures comparable? Is this 6 mills a switchboard price?

Mr. ELY. That is not clear from the material here. I take it that it is a postage stamp rate available wherever the power may be taken.

Senator ANDERSON. Therefore, the two figures are not comparable?

Mr. ELY. That I cannot tell you, sir.

Senator ANDERSON. If it was a postage stamp figure, it is not comparable to the switchboard cost, is it?

Mr. ELY. You are correct to the extent it includes the transmission cost. Whether the 6 mills would be charged to a user near the dam is not clear.

(3) These bills all authorize; for example, S. 500, section 2, the future construction of other projects. These are not designated in the bill, but the Department of the Interior has inventoried over 100 projects in various publications, particularly House Document 419, 80th Congress. It is not clear from section 2 whether these projects must be brought back to Congress for further authorization, or whether the Secretary is authorized by section 2 to build them. Except as to two projects, the O'Mahoney-Millikin amendment to the Flood Control Act of 1944 is waived, and the Secretary need not submit his feasibility reports to the affected States for comment.

(4) When, as, and if the additional irrigation projects referred to in section 2 are built, it will be necessary to store water in downstream storage reservoirs, not for use by the reclamation projects—all of the storage reservoirs, as previously stated, are so far downstream that no water stored there can be used for irrigation or domestic purpose in the upper basin—but for quite a different reason: To enable these section 2 projects to increase the consumptive use in the upper basin above the 4,500,000 acre-feet required by existing projects plus all the section 1 projects, without violating the provisions of article III (d) of the Colorado River compact.

That article of the Compact stipulates that the States of the upper division (Colorado, Utah, New Mexico, Wyoming) will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years. In the driest decade so far, the flow at Lee Ferry was more than 100 million acre-feet, during a time when the upper basin projects were using about 2,500,000 acre-feet per year; and engineers tell us that the upper basin uses can safely rise to about 4,500,000 acre-feet (which is about

the total of existing uses plus all the uses of all the section 1 projects proposed in the most ambitious of these bills), before this 100 million total would shrink to 75 million.

Senator ANDERSON. Would you pause there? It is not an extremely important matter, and I do not wish to dwell on it, but the statement that you have that all these reservoirs are so far downstream that no water stored there can ever be used for irrigation or domestic purposes in the upper basin—and you mentioned the Navaho Dam, and that is above the Navaho-Shiprock project, so called. But I think the statement is true as to the vast majority of them.

Mr. ELY. Yes, your correction is in order, I think.

Senator ANDERSON. Thank you.

Mr. ELY. Thus the ultimate purpose of Glen Canyon Reservoir, and the other holdover storage reservoirs, is to enable the unnamed section 2 projects to be built in the upper basin at some remote time in the future without violating article III (d) of the compact.

The bills all make clear that this measure is intended to commit Congress to a program for the full utilization of all the water which the upper basin claims under the Colorado River compact. Such a declaration of policy appears in section 2. Otherwise, the storage reservoirs are not needed for any water conservation purpose, and are strictly power dams.

The total storage capacity proposed is enough to intercept the whole flow of the river for several years, and it is planned to hold over storage in these reservoirs for 20 to 35 years, or 5 to 9 presidential administrations. This is like holding back from the lower basin water which reached Glen Canyon in 1920 in order to release it to Hoover Dam in 1955. During the 50 years that these reservoirs will serve no necessary function except to generate power, they will evaporate some 30 million acre-feet of water. The evaporation loss from these power reservoirs will be over 600,000 acre-feet per year, enough for a city of 3 million people.

II. THE HISTORICAL BACKGROUND

The dispute, which brings us here and into the Supreme Court, turns primarily upon conflicting interpretations of the Colorado River compact and the Boulder Canyon Project Act, which, ironically enough, were themselves supposed to settle the conflict between the upper basin and the lower.

The chronology is as follows:

Developments prior to 1922

Irrigation in the lower basin developed much more rapidly than in the upper. Palo Verde Valley commenced irrigation in 1877; Imperial Valley's appropriations date from 1891; those of the Yuma project in Arizona from 1904. By 1916 the whole natural flow had been appropriated, and the river was dry for long periods in the summer at the Mexican boundary. Nevertheless, the spring floods, depositing great quantities of silt and raising the river bed several feet in some years, were an increasing menace to lands in Imperial Valley, lying below sea level, and to lands in the Yuma Valley in Arizona. Junior appropriators in the upper basin faced a probable lawsuit by senior appropriators in the lower basin. A great storage dam was a necessity not only for flood control, but also to make possible any

further development at all in either the upper basin or the lower, and for power generation.

But the upper basin, knowing that the lower had a 2-to-1 population ratio (now over 4 to 1), better lands, flatter contours, lower capital costs, and a longer growing season, rightly feared that if the flood-waters were stored, the lower basin would appropriate and use them, unless in some way the upper basin could be insulated against the law of priority of appropriation, which is "first in time, first in right." The United States Supreme Court, in 1922, in the case of *Wyoming* v. *Colorado* (259 U. S. 419), applied this rule on an interstate stream, regardless of State lines.

The Colorado River compact

The Colorado River compact was signed by representatives of all seven States at Santa Fe, N. Mex., November 24, 1922, subject to ratification by their legislatures and the consent of Congress, the latter being a constitutional requirement.

Article II defined the Colorado River system as including the main stream and its tributaries, the upper basin as being the drainage area above Lee Ferry, a point on the river in northwest Arizona, and the lower basin as the drainage area below that point. The 4 States of Colorado, Utah, New Mexico, and Wyoming were defined as the "States of the upper division" and the 3 States of Arizona, California, and Nevada as the "States of the lower division." The terms "division" and "basin" are not quite the same. Utah, New Mexico, and Arizona have areas in both basins.

The negotiators gave up any attempt to allocate all the water, or to allocate to individual States. They agreed on the idea of allocating "beneficial consumptive uses" instead of the flow of a stream, and made a general division as between upper and lower basins, leaving to the future any allocation to States as such. Nor did they attempt to dispose of all the water supply, leaving, as they thought, about 25 percent of it unallocated and untouched by the compact. The mechanics were as follows:

In article III (a) the compact apportioned in perpetuity the "beneficial consumptive use" of 15 million acre-feet per annum of the waters of the Colorado River system, one-half to each basin, to include any rights which "may now exist." This was the protection against the law of priority of appropriation demanded by the upper basin. As article II defined the system to include the tributaries, the apportionment in article III (a) includes the uses on the tributaries as well as on the main stream. The compact did not define the term "beneficial consumptive use."

Article III (b) permitted the lower basin to "increase its use" of waters of the system by 1 million acre-feet per annum.

These 2 paragraphs thus disposed of 16 million acre-feet per annum of which 15 million was insulated against the law of appropriation, basin versus basin, by a perpetual apportionment. A compact title to the other 1 million acre-feet could be obtained by "increase of use" in the lower basin, but not by apportionment irrespective of use.

These two paragraphs did not dispose of all the water available throughout the system. This total was estimated, in reports of the negotiators to Congress, as over 20 million acre-feet.

Article III (c) provided that if the American Government should recognize rights in Mexico, the Mexican burden should be met first out of any water in excess of the 16 million acre-feet, and if that was insufficient, the deficiency should be equally borne by the two basins. The four States of the upper division agreed to deliver water at Lee Ferry to supply one-half of the deficiency in addition to their obligation under article III (d).

In article III (d) the 4 upper States promised that they would not deplete the flow at Lee Ferry below 75 million acre-feet in any 10-year period.

Article III (e) provided that the States of the upper division would not withhold water, and the States of the lower division would not require the delivery of water, which could not reasonably be applied to domestic and agricultural uses.

Article III (f) provided that further equitable apportionment of the beneficial uses of the system unapportioned by paragraphs (a), (b), and (c) might be made after October 1, 1963, if and when the upper basin should have reached a beneficial consumptive use of 7,500,000 acre-feet per annum, or the lower basin 8,500,000 acre-feet.

Article III (g) provided the mechanics for calling such a future conference.

Article IV provided that water might be impounded for power generation, but "Such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes."

Article VII provided that "nothing in this compact shall be construed as affecting the obligations of the United States to Indian tribes."

Article VIII provided that "present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact."

Article XI provided that the compact should become binding when ratified by the legislatures of all seven States and when Congress should give its consent.

Ratification by six States, rejection by Arizona

In 1923 all States but Arizona ratified. Her legislature rejected the compact, after one house or the other had adopted reservations excluding the Gila River and subjecting all power development to a $5 per horsepower royalty.

In 1925, at the suggestion of Colorado, the other 6 States ratified it again, as a 6-State document, waiving 7-State ratification, and presented it to Congress in that form.

The Boulder Canyon Project Act

The Boulder Canyon Project Act was enacted in December 1928, but section 4 (a) provided that it should not take effect unless, at the end of 6 months, the President should proclaim either that the Colorado River compact had been ratified by 7 States, or, failing that, had been ratified by 6 States including California, and, in the latter event, California's Legislature had enacted a statute, in terms prescribed by Congress, limiting California's rights in the Colorado River. The upper basin, in other words, had demanded in 1922 a seven-State compact as the price for the construction of Hoover Dam. Failing to get

Arizona's ratification, they demanded (and got) a second price from California: the enactment of the Limitation Act, to avoid the possibility that California and Nevada might use all the water apportioned to the lower basin, and that Arizona would "raid the river" outside the Compact, i. e., establish priorities against slower upper basin development.

The Boulder Canyon Project Act, in granting consent to a 6-State compact, cut across the 7-State compact in several particulars, in addition, of course, to the change in the number of parties.

Whereas the 7-State compact made no allocations to individual States, but only to basins, the project act recognized California's right to specified quantities—and required her to limit herself thereto—that is, 4.4 million acre-feet of the waters apportioned by article III (a), plus one-half of the excess of surplus waters unapportioned by the compact. As to the latter, whereas the compact, in article III (b), had recognized the lower basin's right to appropriate 1 million acre-feet of surplus, the project act recognized California's right to appropriate one-half of the excess or surplus, which might be more or less than 1 million acre-feet. The project act makes no specific reference to article III (b). The compact did not define "consumptive use," but the project act did, as "diversions less returns to the river." Whereas article IV (c) speaks of State "regulation and control," the project act, in section 5, directed that no one should have the use of stored waters except by contract with the Secretary, but directed him to make contracts in accordance with the Limitation Act; that is, in accordance with section III (a), and section 6 directed him to use the reservoir, among other purposes, for satisfaction of present perfected rights in pursuance of article VIII of the Colorado River compact. (For brevity, the term "appropriation" is used throughout this discussion as including not only rights acquired by appropriation under State law, but rights in waters stored by the United States acquired or confirmed by contract with the United States.) Elsewhere, in section 13, the statute subjected all rights of the United States and of those claiming under it to the compact. Whereas article IV of the compact had declared the Colorado River to be nonnavigable, sections 1 and 6 of the project act directed the dam and reservoir to be used in aid of navigation and flood control.

California passed the required Limitation Act in 1929 to take effect only in the absence of 7-State ratification. The resulting agreement with Congress is referred to in our discussions as the statutory compact between the United States and California, to distinguish it from the Colorado River compact.

The President, on June 25, 1929, proclaimed the failure of 7-State ratification, and the completion of 6-State ratification.

The 6-State compact and the project act thereupon became effective, authorizing the construction of Hoover Dam and the All-American Canal, on the further condition that the beneficiaries contract in advance to repay their cost. Water and power users in California did so in 1930–34. The water contracts now under attack by Arizona in Supreme Court disposed of 5,362,000 acre-feet per annum, equal to 4.4 million acre-feet of water available under article III (a) of the Colorado River compact, and about 1 million of "excess or surplus" available in accord with the Limitation Act.

III. THE PROJECTS PAID FOR BY CALIFORNIA

California is deeply concerned by this proposed interception of the water supply upon which projects costing the people of this State more than a half billion dollars are dependent.

From north to south, these are:

(1) Hoover Dam, whose cost was underwritten by the water and power users of southern California under the authority of the Boulder Canyon Project Act, plus the transmission lines built by California agencies to bring Hoover Dam power to the people in this State (Arizona and Nevada subsequently withdrew 36 percent of the power underwritten by California power contractors);

(2) Parker Dam, about 155 miles below Hoover Dam, paid for by the Metropolitan Water District of Southern California;

(3) The Colorado River aqueduct, built and paid for by the Metropolitan Water District, which carries Colorado River water over 300 miles from Parker Dam to some 60 cities and districts on the coastal plain, of which the largest are Los Angeles and San Diego;

(4) The Palo Verde Irrigation District, an area about 212 miles below Hoover Dam, which has the oldest rights on the river and has been diverting water there since about 1877;

(5) The All-American Canal, which diverts water at Imperial Dam, 303 miles below Hoover Dam and 22 miles above the Mexican border, and transports it into the Imperial Irrigation District and Coachella Valley County Water District. This dam and canal were built by the United States, along with Hoover Dam, as part of the Boulder Canyon project, but these districts were required to underwrite the cost in advance. Imperial Valley's appropriations date back to 1891.

I have omitted from this tabulation the Headgate Lock Dam and the Davis Dam, because their cost was not underwritten by California. I might have included Laguna Dam, because we paid for that, although it served only Arizona.

The quantity of Colorado River water which California claims, for which her public agencies hold contracts with the United States, and which the Colorado River aqueduct, the All-American Canal, and the Palo Verde works have been built to use, is 5,362,000 acre-feet per year. California is not seeking more water for new projects, but to defend the water supply of these three old projects.

More than 5 million people live within the areas served by the Colorado River in California. The assessed valuation exceeds $12 billion. The economy of southern California is dependent on the permanent availability of these waters. California could, in fact, use a great deal more than this, if it were available. The Metropolitan Water District will outgrow its present Colorado River supply, which is 1,212,000 acre-feet per year, in about 25 years on present forecasts, and must look elsewhere for additional water.

These works were built in reliance upon the Colorado River compact and the Boulder Canyon Project Act.

The meaning of both these documents is now in sharp controversy in the Supreme Court in *Arizona* v. *California et al.*, in respects which affect the measure now before you, in the following way:

IV. INTERPRETATIONS OF THE COLORADO RIVER COMPACT INVOLVED IN THE UPPER BASIN STORAGE PROJECT LEGISLATION AND THE PENDING LITIGATION

I am taking these up in the order in which they first appear in the Colorado River compact and not necessarily in the order of first importance, although this first one happens to be a very important one.

1. The method of measurement of consumptive use

Article III (a) of the Colorado River compact, in a single sentence, apportions from the Colorado River system in perpetuity to the upper basin and to the lower basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet per annum, which it states shall include all water necessary for the supply of any rights which may now exist. Manifestly this one sentence must have the same meaning in both the basins to which it refers. But there is sharp controversy over the meaning of the term "beneficial consumptive use." The question is whether it means the quantity in fact used, measured at the place of use, or whether it means the effect of that use measured in terms of stream depletion at some point hundreds of miles downstream, in this case Lee Ferry. The same question arises under the Mexican Water Treaty's so-called escape clause.

This question of interpretation of the Colorado River compact and the Mexican Water Treaty is directly at issue in the present Supreme Court cases. The quantity involved in this dispute, so far as the planning of the upper basin storage project is concerned, is 300,000 to 500,000 acre-feet per annum, according to engineers' estimates. The Reclamation Bureau assumes that the measurement is to be in terms of downstream depletion in the case of the upper basin project, but in terms of diversion minus return flow, measured at the place of use, with respect to California. The Boulder Canyon Project Act (sec. 4 (a)) defines it in the latter terms, and the Mexican Water Treaty says (art. I (j)):

> "Consumptive use" means the use of water by evaporation, plant transpiration, or other manner whereby the water is consumed and does not return to its sources of supply. In general it is measured by the amount of water diverted less the part thereof which returns to the stream.

That corresponds with California's allegation of the meaning of the term in *Arizona* v. *California* (answer to Arizona, par. 8). Arizona denies that this definition applies to her uses (reply, par. 8), and the Reclamation Bureau, in the project before you, assumes that it does not apply to the upper basin, although the projects to be built under these bills are recognized as being subject to the terms of the Mexican Water Treaty (e. g., S. 500, sec. 12).

Another problem arises if the depletion theory prevails. One of its postulates is that when water is stored in a reservoir, the stream below is depleted, and therefore that the consumptive use takes place then and there, in the year when the water is put in storage, not when it is taken out and used. On that premise, to what years is the 48 million acre-feet of holdover storage, i. e., of stream depletion, to be charged? And, in future operations, how is the storage of more than 7,500,000 acre-feet in any one year to be charged? Is the same principle, whatever it may be, applicable to the lower basin reservoirs?

2. The meaning of "per annum" in article III

Article III (a): Does the apportionment of the use of 7,500,000 acre-feet "per annum" mean an average of that amount over a period of years, or a maximum in any one year? Manifestly, as in the interpretation of "consumptive use," the compact must be given the same interpretation in both basins.

The Reclamation Bureau, in submitting this upper basin storage project, makes the assumption that the apportionment means an average over an extended period, apparently 35 years or more. The effect of this theory is that the upper basin may use, say, 9 million acre-feet or more of water in one year, and consider it as apportioned under article III (a), if it uses, say, 6 million or less in some other years, to average 7,500,000 acre-feet.

California alleges in the pending lawsuit that the apportionment means a maximum, like a speed limit on a highway, not an average. If the speed limit says 50 miles per hour, that doesn't mean an average of 50. We allege (answer to Arizona, par. 8) that the words "per annum" in the compact mean "each year," and not an average of uses over a period of years, whether they are our uses or anyone else's. Arizona admits this, but says that the issue is not yet material in the lower basin (reply, par. 8).

The effect, if California is right, is that if the upper basin should use in a given year any quantity in excess of 7,500,000 acre-feet, it is using that excess out of unapportioned surplus, in competition with the appropriations of unapportioned excess or surplus waters which may have been made in the lower basin, and subject to the Mexican treaty burden, which, under article III (c) of the compact, is to be first supplied out of surplus. The amount involved in this particular issue is very large of the order of 1,250,000 acre-feet per year. That is, if the compact means what we think it means, the Reclamation Bureau is in error that much in its assumptions as to the quantity of water which the upper basin can lawfully claim under article III (a), and, by the same token, that much more water must be let down to satisfy the Mexican Water Treaty and prior appropriations of surplus in the lower basin. The same problem arises in the lower basin, but there the Reclamation Bureau has assumed that the limitation imposed upon California's uses by the Boulder Canyon Project Act is a maximum, not an average; so also with its assumptions as to the deliveries to be made under the Mexican Water Treaty and the amounts to be delivered under its water contracts with Arizona, California, and Nevada.

Both assumptions cannot be correct.

This problem of whether the apportionment under article III (a) is of an annual amount, or of an average available over a 20- to 35-year period, has no relation at all to the guaranty in article III (d) that the States of the upper division will not deplete the flow at Lee Ferry below 75 million acre-feet in each 10 years. That problem is discussed below in connection with the Mexican treaty burden.

3. "Rights which may now exist"

Article III (a): Does the statement in article III (a) that the apportionment of the use of 7,500,000 acre-feet per annum "shall include all water necessary for the supply of any rights which may now exist" include two categories or uses in dispute in *Arizona* v. *Califor-*

nia: (1) the uses on the lower basin tributaries, particularly those of Arizona on the Gila River, which she says are not to be charged against the lower basin's apportionment of III (a) water, and (2) Indian uses in both basins? The significance of the Gila appears in connection with the upper basin's obligations under article III (c) and III (d) of the compact, and that of the Indian uses in connection with article VII, and will be outlined when those articles are reached in numerical order.

4. The lower basin's rights under article III (b)

Article III (b) of the compact permits the lower basin "to increase its beneficial consumptive use" by 1 million acre-feet per annum. Arizona says that this is an "apportionment," good in perpetuity against the upper basin. California says that it is not an apportionment, but a license to appropriate. Arizona says all the III (b) water is in the Gila. California says that article III (b) is applicable to the main stream and all the tributaries in the lower basin.

5. The guaranties in articles III (c) and III (d)

Article III (c) provides that the Mexican burden, which is a minimum of 1,500,000 acre-feet per annum measured at the border (and more than that, measured at Lee Ferry), shall be borne first out of surplus, over amounts specified in articles III (a) and III (b) and, if that is insufficient, that the burden of the deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the States of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency, in addition to that provided in article III (d).

Article III (d) provides that the States of the upper division, i. e., Colorado, Utah, Wyoming, and New Mexico, will not cause the flow of the Colorado River at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years.

The interpretation of these two clauses is at issue in *Arizona* v. *California* and is involved in the present bill. The Reclamation Bureau apparently assumes in its presentation here that there will be available at Lee Ferry, after the section 2 projects are built, only about 75 million acre-feet every 10 years. Arizona says (Reply, par. 8, 11) that all this 75 million is III (a) water, that is, that this figure is merely 10 times the quantity apportioned to the lower basin by article III (a) of the compact, and that all of the lower basin's III (a) uses can be made from the main stream. California (Answer to Arizona, par. 8, 11) and Nevada (Petition, par. XIV) deny this, and say that Arizona's uses on Gila, and the uses of Nevada and Utah on the Virgin River, are "rights which may now exist," in the language of article III (a), hence chargeable to (and protected by) article III (a). That would include also New Mexico's uses on the Gila.

Arizona retorts that her uses on the Gila are covered by article III (b) of the compact, an article which says that, in addition to the apportionment in article III (a), the lower basin is given the right to increase its beneficial consumptive use by 1 million acre-feet per annum. If Arizona is sustained by the Court in this position, there is no water for Mexico in the 75 million acre-feet at Lee Ferry referred to in article III (d), and the upper basin, under article III (c), must, in addition, release water to supply one-half of any deficiency in meet-

ing the Mexican burden. When the Reclamation Bureau reported favorably on the central Arizona project, it was on the assumption that Arizona's interpretations were correct, without, however, endorsing them. If California and Nevada are correct, a portion of the 75 million acre-feet at Lee Ferry referred to in III (d), equal to the total of the water supply available and used on the Gila, Virgin, and other tributaries under III (a), is excess or surplus water unapportioned by the compact, available in part for the service of the Mexican Water Treaty and in part for appropriation, contract, and use in the lower basin.

We view the 75 million as a minimum of "wet water," unclassified and unrelated to article III (a), and to be met whether or not there remains available to the upper basin, after meeting that obligation, water to sustain a maximum use of 7,500,000 acre-feet per annum of water apportioned by article III (a).

On the other hand, the upper basin view appears to be that the compact means that if the upper basin lets down 75 million acre-feet in each 10-year period, it is entitled to keep and use what is left. Moreover, the view of some upper basin spokesmen apparently now is that the covenant in article III (d) is not a guaranty at all, and that the apportionment to the upper basin in article III (a) takes precedence over it. We vigorously challenge that interpretation.

6. The right to demand or withhold water

Article III (e) of the Colorado River compact provides that the States of the upper division shall not withhold water, and the States of the lower division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural use.

Article IV (b) provides that the impounding and use of water for power generation shall be subservient to the use and consumption of water for agricultural and domestic purposes.

Glen Canyon Reservoir and the other proposed upper basin mainstream reservoirs will be so located, physically, that no water stored therein can ever be applied to domestic or agricultural uses in the upper basin.

I should correct that with respect to the Navaho, Senator Anderson.

All of the water stored in such reservoirs will be required for domestic and agricultural use in the lower basin and Mexico.

It seems to be the position of the upper basin States that the water which escapes consumptive use in the upper basin may be impounded downstream at Glen Canyon or other dams, and withheld there for power generation, even though required for irrigation and domestic use in the lower basin, so long as 75 million acre-feet are allowed to flow past Lee Ferry in each 10-year period. We deny this, and say that under articles III (b), III (e), and IV of the compact, water appropriated in the lower basin, even though excess or surplus waters, may not be withheld from us, in the upper basin, for the generation of power.

On some of these points, it was refreshing to read the candid statement of Gov. Ed Johnson, of Colorado, released December 20, 1954. After quoting from the reports of the compact negotiators to Congress and the legislatures in 1923, Governor Johnson said:

> I am compelled to keep emphasizing that whatever water is stored in the Glen Canyon and Echo Park Reservoirs will be surplus to the agricultural and

domestic needs of the upper basin, and must be delivered to the lower basin to satisfy the award of 1.5 million acre-feet to Mexico and 1 million acre-feet to the lower basin. Furthermore, should the lower basin require an additional supply of water for agricultural and domestic purposes the water stored in these reservoirs must be released.

Under the 7-State compact the upper States must deliver at Lee Ferry in each 10-year period 75 million acre-feet to the lower States and 7½ million acre-feet to Mexico before they can use one drop of water themselves beyond what they used before the 7-State compact was ratified. In the current 10-year period that will leave only 3,250,000 acre-feet per year for their total use. In the previous 10-year period they would have had 4,150,000 acre-feet a year. In 1902 the upper basin States under this formula would have had no water at all.

The project is planned by the Reclamation Bureau on just the opposite of Governor Johnson's assumptions: namely, the claim of a right to deprive the lower basin of all waters in the main stream in excess of 75 million acre-feet in each 10-year period, which is about 25 percent less than the expectation under the interpretations of the Compact and Project Act on which this same Reclamation Bureau relied in making water and power contracts in the lower basin, and in recommending the Mexican Water Treaty to the Senate.

7. Appropriation of surplus

Article III (f): Does the provision for a further apportionment, by unanimous consent after October 1, 1963, mean that no State may validly appropriate surplus until a new compact is made? California alleges, in the pending litigation, that any State, including the upper basin States, may appropriate surplus waters unapportioned by the compact, subject only to their being divested by a new compact to which such a State is party, or by court decree.

Arizona and Nevada say that no State may acquire any right in surplus until a new compact is made. If they are sustained, then the upper basin can acquire no right in the waters it may use in any year in excess of 7,500,000 acre-feet. Actually, under the compact, the Boulder Canyon Project Act and the Mexican Water Treaty, all excess and surplus water of the Colorado River system has already been appropriated or obligated to uses in the lower basin and Mexico.

8. Indian rights

Article VII of the Colorado River compact provides that nothing in the compact shall be construed as affecting the obligations of the United States to Indian tribes. The upper basin compact (art. VII) provides that use by the United States or its wards shall be charged as a use by the State in which the use is made. California, in the pending suit, takes the same position (answer, par. 14).

The United States denies this (petition of intervention, par. XXXVII), and says that "the rights to the use of water of the Indians and Indian tribes are in no way subject to or affected by the Colorado River compact." The Government's petition tabulates (appendix II) 1,747,250 acre-feet of diversion claims of Indians in the lower basin, of which 1,556,250 are in Arizona. There are Indian claims in the upper basin not tabulated in the petition, to diversion rights exceeding 1 million acre-feet per year.

Arizona says (reply, par. 1) that—

the obligations of the United States to the Indians or Indian tribes are not material or relevant * * *

It is known that the Office of Indian Affairs construes article VII of the compact as meaning that (1) the Indian claims come ahead of the compact, are not chargeable to any State, and the compacting States simply divided the residue after the Indian claims; (2) Indian claims relate back to the date of establishment of the reservation, even though not put to use, and take priority over uses by non-Indians even though the uses by non-Indians may in fact long antedate the actual putting of water to use by the Indians. The Government's pleadings leave it free to make both these assertions. As to the first, Arizona has refused, so far, to disagree with the Indian Bureau's position. Naturally, if Arizona can hope for 1.5 million acre-feet for Indian diversions, outside the compact, in addition to the 3.8 million acre-feet she demands under the compact, there is a temptation to try to get it. Just where the water would come from is not very clear.

Arizona, at a meeting with the Attorney General of the United States on December 3, 1953, was invited to join the upper basin States, California and Nevada in a common statement of position that Indian uses are to be charged under the compact against the State in which they are situated, but declined to do so.

I might add that at the first proceedings before the master on August 5 of this year, the same issue arose and again remained unanswered.

The existence of the Indian claims, and uncertainty as to their accounting, raises serious questions as to the water supply for the projects in both the upper and lower basins. The United States, in this suit, also claims independent rights for the use of the Bureau of Land Management, the Forest Service, the Park Service, for fish and wildlife, and so forth, and denies that all of its rights are subject to the Colorado River compact. The magnitude of these additional claims is not stated.

Those questions will not be resolved until this suit is decided.

9. Present perfected rights: Quality of water

Article VIII provides that "present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact." In the present suit California alleges (answer to Arizona, par. 15) that "unimpaired" as used in this article means unimpaired as to both the quantity and the quality of the waters to which these perfected rights relate. California alleges that, as of the effective date of the compact, her present perfected rights were not less than 4,950,000 acre-feet (answer to Arizona, par. 28).

Senator ANDERSON. Perfected?

Mr. ELY. Present perfected rights. I should say that Arizona admitted present perfected rights in California of approximately 3 million acre-feet per annum measured by depletion, which is the equivalent of a larger quantity measured by diversion less return flow.

The report of the Reclamation Bureau contains no data on the effect of large transmountain diversions coupled with other upper basin uses on the quality of water. Such a study should obviously be made. We know that when the compact was ratified, the report of the Colorado commissioner, Delph Carpenter, stated that—

natural limitations upon the use of the waters within each of the upper States will always afford ample assurance against undue encroachment upon the flow of Lee's Ferry by any one of the four upper States. Colorado cannot divert

5 percent of its portion of the river flow to regions outside the river basin (Hoover Dam documents, H. Doc. 717, 80th Cong., p. A79).

Elsewhere it was testified at that time that Colorado's feasible transmountain diversions could not exceed 300,000 acre-feet per annum. By contrast, the Colorado transmountain diversion projects inventoried in the Reclamation Bureau's various reports aggregate 2 million acre-feet, or over 50 percent of the water allocated to Colorado by the upper basin compact. There would be that much less water to absorb an increasing quantity of salts in passage to Lee's Ferry. The effect on the lower basin is one which the lower basin States are entitled to have studied and reported upon, to the end that their present perfected rights, in the language of article VIII, shall remain unimpaired.

Senator ANDERSON. Before you leave that, you heard my questioning of Mr. Matthew this morning about the Fryingpan-Arkansas. His position was that California was opposed to all diversions outside the basin. Is it still there that way?

Mr. ELY. We feel that before any major transmountain diversions are authorized, this question of quality of water should be thoroughly explored. The Arkansas-Fryingpan project as authorized in the pending legislation (S. 300, I believe) involves a small quantity of water, something under 100,000 acre-feet. However, it is the forerunner and first unit of a 900,000 acre-foot diversion.

When we testified—I testified with Mr. Matthew on the Fryingpan-Arkansas project before this committee in the spring of 1953—the Colorado River storage project had not at that time been recommended by the Bureau of the Budget, and we did not oppose the Fryingpan-Arkansas project. We called attention to its implications; that when the 900,000-acre-foot phase of the project was brought back to Congress we might have to do so. We asked for a study of this quality of water question. Your committee kept the Fryingpan bill for several months. In the meantime, the Colorado River storage project was cleared by the Bureau of the Budget. Consequently, we are now faced with this problem of large transmountain diversions. The effect is primarily with respect to the quality of water.

Senator ANDERSON. Would that reverse your position or keep it the same?

Mr. ELY. No. I would say that it is the same, Mr. Chairman. If the Fryingpan-Arkansas bill for 100,000 acre-feet were all that were before the committee, we would probably react to it as we have to each of the other upper basin bills during the past several years. We have not objected to any of them. All have gone through on the Consent Calendar, as a matter of fact—and this one did through the Senate—and it was not until the Colorado River storage project became active and we realized that we were confronted simultaneously by both that we became seriously concerned about the implications of the Fryingpan-Arkansas bill as involved here.

V. CONCLUSION

California's basic position is that our State is conforming to the Colorado River compact, the Boulder Canyon Project Act, and the other enactments which comprise the "law of the river," and we must insist that the Reclamation Bureau and the upper basin States do

likewise in the planning and administration of the Colorado River storage project.

The Colorado River storage project, as now planned, is based upon interpretations of the compact which, in our view, are wrong and constitute encroachments upon the compact for the benefit of the upper basin to the extent of more than 2 million acre-feet per year.

Essentially, the proposed Colorado River storage project implies the destruction of a substantial portion of the value of the Boulder Canyon project, in terms of water and power production, to enable construction of a new project in the upper basin which will generate power at twice the cost and irrigate lands at many times the cost of the power and irrigation furnished by Hoover Dam and in violation of the Colorado River compact.

We say that the water and power users of California, who have invested more than a half-billion dollars upon the faith of the Colorado River compact, the Boulder Canyon Project Act, and their agreements with the Federal Government, are entitled to the protection of their stake in the Colorado River, both in Congress and the Supreme Court.

Thank you, Mr. Chairman.

Senator ANDERSON. Senator Millikin, I had a great many questions, but I do not have the ability to phrase them in proper legal language, and I have asked Mr. Bennett to handle some of those for me. Do you mind?

Senator MILLIKIN. That is agreeable to me.

Senator ANDERSON. Mr. Ely, I will let Mr. Bennett ask some questions because when it comes to examination between lawyers you are completely out of my element.

Mr. ELY. That is perfectly all right, but from previous experience I would say that you don't need any help.

Mr. BENNETT. To begin with, I would like to say that I feel a little awed because Mr. Ely is a good friend of mine—at least, I have counted him so for many years and we have many common interests. Of course, I have some pretty strong ties in California myself. I went to law school there. So this is a rather interesting position to be in at the moment.

Mr. ELY. I reciprocate all that has been said and I have great respect for Mr. Bennett's judgment and ability, and we will remain good friends even though we meet here on the plains of Philippi.

Senator ANDERSON. We are honored to have you before the committee, Mr. Ely.

Mr. ELY. I may say I have received nothing but courtesy from this committee, notwithstanding that its members, I know, are committed the other way.

Mr. BENNETT. To begin with, to get a common ground here on the facts which the committee is dealing with, is it your understanding that the present uses of water in California are somewhere in the neighborhood of 6 million acre-feet?

Mr. ELY. No; I think that they are slightly over 5 million, Mr. Bennett.

Mr. BENNETT. Is it also your understanding that the uses of water in the upper basin at the present time are something in the neighborhood of 2 million acre-feet?

Mr. ELY. Between 2 and 2½, I understand.

Mr. BENNETT. Is it your understanding further that the authorized projects in the upper basin, such as the Collbran, which have not been constructed, might add three or four or five hundred thousand acre-feet to that total?

Mr. ELY. I think that is probably correct.

Mr. BENNETT. Then we are dealing with a bill which affects a water situation involving present uses of something over 6 million, if we count Arizona. I assume it would be in that neighborhood, in the lower basin?

Mr. ELY. Arizona's existing and authorized projects, as I understand it, will require all together about 1,200,000 acre-feet from the main stream. California's existing and authorized projects would require 5,362,000. The Nevada uses are as yet relatively minor, from the main stream. As to the upper basin uses, I will accept your statement as to what they are.

Mr. BENNETT. Then we have lower basin uses somewhere in the neighborhood of 6½ million acre-feet of water, counting Arizona and California?

Mr. ELY. From the main stream.

Mr. BENNETT. Yes.

Mr. ELY. And from the waters of the Colorado River system, including the Gila, measured as we measure those uses, something over 8 million; measured as Arizona measures them, something over 7 million.

Mr. BENNETT. I believe your statement uses the figure 4½ million acre-feet as being the potential uses in the upper basin if the projects named in this bill were authorized.

Mr. ELY. That is correct. It is an upper figure.

Another figure used here in testimony has been 4,300,000. And I have included in mine the 600,000 acre-feet of evaporation losses, which are, however, on the great reservoirs. So that if the participating projects were built without storage reservoirs, the aggregate would be somewhat less than the figure I have used.

Mr. BENNETT. Would it be a fair statement, Mr. Ely, to say that your opposition to this bill is predicated more on what you fear the Congress will do in the future rather than what the Congress actually does in this bill itself?

Mr. ELY. No; Mr. Bennett. Our concern is twofold, related to the two aspects of the bill. If the particpating projects were all that were involved, what you say would be correct; we would be disturbed by the interpretations of the compact implicit in the bill, and deeply concerned by the effect of transmountain diversions, but we would recognize that the total quantity is within the apportionment. And the danger might be a long time off, as you say.

But we are immediately concerned by the immediate effect upon us of the construction of the storage reservoirs. These confront us with a likelihood that immediately upon the completion of Glen Canyon Dam, when the gates are closed there, as one engineer has said, if Lake Mead is not full on that day it will never fill again, if the upper basin reservoirs are operated as the Reclamation Bureau apparently intends. And that is a calamity that happens to us not in the distant future but happens at once. Glen Canyon Dam will be the first great structure built, and the impact is immediate.

Mr. BENNETT. Then you do not feel that your legal rights are adequately protected by section 8 of this bill and section 12 of this bill?

Mr. ELY. No. May I have a copy of the bill?

Mr. BENNETT. Surely.

I would like to point out that section 8 of the bill reads as follows:

Nothin contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provisions of the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty with the United Mexican States.

Section 12, to use the exact language, in order to avoid any possible misinterpretations through paraphrasing, opens this way:

In the operaton and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjusment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin.

Would you care to comment on why those provisions are inadequate, in your judgment, Mr. Ely?

Mr. ELY. Yes, sir. Section 8 contains a very estimable disclaimer of intent to construe any of these documents, but, as is true of so much of this bill, Mr. Chairman, the operation of the project therein proposed has to be discovered from reading the underlying Reclamation Bureau reports. And from those, it is perfectly plain that they do construe the Colorado River compact, and in a way that is intolerable to us, in the two respects that I outlined early in my statement; first, with respect to the measurement of beneficial consumptive use; second, with respect to the averaging of the apportionment of seven and a half million, instead of treating it as a maximum entitlement in any one year; the combined effect of the two being to enable the Bureau under that interpretation—and it would be in control of Glen Canyon Dam as well as the other dams—to withhold from us the water that we think the lower basin is entitled to and upon which all the lower basin projects have been designed, and, for that matter, upon which the calculation of the system's ability to sustain the Mexican Water Treaty was based.

Now, the fact that the statute might disclaim any attempt to interpret does us no good if the Secretary of the Interior, with the control of these dams in his hand, is in fact interpreting the law of the river, and he is placing Congress on notice, in this report printed as a Senate document, that that is how he intends to operate.

Furthermore, it would appear, from what the engineers tell me, that the financial operations of Glen Canyon are based on the assumption of the availability to the upper basin power dams of water based upon that calculation.

So I would have to answer with respect to section 8, that it is totally ineffective. We would have to see the ground rules spelled out, and to spell them out would mean virtually reversing many assumptions of the Bureau in the underlying report.

With respect to section 12, the direction to the Secretary that he shall conform to all the law of the river is, of course, estimable. He should. But, again, when we differ by 2 million acre-feet as to what

these documents mean with respect to the obligation at Lee Ferry, it doesn't mean very much. He is already placing Congress on notice how he interprets these documents. We do not agree with the interpretation. I suppose if he had this mandate before him, he would go ahead and do just as he has told he is going to do in the underlying report, and we could not tolerate it.

I know we come next, Mr. Bennett, to the authorization for suit against the Secretary in section 12 if he does not comply, but we run into precisely the same trouble all over again. The danger to us—Do you want to take this up and state your own questions in your own way?

Mr. BENNETT. No. That is all right. Go ahead.

Mr. ELY. The language of section 12 in that respect is that:

> In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits.

That goes part way, and I do not mean to discredit the effort to write workable language here, because the intention is good. But the damage to us occurs in two ways: one, that the consumptive use projects when, as, and if built, upstream, are not covered by this mandate at all. They can go ahead and expand to the point where they are using, by our calculation, 9 million acre-feet or more per year, because, by the interpretation of the Secretary, that shall be averaged with years of lesser use and equal only seven and a half.

Also, since there are no ground rules whatever laid down as to storage reservoirs or participating projects, we are not eager to buy a second lawsuit. One is enough. We would much prefer to have the ground rules spelled out than to simply have a license to sue the Secretary at some future time.

Mr. BENNETT. Then the underlying documents constitute a good part of your fears here.

Mr. ELY. That is correct.

Mr. BENNETT. And you feel that Congress in S. 500 has not declared its intention to have the project operated otherwise.

Mr. ELY. That is correct, Mr. Bennett.

Mr. BENNETT. I don't believe that is the committee's intention, and we will proceed. At least, I know it was not the Department's intention.

Mr. ELY. Thank you.

Mr. BENNETT. Secondly, in your statement I believe you used the figure that the project plans contemplate the use on occasion of as much as 9 million acre-feet of water in any given year, in some years at least, in the upper basin. My information is that the project plans do not contemplate any such use, and I wonder if you or any of the engineers with you are in any position to point out where the project plans provide for the use of any more than 7½ million acre-feet of water in any given year.

Mr. ELY. Not being an engineer, I will give you an engineering opinion very freely, as we lawyers do.

At page 152 of House Document No. 364, which is captioned "Colorado River storage project," appears a table captioned "Determination of active storage requirement to permit full utilization of apportioned consumptive use." And that is in six columns; the first being a

tabulation by years from 1914 to 1947; the next being captioned "Virgin flow of Colorado River at Lee Ferry"; the next, "Ultimate use of upper basin apportionment." That is the column to which I shall turn back in a moment. The next is "Ultimate depleted unregulated flow at Lee Ferry." The next is "10-year moving total flow at Lee Ferry." And the final column is "10-year variation from 75 million acre-feet."

In the column captioned "Ultimate use of upper basin apportionment," for the years 1914–47, it shows, for example, for 1914, 9,030,000 acre-feet. For 1915, it shows 6,910,000 acre-feet; for 1916, 8,860,000 acre-feet; for 1917, 9,530,000 acre-feet; for 1918, 7,920,000 acre-feet; for 1919, 6,560,000 acre-feet; for 1920, 9,370,000 acre-feet; for 1921, 9,470,000 acre-feet; and so on; with the other years shown as materially less, ranging down to 6 million, 5 million, and 4 million.

The right to calculate the apportionment on an average basis rather than an annual basis was asserted by the negotiators of the upper Colorado River Basin compact, without translating their assertion into figures, in the hearings of the House Committee on Public Lands on H. R. 2325, 81st Congress, 1st session, at page 57. That was in answer to a questionnaire of the committee directed to the negotiators as to how they interpreted their compact, in answer to question No. 3.

As I have stated, the result of this contention in figures appears in the document to which I have just referred. This shows uses by proposed upper basin projects of more than 7½ million acre-feet in each of the 17 years corresponding to the historical years 1914, 1916, 1917, 1918, 1920, 1921, 1922, 1923, 1926, 1927, 1928, 1929, 1930, 1932, 1938, 1941, and 1942, ranging from an excess of 90,000 acre-feet in a year like 1930 to an excess of 2,030,000 in a year like 1917.

The aggregate use in these 17 years in excess of 7,500,000 acre-feet per annum is 15,680,000 acre-feet, and the average excess for each of the 17 years is 920,000 acre-feet. The average excess for the whole 32-year period is 490,000 acre-feet per annum.

I have been reading from a portion of the brief of the California defendants in support of their motion to join these four States as parties in the present suit.

Mr. BENNETT. Well, is it your contention, then, that there are possible participating projects for consumptive uses in the upper basin that are reflected in this table and which might someday be authorized and constructed?

Mr. ELY. Yes; section 2 declares the intention to put all of the upper basin water to use, and this table shows the Bureau's calculation of how much water is available to put to use.

Mr. BENNETT. However, the project plan for the Colorado River storage project and participating projects has never made recommendations to construct projects to use anywhere near the maximum figures that are reflected here; is that not so, Mr. Ely?

Mr. ELY. S. 500, you mean?

Mr. BENNETT. No, not S. 500. I am thinking in terms of the project plan which was prepared in 1950 or thereabouts. Is this chart not a study of water availability, rather than a reflection of project recommendations made by the Department.

Mr. ELY. These recommendations for projects come forth from time to time. They are inventoried in House Document No. 419, about a hundred projects, which all together, if they were all built, would

come to more than this. Some, such as the Fryingpan Arkansas, are in other bills.

Mr. BENNETT. That is what I wanted to find out.

Mr. ELY. As Mr. Morris referred to this morning, section 2 authorizes unborn projects. We don't know what they are. But they are authorized, and it is declared to be the intention that they will be built in that general way, with this underlying document confronting us, with an assertion of claim to water amounting to over 9 million acre-feet a year.

Mr. BENNETT. I want to get back again to the fact, though, that this was a water availability study rather than being a reflection of any table of uses which the Bureau of Reclamation or anyone else has ever approved.

Mr. ELY. I will take your word for that, Mr. Bennett.

Mr. BENNETT. Well, I mean, the heading is "Determination of Active Storage Requirement to Permit Full Utilization of Apportioned Consumptive Use."

Mr. ELY. The column from which I have read is captioned "Ultimate Use of Upper Basin Apportionment."

Senator ANDERSON. May I ask just a question on that? Actually, that was the exact amount that would be available to the upper basin States if the compact were absolutely strictly applied, is it not?

Mr. ELY. We think that that would be far in excess of the amount lawfully available to you.

Senator ANDERSON. The flow in that year was somewhat in excess of 21 million acre-feet. In reaching this calculation they gave the upper basin States 7½ million acre-feet, the lower basin States 8½ million acre-feet, and they made an allocation for the Mexican Treaty water, and they made an allocation of the million acre-feet, and they divided the surplus that was left. Does not the compact provide for that?

Mr. ELY. Let me take that point by point. The 21 million to which you refer includes the water available on the Gila River and other tributaries.

Senator ANDERSON. I am sorry. It does not. It is virgin flow at Lee Ferry.

Mr. ELY. Are you referring to this table? I am referring to the reports of the negotiators. We are speaking at cross purposes.

Senator ANDERSON. No. You brought this table up.

Mr. ELY. I thought your 21 million was referring to the one used earlier in these hearings as being the report of the negotiators. I am sorry, sir. We are speaking at cross purposes. Would you identify to me what you are speaking of?

Senator ANDERSON. I am talking about the very first column, or rather the second column, 21,220,000 acre-feet. Now, they arrived at this figure by saying if they gave the lower basin 8½ million acre-feet and the upper basin 7½ million acre-feet, and they took the Mexican water and divided it, and so forth, and gave you everything you could possibly imagine under the compact, there was some surplus water remaining, and they divided that between the two basins. What is wrong with that?

Mr. ELY. I would have to say that is not what they did, Senator Anderson.

Senator ANDERSON. How did they get the figure of 21,220,000, then?

Mr. ELY. How did the Bureau of Reclamation? These are Bureau figures. I don't know how.

Senator ANDERSON. Then why do you say it was not the way I said it was.

Mr. ELY. I would be glad to show you how the compact negotiators arrived at the figures, if you would like to have it.

Senator ANDERSON. I am not interested in them. They did not prepare these figures.

Mr. ELY. I thought you were saying: Is this not what the compact did?

Senator ANDERSON. No. we started with 21 million acre-feet, and we take away from it 16 million acre-feet——

Mr. ELY. No. We have to break apart right there. Because the 16 million acre-feet—I take it you are including the III (a) and III (b) water in that?

Senator ANDERSON. The maximum that you could possibly ask for.

Mr. ELY. That must include under the compact uses on the Gila. So right at that point, we come apart.

Senator ANDERSON. Well, if you do, that gives me a half million extra feet advantage which I was trying not to take.

Mr. ELY. Yes, quite so. You have some more surplus in the whole system.

Senator ANDERSON. I agree with that. I was trying to be extremely cautious about it. Take off 15 million acre-feet from 21 million acre-feet, and you have some 6 million acre-feet left.

Mr. ELY. Again, sir, we break at that point each time, because the Colorado River compact divided the waters of the system, not of the main stream. And you must include the waters of the Gila River. This table deals with only the virgin flow of the Colorado River at Lee Ferry, which is one of the assets of the Colorado River system. Other assets are the Gila River, the Virgin River, and other lower basin tributaries, which, under the compact, must be taken into account.

Senator ANDERSON. What is your objection to the 9 million acre-feet?

Mr. ELY. Because the caption is "Ultimate Use of Upper Basin Apportionment." We say the ultimate use of upper basin apportionment to which you are entitled in any 1 year is not to exceed 7½ million acre-feet, not 9,030,000 acre-feet.

Senator ANDERSON. Plus anything? Plus some surplus water if it was there?

Mr. ELY. For our part, we concede the right of the upper Basin States to appropriate surplus. Arizona does not.

Senator ANDERSON. We have your more liberal contention, then, and start with that.

Mr. BENNETT. There are several of them.

Mr. ELY. But I must put a caveat right there.

Senator ANDERSON. We will take care of ourselves against Arizona if we can just get by with California.

Mr. ELY. You are not in too good shape as against us, sir, because we say that all of the excess and surplus has either been dedicated to Mexico or appropriated in the lower basin; so that our concession of your right to appropriate surplus must not be taken as too wide a concession.

Senator ANDERSON. You say that all the surplus is either taken for the Mexican Treaty or is appropriated to the lower basin States?

Mr. ELY. That might not be true in every year.

Senator ANDERSON. Then what is the provision of paragraph (f) under III, that says, at some later date, 1963, they shall get together and divide up this surplus? If it is already gone, why divide it?

Mr. ELY. The problem there is one that I mentioned in my prepared statement and is at issue in the Supreme Court. Does or does not the compact withhold from appropriation in the upper basin and the lower the unapportioned surplus, in the sense that no one can acquire rights in it, and that they all must depend upon unanimous consent at some future day after 1963. We say no, that the unapportioned surplus may be appropriated by any State, surely by California, under the terms of the limitation act, up to one-half of the excess or surplus and no more.

Senator ANDERSON. I am not trying to take your half away from you. I am just trying to get our half.

Mr. ELY. We think you gave your half to Mexico.

Senator ANDERSON. Well, that is extremely broadminded of you.

Mr. ELY. We urged you not to do it.

Senator ANDERSON. I think it is unfortunate. I only wanted to say that it seems to me perfectly natural that they might set up this 9 million acre-feet, because every test I see in the compact was met. There is more than enough water to deliver the appropriate amount of acre-feet, more than enough water to take care of the Mexican Treaty, more than enough water to take care of everything California is entitled to, under the plain language here.

Mr. ELY. Speaking in a general way, you are quite correct, yes.

Senator ANDERSON. And we thought we had a chance at some of that extra water.

Mr. ELY. I am willing to give you the chance. But we say it is not apportioned water. It is excess or surplus.

Senator ANDERSON. I do not say it is apportioned. I say when it becomes surplus, we have a right to divide it with you.

Mr. ELY. We go further. We say you have a right to go ahead and use it if your appropriation of it is senior to ours. You do not have to wait for us to agree that you can use it after 1963. You can appropriate it right now. We say we have appropriated it. If you have senior appropriations to ours, they would be sustained, I suppose, in the present lawsuit. That is one of the issues in the suit.

Arizona denies to all of us the right to make any present appropriations of surplus. She says you cannot acquire any right to it at all until after 1963, and then only by unanimous consent. That is, with Arizona's consent.

Senator ANDERSON. That is what I was trying to get to. Because that is the point that you made in your paper, that there cannot be any surplus water; there is no point in meeting in 1963; if there was any, you have already gobbled it up. And we do not agree with that. We think we have a crack at it yet.

Mr. ELY. We are willing that you should have a crack at it, Senator, but Arizona does not agree that you should have a crack at it.

Mr. BENNETT. Now that we have dealt with the future possible development in the upper basin, I would like to come back again to the provisions of S. 500, which the committee has before it.

Senator ALLOTT. Mr. Chairman and Mr. Bennett, may I ask a question? I want to get out here the plain effect of what you have just said.

In other words, it is your position and your contention that as long as California can withhold any development in the upper Colorado, by way of dams or reservoirs, the water which flows down the river would be California's as long as she keeps devoting it to a consumptive use, and we can acquire no rights under it.

Mr. ELY. Not at all, Senator.

Senator ALLOTT. That is the substance of what you have said.

Senator ANDERSON. That is the only conclusion you can draw from what you have said.

Mr. ELY. Let us come right to grips on that. That is not what I have said, sir. We recognize your apportionment in perpetuity, insulated, which is the expression I have used, against the law of priority of appropriation. You have the right to the beneficial consumptive use of up to 7,500,000 feet in any 1 year. You may take that starting 100 years in the future or take that starting 1 year in the future. The fact that we have in the meantime built up uses which would have to be cut back to enable you to do so is immaterial. That is the intent of the compact, to insulate the upper basin against the law of priority of appropriation in the lower, to the extent, but to the extent only, of the consumptive use of 7,500,000 acre-feet in any 1 year.

The objection we have is that this 7,500,000 foot protection is expanded and ballooned by the Bureau of Reclamation's interpretatiton, which treats it not as a limit in any 1 year but as an average over a 35-year period, with the effect that if they are correct, you could take away from us, from established appropriations in the lower basin, not up to 7,500,000 but up to whatever the figure might be, 9,400,000, nearly 2 million acre-feet more, in any particular year, because in some other year you had used less than 7,500,000.

Senator ALLOTT. That, I think, sir, if I may say so, is begging the question, because under Senator Anderson's question, if I understood your answer to it—I would like to bring you back to that. Is it your feeling that as long as there are no upper Colorado River projects constructed, California can keep on using this water, and by doing so acquire vested rights—and I suppose that you use those terms in the same sense that I do—in the water thereto?

Mr. ELY. No, not under the intent of article III (a). Just the reverse. At any time in perpetuity, whenever you get around to it, you may put that to use, regardless of the quantity in the lower basin that is put to use.

Senator ALLOTT. With that plus your Mexican Treaty water plus your million acre-feet, it is your contention that above that you have acquired vested rights by appropriation and conversion to beneficial consumptive use of the additional waters, and that therefore, the water which Senator Anderson spoke of could not be divided with the upper basin, in such a hypothetical situation?

Mr. ELY. Are you speaking of excess, or surplus?

Senator ALLOTT. Surplus above that.

Mr. ELY. Excess or surplus above the apportioned water?

Senator ALLOTT. That is right.

Mr. ELY. We will put to one side for the moment the relation of the III (b) water, and we will speak of apportioned water on the one hand and the excess or surplus water on the other hand. I say that your right reserved by the compact in perpetuity is to use up to seven and a half million acre-feet, irrespective of the law of appropriation; that if you seek to go beyond that, your are appropriating waters in competition with us.

If you seek to use more than seven and a half million acre-feet in any 1 year, you must acquire the right thereto by appropriation or by further interstate compact or court decree; you are not getting it under article III of the compact as this report attempts to give it to you.

Senator ALLOTT. Are you referring to a year such as Senator Anderson described, when there would be as much as 21 million, using that as the criterion?

Mr. ELY. If there were in a year such an amount as 21 million, there would be water available in that year for appropriation in both the upper basin and the lower. It is a tremendous year. But they cannot build projects upon the availability of water at long intervals like that.

Senator ALLOTT. Yes; but while we would not build a project, neither you nor myself or anyone else, I presume, under such an assumption, the point I am trying to get at is: In such an instance and in such a year, what is your position with respect to this surplus water? Have you then, in that instance, in your mind, acquired such vested rights that none of that water would be available to the upper basin?

Mr. ELY. It would depend entirely, Senator, upon the stated appropriations at that time. So far as we are concerned, our claim is to 5,365,000 acre-feet per year and no more.

Senator ALLOTT. Are you making a difference between appropriations and diversions in your own mind?

Mr. ELY. No. We are entitled to the beneficial consumptive use, diversions less returns to the river, of 5,365,000 acre-feet per year, and no more. In a year such as you are describing, we do not claim and do not have the facilities to use water beyond that. We were required by the Limitation Act to cut ourselves back to 4,400,000 acre-feet of the waters apportioned by article III (a) plus one-half of the excess or surplus. We have built our works to use approximately 1 million acre-feet per year of that excess or surplus, on the expectation that the excess or surplus to which that fraction is applicable would average more than 2 million acre-feet in most years.

Consequently, the case you are posing is entirely hypothetical, as far as we are concerned. We do not have the works to use it. We scrapped and had to scuttle fine projects, such as the Chuckawalla Valley, for which Congress had authorized diversion of water as early as 1910. We abandoned it, because there was not enough water for it under the Limitation Act. The only projects saved by California in consequence of the Limitation Act are the three great diversions, the one of the metropolitan water district at Parker through the Colorado River Aqueduct, the Palo Verde diversion, and the All-American Canal and the total of their water contracts is 5,362,000 acre-feet per year.

Senator ALLOTT. I think by your answer you have convinced me of what your position is, and that is sufficient.

May I ask one more question, Senator Anderson?

Senator ANDERSON. Surely.

Senator ALLOTT. On page 22 of your statement, under article 7, you say:

> California alleges, in the pending litigation, that any State, including the upper basin States, may appropriate surplus waters unapportioned by the compact, subject only to their being divested by a new compact to which such a State is party, or by court decree. Arizona and Nevada say that no State may acquire any right. * * *

Now, did you, in your own mind, have a difference in the use of the words "may appropriate surplus waters," as you used them for California, and "acquire any right" as you used them with relation to Arizona and Nevada?

Mr. ELY. No, not intentionally. We use the word "appropriate" in this discussion as a shorthand way of describing either appropriations under State law or rights acquired or confirmed by contract with the United States to waters stored by the United States.

Senator ALLOTT. That is what I wanted to get at. You meant the same thing in these two instances.

Mr. ELY. Yes, if I understand your question correctly.

Senator ALLOTT. I am asking you in a sense for your evaluation of those terms.

Mr. ELY. Yes, that is correct. We say that California, Arizona, Nevada, the four upper basin States, can appropriate surplus. We say that our appropriations are old and good up to the extent of the Limitation Act, one-half of excess or surplus.

If you would like to have for the record some of the contemporary reports on that, I would be glad to supply them.

Senator ALLOTT. No; the reason I was questioning you was because I wanted to know if there was any reason why you changed your terminology in the two instances.

Mr. ELY. No. The bill, so far as I understand it, does not contain the provision in the Project Act that the right to the use of stored water can be acquired only by contract with the United States; I suppose because with the exception of the Navaho Dam, there are no storage dams above the point of diversion. I suppose it is planned to acquire rights for participating projects directly by appropriation under State laws rather than by contract with the United States.

In our case, as I say, we have the complication that no one can use the stored water except by contract with the Government.

Senator ANDERSON. If I may follow up the questioning for just a second: The phrase I was looking for when you were reading this was on page 22, which is similar to what he was discussing. You say:

> Actually, under the compact, the Boulder Canyon Project Act and the Mexican Water Treaty, all excess and surplus water of the Colorado River system, has already been appropriated or obligated to uses in the lower basin and Mexico.

Now, what you are actually saying is that if we had a wet cycle, and the Colorado River water at Lee Ferry measured 25 million acre-feet a year, for 10 straight years, giving 250 million acre-feet, and we are only obligated to deliver 75 million acre-feet, it is your contention that all of that excess and surplus water has already been appropriated to obligation and uses in the lower basin and Mexico?

Mr. ELY. No; in the light of your analysis, my statement is too broad; California is limited to half the excess of surplus, and our total right is 5,362,000 acre-feet.

Senator ANDERSON. Well, I go back to what I tried to get you to a moment ago.

Mr. ELY. What I mean to say is that as a practical matter, you cannot put the excess to use except by storage.

Senator ANDERSON. That is why we try to build the storage dams. We know that.

Mr. ELY. If all of the waters of the river were salvaged and used, the representation of the Bureau of Reclamation during the Mexican Water Treaty was that the yield available for the lower basin plus Mexico is approximately 9 million acre-feet per year. That is accomplished by a drawdown of Lake Mead of a million and a half acre-feet per year for 10 years, which presupposes that in some other 10 years you are going to get it back from some other place, the upper basin. Consequently, there must be an average of something on the order of 9 million acre-feet coming down. Otherwise your books won't balance for the Mexican Water Treaty.

I have started with the assumption, that you arrive at the 9 million by assuming enough storage on the river to put these great flood years to use. If we did not have it and had "wild water" in some year, then my statement here is not accurate.

Mr. BENNETT. Your statement about the potential uses of 9 million acre-feet of water as having been accepted with approval by the Bureau of Reclamation also carried with it an assumption of fully developed storage in the upper basin, did it not?

Mr. ELY. I assume that they are talking about a fully developed river; yes sir.

Mr. BENNETT. Well, this bill does not authorize the construction of the storage necessary to accomplish that purpose even as described in the reports of the Bureau of Reclamation, does it?

Mr. ELY. There you get into an engineering field, where I hate to step into the flypaper. There is available, as you know, a report by Raymond Hill to the State of Colorado, as to the amount of storage required to fully control the river down to economic limits. My recollection is that the maximum figure that he comes up with is of the order of 23 million acre-feet of storage. That much storage would be provided by Glen alone. As a matter of fact, again going outside my field, I have heard some engineers say that but for the fact that the compact takes Lee Ferry as the point of division, you could perform the 75 million "nondepletion" guaranty and meet the requirements of the Mexican Water Treaty by reckoning the deliveries below Hoover Dam instead of at Lee Ferry; that is, that Hoover alone will accomplish substantially all the regulation required. That may or may not be a sound engineering statement. But the justification for 48 million acre-feet of storage is seriously challenged by any number of engineers, as contemplating a 35-year carryover.

Whether the Bureau assumes, on this table to which you and I have been referring, on page 152 of House Document 364, storage of 44 or 48 million, or 23 million feet, I cannot say.

Mr. BENNETT. As I recall it, the Colorado River storage project contemplated either 9 or 10 storage reservoirs, did it not, for full development of the upper basin apportionment?

Mr. ELY. I think you are correct.

Excuse me. The 48 million acre-feet? There you run into the question of how much was required for full development. I do not know.

Mr. BENNETT. At any rate, this bill does not authorize that amount of storage, does it?

Mr. ELY. Six reservoirs with an aggregate capacity of 44 million, I believe.

Mr. BENNETT. Now, of course, part of the capacity of those reservoirs, if I remember correctly, such as Navaho and Curecanti, is scheduled for actual agricultural and perhaps domestic use; is that not correct?

Mr. ELY. I take your word for that.

Mr. BENNETT. Now, I noticed that the statement is made that these bills all authorize the future construction of other projects. I am a little troubled about that, in two ways. Do you feel that the language of section 2 authorizes the Secretary of the Interior to build any projects which are not specifically referred to in section 1 of this bill?

Mr. ELY. I cannot give you a clear answer on that, because to me, the language is not clear.

Mr. BENNETT. Would you say that you would feel the language was clear if the words "in the future" followed the words "to authorize" instead of preceding them?

Mr. ELY. The matter of language does not concern me particularly. I think that a decision should be made either that they are authorized if the Secretary finds these projects feasible, since the Millikin-O'Mahoney amendment is waived with respect to the necessity for concurrence by the affected States, or prohibit that and tell him to come back and bring in his reports, and Congress will authorize them as they feel like it.

Mr. BENNETT. At any rate, the language on which your interpretation is based is this:

> It is the intent of the Congress in the future to authorize * * *.

and so forth. Of course, I know that the Department has not construed that language as authorizing the Secretary to do anything until Congress tells them to.

Secondly, could you tell me what language in this bill waives the requirements of the Millikin-O'Mahoney amendment as to any of these unnamed projects that you refer to?

Mr. ELY. That is in the bill which Congressman Rogers introduced, and which Governor Johnson had here the other day.

It was in the legislation last year also. As I have said, I do not know which of these various bills you are going to act on.

Senator ANDERSON. We are holding hearings on S. 500.

Mr. ELY. Which will finally emerge, I don't know; whether Governor Johnson's recommendations for amendments are going to be approved or not. I don't know. If they are, that is one that is involved.

Senator ANDERSON. Frankly, I was not conscious that we were approving any propects other than those named in the bill.

Mr. BENNETT. I would like to ask, Mr. Ely, whether you know of any of the named projects in section 1 of this bill, other than the

Gooseberry, San Juan-Chama, and Navaho, where feasibility reports have not already been reviewed by the States of the basin?

Mr. ELY. That I could not tell you.

Mr. BENNETT. You are also familiar with the proviso in section 1 of the bill which requires that the San Juan-Chama and the Navaho projects be submitted in the form of coordinated reports to the States of the Colorado River Basin, and also Texas?

Mr. ELY. Yes, sir. Pardon me. You asked where in this bill there was a waiver of the O'Mahoney-Millikin amendment. Right in section 1 of this bill there is express direction to the Secretary to make supplemental reports on the named participating projects which, as to some of these, are bound to be rather extensive. These projects must need them badly or the Secretary would not be told to make supplemental feasibility findings; and as to those supplemental reports, the language is quite explicit on page 4, line 7:

> Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama and the Navaho participating projects, not be applicable to such supplemental reports.

I do not know why not.

Senator ANDERSON. Those are named projects in the bill on which there exist good reports. The Navaho and San Juan-Chama products do not have feasibility reports.

Mr. ELY. I suppose they all are not good enough or they would not be sent back to the Secretary.

Senator ANDERSON. I can recall the Eklutna project in Alaska, with which Senator Millikin and I wrestled for a long time, and I took a look at it a while back and there were many supplemental reports necessary on it, and when we got into the mountain we found rock of a wholly different substance than we thought to be there.

I think that is all that is intended here, that there be options to do that. In other words, I do not believe this is language designed to permit a whole series of new projects to be pulled in under the tent, and if it helps any to clear that up by some sort of statement that would effect legislative intent, I would have no objection to doing it.

Mr. ELY. I am getting now somewhat outside of my field trying to answer that question, but on page 3, line 15, is the direction that—

> construction of the participating projects set forth in this clause shall not be undertaken until the Secretary has reexamined the economic justification of such projects—

and so on, and render such supplemental report.

Senator ANDERSON. Are not all those referring to the named projects?

Mr. ELY. Yes; but I do not know why the O'Mahoney-Millikin amendment to the 1944 Flood Control Act should not apply to such supplemental reports, since they deal with economic justification.

Mr. BENNETT. At one point—I believe it was on page 4 of your statement, Mr. Ely, at the bottom of the page—you make the statement that the bills all make clear that this measure is intended to commit Congress to a program for the full utilization of all the water which the upper basin claims under the Colorado River compact.

At that point I would like to call your attention to clause 1 of section 2 of the bill which, after the declaration of intent of the Congress as to its future action, says that it contemplates the use of waters of

the upper Colorado River system, the consumptive use of which is apportioned to those States by article III of the compact.

That being the case, is it a fair statement that Congress is here declaring its policy to build whatever projects might be necessary to use up whatever the upper basin States may claim as their interpretation of the compact?

Mr. ELY. Yes; I would think that mine is a fair statement.

Section 2, page 5, line 4, says:

> In order to achieve such comprehensive development as will assure the consumptive use in the States of the upper Colorado River Basin of waters of the Colorado River system, the use of which is apportioned to the upper Colorado River Basin by the Colorado River compact, and to each State thereof by the upper Colorado River Basin compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects authorized in this act, and of new participating projects, as additional information becomes available and additional needs are indicated.

House Document 364 at the table on page 152, to which we referred, gives, I suppose, the Bureau's interpretation of what that "use which is apportioned" is. The column entitled "Ultimate Use of Upper Basin Apportionment," tabulates that "apportionment" on the average method and shows uses in excess of 9 million acre-feet of the so-called apportionment. That is to be read in the light of a specific claim of the right to do so by the upper basin compact negotiators, made in answer to the House committee, in hearings on H. R. 2325 of the 81st Congress, to which I referred.

Mr. BENNETT. Your quotation from S. 500 is the first sentence of section 2 and, as I pointed out before, the second sentence of section 2 explicitly refers to the uses of water apportioned by article III of the compact.

Could you be any more explicit, Mr. Ely, in telling us how the named projects authorized in section 1 of this bill would impair the water supply for the contracts in California?

Mr. ELY. Yes, sir.

Mr. BENNETT. In the light of our beginning understanding that the consumptive uses or the depletions involved in these named projects would not amount to more than 1,800,000 acre-feet of water, added to the existing 2,500,000.

Mr. ELY. I would be glad to try to.

Let us put aside for the moment the effect of the participating projects; I shall refer now only to the effect of the construction of these storage projects, which is an immediate effect.

These storage projects will intercept some 3 years' flow of the river. The water they are storing is not, as has been said erroneously here from time to time, "upper basin water." The compact apportions to the upper basin, as it apportions to the lower basin, only the right to the beneficial consumptive use of the water, not the right to the flow of the stream. It is an apportionment of the right to use.

When it is stored at Glen Canyon or elsewhere, that is water that can only be used in the lower basin and in Mexico. It is not the property of the upper basin.

Commencing when the Glen Canyon Dam is closed, at once, and thereafter for a protracted period of filling, ranging in last year's testimony from 20 to 25 years—I do not know where the Bureau

got the figure this year of 5 years to fill those dams—as of last year it was 20 to 25 years, and we think the larger figure is correct—you are impounding water there and releasing to us only such water as the Secretary of the Interior thinks he is obligated to release under the compact.

If he believes the Bureau's interpretation he is going to release 75 million acre-feet every 10 years, and no more.

If he believes that the upper basin is correct, that the 75 million is subject further to a prior right to their apportionment of 7,500,000 then, when the time comes that projects are built up to use all that, is going to release less than 75 million in each 10 years.

Starting in 1960, or whenever Glen Canyon is finished, our water supply will be cut that year and for the 10 years to follow by 25 to 35 percent, and at once our power production, as Mr. Tillman has demonstrated here, is cut back. So also with the Davis and Parker Dam power.

As Mr. Matthews indicated, the total loss in power in the lower basin during this 20- to 25-year period approaches $200 million, which has not been taken into account in evaluating the upper basin project. But the loss of power is not so important in the long run as the loss of water. If you do that to us lawfully in the filling period, you can do it lawfully at any time in the future, and we no longer have permanent water rights, which were good on the interpretation of the compact which we had assumed. We can expect only the 75 million every 10 years, which is a reduction of 25 percent of the quantity of water upon which both the Interior Department and ourselves relied. The Mexican water was based on a much larger expectation than 75 million, something over 90 million.

Mr. BENNETT. Is it true, Mr. Ely, that your answer to the last question presupposes that the upper basin States have no right to store water, even temporarily, for the generation of power under the compact?

Mr. ELY. We say that the upper basin States and the United States have no right to retain in Glen Canyon or other reservoirs for power generation water which is required for beneficial consumptive use in the lower basin, even though it is excess or surplus water. That statement is derived from our rights under the Colorado River compact and the Boulder Canyon Project Act.

We say second that neither the United States nor the upper basin States have a right to impound and withhold from us water for power generation which is required for power generation at Hoover Dam or elsewhere under contract with the United States in the lower basin.

The right is derived not from the compact, but from the Boulder Canyon Project Act terms of the contract.

Mr. BENNETT. It is derived from the terms of the contract, but certainly you would not say that the Secretary could contract to do anything he was not authorized to do by the Boulder Canyon Project Act, would you?

Mr. ELY. No. He was clearly authorized by the Project Act to make these contracts with respect to the sale of firm and secondary energy. The Project Act required that he obtain in that manner the revenues required to amortize the cost of the Hoover Dam. He is not authorized by any statute—and I do not think he constitutionally

could be—to interfere with his own performance of those contracts by intercepting that water to use it for power generation upstream. He can intercept it for consumptive use, in the upper basin, but not for power generation, as such.

Mr. BENNETT. Is it your contention, then, Mr. Ely, that the generation of power in the lower basin has a priority or preference somehow, under the compact, over power generation in the upper basin, assuming that the rights to the use of the water were on a par otherwise?

Mr. ELY. I cannot answer it in quite that way. We say that the rights established under the Boulder Canyon Project Act, and power contracts made thereunder cannot be lawfully interfered with by the withholding of water at Glen Canyon or other upstream dams, solely for power generation.

Mr. BENNETT. Would you say that that would depend on the interpretation of article IV (b) of the compact?

Mr. ELY. No.

Mr. BENNETT. Even in view of the limitations in the Boulder Canyon Project Act with respect to the applicability of the compact?

Mr. ELY. Let me look at article IV again before I answer it.

No. I take it your question relates to competing claims solely for power generation at Hoover Dam, and, let us say, Glen Canyon?

Mr. BENNETT. Yes.

Mr. ELY. The compact is perfectly blank on that point. The compact would require the water at Glen Canyon be released for beneficial consumptive use in the lower basin in competition with the claim of right to withhold for power generation at Glen, but the right of the Hoover Dam power contractors to have the power delivered to them at Hoover and not interfered with by retention of the water at Glen Canyon for power generation derives from the terms of the Project Act and their contracts, I would say, and not from the terms of the Colorado River compact.

Mr. BENNETT. That again, of course, depends on whether or not the section of the Boulder Canyon Project Act incorporating the terms of the compact is so construed; is that correct?

Mr. ELY. Yes; but there is nothing in the compact which gives to the Secretary or to the upper-basin States, in our view, the right to withhold water for power generation, as against the right for power generation established by Government contract in the lower basin. We deny the right of the Secretary to withhold that water from power generation at Hoover for power generation at Glen, based upon any right that he may claim derived from the Colorado River compact.

Mr. BENNETT. Then also do I understand that you deny the right of the upper-basin States to build storage reservoirs for holdover purposes, in order to make possible the use of the apportionments made to them, whatever those apportionments may be under your definition or anyone else's definition?

Mr. ELY. No; we do not. We don't reach that problem in this bill, if we assume correctly that the total consumptive use of the section 1 projects may be accomplished without any holdover storage whatever.

Mr. BENNETT. In your statement you made considerable reference to the varying theories of measurement of the uses of water under the compact.

That is a very serious problem as between California and Arizona. I think everyone on the committee recognizes that. However, I would like again to emphasize that, even according to your own engineers' estimates, the maximum amount of difference that that would make in use of the upper-basin apportionment is no more than 300,000 to 500,000 acre-feet of water per annum. Is that correct?

Mr. ELY. I think that is substantially correct. I have heard larger figures, but I think that range is fair enough.

Mr. BENNETT. Is it not true that the principal impact of that varying interpretation is wrapped up in the issue of the Gila water uses in Arizona?

Mr. ELY. That is where the big dispute is. The dispute on that river, however, affects the upper basin. I will not attempt to spell it out here, but the question of how much of the 75 million III (d) water is surplus is affected by the question of whether the III (a) uses on the Gila are measured at 1 million or 2 million.

Mr. BENNETT. You will concede then that there are no projects authorized for construction in S. 500 which would push the consumptive uses of water in the upper basin above the 7,500,000 apportionment, even after taking into account all the limitations and restrictions under the compact?

Mr. ELY. I think that is what I said in my prepared statement.

Mr. BENNETT. Is it your understanding that the plan of the Bureau with respect to the storage units involved in this bill is based on supplying average figures over a 20- to 35-year period, derived from this table to which you referred earlier?

Mr. ELY. I think maybe we are talking about two different things. The holdover storage, as I understand it, is calculated on the assumption that water could be successfully held over from 20 to 35 years. Is that your question?

Mr. BENNETT. Yes.

Mr. ELY. However, I don't want to get in too much detail in trying to amplify that answer. It is an engineering subject and is rather complicated.

Mr. BENNETT. But it is your contention that the project before this committee involves an assumption that supplying 7½ million acre-feet of water on a 20- to 35-year average is what the Bureau claims it can do and still meet its obligations to the lower basin? Is that your contention?

Mr. ELY. No. I think we are at cross purposes here. If I understand correctly, the Bureau now assumes that the obligation under the contract of the lower basin at Lee Ferry is only 75 million acre-feet every 10 years, and that the upper basin may keep and use everything else. It proposes to use, as "apportioned," as much as 9,400,000 in some years.

We say the reverse; that the upper basin may use up to 7½ million in any 1 year and everything else must come downstream.

As I mentioned earlier, the contention of some upper basin spokesmen seems to go further, that they are not obligated to deliver 75 million acre-feet in 10 years if that would interfere with their use of 7,500,000 per annum.

Mr. BENNETT. Here again we come back to the point that the section 1 projects would not come anywhere near using 7,500,000 acre-feet of water in the upper basin; is that correct?

Mr. ELY. There is no argument about that. The trouble is with the built-in assumptions and interpretations that go with those projects. If this bill involved only the section 1 projects, and stopped at that point, much of this discussion would not be necessary.

Mr. BENNETT. You indicate your fears arising out of the present litigation between Arizona and California. With respect to the burden both on California and the upper basin in meeting the Mexican Treaty obligations. Would you say that on the average that burden would be anything like 750,000 acre-feet per year, so far as the upper basin is concerned?

Mr. ELY. If Arizona wins the lawsuit, it is. If Arizona is right, the 75 million is the same as the 7,500,000. It is all apportioned. There is no water for Mexico in it. At once the upper basin has to add 750,000 acre-feet or more per year.

Mr. BENNETT. Does that assume there would be no return flow at the Mexican border?

Mr. ELY. We think that that is why Arizona is wrong, that you cannot identify the 75 million and the 7,500,000 that way because, if the lower basin diverts 75 million in 10 years, we surely are not charged with all that, because we are entitled to credit for return flow, and if that was the full resource of the lower basin, then by diverting 75 million in 10 years we would not get the beneficial consumptive use of 7,500,000 per year. The Bureau of Reclamation and the State Department told the Senate that they expected, I think, 900,000 acre-feet per annum of return flow at the Mexican border. You cannot make the books come out right on Arizona's theory, no matter how you treat the Gila, but there is no use arguing the case here.

Mr. BENNETT. On page 20 of your statement, you repeat, for I think the second time, the allegation that the upper basin view is that if it allows 75 million acre-feet of water each 10-year period to pass Lee Ferry, it is entitled to keep and use what is left.

Are you aware of any responsible water authorities in the States, or say, members of responsible congressional committees, who assert that broad a claim in the upper basin?

Mr. ELY. Yes, I have heard much broader claims asserted here in the last few days, namely, that you do not even have to let down the 75 million if it encroaches upon the upper basin use of 7,500,000 per year.

While you were not speaking from manuscript the other day, I gathered that your interpretation was that the 75-million guaranty in III (d) and the 7,500,000 apportionment to the upper basin in III (a) had to be read together, and that the 75 million did not necessarily take preference over the 7,500,000. So I would say that the answer to your question is "Yes," there are responsible spokesmen who do go this far, and further.

Mr. BENNETT. If there was any lack of clarification in my statement, I would like to point out that I was directing myself to only one point; namely, the effect of article III (e) on article III (d). I was pointing out that your interpretation placed on article III (e) would make the accomplishment of article III (d) impossible, so far as

the upper basin was concerned, without charging some water to meet that III (d) requirement to the upper basin's own water apportionment of 7,500,000.

I did not intend by any means to express any opinion that the commitment in article III (d) is not an independent commitment. I was not dealing with that point.

Mr. ELY. I am glad to hear that.

Mr. BENNETT. Is it your contention that this bill would authorize the operation of the projects in such a manner as to permit anyone to hold back water for the generation of power, even though there were needs for that water for domestic or agricultural purposes in the lower basin?

Mr. ELY. Yes, if the proponents say the obligation is only to let down 75 million in every 10-year period, and withhold the balance for power generation. The requirements in the lower basin are in excess of 75 million every 10 years for agricultural and domestic use. Part of it is admittedly excess or surplus.

Mr. BENNETT. We are speaking here of course of the projects which would be authorized in this bill.

Mr. ELY. I suppose by that you mean the six storage dams, as well as the participating projects, and my answer is related primarily to the storage projects.

Mr. BENNETT. Then again you would want to reiterate your position that you do not think section 12 of this bill is actual protection for agricultural and domestic users in the lower basin even though the total uses out of the main stem of the river are only around 6 million acre-feet of water at the present time.

Mr. ELY. Yes; it is not adequate protection, in my view.

Mr. BENNETT. You say "Not adequate protection"?

Mr. ELY. I said "Not adequate protection."

Mr. BENNETT. I think the committee is probably very much interested in having your ideas with respect to what would be adequate protection, since a good deal of the language of section 8 and section 12 is paraphrased from amendments which California people suggested last year.

I know we would be interested at the Department. I cannot speak for the committee.

Senator ANDERSON. I would supplement that and say that the committee would be very happy to have suggestions on it. The other day Governor Johnson opened up a whole new field when he suggested that there was no way to get the money out of the pot after it was put in there. That possibility had never occurred to me, certainly, and I doubt if it occurred to anybody else on the committee. There surely is no objection in trying to clarify it. There may be some points here that we can clarify without too great difficulty.

Mr. ELY. What we had in mind was that we would submit to Senator Kuchel, language which, if he approves it, he might take up with the committee at an appropriate time, to take care of some of these points. I would not want to attempt to spell them out off the cuff, but in general, what we are seeking is the language which will carry out what our witnesses have said here today, the adequate and, so far as we can, complete protection of our water rights.

Senator ANDERSON. In order that there may be no misunderstanding on the time schedule, may I say to you that I hope to have

the transcript ready for the printer within 10 days or possibly within 1 week from the present time, and to start having subcommittee consideration of it afterward. Senator Kuchel is not a member of this subcommittee, and he might ordinarily miss those things. We will try to make sure that he does have it, but, in any event, when you submit them to Senator Kuchel, will you make sure that the clerk of our committee has a copy of them as well, if that is agreeable to you.

Senator KUCHEL. What do you do then? Do you have executive hearings of your subcommittee?

Senator ANDERSON. Yes.

Mr. ELY. If Senator Kuchel approves, he can pass them on.

When I answered before "to protect our water rights," I should have included there and would like to amend my answer to say "and the rights under our power contract."

Mr. BENNETT. On page 21 your attention was called previously to the statement that the upper basin claims a right to deprive the lower basin of all waters in the main stream in excess of 75 million acre-feet each 10-year period. This appears several times in your statement, and for that reason I bring it up again.

Senator KUCHEL. Where are you reading?

Mr. BENNETT. The bottom of page 21 and the top of page 22. It is not your contention, however, that the projects authorized in section 1 would in anyway involve using all the water in the river in excess of 75 million acre-feet in any 10-year period. In fact they will not come anywhere near using 75 million.

Mr. ELY. Let me emphasize that this result would happen to us at once in consequence of the construction of storage reservoirs. It would persist for a protracted period of filling and thereafter would be a continuing and recurring threat against the permanency of our water rights. If it can be done once, it can be done again, and the bill declares the intention to do it again through the completion of more participating projects, at a later time.

Senator ANDERSON. I do want to put in the record at that point, however, that the Upper Colorado River Basin Commission has never made any such claim, and I just asked Mr. Wood, to be sure that we had it. So far as I know, no State official has made it and no Commission has made it. I realize your anticipation that it possibly could be made at a future date.

Mr. ELY. Of course, without protracting the discussion, we all realize that was said here the other day by some of the upper basin spokesmen present, that the 75 million acre-feet guaranty does not take precedence over the 7,500,000 apportionment of the upper basin, carries with it that implication.

Mr. BENNETT. Could the statements to which you refer also have means merely that the upper basin was asserting a right to use the full 7,500,000 if there were adequate storage to meet the commitments to the lower basin, whatever they might be?

Mr. ELY. What the ultimate position of the upper basin States may be, I am unable to say. We hope to find out, if we can force them to file pleadings in our lawsuit.

Mr. BENNETT. However we are trying to find out here just one question, and that is whether we have to find out all those things in order to authorize the projects named in section No. 1.

Mr. ELY. If I may say so, I think it is to the interest of the Congress to wait until you do see the formal position of the upper basin States in their pleadings.

Mr. BENNETT. At one point your fears with respect to section 2 of the bill, the declaration of policy, led you to point out the possibility of transmountain diversions of 2 million acre-feet per year in the State of Colorado alone, if I remember correctly?

Mr. ELY. Yes, sir.

Mr. BENNETT. None of these projects to which you refer here are authorized in this bill, are they?

Mr. ELY. I think you are correct. I am referring to the inventory in House Document 419. Some of them are built or building or pending under other acts of Congress.

Mr. BENNETT. On page 25, in your conclusion, you summarize by saying that "The Colorado River storage project, as now planned"—and I assume that does not refer to just the projects in section 1 of this bill, but is the entire project plan as it was reported in 1950; is that correct?

Mr. ELY. That is correct, including the immediate impact of the withholding of the water in storage dams during the filling period.

Mr. BENNETT. Could you break down your estimate of the encroachments upon the compact amounting to 2 million acre-feet per year, so far as these individual issues are concerned? I believe we started with somewhere between 300,000 and 500,000 on the basis of different methods of measurement.

Mr. ELY. While there are others, there are two that make up the major part of that. Roughly 500,000 acre-feet is on account of the difference in measurement of consumptive use as between the depletion theory and measurement at the site of use. The other major item is the substitution of the average for the annual limitation of 7,500,000 acre-feet. I should say with respect to the latter that there is a further complication, that the assumption of the Bureau, I understand, from our engineers, is apparently that the use of water in the upper basin will be higher in the wet years and lower in the dry years, which we do not completely follow, and which makes it rather difficult to evaluate the forecasts of actual use.

I should add that the immediate impact, as compared with the long-term effect, results from the apparent intention to release to use only 7,500,000 acre-feet per year from Glen Canyon during the filling period instead of the quantity assumed in our power and water contracts and the Mexican Water Treaty, which approximates 10 million a year.

Mr. BENNETT. In the driest 10-year cycle so far, you referred to in your statement, the flow at Lee Ferry was more than 100 million acre-feet of water over a 10-year period; is that correct?

Mr. ELY. That is correct.

Mr. BENNETT. That assumes a depletion of around 2,500,000 acre-feet per year at that time in the upper basin?

Mr. ELY. 2 million to 2,500,000.

Mr. BENNETT. In which decade was that?

Mr. ELY. 1931 to 1940.

Mr. BENNETT. In that period, presumably you would have had 25 million acre-feet available for storage. Is that your deduction?

Mr. ELY. 100 million came past Lee Ferry after the upper basin used during that period 20 million to 25 million.

Mr. BENNETT. One other point:

Some emphasis was given to Indian rights in your statement. You are aware of the fact, are you not, that there was a schedule of Indian claims attached to the pleading of the United States in the litigation, *Arizona* v. *California*?

Mr. ELY. Yes, sir.

Mr. BENNETT. Do you recall offhand the approximate total of diversions claimed on tributaries of that stream which would never be available in the main stream?

Mr. ELY. I do not have the Government petition here. Do you have a copy?

Mr. BENNETT. I do not have a copy of the petition. I understand this is the same chart, but I am not certain of that.

However, if these figures are accurate, which I have in front of me, and which were supplied by the Office of Indian Affairs, the diversions on the Gila River Basin would be 740,000 acre-feet of water.

Would you say that those diversions could in any way affect the uses of water in the upper basin, even if the United States contentions were sustained?

Mr. ELY. Yes, I do. The whole business of Indian claims is highly dangerous, whether the claims are on the tributaries or the main stream.

If the United States can claims water for the Indians outside the compact and ahead of it, then it is entitled to that much water irrespective of the claims of the State of Arizona.

Arizona seeks to acquire title to 3,800,000 acre-feet of water. She says 1 million of that is III (b) water, all in the Gila, and 2,800,000 in the main stream, all III (a) water.

The question squarely came up before the master in our one meeting with him when we insisted that the United States make its position clear, either that these claims are in or out of the compact, and we wanted them proven along with Arizona's claims, before we had to answer the case of either of them.

The Arizona representative at that time indicated—and I am referring to memory, not to anything written before me—that Arizona could not live with the result if the Indian claims were chargeable against her share of compact water, unless she got the full amount she was claiming. Consequently the question of whether Indian claims on the Gila are or are not counted in the total uses, which in turn determines the total amount of surplus—does affect the upper basin, with respect to the Mexican burden.

Mr. BENNETT. At the most that would be half of 1,500,000 acre-feet of water per year.

Mr. ELY. I do not have the tabulation before me.

Mr. BENNETT. I am speaking of the Mexican burden, since the impact presumably is on the Mexican burden. I am thinking that the maximum would be 750,000 that it might cost the upper basin.

Mr. ELY. I just would not attempt to translate it. The effect of the Indian claims is too large an enigma.

In the lower basin we know the claims of diversion rights, whatever that means, are 1,700,000, and in the upper basin we have seen

tabulations running about 1 million. What they will claim I do not know.

Senator ANDERSON. Before Senator Kuchel starts in I want to say, Mr. Ely, that I appreciate very much your courtesy in permitting me to have Mr. Bennett make these interrogatories. Unfortunately the chairman of the subcommittee this year is not a lawyer, and when it came to these legal questions I felt that I could not do it.

The matter of the Department of the Interior and the Bureau of Reclamation is involved, and I thought that the legal counsel might properly do it.

I think if you wanted to properly insist upon your rights, you could have refused to answer the questions, and I therefore appreciate your courtesy in allowing us to develop information on this. That is the purpose of the questions, and I just wanted the record to show that I appreciated very much your courtesy in this matter.

Mr. ELY. Thank you, Senator Anderson. From the way you have cross-examined me and other California witnesses, I think you are a highly competent cross-examiner. Mr. Bennett's questions have been very courteous and fair, and it has been a pleasure to try to answer them. The proceeding has been entirely in order.

Senator ANDERSON. Senator Kuchel?

Senator KUCHEL. I have a request to make of the chairman, but, first, I am going to say, Mr. Ely, I think not only your statement but the discussion here has pretty well indicated the thoroughness on which you and the people of our State base their contentions in this case. It will be of extreme help to me in presenting those views later on.

Senator ANDERSON. With reference to the request made by Senator Kuchel in this morning's session for certain material from the Department of the Interior and the Bureau of Reclamation, in order that the fullest possible information shall be available, the request can be modified or extended by Mr. Ely, representing the State of California when the request is made of the Department.

Senator KUCHEL. Can that be done by letter form, with a copy sent to the committee for its records? Then we will be specific.

Mr. ELY. We will do it in that way. What we would like to specifically request to have amplified is to include the dates when construction would be started on each unit, including not only the storage dams but the participating projects. If other participating projects are to be considered by way of amendment, then we would like to have the same information on that. We would like to have the date of construction to be completed, and operations started, as well as the allocation information requested this morning, and we particularly want to see the payout schedules, as to how the expectation will be carried out that Mr. Larson expressed, the power and irrigational allocations should be repaid concurrently.

Senator ANDERSON. If there is no objection to those requests, they will be made a part of the record.

Mr. BENNETT. I want to make one statement. I do not know that we necessarily have all that information, for all of the storage units in this bill, for the reason that the Department recommended authorization of 2 of those 6. I am not sure that we can have all that information available in the time that Senator Anderson wants it, but we will certainly give you everything we have.

Senator ANDERSON. All we can request is what information you can supply. Angels can do no more. And if any additional information is desired, Senator Kuchel, it shall be done by letter addressed to me, so that there will not be any question as to what has been requested and what we supplied.

Mr. ELY. We may have some supplemental questions on water operations of the project, which we will try to cover by letter.

Senator KUCHEL. Just one more thing that I think we can clear up now, because one of the agencies in Los Angeles is most interested in the data respecting Glen Canyon Dam.

Mr. Larson very graciously had photostated a copy of the December 5, 1949, Bureau of Reclamation report from Denver, Colo., on Glen Canyon, including certain technical data.

I wanted to be sure that if there was anything in addition to this subsequent to this report that was available, the record would have it included in it.

If the field reports are not to be reduced to writing, we cannot have them. I reacognize the burden placed on the Department in this request, but to the extent that there might be any more additional. I would like to ask for them.

Frankly, I do it because of the apprehension that was raised by the letter of the Secretary to which I referred the other day.

May I then request, Mr. Chairman, that if there are any further data in any of the field offices that can be made a part of the record, that they likewise be included?

Mr. BENNETT. I do not know whether we have any more or not, but we will look for it.

Is that all?

Senator KUCHEL. This is all I have, what is right in front of me, and I would like to submit this, Mr. Chairman, for the record, and then repeat my request that if there is any further information on Glen Canyon by way of reports or otherwise that could be added to the record, I would like that the Department furnish those to the committee for the hearing and the report.

Senator ANDERSON. I do not wish to object to this, but are we going to put the reports on every one of these projects in the record?

Senator KUCHEL. No; this is on Glen Canyon only. It was raised primarily by reason of the Secretary's letter in which he raised some serious questions, we thought, with respect to Glen Canyon.

Senator ANDERSON. Very well. I announced before these reports came in when I hoped to go to press with this report, and if we get caught in furnishing materials that run beyond that date it is just too late, because we are trying to get these things underway.

Senator KUCHEL. I would like to ask the chairman if the information is not available at printtime, that it be made available to the chairman and thus to the Members of the Senate.

Senator ANDERSON. With that understanding, these things will be done.

(See letter, p. 555.)

Mr. ELY. Mr. Chairman, may I add as exhibits to my statement a number of items?

I would like to include, if you will be so indulgent, a copy of our motion to join the upper States, our brief in support of that position, our reply brief, a resolution of the Colorado River board in opposi-

tion to the legislation of last year, and a list of the organizations which have filed resolutions in opposition.

Senator ANDERSON. Let me understand. If we start in, do we put in all the pleadings in this case, or how much?

Mr. ELY. That is up to you, of course, Mr. Chairman.

Senator ANDERSON. I have tried, Mr. Ely, to not burden these records with a lot of material that is available elsewhere. I am not trying to shut you off.

Mr. ELY. I realize that.

Senator ANDERSON. If you will try to see that we get in here material that is not easily available elsewhere, then I have no objection to it, but I would hate to reprint documents because it just leads to going back and forth. You put yours in and Arizona puts in theirs and you say "We subsequently issued another brief on that."

Mr. ELY. I think your comment is perfectly fair. Suppose we furnish you for each member of the committee, copies of our briefs. If the other side wants to do the same, they are welcome to do so, and I would suggest that we simply ask to have printed here the statement of issues which attempts to summarize it.

Senator ANDERSON. I appreciate that, and it will be done in that fashion.

IN THE SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1953—NO. 10 ORIGINAL

STATE OF ARIZONA, Complainant, *vs.* STATE OF CALIFORNIA, PALO VERDE IRRIGATION DISTRICT, IMPERIAL IRRIGATION DISTRICT, COACHELLA VALLEY COUNTY WATER DISTRICT, METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, CITY OF LOS ANGELES, CALIFORNIA, CITY OF SAN DIEGO, CALIFORNIA, AND COUNTY OF SAN DIEGO, CALIFORNIA, Defendants. UNITED STATES OF AMERICA, Intervener.

SUMMARY OF THE CONTROVERSY (EXHIBIT A)

(As appended to Answer of California Defendants to Petition of Intervention on Behalf of the United States.)

The pleadings filed by Arizona, Nevada, the United States, and California, to date, disclose complex questions of fact and law, many of which are interrelated. The summary of principal questions presented below is divided into four parts: (I) the quantities of water in controversy; (II) the ultimate issues, from the standpoint of the respective prayers; (III) a tabulation of factual issues; and (IV) the issues of interpretation of the basic documents involved. Under this division, certain questions reappear and to this extent reflect the interlocking nature of the problem.

I. THE QUANTITIES OF WATER IN CONTROVERSY

The United States seeks to quiet title to rights to the use of water, consumptive and otherwise, "as against the parties to this cause," for federal purposes, in unstated amounts.

Arizona seeks to quiet title to the beneficial consumptive use of 3,800,000 acre-feet per annum of the waters of the Colorado River System (measured by "man-made depletion of the virgin flow of the main stream") and to enjoin California's right to permanently use any water in excess of approximately 3,800,000 acre-feet per annum (measured by "diversions less returns to the river"), that being the effect of (1) reducing 4,400,000 acre-feet of III (a) water by reservoir losses, and (2) denying California any permanent right to use excess or surplus waters.

California asserts a right to the beneficial consumptive use in California of 5,362,000 acre-feet per annum of the waters of the Colorado River System (measured by "diversions less returns to the river") under contracts with the United

States, comprising 4,400,000 acre-feet of the waters apportioned by Article III (a) of the Colorado River Compact and 962,000 acre-feet per annum of the excess or surplus waters unapportioned by the Compact, including in such excess or surplus the "increase of use" permitted to the Lower Basin by Article III (b) of the Compact.

Nevada seeks to quiet title to 539,100 acre-feet per annum (measured in part by both methods) of the beneficial consumptive uses apportioned by Article III (a) of the Colorado River Compact, and to not less than a total of 900,000 acre-feet from all classes of water.

As the States differ in their definition of "beneficial consumptive use," their claims require restatement in terms of a common denominator in order to evaluate their effects. Thus:

The quantity to which Arizona seeks to quiet title, 3,800,000 acre-feet per annum, measured by the method she urges, "depletion of the virgin flow of the main stream occasioned by the activities of man," is equivalent to more than 5,000,000 acre-feet measured by consumption at the site of use or "diversions less returns to the river," the standard established by the Boulder Canyon Project Act and asserted by California. The difference is due primarily to the fact that under Arizona's interpretation, the Compact deals with the virgin flow in the main stream only and that the use of water "salvaged by man' is not charged as a beneficial consumptive use, whereas under California's interpretation the Compact deals with the waters of the entire river system and such salvage is so charged.

Conversely, the aggregate of the California contracts, 5,362,000 acre-feet per annum, measured by "diversions less returns to the river," is equivalent to only about 4,500,000 acre-feet measured by "man-made depletion" (without charge for salvaged water). If Arizona's prayer should be granted, California's rights would be reduced to about 3,800,000 acre-feet per annum, measured by "diversions less returns to the river," or to about 3,000,000 acre-feet measured in terms of "depletion of the virgin flow of the main stream."

The impact of Nevada's claims on those of othe other states is not readily evaluated.

II. ULTIMATE ISSUES

The ultimate issues, in the sense of the results sought by each party, may be grouped as follows:

The United States

Does the United States have rights, "as against the parties to this cause, to the use of water in the Colorado River and its tributaries" in the following categories?

(1) for consumptive use of all projects in the Lower Basin, which it asserts independently of any rights claimed by the States in which such projects are located;

(2) to fulfill its obligations arising from international treaties and conventions; but this involves, with respect to the burden of the Mexican Water Treaty, the obligations as between the States of the Upper Division and the States of the Lower Division under Articles III(c) and III(d) of the Colorado River Compact, and involves also the effect of the so-called "escape clause" of Article 10 of that Treaty, which allows reduction in the guaranteed deliveries to Mexico, in the event of extraordinary drought, in the same proportion as consumptive uses in the United States are reduced, "consumptive uses" being defined in Article 1 of the Treaty;

(3) to fulfill all its contracts for the delivery of water and electric power, i. e., with or in Arizona, California, and Nevada; but it alleges that the water available is not sufficient to satisfy all these obligations;

(4) to fulfill the Government's obligations to Indians and Indian Tribes; but this involves not only the questions of the magnitude and priorties of these claims but the questions of whether or not they are chargeable under the Colorado River Compact to the Basin and State in which such uses are made, what the obligation of the Upper Division States may be to release water for use by Indians in the Lower Basin, and what rights the United States may have to withhold water in reservoirs in the Upper Basin for use by Indians in both Basins;

(5) to protect its interests in fish and wildlife, flood control and navigation; but such rights as it may have for these purposes may require the impounding and release of water from reservoirs in both Basins, and not

merely reservoirs bordering or within Arizona and California, and again involves the question of accounting under the Compact; and

(6) for use of the National Park Service, Bureau of Land Management, and Forest Service; but if the United States has claims " as against the parties to this cause" for these functions, such claims apply to all the waters of the Colorado River System in both Basins.

The adjudication of these claims of the United States requires consideration and resolution of: questions of fact, referred to later; the power of the United States to impound and dispose of water independently of rights derived from the States; the extent of its obligations under treaties and contracts; the impact and effect of its treaties upon rights of domestic water users; how its claims to the use of water shall be measured; the location, magnitude and priorities of Indian claims, and claims for other alleged federal purposes; the extent to which its rights and obligations are controlled by the Colorado River Compact; and the extent to which its claims may be exercised in futuro in derogation of intervening rights and uses.

Arizona

Is Arizona entitled to a decree?

(1) Quieting title to 2,800,000 acre-feet per annum of the beneficial consumptive uses apportioned to the Lower Basin by Article III (a) of the Colorado River Compact, substantially all to be taken from the main stream, and measured in terms of man-made depletion of the virgin flow of the main stream?

(2) Quieting title to all of the 1,000,000 acre-feet per annum by which the Lower Basin is permitted to "increase its use" by Article III (b) of the Colorado River Compact (notwithstanding the decision of this Court in *Arizona* v. *California et al.*, 292 U. S. 341 (1934)), to the exclusion of the other States of the Lower Basin, all to be taken from the waters flowing in the Gila River, and to be measured in terms of man-made depletion of the virgin flow of the main stream?

(3) Reducing California's right to the uses apportioned by Article III (a) of the Colorado River Compact to approximately 3,800,000 acre-feet per annum, in consequence of reservoir losses?

(4) Enjoining California's right to receive and permanently use under its government contracts 962,000 acre-feet per annum, or any part thereof, in excess of 4,400,000 acre-feet per annum?

The determination of Arizona's claims involves: the questions of fact, later referred to; the standing of Arizona to seek a declaratory decree quieting title to a "block" of water for projects not yet constructed or authorized (about 1,600,000 acre-feet per annum of the 2,800,000 claimed from the main stream); the source of title to Arizona's claims to 2,800,000 acre-feet of III (a) water and 1,000,000 acre-feet of III (b) water; the status of the uses on the Gila; the measurement of uses thereof and of the main stream; whether Arizona's status is that of a party to the Colorado River Compact or that of a third party beneficiary of the Statutory Compact between the United States and California, and if so, whether Arizona is bound by the interpretations placed thereon by the principal parties thereto in its formulation and administration; and the validity and effect of Arizona's water delivery contract with the United States.

Most of the questions posed by Arizona's claims revolve around the issue of whether the Gila River shall be treated as a part of the Colorado River System for all purposes, or shall receive special treatment in respect of (1) the identification of uses thereon with the waters referred to in Article III (b); (2) the corollary exemption of "rights which may now exist" on the Gila from any charge under Article III (a); and (3) the devaluation of the charge for beneficial consumptive uses from the quantity which is in fact consumed on the Gila (alleged by California to be about 2,000,000 acre-feet per annum) to the lesser quantity represented by the resulting depletion in the virgin flow of the main stream (alleged by Arizona to be about 1,000,000 acre-feet per annum).

California

Are the contracts between the United States and the defendant public agencies of California for the storage and delivery of water valid and enforceable? Inasmuch as these contracts are, in terms, for permanent service but subject to the Colorado River Compact, the Boulder Canyon Project Act and the California Limitation Act, the issue is whether these enactments, considered together as a Statutory Compact established by reciprocal legislation, authorize and permit the Secretary of the Interior to presently contract for the storage and delivery for permanent beneficial consumptive use in California, of 4,400,000

acre-feet per annum of the waters apportioned by Article III(a) of the Colorado River Compact plus one-half of the excess or surplus waters unapportioned by the Compact, including in such excess or surplus the "increase of use" permitted to the Lower Basin by Article III(b) of the Compact. The aggregate of these contracted quantities, subject to physical availability of the amounts of excess or surplus waters, which vary from year to year, is 5,362,000 acre-feet per annum.

The determination of California's claims involves: the questions of fact, later referred to; the extent to which rights have vested in both the United States and California under the Statutory Compact; whether Arizona is estopped by her previous conduct from asserting her present position; whether the limitation is net of reservoir losses; how California's uses shall be measured; whether California is chargeable with the use of salvaged water; the effect of California's appropriations in their relation to the expressions "rights which may now exist" and "present perfected rights" in the Compact and Project Act; the definition of the Project Act term, "excess or surplus waters unapportioned by" the Colorado River Compact; the availability of such waters for permanent service; the intent of Congress with respect to the waters referred to in Article III(b); and the relation between California's contracts and the later agreements which the Secretary of the Interior has entered into with others.

Nevada

Is Nevada entitled to a decree:

(1) Quieting title to 539,100 acre-feet per annum of the beneficial consumptive uses apportioned to the Lower Basin by Article III(a) of the Colorado River Compact?

(2) Reserving for a future agreement the disposition of the use of the 1,000,000 acre-feet referred to in Article III(b) of the Colorado River Compact, and preserving to Nevada an equitable share thereof?

(3) Assuring Nevada the ultimate beneficial consumptive use of not less than 900,000 acre-feet per annum, from all classes of water?

The determination of Nevada's claims requires the consideration and resolution of: the questions of fact later referred to; the questions of interpretation previously mentioned; the question of whether Nevada's share of III (a) waters has been determined or limited to 300,000 acre-feet per annum; whether, as to stored waters, Nevada may claim any quantity in excess of her contracts with the United States; and the source of title to her claims to 539,100 acre-feet per annum of III (a) water and not less than 900,000 acre-feet per annum from all sources.

Interests of other States

There remains the question whether the claims of the United States, Arizona, California, and Nevada can be effectively determined without concurrently determining the rights and obligations of Utah and New Mexico with respect to the waters of the Lower Basin, and the rights and obligations of those States and Colorado and Wyoming with respect to other waters of the Colorado River System, to the extent that they are affected by the issues in controversy here.

In more detail, these "ultimate issues" depend upon the resolution of the following questions of fact and of the interpretation of the Colorado River Compact, the Boulder Canyon Project Act, the Statutory Compact between the United States and California, and the Mexican Water Treaty.

III. FACTUAL ISSUES

There are substantial issues of fact, raised by the pleadings to date. These include, but are not limited to, determination of:

(1) the investments and obligations undertaken by the parties in the construction of works and in the performance of their contracts with the United States, and the investments and obligations undertaken by the United States in reliance upon such contracts;

(2) the location, magnitude and priorities of the water rights necessary to enable the United States to perform its obligations to Indians and Indian tribes pursuant to Article VII of the Compact;

(3) the requirements of the United States for (a) flood control, (b) navigation, (c) fish and wild life, and (d) the other claims which it makes;

(4) the quantities of water physically available for beneficial consumptive use in the Lower Basin, assuming full use by the Upper Basin of its Compact apportionment, full regulation of the supply available to the Lower Basin, and full performance of the Mexican Water Treaty;

(5) the uses, present and potential, on the main stream and on each tributary, determined as of the place of use, as California contends is the proper method, and the effect of those uses in terms of man-made depletion of the virgin flow of the main stream, as Arizona contends is the proper method;

(6) the quantities of water "salvaged" by the activities of man, on the main stream and on the tributaries;

(7) reservoir losses, present and potential, gross and net;

(8) appropriative rights, priorities, and uses thereunder, on the main stream and tributaries;

(9) the extent and place of use of "rights which may now exist" and which, under Article III (a) of the Compact, are to be charged as uses of water apportioned by Article III (a), and of "rights which may now exist" in California, within the meaning of Section 4 (a) of the Project Act; and

(10) the extent and place of use of "present perfected rights" protected by Article VIII of the Compact and directed by the Boulder Canyon Project Act to be satisfied in the operation and management of the Project.

IV. THE ISSUES OF INTERPRETATION OF THE COLORADO RIVER COMPACT, THE BOULDER CANYON PROJECT ACT, THE STATUTORY COMPACT, AND THE MEXICAN WATER TREATY

Questions relating primarily to Article III (a) of the Colorado River Compact include the following: Whether the Colorado River Compact deals only with the main stream or treats with Colorado River System waters wherever they may be found; whether the uses apportioned by Article III (a) to the Lower Basin are to be taken only from "water present in the main stream and flowing at Lee Ferry," as Arizona contends, or from the tributaries as well, as California and Nevada contend; whether the 7,500,000 acre-feet referred to in Article III (a) is related to the 75,000,000 acre-feet referred to in Article III (d), as Arizona contends, or whether the latter figure includes excess or surplus waters, unapportioned by the Compact, as California contends; by what process Arizona claims to have acquired an apportionment of 2,800,000 acre-feet of Article III (a) water, to be taken from the main stream; whether the apportionment of 7,500,000 acre-feet "per annum" is a statement of a maximum, or of an average, and, if the latter, over what period of years; the definition and measurement of "beneficial consumptive use"; the accounting for water added to and withdrawn from storage on the main stream and tributaries; whether the use of water salvaged by man on the main stream and tributaries is to be charged under the Compact; the definition of "rights which may now exist," which are to be included in charges to water apportioned by Article III (a) and their magnitude on the main stream and tributaries; the date to which this last expresson refers; whether, in the absence of a compact among the Lower Basin States, the division of water among them is to be affected by appropriated rights, i. e., "rights which may now exist"; whether Indian rights, and other federal claims to consumptive use, are included within that expression and are to be charged under the Compact; whether reservoir losses are chargeable as beneficial consumptive uses, and if so, their classification under the Compact and their relation to other uses.

Questions relating primarily to Article III (b) of the Colorado River Compact include the following: The questions relating to the definition of "beneficial consumptive use" and "per annum" previously stated in connection with Article III (a); whether the "increase of use" permitted to the Lower Basin by Article III (b) is an apportionment in perpetuity as in Article III (a), as Arizona contends, or a license to acquire rights by appropriation and contracts under the Project Act in excess or surplus waters unapportioned by the Compact, as California contends; whether this right to increased use is identified solely with the water found flowing in the Gila River, as Arizona contends, or is identified with the first 1,000,000 acre-feet of increased use (above 7,500,000) per annum throughout the Lower Basin, as California and Nevada contend; whether this right is available to all five States of the Lower Basin, or to Arizona alone, as she contends (notwithstanding the decision of this court in *Arizona* v. *California et al.*, 292 U. S. 341 (1934)); the status of uses in New Mexico on the Gila; the status of uses on other tributaries; and to what degree reservoir losses are chargeable to this increase of use. Reference to the relation of the Mexican Treaty burden to the uses under Article III (b) appears below in connection with Article III (c).

Questions relating primarily to Article III (c) of the Colorado River Compact include the following: Whether the waters to be supplied Mexico are "apportioned" thereby (this bears upon the determination of the meaning of the

expression "excess or surplus waters unapportioned by" the Colorado River Compact, appearing in the Boulder Canyon Project Act, *infra*); whether, if the quantities in excess of those specified in Articles III (a) and III (b) are insufficient to supply the deliveries to Mexico, the burden, with respect to the Lower Basin, falls first upon the uses referred to in Article III (b), as California contends, or upon those referred to in Article III (a), as Arizona contends; and the relation of the "escape clause" in Article 10 of the Treaty, which permits reduction in deliveries to Mexico in case of extraordinary drought in proportion to the reduction in consumptive uses in the United States. The relation of Article III (c) to Articles III (d) and III (a), with respect to the obligations of the Upper Division States, is referred to below in connnection with Article III (d).

Questions relating primarily to Article III (d) of the Colorado River Compact include the following: As a corollary to one of the questions stated with reference to Article III (a), whether the 75,000,000 acre-feet referred to in Article III (d) is related to the 7,500,000 acre-feet apportioned by Article III (a) to the Lower Basin, or whether the 75,000,000 acre-feet include excess or surplus waters available for delivery to Mexico or use in the Lower Basin; the resulting effect on the obligation of the States of the Upper Division stated in Article III (c) to furnish additional water to meet the deficiency if surplus above the quantities specified in Articles III (a) and III (b) is insufficient to supply Mexico; and whether the Lower Basin is entitled to demand release of this 75,000,000 acre-feet notwithstanding the consequent inability of the Upper Basin to make beneficial consumptive use of 7,500,000 acre-feet per annum.

Questions relating primarily to Article III (e) of the Colorado River Compact include the following: whether, if excess or surplus waters are appropriated (or contracted for) in the Lower Basin, their release from storage in the Upper Basin may be required; whether, if Indian uses are not subject to the Colorado River Compact, the United States may require release of water from reservoirs in the Upper Basin to satisfy them, in addition to the water which the States of the Upper Division are required to release in performance of Articles III (c) and III (d) of the Compact; so also with respect to the other federal claims asserted by the United States "as against the parties to this cause," for use of water in the Lower Basin.

Questions relating primarily to Articles III (f) and III (g) of the Colorado River Compact include the following: whether the provisions in these articles with reference to a compact to be made after October 1, 1963, are permissive or mandatory; whether, in the light of the Statutory Compact, these provisions preclude the acquisition of rights in excess or surplus waters by appropriation and by contract with the United States in the interim, subject only to further apportionment as between Basins by such a future compact; and whether, in the event of competing interstate claims to such excess or surplus waters, in the absence of a compact apportioning them, priority of appropriation, including contracts with the United States, controls.

Questions relating to Article VII of the Colorado River Compact include the following: Whether uses by Indians are subject to the Colorado River Compact; whether Indian uses are chargeable under the Compact to the Basin and the State in which they are situate; if not, whether they are prior and superior to the apportionments made by the Compact, or are in competition with appropriations of others which are subject to the Compact; the location, magnitude, and asserted priority of Indian claims; their effect upon the quantities available to non-Indian users under Articles III (a), III (b), etc.; their effect on the distribution of the Mexican Treaty burden; and their effect on the obligations of the States of the Upper Division under Articles III (c) and III (d).

Questions relating primarily to Article VIII of the Colorado River Compact include the following: The date to which the expression "present perfected rights" relates, i. e., 1922, 1929, or some other date; the definition of said term; whether such definition is to be determined under the law of the State under which the right arose; whether the assurance against impairment extends to quality as well as quantity; the extent of these rights in each State; their relation to the expression "rights which may now exist," as used in Article III (a) of the Compact and Section 4 (a) of the Project Act; and the impact of reservoir losses when present "perfected rights" attach to, and are satisfied from stored waters, pursuant to the direction in Article VIII.

Questions relating primarily to the Boulder Canyon Project Act and the resulting Statutory Compact between the United States and California include the following: Whether the alternative consent given in the Project Act to a Seven-State or Six-State Compact became final on June 25, 1929, in establishing the latter; whether Arizona could, or did, effectively ratify a Seven-State Compact thereafter; if so, whether the Statutory Compact authorized by the Project Act as a corollary to a Six-State Compact remains in effect; if it does, whether Arizona can claim the benefits of both; whether the Statutory Compact authorized contracts to be made with the California defendants for the permanent service (in addition to 4,400,000 acre-feet of III (a) waters) of one-half of the excess or surplus waters unapportioned by the Compact for use in California; whether it included therein the waters referred to in Article III (b), or precluded California from use of such waters; whether the "excess or surplus," of which California may use one-half, is to be reckoned before or after deduction of the quantity required to be delivered to Mexico; the effect on California's right to "excess or surplus" of a future compact apportioning such waters; whether the limitation "for use in California" is net of reservoir losses, or is subject to further reduction in consequence of such losses; whether the definition of consumptive uses applicable to California is applicable to Arizona, and vice versa; whether California is free to make use of salvaged waters without charge under the Compact or the Limitation Act; the effect of California's appropriations; the meaning and effect of the reference to "rights which may now exist" in Section 4 (a) of the Project Act; the extent of California's "present perfected rights" as referred to in Section 6 of the Project Act; whether by the Project Act, or otherwise, the shares of Nevada or Arizona in the waters of the Colorado River System have been determined; and the construction and effect of the water delivery contracts held by those States.

Mr. ELY. We will not ask to have reprinted the many resolutions offered against this project when it was before you last year as S. 1555, but do ask that a list of the organizations on record as opposed to some if not all of the features or policies of this legislation be printed. Many of the resolutions were printed last year.

We also ask that you print the resolution of the Colorado River Board.

Senator ANDERSON. All right.

(The material referred to follows:)

OPPOSITION TO COLORADO RIVER STORAGE PROJECT (S. 1555, 83D CONG.)

At least some one, if not all, of the features or policies of this legislation have been opposed either during the course of the hearings, or through the submission of statements, the enactment of resolutions, or other pronouncements by the following:

Engineers Joint Council (a federation of the eight major engineering societies: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Water Works Association, American Institute of Electrical Engineers, the Society of Naval Architects and Marine Engineers, American Society for Engineering Education, and American Institute of Chemical Engineers)
American Public Power Association
Izaak Walton League
National Parks Association
The Wilderness Society
Sierra Club
The American Planning and Civic Association
National Wildlife Federation
Wildlife Management Institute

And the following California entities:

Colorado River Board of California
Imperial Irrigation District
Metropolitan Water District of Southern California
Los Angeles City Council
Department of Water and Power of the City of Los Angeles

San Diego County Water Authority
San Diego City Council
Imperial County Board of Supervisors
Imperial County Farm Bureau
Holtville Chamber of Commerce
Calexico Chamber of Commerce
Calexico City Council
Coachella Valley County Water District
Rainbow Municipal Water District, San Diego County
California State Chamber of Commerce, Southern California Council
Brawley Chamber of Commerce
Brawley City Council
Calipatria Chamber of Commerce
Westmorland City Council
Council of the City of Burbank
Board of Supervisors of Orange County
Board of Directors of the City of Pasadena
City Council of San Jacinto
City Council of Santa Ana
City Council of Torrance
City Council of Hemet
City Council of Glendale
City Council of Costa Mesa
City Council of Laguna Beach
City of Beverly Hills
City Council of Chino
City Council of Newport Beach
City Council of Compton
City Council of Ontario
City Council of Long Beach
City Council of Fullerton
City Council of Perris
Board of Supervisors of Los Angeles County
Council of the City of Anaheim
City Council of Santa Monica
City Council of San Marino
City Council of Fontana
City Council of Upland
Council of the City of Pomona
City Council of El Centro

Also:

Central Labor Council of Los Angeles
Railroad Brotherhood's Joint Legislative Council of California
Executive Committee, California State Grange
Property Owners' Association of California, Inc.
And the Los Angeles Clearing House Association

In addition, taxpayers' associations throughout the country have expressed alarm at the tremendous burden this legislation will place upon citizens everywhere to subsidize this project.

RESOLUTION OF THE COLORADO RIVER BOARD OF CALIFORNIA, JUNE 2, 1954

The Colorado River Board of California opposes the enactment of S. 1555 and H. R. 4449, 83d Congress, bills to authorize the Secretary of the Interior to construct, operate, and maintain initial units of the Colorado River storage project and participating projects, and for other purposes.

California favors the continuation of the development of the water resources of the Colorado River Basin on a sound economic basis, as the need for such development occurs. This State recognizes the right of the upper basin States to so utilize the waters apportioned to that basin by the Colorado River compact as approved by the Boulder Canyon Project Act, but subject to the terms and conditions of those documents as the Supreme Court may construe them in the case of *Arizona* v. *California* now pending.

By the same token, California, in the protection of its investment of nearly $700 million in water development projects which it has made in reliance upon the Colorado River compact and the Boulder Canyon Project Act, and the economy

and population of more than 4 million people dependent upon these works, must resist legislation which would encroach upon the rights recognized in the lower basin States by those documents.

The proposed Colorado River storage project legislation adversely affects the lower basin States in much the same way as would the proposed central Arizona project legislation. Both are based upon interpretations of the Colorado River compact and the Boulder Canyon Project Act with which California cannot agree and which are now at issue in the United States Supreme Court. Each of them contemplates developments which would encroach upon the Compact and Project Act, as interpreted at the time of enactment of those laws, to the extent of more than a million acre-feet per year. Both proposals are based upon unrealistic water supply estimates. Each is in conflict with the presentation made to the Senate by the supporters of the Mexican Water Treaty. Each ignores the legal claims which are in conflict with it, and both ignore the damage which their construction would cause to the investments already made by their neighbors. Each of these proposals is dependent upon Federal subsidies for irrigation amounting to many times the value of the land when fully developed, and most of these subsidies are concealed. Both would commit the Congress to new feasibility standards and pay-out formulas with which this Board and other California State agencies have officially expressed disapproval.

The Colorado River storage project would intercept the lower basin's water supply with giant reservoirs at Glen Canyon, Echo Park, and Curecanti, capable of storing several years' flow of the river. In the absence of statutory controls of the operation of such reservoirs designed to protect the output of firm power at Hoover Dam, upon which the United States and the power contractors relied, the use of such large storage could result in seriously curtailing the revenues at Hoover Dam and other dams on the lower river and upon which these lower projects depend for financing. It is against the best interest of both the power users in the lower basin and the Federal Treasury to so legislate.

Both Glen Canyon and Echo Park Reservoirs would be located downstream from any point of use by the proposed irrigation projects in the upper basin and their major purpose would be to provide revenues, commencing almost 50 years hence, to pay the capital cost, without interest, of the irrigation projects proposed for construction now. This postponement for nearly 50 years from the commencement of repayment of irrigation would result in a Federal subsidy amounting to over $2,500 per acre of irrigated land—an unwarranted and unjustified burden on the Nation's taxpayers.

California, as a major taxpaying State, is doubly affected, for the amount of the overdraft on the water supply of the Colorado River Basin is directly related to the amount of Federal subsidy to the irrigation projects creating the overdraft.

The bills delegate to the Secretary of the Interior power to resolve the feasibility of the participating irrigation projects. If reclamation feasibility standards are to be changed, that should be done by Congress, in general legislation, after the Hoover Commission has had an opportunity to report upon this very matter, heretofore committed to their study.

The proposed legislation includes some, and foreshadows other, large transmountain diversion projects in the upper basin using several million acre-feet of water annually, thereby impairing the quality as well as the quantity of the water available to the lower basin and to which the lower basin is entitled under the Colorado River compact.

For all these reasons, the Colorado River Board of California respectfully requests the representatives of this State in the Senate and House of Representatives of the United States to oppose the enactment of legislation to authorize construction of the Colorado River storage project and participating projects as proposed in these bills—S. 1555 and H. R. 4449—or similar legislation, and instructs its officers and staff to make the appropriate presentation of the views of this board to the congressional committees and executive agencies concerned with such legislation.

Senator ANDERSON. In that connection, I have here a telegram that came in this afternoon from Governor Johnson and some people from Colorado.

If they all want these to go in the record, I must say we have a lot of them, and I think we would like to take a look at the final printing

and if it looks to be too expensive we would just say that resolutions had been received, and if they are not too voluminous we might print some of them. These things cost money even though they go straight to the Government Printing Office, and they come out of your pocket and mine in the last analysis.

Mr. ELY. If you decide to print resolutions, we would like to have ours printed.

Senator ANDERSON. I have a folder full of them about this thing and I have not brought them into the record because a thousand dollars is a thousand dollars, I think, saved.

Mr. ELY. Some questions have been asked here about the Central Valley project. I have telegraphed for the figures and will ask you to include a summary of that in the record.

Senator ANDERSON. They will be placed in the record at this point.

(The material referred to follows:)

CENTRAL VALLEY PROJECT DATA

1. Total investment

A. As of Jan. 1, 1955 (From Bureau report released Mar. 3, 1955. This figure does not include expenditures by Corps of Engineers to Jan. 1, 1955, on Folsom Dam of $60,669,000. If added, this would bring total project investment as of Jan. 1, 1955, to $496,074,525.)	$435,405,525
B. Estimated investment for completed project (Including all authorized units such as Trinity. This figure latest released by Bureau for total cost but no breakdown of it available at this moment. Accordingly, figures which follow based on reports as identified.)	$750,071,106

2. Date of final payout

For initial units	Year 2006.
Including Trinity and Sacramento Canals	Year 2013.

3. Surplus

$170,678,200 (With Trinity and Sacramento Canals)	Through year 2013.

4. Use of interest component or Collbran formula

The interest component is not being applied on the Central Valley project. It was shown on Bureau reports through 1953. The three most recent reports on project units (Trinity, March 1954; San Luis, August 1954; Folsom South, February 1955), however, do not show any of the interest ($101,508,300) on power or interest ($21,326,500) on municipal and industrial water as used for the repayment of any capital costs.

The Reclamation Bureau reports show that the Collbran formula is now incorporated in the planning to the extent that power and municipal and industrial revenues may be used, after allocations to these purposes have been paid out with interest to repay about 17 percent of the irrigation allocation. (See 5 and 6 below.)

5. Allocations and manner of repayment with percentages

Purposes	1 Allocations	2 Percent of total cost	3 Amount to be repaid by each purpose	4 Percent of total to be repaid (col. 3)	5 Percent of repayment to total cost
Nonreimbursable:					
Navigation	$8,055,000				
Flood control	44,999,000				
Fish	1,478,000				
Total	54,532,000	6.7	0	0	0
Reimbursable:					
Irrigation	399,378,000	49.5	$324,392,500	43.2	40.2
Power	280,221,000	34.8	346,856,600	46.1	43.1
Municipal and industrial	20,782,000	2.6	29,131,900	3.9	3.6
Total	700,381,000		700,381,000		
Distribution systems	51,455,000	6.4	51,455,000	6.8	6.4
Grand total	806,368,000	100.0	751,836,000	100.0	93.3

6. Percentage to be paid by irrigators of amount allocated to irrigation, including distribution works

	Cost	Repay
Irrigation	$399,378,000	$324,392,500
Distribution systems	51,455,000	51,455,000
Total	450,833,000	375,847,500

Percentage of repayment, to cost, by irrigators equals 83.3 percent.

Source: Foregoing material re Central Valley project based upon information received by teletype dated Mar. 4, 1955, from the office of the executive officer, water project authority, State of California.

Mr. ELY. May I ask whether the Hill report has been printed in a form that is available for the Congress? We do not agree in all respects with it, but it is highly informative. It is 61 pages long, double spaced. I think it would be an informative part of your record.

Senator ANDERSON. I surely hate to put 61 pages into the record in one big batch.

Suppose we consider it?

Before we complete, I want to just read one sentence of a letter from Herbert Hoover to Delph Carpenter. I do not say this is of extreme importance, but it is on page A–103 of the Hoover Dam documents.

Delph Carpenter was asking about the use of the additional million acre-feet and no more:

> There is nothing in the compact to prevent the States of either basin using more water than the amount apportioned under paragarphs (a) and (b) of article III, but such use would be subject to the further apportionment provided for in paragraph (f) of article III, and would vest no rights under the present compact.

That is why I sort of questioned the statement about the upper States having no rights.

Mr. ELY. There is a somewhat similar statement in Mr. Hoover's answer to Senator Hayden's questionnaire of January 1923, with which you are familiar, and I will supply that citation for the record.

(For the citation referred to, see answers to questions 10 and 16 at pp. A36 and A39 of Hoover Dam documents (H. Doc. 717, 80th Cong.).)

Senator ANDERSON. Are there any more questions?

Senator KUCHEL. No, Mr. Chairman.

Senator ANDERSON. Thank you very much, Mr. Ely, for a very fine presentation of this whole question, and I appreciate the way in which you handled it.

Mr. ELY. Thank you, Mr. Chairman, and the committee, for your patience and courtesy, as always.

Senator ANDERSON. We will meet at 10:15 in the morning.

(Whereupon at 5:20 p. m., Friday, March 4, 1955, the committee recessed until 10:15 a. m., Saturday, March 5, 1955.)

COLORADO RIVER STORAGE PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

EIGHTY-FOURTH CONGRESS

FIRST SESSION

ON

S. 500

A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONSTRUCT, OPERATE, AND MAINTAIN THE COLORADO RIVER STORAGE PROJECT AND PARTICIPATING PROJECTS, AND FOR OTHER PURPOSES

FEBRUARY 28, MARCH 1, 2, 3, 4, AND 5, 1955

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built. These cities as well as other cities use much water. The only solution is more water.

The San Juan-Chama project plan would provide a supplemental water supply for some 40,000 acres out of a total of about 75,000 acres in the upper reaches of the Rio Grande. It would provide a supplemental supply of water to about 24,000 acres of lands in the upper Canadian Basin; it would provide a supplemental water supply to about 180,000 acres of land along the Rio Grande from Espanola to the Texas-New Mexico State line; and it would provide a municipal and industrial water supply for cities such as Los Alamos and Albuquerque where we have large atomic energy and defense installations.

The project would also provide a domestic supply of water for the many Indians as well as whites living within the Rio Grande and upper Canadian Basins. It would enable the people living on many of the small irrigated farms to receive a full water supply for their small farms, thereby improving their standards of living. In producing more feed for their livestock on irrigated farms, it would relieve the overgrazed condition of the pasturelands which is recognized as one of the principal causes of erosion.

There are many more things that I could say about the need for constructing the Navaho and San Juan-Chama projects, but I do not wish to take up any more of your time. The upper Colorado project is vitally important to the upper Colorado Basin States, and I will lend my full support to its authorization, and I strongly urge you to include the two small projects, Hammond and Pine River extension, as well as the much-needed Navaho and San Juan-Chama projects.

Senator ANDERSON. Are there any other Members of the Senate that desire to make statements before we start our regular program?

Senator Millikin, I regret to say, is detained for a short time. We all appreciate the very wonderful work which he did in the preparation of the hearings 7 or 8 months ago and the very fine work which he did in working out an acceptable bill to be reported to the floor. I am sure he will be with us shortly again, and we will have the benefit of his advice and counsel.

Without objections at this point, I will put in the record a copy of Senate bill 500, introduced on January 18.

(Senate bill 500 is as follows:)

[S. 500, 84th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams,

reservoirs, powerplants, transmission facilities and appurtenant works: Cross Mountain, Curecanti, Echo Park, Flaming Gorge, Glen Canyon, and Navajo: *Provided*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase); Emery County, Florida, Gooseberry, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo: *Provided*, That (a) construction of the participating projects set forth in this clause (2) shall not be undertaken until the Secretary has reexamined the economic justification of such project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of this Act can be met. The Secretary's supplemental report for each such project shall include, among other things, (i) a reappraisal of the prospective direct agricultural benefits of the project made by the Secretary after consultation with the Secretary of Agriculture; (ii) a reevaluation of the nondirect benefits of the project; and (iii) allocations of the total cost of construction of each participating project or separable features thereof, excluding any expenditures authorized by section 7 of this Act, to power, irrigation, municipal water supply, flood control or navigation, or any other purpose authorized under reclamation law. Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama and the Navajo participating projects, not be applicable to such supplemental reports; and, (b) that no appropriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been approved and authorized by the Congress: *Provided further*, That with reference to the San Juan-Chama project, it shall be limited to a single offstream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission.

SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River system the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phases thereof)—

(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and

(2) for which pertinent data sufficient to determine their probable engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any par-

ticipating project authorized in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law.

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 338, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under, or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994).

SEC. 4. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts, (2) payment as required by subsection (d) of this section, (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act, and (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277): *Provided*, That revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit, participating project of separable feature thereof, or, in the cases of the Paonia project and of Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bit quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project or separable feature thereof the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1955, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty With the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the Cross Mountain, Flaming Gorge, Glen Canyon, Navajo and Echo Park initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

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SEC. 10. There are hereby authorized to be appropriated such sums as may be required to carry out the purposes of this Act.

SEC. 11. The appropriate agencies of the United States are authorized to convey to the city and county of Denver, Colorado, for use as a part of its municipally owned water system, such interests in lands and water rights used or acquired by the United States solely for the generation of power and other property of the United States as shall be required in connection with the development or use of its Blue River project, upon payment by Denver for any such interest of the value thereof at the time of its acquisition by Denver, and provided that any such transfer shall be so limited as not to preclude the use of the property other than water rights for the necessary functions of the United States Government.

SEC. 12. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits. No right to impound or use water for the generation of power or energy, created or established by the building, operation or use of any of the powerplants authorized by this Act, shall be deemed to have priority over or otherwise operate to preclude or impair any use, regardless of the date of origin of such use, of the waters of the Colorado River and its tributaries for domestic or agricultural purposes within any of the States of the Upper Colorado River Basin.

SEC. 13. As used in this Act—

The terms "Colorado River Basin," "Colorado River Compact," "Colorado River System," "Lee Ferry," "States of the Upper Division," "Upper Basin," and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785); and

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

Senator ANDERSON. I will also put in the record the report of the Department of the Interior to the chairman of the committee, Senator Murray, dated February 25, 1955.

(The report is as follows:)

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington D. C., February 25, 1955.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington, D. C.

MY DEAR SENATOR MURRAY: A report has been requested from this Department on S. 500, a bill to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

COLORADO RIVER STORAGE PROJECT

TUESDAY, MARCH 1, 1955

UNITED STATES SENATE,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met at 10 a. m., pursuant to recess, in the committee room, 224 Senate Office Building, Senator Clinton P. Anderson (New Mexico), presiding.

Present: Senators Clinton P. Anderson (New Mexico); Joseph C. O'Mahoney (Wyoming); Eugene D. Millikin (Colorado), and Arthur V. Watkins (Utah).

Present also: Senators Alan Bible, Nevada; Thomas H. Kuchel, California; Frank A. Barrett, Wyoming; Barry Goldwater, Arizona; Gordon Allott, Colorado; and Wallace F. Bennett, Utah.

Representative at large Keith B. Thompson of Wyoming; Representative Byron G. Rogers, Colorado.

Present also: Stewart French, staff director and chief counsel; Goodrich W. Lineweaver, staff member for reclamation; William K. Coburn, staff member for public lands; James Gamble, staff member for Indian Affairs; Richard L. Callaghan, chief clerk; N. D. McSherry, assistant chief clerk.

Senator ANDERSON. In view of the fact that some members may have obligations to other committees, I thought we would try to accommodate them in order that they may get to other hearings.

Senator ANDERSON. Senator Allott, would you like to present your statement at this time?

Senator ALLOTT. Yes, I would.

STATEMENT OF HON. GORDON ALLOTT, UNITED STATES SENATOR FROM THE STATE OF COLORADO

As previously stated in open hearing, I do unqualifiedly endorse the upper Colorado River project and urge its passage by Congress. It is a necessity for the development of the West; it is a necessity for the development of the upper Colorado River Basin and the upper Colorado River States; it is a necessity if we are to meet the demands for electric power now existing within the Western States; it is a necessity if we are to have available for our national economy the future development which the next 20 years of construction will make possible; it is a necessity if there is ever going to be any justice in a division of the water of the upper States basin, and any attempt to thwart the upper Colorado River project in its development is an attempt to continue the injustice which goes on daily.

I must admit that I had written so previously, but I must also admit that I was wrong in doing so. Seeing the country in which the canyon waters will be impounded we also saw the good that such stored waters could do to this arid, but fertile, region.

It was proven to us beyond doubt that many of the arguments that had been advanced by conservation groups opposing the dam were without basis in fact and the opposition unjustified.

The Dinosaur Monument and adjacent beauty spots will not be spoiled by this dam and its impounded waters. In fact, the development of this lake will make the area 100 times more accessible to those who would like to see it, and the water will cover only 500 feet of a dangerous canyon bottom that is more than 2,700 feet deep.

It seems as though 3 or 4 Far Western States are confusing the issue in their efforts to permit more water from the upper Colorado River to reach their own home States before it is distributed.

The effect of the position taken by conservationist leaders is to urge that the United States Government break faith with the people of Utah and the upper basin and repudiate solemn promises as well as President Roosevelt's Executive order.

Since the Echo Park Dam is obviously neither an invasion nor a precedent, the discussion about alternate sites should be centered only on selecting the best sites. Competent engineers after years of study testify that the Echo Park Dam best meets the needs of the project and the area from all points of view.

In conclusion, the project is needed to protect the safety of the United States to assure a safe source of supply of uranium and the vast storehouse of other essential defense metals. The project is essential to enable Utah and the upper basin to share in the future growth of the Nation.

Since southern California has had first turn on the river, she has enjoyed an incalculable advantage. The upper basin States have pledged to honor the compact. Southern California, as a signatory to that same compact, should, in the interest of fair play, adopt a more cooperative attitude, rather than one of obstruction.

Lastly, the cry that Echo Park Dam is an invasion of the national-park system is unfounded in fact.

I am sure that this committee will again report the project favorably to the Senate, and I hope that the Senate, relying on the judgment of this committee, will approve the project by a substantial majority.

Senator ANDERSON. Is there anyone here who has a committee assignment?

If not, we will continue the hearings with the statement from our long-time colleague and personal friend of so many of us, Governor Johnson.

Governor, we welcome you back. We are happy to have you as a witness now.

STATEMENT OF HON. EDWIN C. JOHNSON, GOVERNOR OF THE STATE OF COLORADO

Governor JOHNSON. Thank you, Mr. Chairman and members of the committee. This is a very important committee to the Western States, especially, and to the country as a whole.

A long time ago I was a member of this committee. I regret that I do not have my statement reduced to writing altogether.

I am familiar with the rules, but I just have not had an opportunity to get the job done, Mr. Chairman.

Senator ANDERSON. I am happy to say that our former colleague from Colorado, when he was presiding last year, was courteous to some of us who had not observed the rules. I guess we can take care of you on the same basis.

Governor JOHNSON. Well, that is being very generous. I apologize to you, but I am a little bit short on written material.

I have been disappointed, too, in one matter. I have some suggested amendments or, at least, some references to the language in the bill which I want to call to your attention for whatever merit it may deserve.

And in order to get a quick job of printing, Congressman Rogers volunteered to help me out by inserting my suggested amendments in the form of a bill. It went down to the Public Printer with a request that it be an expedited job, but Mr. Rogers tells me that the Public Printer has fallen down on the job and does not have the material here. It may be here before we get through, but I want to make that statement so that you will not think that I am totally disregarding the rules of this committee to have written statements before the committee.

I do, however, have one copy, Mr. Chairman, of part of my statement.

Senator ANDERSON. We are not worried about that at all, Governor Johnson. You just go right ahead.

Governor JOHNSON. I do have copies of some statistics I expect to offer and plenty of them.

Now, Mr. Chairman, I wish to make a statement concerning the 18 participating projects in Colorado which the Upper Colorado River Commission, the Colorado Water Conservation Board, and the Colorado General Assembly have recommended for inclusion by amendment in S. 500.

As this bill was introduced in the previous bill, Senate bill 1555, 83d Congress, 2d session, provision was made for only 5 participating projects in Colorado, the total cost of which was estimated by the Bureau of Reclamation at $25,635,500. And the depletion of the stream by these 5 projects was something in the neighborhood of 62,000 acre-feet annually.

Unfortunately, Colorado was unable to secure even reconnaissance reports on the units of the Cliffs-Divide project until the spring of 1954. These reports are now available and although they are not of feasibility grade, they cover the subjects in sufficient detail to enable the State to request inclusion in the bill on the same basis as similar projects in other States.

It is estimated total cost of the 18 additional participating units and projects comes to $218,175,500. The total for all these participating projects in Colorado, therefore, will amount to $244,811,000.

Inasmuch as Colorado is to receive 15.75 percent of the water allotted to the upper basin States, this sum in comparison is not out of line. The 18 projects with data concerning their costs and benefit-cost ratio and stream depletion are shown in the following table. You have the table before you.

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(The table referred to is as follows:)

Additional Colorado participating projects, Colorado River storage project

	Capacity of project reservoirs	Construction cost	Average annual stream depletion	Benefit-cost ratio
Gunnison River project units:	*Acre-feet*		*Acre-feet*	
Fruitgrowers extension	6,900	$1,783,000	5,540	2.4
Tomichi Creek	60,000	11,996,000	17,700	6
East River	0	209,000	2,100	2.5
Ohio Creek	10,000	3,526,000	9,300	1.0
Fruitland Mesa	41,000	11,331,000	25,100	1.2
Bostwick Park	9,000	2,753,000	4,800	1.7
Grand Mesa	71,000	20,630,000	24,700	1.4
Dallas Creek	41,200	10,760,000	31,000	1.5
Total	239,100	62,988,000	120,240	.....
Cliffs-Divide project units:				
Parshall	43,000	12,026,100	28,600	1.0
Troublesome	20,100	5,387,700	13,000	1.2
Rabbit Ear	22,500	4,846,600	16,400	1.3
Eagle Divide	12,800	3,498,200	12,000	1.1
Woody Creek	0	184,400	1,400	3.9
West Divide	118,000	84,676,900	88,100	.9
Bluestone unit (without DeBeque)	0	3,445,600	19,900	2.0
Battlement Mesa	25,000	5,987,400	10,700	1.1
Total	241,400	120,052,900	190,100	.....
San Juan Dolores: Dolores	153,000	26,179,000	69,370	1.1
White-Yampa: Savery-Pot-Hook (Colorado)	65,000	8,956,000	+20,000	1.21
Total	698,500	218,175,900	399,710	.....

Governor JOHNSON. The first column indicates the capacity of project reservoirs in acre-feet.

The second column represents the construction costs.

The third column represents the average annual stream depletion in acre-feet.

The fourth column represents the benefit-cost ratio.

I think you are all familiar with the benefit-cost ratio.

For instance, the first project, the Fruitgrowers Extension, shows a cost ratio of 2.4. That means that the benefits in that project are 2.4 times the cost.

These projects, as you will note, are divided into four general projects:

The Gunnison River project units, consisting of eight projects.

The Cliffs-Divide project units, consisting of eight projects.

The San Juan-Dolores project, under Dolores River.

And in the White-Yampa area, the Savery-Pot Hook.

It will be noted from the last column in the table that all but two have benefit-cost ratios greater than 1.30.

The Tomichi Creek unit of the Gunnison project is below par in this respect. However, it is thought that a restudy may bring the ratio up to the desired value. The Tomichi Creek reservoir is a reservoir of very great importance in the upper Gunnison River Valley and we hope that it may prove to be up to the standard which is required.

Further surveys will have to determine that fact.

The West Divide unit of the Cliffs-Divide project occupies a most commanding position in an area which promises startling industrial development within the next decade. An inspection of the proposed project indicates alterations in the preliminary plan which in all probability raise the benefit-cost ratio considerably above 1.0 to 1.

Senator MILLIKIN. What project is that, Senator?

Governor JOHNSON. That is the West Divide unit in the Cliffs-Divide project. You will find West Divide sixth down in the second set of units.

Senator ANDERSON. From a money standpoint it represents two-thirds of all the money set forth.

Governor JOHNSON. That is right. It is an important project and, of course, from a money point of view, it represents a very large investment.

Whether that project will finally measure up or not remains for further study.

The topography of western Colorado in the basins of the Colorado and Gunnison Rivers is such that, with one exception, the possible irrigation projects are all small in size and the land involved is located in discontinuous areas. For this reason it is not possible to build 1 or 2 large structures which will store water for the use of the several potential irrigation units.

Each must have its own storage reservoir.

This viewpoint was evidently held by the Bureau of Reclamation officials when they made their studies on these two rivers because the project study in one case is known as the Gunnison River project, and in the other the study on the main stem of the Colorado River as the Cliffs-Divide project, each embracing the entire stream concerned. Each project is made up of numerous units, so really, the State of Colorado is asking for the inclusion of only 4 additional projects, rather than 18. These additional projects are portions of, first, the Gunnison River project, and, second, the Cliffs-Divide project; third, the Dolores project, and, fourth, the Savery-Pot Hook project.

The large downstream reservoirs, in addition to furnishing cyclic storage, are a means of earning money to pay for the construction in a large measure of the upstream participating projects.

It should be clear in everyone's mind that the latter, the participating projects, cannot come into existence until the small upstream reservoirs are constructed to hold back the spring runoff and, thus, afford water supplies for irrigation of the land.

Last spring in my appearance before the Senate Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, I stated that the maximum quantity of unallocated waters available for consumptive use in Colorado was 1,347,000 acre-feet.

In the table on the previous page, you will note that the 18 units and projects suggested would deplete the several streams in a total amount of approximately 400,000 acre-feet. This is less than a third of the unallocated water available for consumptive use in Colorado.

The five participating projects mentioned in Senate bill S. 1555 and again in this bill, would deplete the streams in the amount of only 62,400 acre-feet, a total of 462,000 acre-feet for all Colorado participating projects, only a fraction of Colorado's allocation.

In summation, may I emphasize the fact that all of these additional participating units and projects are located high up on the mountain streams where the flood flows can be conserved and used for irrigation on adjacent lands. They are all necessary elements in the economy of Colorado and will contribute in a large measure to the economy of the Nation.

The Fruitgrowers Extension project and the Savery-Pot Hook project have feasibility reports which as yet have not been released by the Interior Department. All other units have reconnaissance reports which indicate that feasibility studies will show them well within the requirements set up by the Bureau of Reclamation and the Congress for such projects.

The addition of these units to the upper Colorado River storage bill places the State of Colorado in its rightful position when compared with other States of the upper basin.

Now, Mr. Chairman, before we add these projects to the bill, this is the percentage of the expenditures which will be used by each of the four upper basin States. Colorado will receive 3½ percent. I am talking about participating project only, not storage project.

Colorado, 3½ percent; Utah, 37 percent; Wyoming, 6 percent; New Mexico, 53½ percent.

After these bills are added, if they are added, and I most sincerely hope that they are and urge that they be made a part of this bill, Colorado will have 28 percent instead of 3½ percent; Utah will have 27 percent; Wyoming 5 percent, and New Mexico, 40 percent.

I don't mean to indicate that anything is to be taken away from New Mexico or Utah, but by adding Colorado the percentage becomes more balanced and that is the reason for the change in the percentage ratios between the States concerned.

Senator MILLIKIN. Would you mind repeating again, Senator, what percentage of the water from the streams originates in Colorado?

Governor JOHNSON. 72.18 percent of the upper Colorado River is produced by Colorado.

Senator MILLIKIN. How much water was allocated to the upper basin compact?

Governor JOHNSON. 51.75 was allocated to Colorado. Twenty-three percent to Utah; 14 percent to Wyoming, and 11.25 to New Mexico.

Colorado, of course, produces most of the water of the upper Colorado River. Colorado and Wyoming produce a great deal of the water in the upper Colorado.

But under the compact that has been entered into, among the upper basin States Colorado shares still 51.75. So it seems very much in point that Colorado's participating projects should be raised from the extreme low of 3½ percent to something that is more in line with the other States when it is pushed up to 28 percent.

Senator O'MAHONEY. Governor, may I ask you what is the basis of this latest percentage figure you gave? Percent of what?

Governor JOHNSON. That is the percentage of the money that is estimated will be required to build these projects in the various States.

Senator O'MAHONEY. You are not suggesting any change of the compact division of the water?

Governor JOHNSON. No, sir; that is irrevocable and fixed. The only percentage that I am talking about is the percentage of the money that Senate bill 500 is estimated to use in the building of the various projects which are included in this bill, the participating projects.

I want to say that the Savery-Pot Hook project in northern Colorado is also a Wyoming project. It irrigates land in both States and

adds supplemental water in both States. It adds more supplemental water in Wyoming than it does in Colorado, but it is included here.

There is no division made with respect to the cost of building that project as between the State of Colorado and the State of Wyoming.

Now, Mr. Chairman, if you have Senate bill 500 before you and if you will turn to page 2 of that bill, line 15, I am urging that Cross Mountain be stricken and that after "Glen Canyon," "Juniper," be added.

Now, these printed copies have come. These are the amendments which I will recommend be inserted in H. R. 4488, by Congressman Rogers.

You can find the language in each one of them that I am bringing up for your consideration.

(The bill introduced by Representative Rogers, H. R. 4488, follows:)

[H. R. 4488, 84th Cong., 1st sess.]

A BILL To authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, the Congress, in the exercise of its constitutional authority to provide for the general welfare, to regulate commerce among the States and with the Indian tribes, and to make all needful rules and regulations respecting property belonging to the United States, and for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the upper basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionment made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods and for the improvement of navigation, and the generation of hydroelectric power, as an incident of the foregoing purposes, hereby authorizes the Secretary of the Interior (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, tranmission facilities and appurtenant works: Curecanti, Echo Park, Flaming Gorge, Glen Canyon, Juniper, and Navajo: *Provided*, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or a reservoir of such greater capacity as may be acceptable to local interests in the vicinity of the city of Gunnison, Colo., and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase): Cliff-Divide (consisting of eight project units), Dolores, Emery County, Elkhorn, Florida, Gooseberry, Gunnison River (consisting of eigth project units), Hammond, Kendall, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Savery-Pot Hook, Seedskadee, Silt, Smith Fork, San Juan-Chama, Navajo: *Provided*, That (a) construction of a participating project set forth in this clause (2) shall not be undertaken until the Secretary has reexamined the economic justification of such project and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress, through the President, that, in his judgment, the benefits of such project will exceed its costs, and that the financial reimbursability requirements set forth in section 4 of this Act can be met. The Secretary's supplemental report for each such project shall include, among other things, (i) a reappraisal of the prospective direct agricultural benefits of the project made by the Secretary

after consultation with the Secretary of Agriculture; (ii) a reevaluation of the nondirect benefits of the project; and (iii) allocations of the total cost of construction of each participating project or separable features thereof, excluding any expenditures authorized by section 7 of this Act, to power, irrigation, municipal water supply, flood control or navigation, or any other purpose authorized under reclamation law. Section 1 (c) of the Flood Control Act of 1944 shall, except as hereinafter provided for the San Juan-Chama and the Navajo participating projects, not be applicable to such supplemental reports; and, (b) that no appopriation for or construction of the San Juan-Chama project or the Navajo participating project shall be made or begun until coordinated reports thereon shall have been submitted to the affected States, including (but without limiting the generality of the foregoing) the State of Texas, pursuant to the Act of December 22, 1944, and said projects shall have been approved and authorized by the Congress: *Provided further*, That with reference to the San Juan-Chama project, it shall be limited to a single off-stream dam and reservoir on a tributary of the Chama River to be used solely for the control and regulation of water imported from the San Juan River, that no power facilities shall be established, installed, or operated along the diversion or on the reservoir or dam, and such dam and reservoir shall at all times be operated by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission.

SEC. 2. In order to achieve such comprehensive development as will assure the consumptive use in the States of the Upper Colorado River Basin of waters of the Colorado River system the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, it is the intent of the Congress in the future to authorize the construction, operation, and maintenance of further units of the Colorado River storage project, of additional phases of participating projects authorized in this Act, and of new participating projects as additional information becomes available and additional needs are indicated. It is hereby declared to be the purpose of the Congress to authorize as participating projects only projects (including units or phases thereof)—

(1) for the use, in one or more of the States designated in article III of the Upper Colorado River Basin Compact, of waters of the Upper Colorado River system the consumptive use of which is apportioned to those States by that article; and

(2) for which pertinent data sufficient to determine their probable engineering and economic justification and feasibility shall be available. It is likewise declared to be the policy of the Congress that the costs of any participating project authorized herein or in the future shall be amortized from its own revenues to the fullest extent consistent with the provisions of this Act and Federal reclamation law. Furthermore, participating projects authorized in the future shall be on a full equality with participating projects authorized herein with respect to all considerations including economic justification, appraisal of agricultural and other benefits, irrigation repayment contracts and obligations, interest charges, financial reimbursability requirements and payment, allocation of costs of construction to power, irrigation, municipal water supply, flood control and any other purpose or benefit authorized under reclamation law.

SEC. 3. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): *Provided*, That (a) contracts shall be entered into which (except as otherwise provided for the Paonia and Eden projects) provide for repayment of the irrigation obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs

within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564). All units and participating projects shall be subject to the apportionments of the use of water between the upper and lower basins of the Colorado River and among the States of the upper basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States) (Treaty Series 994).

SEC. 4. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 7.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 7, shall be credited to the Basin Fund as advances from the general fund of the Treasury, and such funds shall be available for expenditures within the limitations of the provisions of this act and of the provisions of the appropriations.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts, (2) payment as required by subsection (d) of this section, (3) payment of the reimbursable construction costs of the Paonia project which are beyond the ability of the water users to repay within the period prescribed in the Act of June 25, 1947 (61 Stat. 181), said payment to be made within fifty years after completion of that portion of the project which has not been constructed as of the date of this Act, (4) payment in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277); and (5) any remaining surplus to be available only for appropriation for construction of the units and participating projects authorized by or pursuant to this act.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to the extent required to return for that year—

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 5 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (e), and interest due shall be a first charge; and

(4) the costs of each unit, participating project, or any separable feature thereof which are allocated to irrigation pursuant to section 5 of this Act within a period not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such unit, participating project, or separable feature thereof, or, in the cases of the Paonia project and of the Indian lands, within a period consistent with other provisions of law applicable thereto.

(e) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

(f) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

SEC. 5. Upon completion of each unit, participating project, or separable feature thereof the Secretary shall allocate the total costs (excluding any expenditures authorized by section 7 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation, and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with the fiscal year 1955, upon the status of the revenues from and the cost of constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

SEC. 6. The hydroelectric powerplants and transmission facilities authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but no exercise of the authority hereby granted shall affect or interfere with the operation of any provision of the Colorado River Compact, the Upper Colorado River Basin Compact, or the Boulder Canyon Project Act: *Provided*, That power produced pursuant to this Act shall be sold at the highest practicable price to enhance the development of the Upper Colorado River Basin and operation in conjunction with other powerplants shall not deprive the Basin Fund of revenues which it would receive in the absence of such joined operation.

SEC. 7. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) faciilties to mitigate losses of and improve conditions for the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest, and with due regard for any change in use that may occur at some future time. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

SEC. 8. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with any provision of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty With the United Mexican States (Treaty Series 994).

SEC. 9. Expenditures for the Curecanti, Echo Park, Flaming Gorge, Glen Canyon, Juniper, and Navajo initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

SEC. 10. There are hereby authorized to be appropriated such sums as may be required to carry out the purposes of this Act.

SEC. 11. The appropriate agencies of the United States are authorized to convey to the city and county of Denver, Colorado,, for use as a part of its municipally owned water system, such interests in lands and water rights used or acquired by the United States solely for the generation of power and other property of the United States as shall be required in connection with the development or use of its Blue River project, upon payment by Denver for any such interest of the value thereof at the time of its acquisition by Denver, and provided that any such transfer shall be so limited as not to preclude the use of the property other than water rights for the necessary functions of the United States Government.

SEC. 12. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits. No agency or official of the United States shall seek or accept a right to impound or use water for the generation of power or energy, created or established by the building, operation, or use of any of the powerplants authorized by this Act.

SEC. 13. As used in this Act—

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "upper basin", and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact.

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "upper basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785); and

The term "treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof.

Governor JOHNSON. I want to say that I got some of my early training under Governor Adams of Colorado, who saw 50 years of public service, most of it in the Colorado Senate. I was his secretary at one time, and while Governor Adams was not an attorney, he rendered a great service to Colorado by studying every bill that came before the general assembly with great patience and thoroughness. He would go over every bill line by line and word by word and try to find anything that wasn't clear or that might, in his opinion, not be good policy.

I have attempted to do that same thing for this bill. You will note on page 2, line 19 in the bill, in the proviso, I have suggested that in line 19 that "will create" be stricken out.

Senator MILLIKIN. What bill are you referring to, Governor?

Governor JOHNSON. I am talking about Senate bill 500. This is an amendment to Curecanti.

That the words "will create" be stricken out on line 19, so that it will read—

forty thousand acre-feet of water or reservoir of such greater capacity as may be acceptable to local interests in the vicinity of the city of Gunnison, Colorado.

Then drop down to line 22—

and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the

economic justification of such unit and, accompanied by appropriate documentation.

and so on.

In the Rogers bill that will be found on lines 17, 18, and 19, on page 2. That amendment which I have suggested gives a little more leeway to work out the problems of the Curecanti project at Gunnison.

As you know, the people of Gunnison have objected to the large Curecanti, so-called, inasmuch as at low-water time it would leave a lot of muddy flats in the area of the city of Gunnison.

This amendment which I have offered is expected to make the project when it is finally agreed upon, acceptable to Gunnison County and the town of Gunnison.

On page 5, on line 19, there is a typographical mistake. I suppose you have found it. It says "for the use in one of more" and it means "for the use in one or more". "Of" is changed to "or".

In the same section, section 2, on page 6, line 3, it reads, "Any participating project authorized in the future".

I have inserted "herein or in the future".

I am sorry I have not had time to mark these proposed amendments out on the Rogers bill.

Now, the object of that amendment is to make the participating projects which are to be approved in the future, according to the same standards as the participating projects which are approved in this bill.

We have a great many potential participating projects in the State of Colorado in addition to the 18 which have been suggested.

When the upper basin is finally developed, all of these participating projects will most certainly be improved and be developed.

But we do not want—it does not seem to me that it would be wise to enact a bill today having one standard and one standard for the participating projects that are provided for in this bill, in section 1 of this bill, and then to have a different standard apply to the projects that are to come in the future.

So I have suggested in line 3 "participating projects authorized herein or in the future". And you will find that same language in the Rogers bill on page 6, line 6, beginning at line 6. You will find that language which I want to read into the bill after "reclamation law". It reads as follows:

Furthermore, participating projects authorized in the future shall be on a full equility with participating projects authorized herein with respect to all considerations including economic justification, appraisal of agricultural and other benefits, irrigation repayment contracts and obligations, interest charges, financial reimbursability requirements and payment, allocation of costs of construction to power, irrigation, municipal water supply, flood control, and any other purpose or benefit authorized under reclamation law.

You will find that language printed in the Rogers bill on page 6, beginning with line 6, and ending on line 15.

It seems to me that that proposed amendment ought to have serious consideration by this committee.

Now, on page 7 of the bill, first, we go now to section 4. I have read section 4 over very carefully a good many times. While I have not had an opportunity of discussing section 4 with a water attorney, it seems to me that there is something missing in section 4.

Now, perhaps I am mistaken. I have been mistaken a good many times, but I have read it over carefully and it just seems to me that there is something that needs to be added to section 4. For instance, turn to paragraph (b) of section 5, on line 21, page 7.

May I say that the purpose of section 4 is to set up a separate fund in the Treasury of the United States which may be known as the upper Colorado River Basin fund. And that is a very important step to be taken.

Now, on line 21 (b) it says that:

(b) All appropriations made for the purpose of carrying out the provisions of this act, other than section 7, shall be credited to the basin fund as advances from the general fund of the Treasury.

Now, that does not say part of the appropriations; that says all of the appropriations, all of the appropriations that are made for the purpose of carrying out the provisions of this bill shall go into this fund.

But I cannot find any place in section 4, or any other part of the bill, that provides for the use of the appropriations which are made to carry out the objectives of this bill. I cannot find where there is any provision at all made for such appropriations to come out of the bill for construction purposes.

Senator ANDERSON. I do not follow you there.

Governor JOHNSON. You put money in the fund. You have a basin fund and you put money into that fund. (b) says:

All appropriations made for the purpose of carrying out the provisions of this act, other than section 7, shall be credited to the basin fund as advances from the general fund of the Treasury.

Now, would you think that if all appropriations which are made have to go into that fund there ought to be some place for the funds to come back out for construction.

Senator ANDERSON. Other than section 7?

Governor JOHNSON. Other than section 7, which is a recreation section.

Senator O'MAHONEY. What is the meaning of the conclusion of that sentence beginning with the word "and" after the word "Treasury" in line 8?

and such funds shall be available for expenditures within the limitation of the provisions of this act and the provisions of the appropriation

Governor JOHNSON. That is the language which I propose to be added.

Senator O'MAHONEY. I was reading from the Rogers bill.

Governor JOHNSON. Yes. The purpose of that is to make the appropriations available for expenditures within the limitations of the provisions of this act, Senate bill 500, and of the appropriation bill.

Senator WATKINS. Does it not seem to you that it is implicit in the statement:

All appropriations made for the purpose of carrying out the provisions of this act, other than section 7, shall be credited to the basin fund?

The appropriations for carrying out this act, and appropriations can be used from the basin fund, it seems to me that is implicit?

Governor JOHNSON. You don't say so.

Senator WATKINS. Well, you do not spell out every power in minute language.

Governor JOHNSON. It says:

All appropriations made for the purpose of carrying out the provisions of this act shall be credited to the basin fund as advances from the general fund to the Treasury.

Then you go on with the rest of the bill and you make your provisions for taking money out of the basin fund and after you take the money out for the purposes that are set up in the bill, then the rest of the money goes back into the Treasury.

Senator WATKINS. One of the purposes is the construction of these projects.

Governor JOHNSON. That is right.

Senator WATKINS. For the purpose of carrying out the provisions of this act.

Governor JOHNSON. That is right.

Of course, all appropriations go in here.

Senator WATKINS. To me it seems to say so in very plain language that the money is available for the purpose of this act even though it is in that fund.

But if there is any doubt in anybody's mind, if we have to put in 3 or 4 words to get it out of that fund, I am for it.

Senator ANDERSON. Does not section (a) take it out:

There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin (hereinafter referred to as the basin fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this act other than section 7.

So whatever is done, to build dams or anything else, is taken out of the basin fund.

Governor JOHNSON. I cannot see it the way you do, but I cannot argue the matter with you. The money goes into that fund and it remains in that fund——

Senator ANDERSON. Until it is expended for the purposes of the act.

Governor JOHNSON. If you stop right there that might be all right, but you go on with all of these provisions on pages 8 and 9 and 10 and 11, and you list the expenditures from this fund in detail and there is nothing in any of them that says anything about construction cost.

Senator ANDERSON. Except section (a).

Governor JOHNSON. Which doesn't say anything about it. It says:

There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin fund which shall remain available until expended as hereafter provided.

Now, "hereafter provided" means (b), (c), (d), and all these other arrangements that go clear to page 11, line 11.

Can you find any place in that bill where any money can be expended for construction? It has everything else in there, but not for construction.

Then down here on page 8, line 17, it says:

Provided, That revenues created to the basin fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act.

Now, I would like to know what that language may mean.

Senator O'MAHONEY. Where is that language?

Governor JOHNSON. On page 8, line 17, proviso.

Senator ANDERSON. Do you recognize the difference between revenues and appropriations?

Governor JOHNSON. Well, I think an appropriation becomes revenues after it goes in the fund. I think it is an appropriation until after it gets in the fund and then after that it becomes a revenue.

Senator MILLIKIN. Could that not be cleared up with some language?

Governor JOHNSON. Yes.

Senator MILLIKIN. I suggest that it be done.

Governor JOHNSON. All I am doing is calling attention to it. I have prepared language which may not be appropriate.

On the other hand, it may be appropriate.

Senator O'MAHONEY. Governor, I think there is a difference in the meaning of revenues and appropriations. If you look on page 7, beginning with line 21, it says specifically:

All appropriations made for the purpose of carrying out the provisions of this Act.

Now, the provisions of the act include construction.

Governor JOHNSON. That describes the appropriation.

Senator O'MAHONEY. Then this other provides that revenue—the word "revenue" does not include appropriations.

Governor JOHNSON. It does after they get into the fund, they become revenues.

Senator O'MAHONEY. No: appropriations are one thing; revenues are another. Revenues arise from the sale of power, for example.

Then on line 24:

The cost of each unit, participating project, or any separable feature.

I do not believe there was any intention on the part of anybody drafting this bill to make the distinction that you point out. I am sure that nobody on the committee would hesitate to clarify the matter.

Governor JOHNSON. All I am doing it for, Senator, and I am sure you know that, is to be helpful and constructive. I tell you why I was so anxious about it. I was anxious to know whether the funds that were appropriated could be used for the building of participating projects, and especially whether the funds that were earned by the projects could be used for the building of participating projects in the upper Colorado River Basin.

When I read section 4 I was surprised to find that you can take the money out of the basin fund for any number of purposes except construction. And there is no way of taking any money out of that fund for construction. At least it is not written out here.

Senator MILLIKIN. Mr. Chairman, I think the Senator has brought up a very important point. On that there ought not to be the slightest possibility of argument.

Therefore, I suggest that the committee agree that that should be clarified so that there cannot be any question about it.

Senator WATKINS. Mr. Chairman, there will be a number of matters in connection with the draftsmanship of the bill. I take it they will be considered by the committee when it comes time to mark up the bill and that suggestion will be considered at the same time.

To me it means that the money can be taken out, but if there is any doubt in anybody's mind I would not go through all the pains of getting the bill passed and find out we cannot spend the money.

Senator MILLIKIN. It will take only a few words to clarify it and I suggest we clarify it.

Governor JOHNSON. I thank my former colleague.

Senator ANDERSON. I want to call Governor Johnson's attention to the fact that this is set up precisely as the Colorado River Dam fund was set up, the same general language of putting money in the fund, and there have been expenditures from that fund in his State and other States. That was the intention of this.

Governor JOHNSON. I am sure that that was the intention.

Senator ANDERSON. The same happened on the Bonneville Dam and the expense money on the Bonneville Dam.

Governor JOHNSON. I am positive that that is the intention.

Now, in section 6, I think this is a typographical change on line 12, "the hydroelectic powerplants and transmission facilities," "and transmission facilities" were left out at that particular point.

In other places in the bill it occurs. That is on page 11, "the hydroelectric powerplants." Other places in the bill whenever you say "the hydroelectric powerplants" you add "and transmission facilities" but in this the "and transmission facilities" is left out.

Senator ANDERSON. Perhaps it is due to the fact that transmission facilities do not generate any power and this is dealing only with generation of power in such ways as will be most useful.

Governor JOHNSON. If it is operated and maintained, then your transmission facilities are needed at that time.

On page 11, line 21, I added a proviso there. You will find on the Rogers bill on page 12, line 9;

Provided, That power produced pursuant to this Act shall be sold at the highest practicable price to enhance the development of the Upper Colorado River Basin and operation in conjunction with other powerplants shall not deprive the basin fund of revenues which it would receive in the absence of such joined operations.

Section 6 deals with cooperation with other powerplants on the river and the proviso which I have offered I would like to have you give what consideration it merits.

As I say, you will find the language of it on page 12, line 9.

On page 12 of the bill I inserted an amendment, line 17. Following "interest" change the period to a comma and add "and with due regard for any change in use that may occur at some future time."

That is on the exchange of land and is meant to provide for a recovery of land that might be disposed of.

Now, section 12 on page 14, beginning with line 14, the bill says:

No right to impound or use water for the generation of power or energy, created or established by the building, operation or use of any of the powerplants authorized by this Act, shall be deemed to have priority over or otherwise operate to preclude or impair any use, regardless of the date of origin of such use, of the waters of the Colorado River and its tributaries for domestic or agricultural purposes within any of the states of the upper Colorado River Basin.

I think the last part of that proviso beginning on line 17 is in conflict with the Boulder Canyon Project Act and the seven-State compact.

In article 4 of that compact there is a proviso (c) that says:

That the provisions of this article shall not apply to or interfere with the regulation and control by any State within its boundaries of the appropriation, use, and distribution of water.

It seems to me that that proviso there on page 14 interferes with paragraph (c) of article 4 of the compact and in the first part on page 14 you state that this bill S. 500 complies with the Colorado River compact and the Boulder Canyon Project Act and so on.

So I am proposing that the language be changed which will give the same effect, but which will not fly in the face of the seven-State compact.

After the word "no" in line 14 of page 14, I suggest that you add this language:

No agency or official of the United States shall seek or accept a right to impound or use water for the generation of power or energy, created or established by the building, operation, or use of any of the powerplants authorized by this Act.

Senator O'MAHONEY. Will you read that again, please.

Governor JOHNSON. You will find that on page 15 of the Rogers bill, lines 9 to 13.

Article 4 of the compact makes a distinction between powerplants used for storage which are interstate and those which are used intrastate.

(b) Provides for your interstate.

Senator WATKINS. Where are you reading?

Governor JOHNSON. Do you want the place in the bill? Do you have the Rogers bill, Senator?

Senator WATKINS. Yes.

Governor JOHNSON. Now, look at lines 9 to 13 on page 15. Article 4 of the compact is divided into three paragraphs, (a), (b), and (c); (b) has to do with the power rights on interstate reservoirs; (c) has to do only with intrastate projects.

Now, I might give you a good example of what I am talking about. In Colorado we have the Green Mountain Reservoir. The Green Mountain Reservoir is completely an intrastate power project. The Interior Department, the Reclamation Bureau through an agent, filed on the power rights on the Green Mountain Reservoir. That is an intrastate reservoir in every way and they had a right to do that.

I do not think that this proviso on page 14, beginning with line 14, as it is written here, will stand up against paragraph (c). I am just calling your attention to what I think is very important, that you ought to take a pretty good look at that and see whether it does the job that it is supposed to do in connection with paragraph (c) of article 4 of the compact.

Senator KUCHEL. How do you interpret the language in S. 500 beginning at line 14 on page 14? What do you think that language attempts or purports to accomplish?

Governor JOHNSON. I think its intent is clear enough, but I do not think it can fly in the face of the seven-State compact.

You say right up there on top of page 14 that:

The Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River compact, Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act—

and so on.

Yet you go down here and you fly right in the face of paragraph (c) and make a provision that I do not think does comply because paragraph (c) says:

The provisions of this article shall not apply to or interfere with the regulations and control of any State within its boundaries, of the appropriation, use, and distribution of water.

On an interstate reservoir I am very sure that the Department of Interior and the reclamation people can file on reservoir rights.

Senator O'MAHONEY. May I interrupt you at this point?

Governor JOHNSON. Yes.

Senator O'MAHONEY. I am calling your attention now to page 15 of the Rogers bill, the new language that you are proposing for the language beginning on line 14, of page 14, of S. 500.

Governor JOHNSON. Yes.

Senator O'MAHONEY. I want to be sure that I understand what you believe this new language to mean. It says:

No agency or official of the United States shall seek or accept a right to impound or use water for the generation of power or energy, created or established by the building, operation, or use of any of the power plants authorized by this Act.

Now, I take it that those words beginning in line 11 "by the building, operation or use of any of the powerplants authorized by this Act," are intended to convey the meaning that you believe that any agency or official of the United States properly authorized to do so may build, may operate and may use any of the powerplants authorized in the act?

Governor JOHNSON. Yes, that is right.

Senator O'MAHONEY. You do not intend to deny that?

Governor JOHNSON. I do not intend to deny that at all.

Senator O'MAHONEY. You are merely trying to deny impounding or using water for the exclusive purpose of filing?

Governor JOHNSON. No, what I am trying to do is what the Interior Department is permitted to do under the seven-State compact, to do what the Interior Department did do in Green Mountain Reservoir. They went in there and filed on the power rights. They had a right to do it.

Senator O'MAHONEY. They had or had not a right to do it?

Governor JOHNSON. They did have a right, because they were given that right by the seven-State compact, article 4, because the Green Mountain Reservoir is an intrasate reservoir and because it was an intrastate reservoir, under paragraph (c) they had a right to go in there and file on the power rights, and they did file.

And there is a lawsuit pending because they did file, now.

I do not think you can do what you say you want to do here in the rest of the language.

Senator O'MAHONEY. I am trying to find out what you want to do.

Governor JOHNSON. I don't want them to file on the power. I don't want the Federal Government to file on the power in any of the reservoirs in this development plan.

I don't want them to do that.

Senator O'MAHONEY. You do not believe that the Colorado River compact is not an interstate compact, do you?

Governor JOHNSON. Well, some of the projects are not interstate. The Green Mountain Reservoir is not interstate.

Senator ANDERSON. How do you make that distinction, just because it is within a State?

Governor JOHNSON. It is within a State and all the uses of the water which it impounds is within the State.

Senator ANDERSON. Is not it part of an interstate stream?

Governor JOHNSON. That is right. It is part of an interstate stream.

Senator O'MAHONEY. Now, we have created an interstate system, have we not? Congress has done that over a period of more than 30 years now, dating from 1922. The whole purpose of the compact was to create an interstate agreement whereby the waters of the Colorado River Basin could be utilized in 2 segments, 1 segment for the lower basin and 1 segment for the upper basin.

Governor JOHNSON. But the compact has been very careful to state that it was not interfering with the States appropriation of water or the use of its water, its allocation; it did not go into that matter at all.

Senator O'MAHONEY. I think we may be just talking about words. I understand your intent to be like that of the rest, to make the best possible division in fairness and in accordance with the terms of the compact of the waters of the whole system among those States involved.

Governor JOHNSON. And I do not want any State to be able to file on the power rights on any intrastate reservoir. That is what I am talking about.

I do not believe you can do what you are attempting to do.

Senator O'MAHONEY. You said no State. You meant no agency?

Governor JOHNSON. I meant no official of the United States; that is what I mean.

Senator KUCHEL. Governor, if I may interrupt you, what your fear is of the present language of the bill S. 500 is that you might create a right on the part of the Federal Government to file on power in connection with an intrastate dam, and to that extent interfere or deny your State the right to use those waters for its own beneficial use; is not that it?

Governor JOHNSON. That is right; and to get a power right in a reservoir just as the Federal Government claims to have a power right by filing on the power in the Green Mountain Reservoir.

Senator MILLIKIN. Governor Johnson, is the following language of article 4 of the compact that to which you are referring?

(b) Subject to the provisions of this compact, water of the Colorado River system may be impounded and used in the generation of electric power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

Is your point the way the bill is drawn that there is a conflict between that part of article 4 and the way the bill talks?

Governor JOHNSON. No; there is no conflict with paragraph (b). But there is a conflict with the next paragraph, (c), which says: "The provisions of this article"—that means article 4—

shall not apply to or interfere with the regulation and control by any State within its boundaries of the appropriation, use, and distribution of water.

Senator ANDERSON. Does that not deal only with compliance with the State law in the acquisition of rights to use water?

Governor JOHNSON. No; I don't think so. I think it applies to intrastate reservoirs.

Senator ANDERSON. How can it be an intrastate reservoir on an interstate stream once the stream has been taken into an interstate system?

Governor JOHNSON. Because paragraph (c) gives it that right.

Senator ANDERSON. This gives it the right to have an intrastate reservoir?

Governor JOHNSON. Well, it evidently takes that possibility into consideration because it says:

> The provisions of this article shall not apply to or interfere with the regulations and control by any State within its boundaries of the appropriation, use, and distribution of water.

And yet the Federal Government or an agent of the Reclamation Bureau filed on the power rights in Green Mountain Dam because that was an intrastate reservoir.

Senator ANDERSON. We have a whole list of projects up there. Some of them are inside the States. That does not make them intrastate projects; does it?

Governor JOHNSON. I think it would if all the use of the water that they impounded was to be used within the State because the compact itself——

Senator ANDERSON. The Eden project is all within the State of Wyoming. Is that an intrastate project?

Governor JOHNSON. It is if all the waters that are impounded are used in the State of Wyoming.

Senator ANDERSON. And the Seedskadee project is also within the State. All the water is within the State of Wyoming.

Governor JOHNSON. I don't know whether all the waters that it impounds are used in Wyoming, but if that is so, I think it would come under the description of paragraph (c) in article 4.

Senator O'MAHONEY. Assuming that a certain project for irrigation and reclamation, that is to say, for agricultural use, could not be built by the State within the borders of which the possibility exists, there would be a logical possibility; suppose the water could be irrigated only through the reclamation law and by the appropriation of Federal money, and suppose that Federal money were expended to build such a reservoir and that the land to be irrigated could not possibly be paid for unless you had power revenues, would you say by the argument that you are making here that that reservoir could not be built; that that power could not be used, and therefore, that the water could not be put upon any land for reclamation?

Governor JOHNSON. Well, I would like to have you use the Green Mountain Reservoir.

Senator O'MAHONEY. I do not know anything about the Green Mountain Reservoir.

Governor JOHNSON. The Green Mountain Reservoir is a compensating reservoir that was built in connection with the Big Thompson. It is a compensating reservoir. It provides water for agricultural uses and for other industrial uses in the State of Colorado, including the development of oil shale and so on.

Senator O'MAHONEY. Is not that power developed by the construction for which the Federal Government made appropriation?

Governor JOHNSON. The Federal Government made the appropriation and built that. And filed on the power.

Senator O'MAHONEY. Then do you say to this committee that the Federal Government was wrong in filing on that power?

Governor JOHNSON. No, sir; I do not say it was wrong in filing on that power.

Senator O'MAHONEY. Do you say that that power use is subservient to agricultural uses on the west slope of Colorado?

Governor JOHNSON. I don't say that because I don't know.

Senator O'MAHONEY. Would not you have to say that if you continue the argument?

Governor JOHNSON. No, I wouldn't have to say that because I just don't know.

I know that they filed on that power.

Let me ask you a question. Why do you have this proviso in here at all?

Senator WATKINS. The one you are objecting to?

Governor JOHNSON. I am not objecting to it. I am trying to make it in harmony with the 7-State compact, but beginning on line 14, down to line 22, why do you have that provision there?

Senator O'MAHONEY. I had nothing to do, Governor, with the drawing of this bill, but I assume on reading this, without having had a chance to talk with the engineers with respect to the meaning of this precise language, I assume that it is intended to protect upstate water users.

Governor JOHNSON. Exactly. That is exactly what it was put in there for.

Senator O'MAHONEY. I think we are just debating about words and not about substance.

Governor JOHNSON. No.

Senator WATKINS. May I ask you a question about your interpretation of the language you propose, and I will read it again:

> No agency or official of the United States shall seek or accept the right to impound or use water for the generation of power or energy created or established by the building, operation or use of any of the powerplants authorized by this act.

With respect to Glen Canyon, what is your interpretation with respect to that project?

Governor JOHNSON. Glen Canyon is an intrastate reservoir.

Senator WATKINS. But it is one being built under this act.

Governor JOHNSON. Sure it is being built, but you do not want Uncle Sam to go in there and file on that power in Glen Canyon.

Senator WATKINS. He files on the power in behalf of the project as a trustee for the project, just as he has done in my State numerous times as a trustee for the benefit of the project itself on the water applications.

Governor JOHNSON. That is a different thing.

Senator WATKINS. That is the way they operate. They are trustees for the people under an arrangement of that kind.

Governor JOHNSON. That is right, but that is not the way it was filed on Green Mountain Dam.

Senator WATKINS. It seems to me, Governor, that language you propose would prohibit the generation of electricity in any of these plants. Every one of these on the main stem as well as everywhere else on the project.

Governor JOHNSON. I am sure not, but I am submitting it for what it may be worth.

Now, going back to section 4 again, I want to call your attention to the Boulder Canyon project, and this is the way it is handled in the law.

I want to say this, Senators, that I have been quite disturbed about the possibilities that the profits that are earned from the sale of power on the storage projects may not be dedicated to the development of the Upper Colorado River Basin. It think it is exteremely important that that money be dedicated for that purpose. That is one of the principal arguments for building the reservoirs on the river, that is, the large storage reservoirs.

This is the way the Boulder Canyon project handled the matter. I am reading from the act:

After the repayments to the United States of all money advanced with interest charges shall be on such basis and the revenues derived therefrom shall be kept in a separate fund to be expended within the Colorado River Basin as may hereafter be prescribed by the Congress.

I want to read from the bill on page 8, line 17, in which it says,

Provided, That revenues credited to the basin fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this act.

To me there is a vast difference between the two texts. One of them says it is to be used and the other says it cannot be used.

So I have suggested an amendment on line 17, and add a "fifth" there. There are four paragraphs. I add a fifth.

Any remaining surplus to be available for appropriation for construction of the units and participating projects authorized by or pursuant to this act.

It seems to me that it is very important that in this great project with all of the storage reservoirs and all of the participating projects and all, that the power money ought to be used for the construction of the participating projects remaining in this basin.

Senator WATKINS. As I understand it, the money goes to the United States Treasury, and it is reappropriated under the theory of this bill for this fund. You are doing away with this idea of interest that we had so many arguments about in the past.

Governor JOHNSON. You set up ways that the money can be used, but when you get down to the building of reservoirs, you say, "*Provided*, That revenues credited to the basin fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this act."

I am making this comparison with the language in the Boulder Canyon Project Act:

After the repayment to the United States of all money advanced with interest, charges shall be on such basis and the revenues derived therefrom shall be kept in a separate fund to be expended within the Colorado River Basin as may hereafter be prescribed by the Congress.

Senator ANDERSON. Of course, that is what was intended by this. This is the same language exactly in the bill introduced by Senator Millikin, and on which you were a joint author last year and designed to make sure that you cannot come ahead and the man administering the fund out there can build the reservoirs wherever he wishes without submitting the projects to the adjoining States.

This merely requires that you have to come back for the same kind of approval by the Congress, and to permit the other States to register their objections to building reservoirs we now have in the law. Otherwise you would have a tremendous amount of money rolling into the Department of the Interior and they could build reservoirs wherever they wished without reference to the desires of the people of that State or the people of the adjoining States.

Governor JOHNSON. But listen to the proposed amendment that I suggest for it. I suggest in line 17 of the bill after the semicolon, you add this language:

(5) Any remaining surplus to be available only for appropriation for construction of the units and participating projects authorized by or pursuant to this act.

What I am trying to do in that is to tie the profits on the power projects in this bill to a development of the projects in the upper basin. It is my opinion—and my opinion is not expert by any means—that the money that is earned by these powerplants in the upper Colorado River Basin can be used in any reclamation project in any basin outside of the Colorado River. I think it goes into the reclamation fund.

Senator ANDERSON. You understand, of course, that we are now dealing with something in the neighborhood of 2050 as far as years are concerned, because it would take at least that long to finish all the projects that might be available under this out of the earnings. It was our thought at least that probably it could wait and find out if some new source of energy might come in that would reduce the value of some of these water plants. I see no objection to saying that is to be spent within the area. That certainly is contemplated. But it would be a long, long time before all of these projects will have been paid out.

Senator MILLIKIN. Mr. Chairman, it seems to me that that very fact requires some protection that there will be money available to build them when the time comes no matter how far removed. I think the Senator has a good point.

Senator WATKINS. May I call to your attention that there have been many objections to the reclamation program and the interest increment and other things that were converted to the use of the projects. There was an attempt made in this bill to turn all the money in the United States Treasury except certain phases of it, and it was named on page 8, starting in line 3:

These revenues shall be available for defraying the cost of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects within such separate limitations as may be included in annual appropriation payments.

What they are attempting to do is not to make available this revenue for the construction purposes, but a limited use for matters I have just mentioned, operation, maintenance, and replacements.

That was to make a clear-cut program in which the money is all appropriated from the United States Treasury for construction purposes and none of this money is converted under any kind of a theory into construction that comes from the operation of the program. That was the attempt made and it was an attempt to meet the objections that were raised time and time again that we were doing some-

thing here that we should not do. Congress took vigorous exception to that interest increment.

Governor JOHNSON. Do you not believe, Senator, that the power profits from the Glen Canyon project should be used for the construction of participating projects in the basin?

Senator WATKINS. If it goes into the Treasury and the United States appropriates the money directly, I have no objection to that program. I have an idea when the thing is finished and paid for, yes, but while it is under operation I think this program meets the objections that were made by so many people to the financing that had been in operation on other projects. That came under violent attack and opposition in the United States Congress.

Governor JOHNSON. I call your attention to the fact that in the Boulder Canyon Project Act, it says after the repayments to the United States of all moneys advanced with interest charges shall be on such basis and the revenues derived therefrom shall be kept in a separate fund to be expended in the Colorado River Basin as may hereafter be prescribed by Congress. You think that was a bad arrangement?

Senator WATKINS. No, I do not. The fact is that a number of years ago I introduced a bill that would accomplish the same purpose on all the reclamation projects after the United States had been made whole. That is not taken care of in this bill. You are aiming at the time if and when the thing is paid for. That is what you are quoting.

Governor JOHNSON. So is this other proposal.

Senator WATKINS. No, this other proposal leaves it wide open what is paid for after the profits come in.

Senator MILLIKIN. This is an evolutionary program. As you pointed out a while ago, Mr. Chairman, it may be a hundred years before we finish the participating projects. What is the matter with the Senator's suggestion?

Senator WATKINS. It brings us right back to the interest increment.

Senator MILLIKIN. I do not see where the interest increment comes in.

Senator ANDERSON. I think there is no objection to a declaration of policy at all if it is necessary. We tried by section 2 to say that in order to achieve such comprehensive developments as will assure the consumptive use in the States of the upper Colorado River Basin of waters and so forth, Congress pledges itself to the construction and operation of all these projects. As I have tried to say, I know that there are projects which will not be paid out and all this money is going to be required until after 2050. If it is necessary to say after 2050, no money shall come out of there, but it shall stay in the Treasury and be used for the development of the upper Colorado River Basin. I have no objection.

Senator WATKINS. I do not either. I did not want to cross that bridge now.

Governor JOHNSON. The difficulty is that this bill, S. 500, takes care of the other States in the upper basin, but Colorado, the State that produces 71.18 percent of the water in the upper basin, has a great many participating projects that are not included in the bill and will not be included in the bill even if the 18 which I have suggested go in.

The other States have had their needs completed by the bill, but we are going to have participating projects in Colorado for a good long time.

My purpose is to get some of that money in the way of profits flowing back for the building of these participating projects.

This comes from the Reclamation Bureau. It shows this. They have a column here, and this was prepared by Mr. Jacobson and presented to the Upper Colorado River Commission, and has a column showing irrigation costs to be repaid from Glen Canyon and Echo Park power. It shows in Utah $90,246,500. For Colorado, it shows $16,595,700.

Senator WATKINS. Is not that reference to the first stages, Governor? You realize that this is a comprehensive program for the development of the waters of the upper Colorado which are allocated under the compact of 1922, and that there had to be various stages of preparation. As I understand it, the projects you recently mentioned you are adding to the bill are ones which have not been developed or investigated to the point where reports have been made on them. They are all contemplated to be under the same sort of a help from the revenues going into the Treasury or whatever it is to make the balance come up to the point where the project will practically pay for itself.

You mentioned several times about the percentage that Colorado gets out of this. I think you overlooked, and probably not purposely, a chart here showing what Colorado has already had in the way of development. I have the Fruitgrowers Dam, $200,741; Grand Valley, $5,667,000. That is, they already have had it or it is provided under the program of construction now underway. Mancos, $3,875,797; Panonia, $1,886,700; Pine River project, over $3,382,000. Another one, $10,663,000. And Colorado-Big Thompson, $159,461,000. A total of $185,137,000.

The other States—Utah has had $17,761,000; Wyoming, 5,989,000; and New Mexico has had $104,000 on the development of the Colorado River.

I know you did not intend to make this misleading but you left out all the projects Colorado has had for the development of the upper basin and the Colorado water rights. I do not know the total amount of water that is being developed or taken care of in this program that I have just read to you, but I do know that apparently in the figures you gave earlier, you left out the evaporation charges on the major dams that should be charged to Colorado. That would be Colorado water, too.

Governor JOHNSON. Colorado, of course, will be charged for the evaporation on the dams that you are reluctant to give us any profits from the production of power. For instance, on Glen Canyon, the evaporation is 626,000 acre-feet plus another 100,000 of silt that otherwise would be measured as water at Lee Ferry. I misstated that. It is 526,000 of evaporation and 100,000 of silt, that otherwise would be measured as water and 51.75 percent evaporation is charged to the State of Colorado under the upper States compact.

Senator WATKINS. Each State gets its proportionate share of the charge.

Governor JOHNSON. That is right. We are not kicking about that, but we think as long as we have to pay for the evaporation of these

reservoirs, that our participating projects ought to receive some of the revenues or profits from them.

Senator WATKINS. I would say that the same fellow that takes in the revenue and keeps it during the period until the time they are paid for is the fellow who appropriates the money for the construction. The revenues from the operation and maintenance can be used for those purposes. What we are trying to do in this bill is to meet the objection—it is somewhat a matter of bookkeeping—if we put the money into the United States Treasury and the payouts come in and are credited to the fund, and the revenues are credited to the extent that we use them for operation and maintenance. Then to make a clean-cut operation, we appropriate directly from the United States Treasury to this project until it is finished.

Now, when it is finished, I will agree with you. My own personal view is after these projects have been paid for, the people who have paid for them should own them. They should pay the United States in full, and the United States should get out except for the protection of whatever rights it has for navigation and wildlife and other things of that sort. That is not here. Nobody approved my bill when I introduced it.

Senator ANDERSON. Governor, may I say this, that I do not believe there is anybody concerned in this problem who does not want Colorado to have the fullest possible development of its resources, who does not want Colorado to get participating projects up to the full amount that it is entitled to. We are only trying in this bill to dispose of about 1,700,000 acre-feet out of some 4 or 5 million acre-feet available to the upper basin States. I do not believe there is the slightest wish on anybody's part to keep Colorado from having participating projects and have them paid for. You recognize that there was a long time a little difficulty in Colorado in deciding just how the water resources of that State should be done. Perhaps that has delayed to some degree the preparation of eligible projects. But we are as happy as we can be to see proper projects come in from Colorado. There is not anybody I know of on this committee or in Congress that would like those shunted to one side.

Senator MILLIKIN. I understand the Senator's point. He wants to be sure that there is money available to build those projects.

Senator ANDERSON. I think some declaration can be put in there to cover that.

Senator MILLIKIN. We are not at the early end of the construction. The Senator, as I understand his point, is looking forward to the day when it will take money to do the job, and he wants to be sure there are normal safeguards there.

Senator ANDERSON. I think that is a proper precaution.

Senator WATKINS. There is one thing we should keep in mind, that the repayment contracts even on the small projects contain a provision subject to the appropriations by the Congress. No future Congress can be bound to make appropriations. If they should suddenly stop making those appropriations, we would all be in the same spot.

Senator MILLIKIN. That would wash out the whole project.

Senator WATKINS. It might.

Senator MILLIKIN. We are not going to work here and build up an act on the theory that it is going to be wiped out by a future Congress.

Senator WATKINS. We do not expect it to be. That is why I say, if this program which comprehends the full development, including all States——

Senator MILLIKIN. Governor Johnson is making the point, as I understand it, that when the time comes that Colorado comes in with its participating projects, where is the money coming from? He wants the language in the bill to assure it coming from the basin.

Governor JOHNSON. That is correct.

Senator WATKINS. Then you have to change the whole theory of this repayment setup.

Senator MILLIKIN. I do not think so.

Senator ANDERSON. I think you might be able to protect that point without too much trouble, and as far as I am concerned, I am not opposed to protecting it.

Senator WATKINS. I am not either, as far as we can do it.

Governor JOHNSON. The point is that in this bill the participating projects of Wyoming, Utah, and New Mexico are included. The projects for the State of Colorado are not included, and we have many participating projects. It would just seem to me that it would be only fair to assure these participating projects in Colorado which are left out of this bill that they would be taken care of the same as the participating projects that are already listed in the bill.

Senator ANDERSON. I think that might be possible.

Senator WATKINS. I would not object to that.

Senator MILLIKIN. That is all the Governor is trying to do, as I understand it.

Governor JOHNSON. That is correct.

Senator WATKINS. If we modify this language we get back to interest increment.

Senator MILLIKIN. We have to conform the language to the proper concept and the proper concept is the one Governor Johnson has suggested, that since there will be future participating projects out of the river system there should be money to do the business.

Senator WATKINS. We will all agree to that.

Senator MILLIKIN. That is all the Governor is talking about. It is not an unprecedented thing. He has read from the Boulder Canyon Act.

Governor JOHNSON. I would like to call Mr. Larson back to the witness stand, and have him go into more detail about these 18 projects that have been approved by the Upper Colorado River Commission, the Colorado State Board of Water Conservation, the General Assembly of the State of Colorado, and we hope that they will be included by this committee.

Mr. Larson has some additional data that I think ought to go into the record with respect to these 18 projects. I ask that he be called to the witness stand to offer that testimony.

Senator ANDERSON. You will have no difficulty on that. We are very anxious to have that information in the record.

Governor JOHNSON. I am sure you are.

Senator MILLIKIN. Mr. Chairman, I would like to have the Governor emphasize again, if it is not sufficiently emphasized, that these 18 projects have been approved by the Upper Colorado River Commission, by the State water board, by the State Legislature of Colorado.

Senator ANDERSON. I am glad to have that emphasis, because I really believe, Governor Johnson, that one of the reasons why there are more projects from other areas than your State is that there was not for a substantial period of time representations made by your State as to the projects upon which there had been agreement. As rapidly as that agreement comes forward, and the material is ready, we are extremely anxious to add those projects to the bill.

Governor JOHNSON. I want to make one other request. Later on I think this subcommittee is going to hold hearings on Senate bill 300, and I will not be able to come back when you take testimony on S. 300, the so-called Frying Pan-Arkansas, but I would like to hand to you now my testimony with respect to that project, and ask that at the proper time it be added to the testimony.

Senator MILLIKIN. I move that be done.

Senator ANDERSON. I will say to you, Governor Johnson, that we intend to have hearings on the Frying Pan-Arkansas upon the conclusion of these, and a reasonable time for the preparation of the material to go to the printer. Just as soon as that is finished, we intend to go forward with the Frying Pan-Arkansas project, and if you will leave your statement with the committee, it will be put in the record at the opening of the hearings on that.

Governor JOHNSON. Thank you very much, Mr. Chairman. That is all that I have to say.

Senator KUCHEL. Mr. Chairman, there are some questions which, if the Governor would permit, I would like to ask him either now or subsequent to Mr. Larson's statement. Would that be agreeable to you, Governor?

Governor JOHNSON. Yes, sir; if it is agreeable to the committee.

Senator ANDERSON. Do you want to do it now?

Senator KUCHEL. Perhaps it would be better if you heard from Mr. Larson first, Mr. Chairman.

Senator ANDERSON. You may proceed, Mr. Larson.

STATEMENT OF E. O. LARSON, REGIONAL DIRECTOR, BUREAU OF RECLAMATION, REGION 4, SALT LAKE CITY, UTAH

Mr. LARSON. Mr. Chairman, Assistant Secretary Aandahl explained yesterday to the committee that the Department must withhold recommendations on any projects for which reports have not been completed and reviewed by the affected States, the interested Government agencies, and the Bureau of the Budget. It was my purpose to prepare such information as we have on those additional projects referred to in House bill 3384. I did not submit them yesterday because those particular projects were not included in Senate bill 500.

I have with me a short one-page statement and a summary sheet showing the irrigated acreage, the principal agricultural production, the water supply, construction costs, annual operation and maintenance cost, and benefit-cost ratio of the 20 additional projects in House bill 3384, 18 of which I believe were referred to by Governor Johnson in his statement this morning.

Senator O'MAHONEY. Mr. Chairman, may I ask Mr. Larson if this summary includes the Sublette unit in Wyoming.

Mr. LARSON. Yes; I will cover that in just a moment. It does include it.